UNION OF SOUTH AFRICA

DEPARTMENT OF AGRICULTURE

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INDEX

—TO—

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INDEX

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VOLUME II.—JANUARY TO JUNE, 1921.

[Items marked (N.) indicate Notes—Editorial and other—as distinguished from articles; those marked (*) are illustrated.]

AUTHORS' INDEX.

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PRINCIPAL CONTENTS.

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CONTENTS.

JANUARY, 1921.

DEPARTMENTAL NOTICES.

Courses at the School of Agriculture.—The new session for the diploma courses commences about the third week in January at all the five schools. Prospectuses of the respective schools and forms of application may be obtained by applying to the—

Principal, School of Agriculture, Elsenburg, Mulders Vlei, Cape Province;
Principal, School of Agriculture, Grootfontein, Middelburg, Cape Province;
Principal, School of Agriculture, Cedara, Natal;
Principal, School of Agriculture, Potchefstroom, Transvaal;
Principal, School of Agriculture, Glen, Orange Free State.

Applications for the new courses have in most cases been heavy, and students who are writing for examinations are advised not to await the results of their examinations but to apply immediately, informing the principal in each case of the circumstances, when it may be possible to reserve accommodation.

IMPORTATION OF ORANGE, LEMON, AND OTHER CITRUS PLANTS.

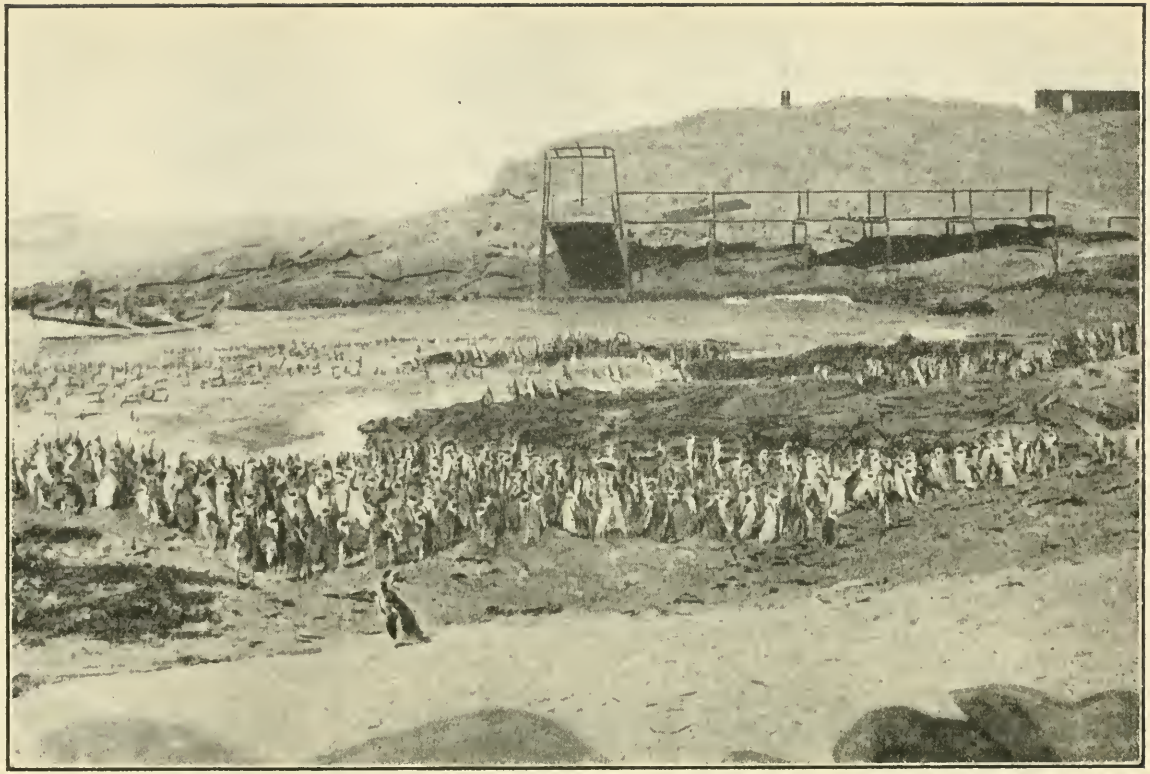
The public is hereby notified that under the provisions of the Agricultural Pests Act, 1911, and of Government Notice No. 266 of 1912, permits for the introduction of citrus plants from oversea must limit such introductions by any person in a calendar year to a maximum of ten trees or one hundred scions in any one variety, and will *not* be issued in respect of a variety procurable from nurserymen in the Union, except under special justifying circumstances, the chief of which is convincing evidence being brought to show the strain of the variety procurable in the Union to be an inferior one or untrue to type.

The issue of any permit lies in the discretion of the Department of Agriculture. It has been decided that all applications for permits to introduce citrus plants will be considered by a Departmental Committee, consisting of the Chiefs of the Divisions of Entomology, Botany, and Horticulture, and that the Department will accept the advice of this committee when its several members agree. Any rooted plants will only be admitted conditionally on any foliage and young growth that comes on them being removed and destroyed, and, in addition to being cyanide fumigated as long as required by regulations, on their being disinfected with copper sulphate solution of one-half per cent. strength (one pound of sulphate in 20 gallons of water). The introduction of scions is considered to be attended with more risk of bringing disease than the introduction of heavily cut-back young trees, in part because they cannot be subjected to equally efficient precautionary treatments, and hence applications for permission to import sciens are less likely to receive favourable consideration. No permits for trees or for scions will be given unless the applicant makes satisfactory arrangements for growing the plants and any plants propagated from them in quarantine for a period of two years. The Government has no recognized quarantine ground; and, in general, the place of quarantine will have to be a suitably isolated site under the immediate control of the applicant, who must pledge himself to see that no growth from the plants is removed from the site during the quarantine period, and to consent, in case disease becomes manifested, without any claim to compensation, to the destruction, under orders from the Minister of Agriculture, of any and all plants the Department may consider likely to have become infected. No site will be accepted as suitable if less than two hundred yards separate the quarantined plants from other citrus plants, and a far greater degree of isolation must be provided when practicable. During the period of quarantine the plants shall be subject to inspection by the Division of Botany, and shall remain in quarantine for two full years from the date of the arrival of the introduction at the quarantine site, unless a formal release is granted earlier by this Division. The owner of the plants shall meanwhile have them kept under close observation, and at once report any unusual development.

The Department of Agriculture views any introduction of citrus plants to be attended by some risk of establishing new diseases in South Africa, notwithstanding precautions of inspection, cutting back, fumigation, disinfection, and quarantine; and, in the issue of a permit to authorize an introduction of plants, the Government assumes no responsibility whatever for any loss from or through a trouble that might incidentally get into the country.

P. J. DU TOIT,
Secretary for Agriculture

Pretoria, 15th December, 1920.



HALIFAX ISLAND, NEAR LUDERITZBUCHT, SOUTH-WEST PROTECTORATE
(One of the Government Guano Islands), showing Loading Stage, and Penguins taking to the Water.

JOURNAL OF THE DEPARTMENT OF AGRICULTURE.

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NOTES.

THE SECRETARY FOR AGRICULTURE.

The Appointment of Mr. P. J. du Toit as Secretary for Agriculture, has now been confirmed by the Government, as from 1st October, 1920, from which date he has been filling the Office in an acting capacity.

The Manuring of Vineyards.

An article on the above subject by Dr. A. I. Perold was published in 1911 and has proved of great value to viticulturists. The publication is out of print, but arising out of Dr. Perold's article the subject has now been exhaustively written up by Dr. Ross, the Research Chemist, at Elsenburg, and Mr. S. W. van Niekerk, the Government Viticulturist, and is published in this issue of the *Journal*. The ideal system of manuring is one which provides for a return to the soil of at least as much of each of the important plant foods as are removed by the crop; this will maintain the fertility of the soil from year to year and, indeed, may even increase it. In this respect the requirements of the vine are dealt with at length in the article and also the various fertilizer materials which are available to the farmer and the use thereof, the systems of manuring and the use of lime in vineyards. The authors strongly advise farmers who are wine producers on a large scale to obtain their own experimental evidence by carrying out tests, and in their article furnish plans for manurial experiments, a practice which we commend, for our vineyard soils are of many different types and a system of fertilizing which may give the best results in one locality may not be the best or most economical in another. We feel sure that the publication of this article is timely and will prove of the greatest value to viticulturists to whom we recommend its careful perusal and application.

Union Successes at the London Dairy Show, 1920.

The London Dairy Show was held at the Agricultural Hall, Islington, on the 19th to 22nd October last, and for the second year in succession South African exhibitors scored several striking successes. In 1919 the gold and silver medals were secured for cheese, but at the last show, in addition to these, the bronze medal and reserve ticket were also won. South Africa thus obtained the first four places in competition with exhibits from Canada, Australia, and New Zealand, an achievement to be proud of. The successful exhibitors were: G. W. Young, jun., The Meadows Cheese Factory, Franklin, East Griqualand—Gold Medal. The Aliwal North and Districts Creameries, Ltd., Aliwal North—Silver Medal. Rocky Ridge Cheese Factory Co-operation, Ltd., Kokstad, East Griqualand—Bronze Medal. Jack Moxham Co-operative Industries, Ltd., Kokstad—Reserve.

East Griqualand cheese manufacturers have thus justified the high position they have held for several years in the cheese industry of the Union. Mr. G. W. Young, jun., was a consistent winner during our last show season, and his success at the London show comes as a fitting climax.

These successes should act as a stimulus to the already promising cheese-making industry of the Union, and it is hoped that, given a favourable season, the farmers producing the raw material and factories manufacturing cheese, will make every effort to increase production and enable a steady export trade to be maintained. There is no doubt that the grading scheme in operation in East Griqualand has had much to do with the improvement in the quality of the cheese produced in that area, and its extension to other districts is at present under consideration, and it may be possible to provide facilities whereby any factory in the Union can have its cheese graded, before placing it on the market, by a Government grader at a small charge.

In addition to the cheese successes, South Africa secured the gold medal for the best collection of Colonial produce in competition with other Dominions. The outstanding features of the exhibition were butter, cheese (both Cheddar and Gouda), bacon, hams, poultry, eggs, honey, fruit, cotton, hides, fibres, etc., all of which were contributed by local producers or manufacturers, and staged by the Trade Commissioner. The Exhibition attracted considerable attention, and afforded a valuable advertisement for South African industries.

Further successes were obtained by our bacon, the Farmers' Co-operative Bacon Factory, Estcourt, Natal, winning both the gold and silver medals and also the reserve ticket in this class, while Messrs. Lurie Bros., Capetown, won the gold medal for eggs, and Messrs. Tollman & Davies, Johannesburg, that for poultry.

Only two South African creameries entered in the butter classes but were not successful, which is hardly surprising as the month of September, during which the butter had to be made, is about the worst in the year, owing to the fact that farmers are then generally producing cream only in small quantities, and in consequence collect it over too long a period before sending to the creamery, and it is not possible to manufacture show butter from such cream. Butter manufactured at that time of the year does not possess the flavour, colour, or bloom of butter made during the spring and summer.

Co-operative Agricultural Societies.

The Seventh Congress of Co-operative Agricultural Societies in the Transvaal and Orange Free State was held last June, and we publish in this issue the minutes of the proceedings. There are many problems which arise in connection with the administration of these societies in securing the best interests of co-operators, and these are discussed from time to time at these congresses. The spirit of co-operation is growing in the Union, the subject being one of moment to every farmer, and a perusal of the minutes will be helpful in throwing light on some matters which have exercised the minds of farmers recently, and interesting in disclosing the growth of the movement under direct Government control in the Transvaal and Orange Free State.

The Tobacco Leaf Slug.

Yet another pest with which the farmer has to contend has made its unwelcome presence in the form of a beetle which is attacking tobacco plants. Until recently this plant had been considered free from particularly dangerous pests in the field, and the advent of the beetle, which has been given the popular name of Tobacco Leaf Slug, will be viewed with concern by all tobacco growers. Prompt measures have been taken by the Department in controlling the pest and an article (with illustrations) on the subject by Mr. C. P. van der Merwe, of the Division of Entomology, is published in this issue of the *Journal*, and should be carefully studied. The article gives a brief sketch regarding the occurrence of the pest in the Union from the time it was first observed at Cedara, Natal, up to the present, its appearance having now been noted in a number of tobacco centres. The nature of the injury from the beetle, its life history and habits, the plants other than tobacco it feeds on, natural enemies, as well as other observations, are carefully set out by Mr. Van der Merwe. Special attention is drawn to the clear directions given for controlling the pest which, it is pleasing to state, can successfully be kept down. We would specially request farmers and others who may observe the insect, whether feeding on tobacco or other plants in localities other than those referred to in the article, to communicate with the Division of Entomology.

Successful Farming.

We draw attention to an article we publish elsewhere giving some interesting figures concerning a season's farming on the high veld by a farmer having a Government small-holding. The season was not exceptionally favourable, but the returns for the year show a handsome return and afford an encouraging example of what real honest toil, common-sense methods, and sufficient though modest capital can win. Farming systems are daily becoming more intensive and farmers are more and more constrained to watch, as of primary importance, the economic aspect of their operations. The figures of production, income, and expenditure have been carefully collected and should prove of special interest to farmers with small propositions, to whom they will doubtless be welcome in view of the dearth of statistical data which prevails in connection with the economy of farming in the Union.

The Nodular Worm.

This issue of the *Journal* contains a valuable contribution by Sir Arnold Theiler on the Nodular Worm and the lesions caused by it. The effects of the nodular worm infection show themselves both in lambs and sheep, but more acutely in the former, and many farmers have been puzzled as to the cause of the wasting condition and death of their stock, not connecting it with the presence of the worm. Others have seen the worm, some drawing special attention to the fact that although our remedy was very effective against wireworm it was not so against the nodular worm in the large intestines. This, the author states, was known, as, at the time of the first issue of the drug, efficacy against wireworm only was claimed, though it stands to reason that, with the removal of the wireworm, a sheep will stand parasitic infection much better, therefore, sheep dosed regularly with the wireworm remedy are less subject to the effects of worm infection. The article sets out very clearly the description of the disease, the complications resulting from infection, the life-history of the worm, and contributes valuable data on a matter of considerable importance to sheep farmers, and calls for their special study, for, quoting the author, "the only effective way to deal with the nodular worm infection is to prevent the entry of the worm into the sheep."

Production and Consumption of Spirits in the Union.

The report of the Superintendent of Excise for the year 1919 contains most interesting information which should be studied by all concerned in our viticultural industry. Referring to the consumption of Cape spirits (produce of the vine) the Superintendent points out that, as expected, the consumption, as ordinary liquor, of Cape wine spirits in 1919 was 2.5 per cent. less than in 1918. He is of opinion also that the inordinately high prices obtained for wine spirit and wine, only explained by trade rivalry and speculation, will prove in the end to be most detrimental to the industry, for a lowering of prices will not bring a return of the trade which has been lost on account of the high prices. Some of the effects resulting from these high prices are (*a*) the utilization of Natal spirits for making gin hitherto made from wine spirits; (*b*) the substitution of Natal spirits for wine or wine spirits in vinegar-making; (*c*) the non-production of canteen or other cheap wine; and (*d*) the conversion of good wine—even sherries, ports, etc.—into spirits. The manufacture of whisky in the Union, preparations for which were made as a result of certain tariff conditions, was substantially encouraged by the high price of wine. In respect of the export of spirits from the Union to countries oversea rendered possible on account of conditions set up by the war, it is disappointing to learn that the hopes of retaining this market on the removal of these conditions have not been realized. Our production of Cape wine spirits has increased from 2,201,392 proof gallons in 1918 to 2,248,782 proof gallons in 1919, and the latter quantity exceeds the consumption for the year by 30,925 proof gallons, and at the end of 1919 the stock on hand was equal to about five months' supply. On the other hand the production of Natal spirits (produce of the sugar-cane) has decreased from 1,934,040 proof gallons in 1918 to 1,576,619 proof gallons in 1919, on account of the demand by the Imperial Government for spirits having disappeared since April, 1919.

Tractor Demonstration at Elsenburg.

On 15th November, 1920, a tractor demonstration was given at Elsenburg by Messrs. Chalmers & Fraser, Ltd., with their 5-ton Holt caterpillar tractor. The trial was begun in the morning on a particularly hard piece of hilly land, which contained a medium amount of young bush, when the work of the tractor was considered fairly satisfactory, taking into consideration the nature of the soil. In the afternoon a further test was made on an equally hard piece of level vlei land, the result being clearly evident more satisfactory than that of the morning. In both cases the tractor drew a 4-furrow mouldboard plough, working to a depth of from 6-8 inches, though on the hilly land this depth was often not maintained.

The type of plough used was not suited to the tractor, nor to the severe conditions of the soil to be ploughed.

The consensus of opinion was that the 4-furrow disc plough would have done infinitely better work, and would also have required less power.

The Holt caterpillar tractor has a 12-20 horse-power engine, and appeared to have plenty of reserve power, particularly when in low gear. In both morning and afternoon trials the land was broken up in rather big lumps owing to the hard nature of the soil. Extra weight was required to keep the plough into the ground, while on the hillside it was noticed that the wheel attached to the rear of the plough occasionally ran on the top of the furrow, and so caused the shears to be lifted slightly from the ground.

Crop-yields of the Northern Hemisphere in 1920.

The October Statistical Bulletin of the International Institute of Agriculture announces the results of cereal crops in most of the countries of the northern hemisphere. Data are now to hand from almost every quarter, with the exception of Russia, and the totals resulting from available and comparable data amount to 56.8 million metric tons (2200 lb.) of wheat and 5.6 million of rye. This quantity is slightly larger than the yield in 1919 (61.7 million), and identical with the average of the preceding five years.

The comparable data for barley dealing with a number of countries producing just under one-half of the world's yield, make a total of 12.7 million tons, 8 per cent. larger than the production of 1919, and 5 per cent. below the five years' average.

The yield of oats in countries furnishing all the required data (affording about 60 per cent. of the world's yield) is estimated at 38.3 million tons, showing an increase of 21 per cent. over last year, and 9 per cent. over the average.

The maize crops of south-eastern Europe are reported as good, that of Italy as fair, while the United States yield amounts to 81.7 million metric tons, 10 per cent. over last year's, and 16 per cent. above the average.

Reports on the probable yield of beet sugar are favourable from Austria, Belgium, France, Germany, Italy, Netherlands, Sweden, and Canada, also for both cane and beet sugar from the United States.

The export from British India of 400,000 tons of wheat has been sanctioned and will take place unless internal prices advance beyond the purchase limit officially fixed. The weather in October has not been favourable for crop developments

A Soil Survey of the Union.

Farmers are aware that an enormous amount of research has been carried out for years past by officers of the Department in connection with the analyses of the many types of soil found throughout the Union and the problems connected therewith. The results of the analyses and the lessons arising therefrom have been published from time to time, but the work has hitherto not been carried out on any systematic basis or under a paramount control embracing all effort and guiding it to the fruition of a single aim—the complete survey of the agricultural soils of the Union. The need for carrying out this object has been advocated for many years, and it is patent to all that its fulfilment will mark one of the great epochs in the forward movement of agriculture in South Africa. It is pleasing to say, therefore, that a definite stage has been reached in the furtherance of a scheme of such importance to the country, for emerging from the labours of the past there is every likelihood that a commencement will be made at an early date of the great work of collating, indexing, and bringing into one connected system the data already available, and inaugurating the first step in a systematic soil survey of the Union. Making the fullest use of past investigations, future work will be carried out under a clearly defined programme calculated in time to cover the whole country. And this definite stage in the movement may be said to be the result of the conference of chemists of this Department, held at Pretoria on the 18th November last, for the purpose of discussing the subject of a soil survey and of formulating proposals in regard thereto. At this conference the following resolutions, among others, were passed:—

(1) That a soil survey is desirable as the basis of the agricultural development of the country, in order to indicate the agricultural potentialities of different localities.

(2) That the scope of the survey should include soil classification, which, to be of the largest value, must effect the accurate separation of materials with reference to all important agricultural differences. It should therefore embrace the following heads:—

(1) Careful survey of the country with the view of delimiting the areas covered by the various types of soils, and including the construction of large-scale soil maps.

(2) The field characteristics of such soils as regards depth, drainage, water capacity, aspect, climate, etc.

(3) The physical, chemical, and biological investigation of the soil.

(4) The botanical and agricultural characters of the various soil types.

(5) Field experiments on each type of soil in various parts of the Union.

Matters concerning the use of information already available and the machinery necessary for carrying out the survey were also discussed.

The matter is at present receiving the attention of the Government, and we express our confidence that circumstances will permit of the work being taken in hand at no distant date.

Wheat Conservation and Rye Growing.

We do not grow sufficient wheat to supply our population with a wheaten loaf and the shortage has to be imported from other countries. When a prospect of poor harvests and other circumstances caused much anxiety recently as to the means of obtaining supplies to meet the Union's requirements, the question of our bread supply was a topic of general discussion. We publish elsewhere in this issue a short article on the subject in which the suggestion is put forward that any occasion for anxiety regarding our bread supply in the future should be removed by engendering a habit for rye bread or for bread containing a proportion of rye. Rye growing is not extensive in the Union but there are large areas very suitable for the crop, and given the demand there seems no reason why it should not prove a remunerative undertaking and solve the problem of our bread supply, placing us in an independent position in that matter of supreme importance.

Stock Dips.

We draw the attention of importers, manufacturers, dealers, and others concerned to the draft regulations, published in this issue, which it is proposed to introduce in connection with the sale of stock dips. It is intended to put these regulations into force as from the 1st April, 1921, but in the meantime the Department will be prepared to give consideration to any representations which may be made in regard to any of the terms thereof. The dipping of live stock has become a matter of general necessity, and it is trusted that the opportunity now afforded manufacturers and others of becoming acquainted with the proposed regulations governing the sale of stock dips will be availed of so that the adequate fulfilment of the object of the Act in this connection may be ensured from the start.

Tsetse Fly and Nagana.

In connection with the serious losses in live stock suffered by settlers and farmers in Zululand through the disease nagana (Trypanosomiasis), it has been decided to widen the scope of the investigation into the matter. We referred in our last issue to the investigations being undertaken by the Division of Entomology into the life-history of the tsetse fly, for which purpose an entomologist is to be stationed in Zululand with the dual object of investigating the local problem and of combining in a general scheme inaugurated by the Imperial Government to investigate the bionomics of the tsetse fly simultaneously in six widely separated "fly belts" in Africa. But, in addition, the Government has now decided to carry out an investigation into the disease itself, and for this purpose a veterinary research officer will be stationed in the infected area in Zululand. This officer will work in collaboration with the entomologist, studying the relationship between the tsetse fly, game, and nagana, and will also carry out therapeutic tests on animals affected with the disease in the hope of saving stock that would otherwise die. Houses, offices, etc., are to be erected, if possible, near the Empangeni Settlement on the Lower Umfolozi River for the accommodation of the investigators. At present the infected area is visited regularly by a Government veterinary officer, who spends a fortnight in each month there.

It will thus be seen that the matter is being thoroughly dealt with, and, while the investigations are expected to run over a number of years, it is hoped that as a result we will thereafter be able to deal effectively with nagana as well as other trypanosome diseases, and so achieve yet another success in our campaign against the stock diseases found in South Africa.

Supplies of Wheat and Rye available for Importing Countries.

A recent publication by the International Institute of Agriculture, Rome, furnishes data of very great interest as to the quantities of wheat and rye which importing countries may obtain during the season from 1st August, 1920, to 31st July, 1921.

On the basis of data now available, and of forecasts of an average yield from the growing crops in Argentina and Australia, it is estimated that Bulgaria, the Serb-Croat-Slovene State, Canada, the United States, British India, Argentina, and Australia should be able to export during the season 17.5 million tons (metric tons of 2,200 lb.) of wheat and 800,000 tons of rye, making a total of 18.3 million tons of breadstuffs. Taking into account the fact that the quantity afloat on 1st August, 1920, was very large, the aggregate quantities at disposal of importing countries are estimated at 18.6 million tons of wheat and 900,000 tons of rye; the complete total is therefore 19.5 million metric tons, against a quantity amounting to 18.5 million tons of wheat and rye, forming the actual receipts of importing countries during last season.

On the other hand, the total production of the two cereals in the importing countries comes out very nearly the same as it was last year (33.2 million tons against 33.5 million).

It follows that overseas requirements should not be much greater than last year's, while potentially about 1 million tons more than they imported last season will be at the disposal of importing countries.

But there is no positive assurance that the potential exportable surplus will in its entirety reach the countries that may need it, inasmuch as it is not certain that India will export all its apparent surplus, while present expectations regarding harvests of Argentina and Australia may need to be modified. Prudence dictates abstention from undue optimism in view of these uncertain factors of the situation.

Wine Show at Capetown, 1920.

Commenting on the Wine Show held by the Western Province Agricultural Society at Capetown last year, Mr. S. W. van Niekerk, the Government Viticulturist, says that in the number of entries the show was a success as compared with previous years, entries amounting to 179, as against 30 in 1919. The quality generally was good, although it was noticeable that, on the whole, the condition of the wines was not up to the standard of previous years. This may be due to the fact that the samples had to be forwarded in August instead of towards the end of October, as in previous years.

The increase in entries was due not to the earlier show date, but to the appointment of a wine expert by the Wynboere Ko-operatiewe Vereeniging van Zuid-Afrika, in the person of Mr. F. Myburgh, who

persuaded farmers to enter and helped them to prepare their wines. In going over the prize list, it is noticeable that under light dry white wines for Classes 1, 2, 3, 6, 7, 8, 9, and 10, all the prizes were awarded to farmers in the Paarl and Tulbagh districts, whereas the Constantia area took all the first prizes for light dry red wines for Classes 11, 12, 16, and 17. From the above it must be concluded that for light dry white wine, Paarl, Tulbagh, and probably Stellenbosch are more suitable, and the Constantia area for light dry red wine. That the Constantia area produces such excellent red wines is usually attributed to its climate and soil, but in that area a large amount of Carbernet Sauvignon is grown, and there is no doubt that this grape produces an outstanding quality wine. It is well known that a Hermitage can be improved in quality with a blend of 20 per cent. Cabernet. It is hoped that other districts will start to grow Cabernet, as very little is grown at present outside Constantia. Blends with Cabernet made at Elsenburg and the Paarl Viticultural Station have been submitted to merchants, who expressed the opinion that these wines ran the Constantia wines very close if they were not as good. Particularly with a view to export, owners of large vineyards of Hermitage should plant a certain amount of Cabernet with which to improve their whole crop of red wines.

Two types of wine which are usually very disappointing at the show are Sherry and Port, and Mr. Van Niekerk does not remember ever having tasted a wine with a good Sherry character at these shows. This is not surpising, as very few farmers ever try to produce a wine with a true Sherry character, and besides very few wines will develop that character within twelve months, and more so if not specially made. The 1920 show showed no improvement. The so-called Port types are usually a collection of sweet wines with traces of no Port character. In 1918 and 1919 Mr. R. Cloete, of Constantia, exhibited a sample of Port. Many readers will remember that the judges in 1918 expressed the opinion that it was one of the best samples of this type ever exhibited. For some reason or other the 1920 sample was not up to the standard of the two previous years, and it did not even get the first prize—although it must be stated that many of the public who visited the show did not agree with the judges' decision. Mr. Van Niekerk suggests that prizes be offered for Sherry and Port types of not less than 15 months old, as in the case of brandy. Then probably samples with more of the true character of these types than at present will be shown.

Another class that seems to be regrettably neglected is the Sweet Muscadel. It is hoped that the districts of Montagu, Robertson, and Worcester will in the near future take up seriously the matter of making these wines and produce a class of sweet wine as good as can be produced anywhere.

Oversea Exhibition of Union Produce.

To advertise the products of the Union, the Trade Commissioner is arranging a permanent exhibition in London. One is also being held this year in Amsterdam. In this connection sheep and Angora breeders have been asked by the Department to co-operate in the collection of a creditable exhibit in advertisement of their products, and it is trusted that they will grasp the opportunity offered and rise to the occasion.

Salt-bush.

Co-operative experiments, conducted by the Government Agronomist with the aid of farmers over a number of years, have shown the merits of the undermentioned Australian varieties of salt-bush:—

(*a*) *Atriplex nummularia,* Lindl. (Round-leaved or Old Man Salt-bush);

(*b*) *Atriplex semibaccata,* R. B. (Half-berried or Creeping Salt-bush);

(*c*) *Atriplex halimoides,* Lindl. (Halimus-like or the Grey Salt-bush);

(*d*) *Atriplex leptocarpa*;

(*e*) *Atriplex holocarpa,* F. v. M. (All-fruited Salt-bush);

(*f*) *Atriplex visicarium*;

(*g*) *Atriplex angulata,* Benth (Angular-fruited Salt-bush);

in regard to which the following points are noted:—

(*a*) A perennial, erect shrub; resists drought to a remarkable degree, reaching a height of 5 to 8 feet in four years, and grows on very brack soils.

(*b*) Habit of growth is prostrate and branching, forming a dense growth on the surface of the land. Also grows on soils too alkaline to support any other form of cultivated plants. It is a perennial, but some farmers are of opinion that it should be treated as an annual in districts where the winter is exceptionally severe.

(*c*) A low bush creeping along the ground, described by some as a perennial and by others as an annual; dependent presumably on the winter temperature. It is recommended to sow this variety in the spring.

(*d*) (*e*), (*f*), (*g*) These varieties are, more or less, annuals, and although they make excellent stock feed, farmers prefer the perennials. The Holocarpa (*e*) is highly recommended by some farmers for land liable to be flooded.

All salt-bushes prefer moist brackish land, but are able to accommodate themselves to a great variety of conditions. Seed may be sown at any time during the spring or summer months when the soil is moist.

Manner of Planting.—Some people loosen the soil with a spade or a hoe in patches some little distance apart, and six to twelve seeds are planted in each plot, according to the size of the patch. Others plough the ground and harrow the seed in. The bush will naturally spread much faster on properly tilled land. The quantity of seed required will vary with the distance apart of the patches or rows, as the case may be. About 20,000 seeds go to the lb., so that ten seeds every 2 yards means only 1¼ lb. per morgen, while at 10 yards apart about ½ lb. per morgen will be required. Various methods of planting salt-bush seed are employed by farmers, and 1¼ to 1½ lb. is generally used per morgen, or half that amount per acre. The seed is covered from ¼ to ½ inch deep (the shallower the better), and young plants must be protected from the too-assiduous attention of live stock. When once well established salt-bushes require very little care, beyond being occasionally protected so as to permit them to flower and resow themselves. The Australian salt-bushes seem to possess a more vigorous growth and seed more freely than our own, although some farmers speak very highly of our *Atriplex capensis* (Cape salt-bush) and claim that it is more drought-resistant than any of the exotic species. Salt-bush will also grow from cuttings, but this is a somewhat slow method.

Sugar Production and Consumption in the Union.

The cultivation of sugar-cane in the Union is confined to the coastal districts of Natal and Zululand. In the former place, about the year 1850, was commenced an industry which in recent years has developed rapidly and now occupies an important position in the country's agricultural and industrial production.

Up to as recently as two years ago local sugar production was insufficient to meet the Union's requirements, and the shortage had to be met by importation, principally from Mauritius and Mozambique. Like several other Union products, however, a most gratifying change has since taken place, the 1918-19 season marking an epoch in the history of the industry, for it produced sufficient sugar for our own needs and a surplus for export, notwithstanding a considerable increase in local consumption.

The following statement shows the total quantity of sugar imported and of the South African product exported each calendar year since Union:—

Estimated Production.		Outside Trade—Tons.		
Seasonal Year (May to April).	Tons.	Calendar Year.	Imports.	Exports (S.A. Produce).
1910–11	82,000	1911	36,482	141
1911–12	92,000	1912	19,385	237
1912–13	96,000	1913	29,227	178
1913–14	92,100	1914	23,516	113
1914–15	102,600	1915	8,428	1,269
1915–16	113,300	1916	3,512	1,762
1916–17	114,700	1917	12,642	2,007
1917–18	105,000	1918	21,239	2,671
1918–19	150,000	1919	2,827	18,974

(NOTE.—The above figures exclude the quantity of imported sugar exported, which was negligible excepting in 1918, when it amounted to 2324 tons. Nor are ships' stores included in the exports since 1917, the tonnage being: 1917, 316; 1918, 188; and 1919, 189.)

SUGAR CONSUMPTION.

The quantity of sugar consumed in the Union (and Rhodesia) prior to the year 1917 was, generally speaking, not more than 120,000 tons per annum, but there commenced a rapid increase in 1917, according to the statistics hereunder furnished by the Controller of Customs and Excise at Durban, and it is estimated that our requirements this year will amount to something like 160,000 tons of sugar, viz.:—

SOUTH AFRICAN CONSUMPTION, INCLUDING RHODESIA.

Seasonal year ended 30th April,	1914-15	...	114,454 tons.
,, ,, ,,	1915-16	...	118,835 ,,
,, ,, ,,	1916-17	...	114-348 ,,
,, ,, ,,	1917-18	...	125,533 ,,
,, ,, ,,	1918-19	...	143,639 ,,
,, ,, ,,	1919-20	...	165,715 ,,

A RECORD YIELD AND A SET-BACK.

The Union's sugar industry established its record in the 1919-20 season, which is estimated to have yielded 190,000 tons of sugar, sufficient to furnish a surplus for export and adding something

like £5,000,000 to the value of the country's production. Unfortunately this gratifying progress has been arrested by droughty conditions, and, according to reports received at the time of writing from the South African Sugar Association, the 1920-21 season will produce approximately 150,000 tons of sugar only, 10,000 tons short of the Union's estimated requirements that year.

The rapid increase in the Union's consumption of sugar is due chiefly to our large native population steadily developing a demand for sugar; also local jam and sweet factories, which are extending in the Union, as shown in the following statement:—

Calendar Year.	Jams and Jellies (Short Tons).				Sweets* (Short Tons).		
	Imports.	Exports.	Excess of Imports over Exports.	Excess of Exports over Imports.	Imports.	Exports.	Excess of Imports over Exports.
1910	1,122	68	1,054	—	2,106	41	2,065
1911	1,165	133	1,032	—	2,663	32	2,631
1912	894	175	719	—	2,641	26	2,615
1913	1,107	217	890	—	3,015	27	2,988
1914	676	94	582	—	2,323	22	2,301
1915	438	160	278	—	3,065	51	3,014
1916	354	909	—	545	2,334	98	2,236
1917	302	1,165	—	863	629	103	526
1918	31	1,650	—	1,619	316	165	151
1919	134	4,318	—	4,184	844	146	698

* Confectionery N.O.D.

This shows that in 1919 local sugar was obtainable for the manufacture of all jams and jellies consumed in the Union, and also a surplus of 4000 tons, while, compared with 1910, exports replaced imports, a reversal of trade amounting to 5200 tons. Similarly the confectionery trade in 1919 compared with 1910 shows a reversal in favour of the Union of 1369 tons. When the increased internal consumption in these commodities is taken into account it will be seen that they have an important bearing on the Union's mounting sugar consumption.

By-products.

A by-product of sugar manufacture is molasses, which is of two main kinds, namely: That derived from the process of refining and that obtained as a residue at the sugar-mill. In Natal the former is chiefly exported as "refined treacle," and there is also manufactured golden syrup. The table below gives the imports of golden syrup and the export of refined treacle, but it should be noted that these are not identical. The former is entirely a foodstuff for direct consumption, while the latter is only partly so used, the balance having special uses peculiar to importing countries, mainly the United Kingdom.

	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.
† Golden Syrup Imports, tons ...	4,802	6,185	7,291	7,204	3,255	2,064	817	186	16	226
‡ Refined Treacle Exports, tons ... (S.A.P.)	3,330	3,687	5,164	5,845	6,213	5,490	4,285	212	378	4,459

† Includes molasses and treacle. ‡ Includes molasses.

Molasses, the residue from the manufacture of sugar at the mills, are being utilized in increasing quantities in the manufacture of rectified spirits, industrial alcohol (including methylated spirits), motor fuel (Natalite), ether (anaesthetic and commercial), chloroform, and a specialized article known as "Instanto," used as a liquid soap. A wax is derived from the sludge obtained from filter presses, and this residue is, in its turn, used as a fertilizer in the cane fields.

The cane itself, after the extraction of the juice, is used as fuel in the mill furnaces, and in an efficiently running mill this "bagasse" is usually sufficient for all steaming purposes. There is an impression that this use of "bagasse" is wasteful, as it is understood paper could be made from it, but it is calculated that to replace the bagasse would require 250,000 tons of coal which, at to-day's prices, would cost, delivered at the mills, £375,000. At present bagasse has a fuel value, compared with coal, of 10s. per ton.

ACREAGE AND YIELD.

The area under cane was returned in the 1918 census as 87,035 morgen. During last season the area cultivated could not have been less than 100,000 morgen. The cane used to produce the sugar output was 2,278,000 tons. The yield of cane per acre varies considerably, but is generally taken to average 20 tons per acre every 20 to 24 months. The quantity of cane required to produce a ton of sugar also varies from year to year on account of climatic conditions, and the duration of the crushing period; but the class of sugar made and the efficiency of plants are the chief factors governing this figure. Last season's practice showed that raw sugar could be made from as low as 9.87 tons of cane, and white sugar made from as low as 10½ tons of cane. Taken as a whole (refining losses being excluded) the average was approximately 11½ tons of cane to a ton of sugar.

In this connection it is of interest to learn from a Reuter message, dated 31st August, published in the Press, that an official estimate places the season's sugar production in Australia at 160,000 tons, leaving a shortage in that country of 100,000 tons which will have to be met by importations.

Fruit Export.

The following is a return of the fruit shipped overseas on the 26th November and 3rd December last, being the first shipments of the 1920–21 deciduous season.

Variety.	*Ex* Durban. Boxes.	*Ex* Port Elizabeth. Boxes.	*Ex* Capetown. Boxes.	Total. Boxes.
Apricots	—	—	112	112
Peaches...	—	—	197	197
Plums	—	—	679	679
TOTAL	—	—	988	988

South African Wine in Competition.

We are advised that at the recent Brewers' Exhibition, held in London, Messrs. J. Sedgwick & Co., Capetown, were awarded nine first and three second prizes, and Messrs. E. K. Green & Co., Capetown, two first, two second, and two third prizes for their exhibits in the Colonial Wine Competition.

DEPARTMENTAL ACTIVITIES

November, 1920.

(NOTE.—The work of the several Divisions and Schools of Agriculture covers a wide range of agricultural industry in the Union, and we give hereunder notes and observations from certain of them treating with matters of special interest coming under their purview during the month. The object of these notes, which are not concerned with general routine work, is to inform the farmer of such matters as are calculated to be of interest and helpful to him at the present time.—EDITOR.)

THE DIVISIONS.

ENTOMOLOGY.

Potatoes from East Africa.—A number of consignments of potatoes, aggregating 1400 to 1500 bags, reached Durban from Kenya (British East Africa) during October and November. Every one arrived in a filthily rotting state. Of one lot of 170 bags the health authorities condemned 110 outright, and the remaining 60 bags, on being sorted over, yielded only 35 bags of sound tubers. The clearance of several consignments was seriously delayed owing to the non-production for a time of the necessary "consignor's declaration" under the plant import regulations; but from the inspector's reports it appears the decay is chiefly attributable to the potatoes having been carried in bags stored in the holds of the ships. The potatoes have been a source of much complaint at the port, owing to the horrible stench arising from them. The entomologist and botanist had anything but an enviable time inspecting them.

Codling-moth Parasites.—When visiting Naples in June last, Mr. C. P. Lounsbury, Chief of the Division of Entomology, arranged with Professor F. Silvestri, the chief of the Italian entomological service for southern Italy, to have codling-moth larvæ collected during the autumn months and sent to South Africa with the view of introducing Italian parasites of the codling-moth into this country. In Italy the codling-moth is of slight importance as a pest compared to what it is in South Africa, due in a large measure, it is thought, to the presence of parasites in the former country and not in the latter. However, to get the major Italian codling-moth parasites established in South Africa may prove a most difficult and perhaps impractical task; and if they do become established it does not follow that they will do satisfactory work. Dr. F. W. Pettey, the entomologist at the Elsenburg School of Agriculture, who for several years has made a special study of the codling-moth, has been entrusted with the responsible and arduous work of dealing with the project at the South African end, and on 24th November he received the first batch of material from Professor Silvestri.

Woolly Aphis Parasites.—The Division of Entomology is making an effort to introduce a certain woolly aphis parasite (*Aphelinus mali*) from America. No internal parasite of the pest insect is known in South Africa, and none appears to be known in Europe or Australia, but the species named has long been recorded to infest woolly aphis in eastern America without, however, much being known of its importance. It attacks various aphides other than the woolly aphis, and it may be that it might prove a beneficial insect and worth a great deal of trouble to get it established in South Africa. When Mr. A. E. Lundie went from South Africa to Cornell University a year ago to take advanced studies in entomology, he was asked to search for the parasite, make a special study of its work, and, if practicable, breed and ship material to the Division. Mr. Lundie has had gratifying success, and Mr. C. W. Mally, the senior entomologist at Capetown, recently received from him a shipment of woolly aphis parasitized under observation. The material was carried from New York to Capetown in the cool-room of the s.s. "Eten," through the kindness of the captain, and arrived in apparently excellent condition, although up to the time of writing this note none of the parasites has emerged. The temperature of the cool-room of the ship varied from 34 degrees to 48 degrees. Mr. Mally was prepared for handling the material when it arrived, having been advised by cable when it left New York, and fruit-growers may rest assured that no effort will be spared to breed the parasite.

Locusts.—Outbreaks of voetgangers in swarms occurred during November in the districts of Graaff-Reinet, Aberdeen, Pearston, Jansenville, Steytlerville, and Willowmore. From not one of these districts did the Department receive any report from a resident that any winged locusts at all occurred before winter, when it must be supposed the eggs were laid. Despite all that has been said and published, it is still the exceptional farmer who distinguishes ordinary grasshoppers from the true locust when the latter insect is not in proper swarm formation. Yet the winged locust has milky white under-wings and a peculiar flight, when away from a swarm, by which it is readily recognizable. The locust has persisted year after year in the Karroo, to the certain knowledge of the Division of Entomology, and it is now breeding up rapidly in that area, as the Division apprehended it would after the recent big drought. Great numbers of flyers must have gathered together to lay their eggs to account for the true swarms of voetgangers that are now in evidence; and breeding "in open formation" and as widely scattered individuals is also continuing to take place. The latter type of breeding up is doubtless also occurring in many districts other than those mentioned. The district locust officer of Richmond in the investigation of a rumoured outbreak reported many flyers in his district; the district locust officers in the west of the Orange Free State have reported numbers, while enough scattered flyers to form a considerable swarm, were they to gather together, were reported early in November to be near Conway, in the south-east of the Middelburg district, and somewhat later some were reported on the farm Rocklyn, in the Tarka district. The last report would not be fully credited, on account of the locality being so far east from where locusts have been recorded for many years, were it not substantiated by specimens of the insect. The swarms of voet-

gangers are the most numerous in Graaff-Reinet district, where up to 26th November 132 swarms were reported to have been destroyed. The outbreaks in Willowmore district are fortunately less serious than was at first supposed when a kind of "stinksprinkhaan," occurring extensively in Baviaanskloof, was mistaken for the locust. Reports of outbreaks in central districts of the Orange Free State have also been found to be based on stinksprinkhane, insects which in all stages are strikingly coloured and quite unlike the locust to any one at all familiar with it. The stinksprinkhane hoppers are black with bright yellow markings. At Rustenburg, Transvaal, a reported outbreak was found to be due to a remarkable abundance of a grasshopper voetganger so closely resembling the genuine locust voetganger that experienced locust officers at first sight of a specimen mistook it for the latter insect; no similar case has ever before come to the notice of the Division.

BOTANY.

During the month Mr. Melle toured the Cape Province, obtaining information about lucerne growing. He visited the Sundays River Settlement at Addo, Oudtshoorn, and Robertson. In the valley of the Sundays River Settlement he was much impressed with the vast possibilities for lucerne growing. In the Oudtshoorn district he considers Mr. Edmeade's farm, where the growing of lucerne is undertaken on scientific lines, an object lesson to all growers. At Robertson Mr. Melle found that much lucerne land had gone out of cultivation and that cereals and fruit trees had taken its place.

Miss A. M. Bottomley, B.A., relieved Dr. v. d. Bijl at Durban during part of the month and undertook the inspection of potatoes imported into the Union on the mail boats She found these infected in varying degrees with *Rhizoctoma*, *Actinomyces*, *Chromogenus* (scab), and *Fusarium*. Seed potatoes, chiefly the varieties "Up-to-Date" and "Early Rose," especially those from France, were for the most part in excellent conditions. Potatoes imported from British East Africa for eating purposes were in a disgraceful condition—about 60 per cent. being absolutely rotten. Miss Bottomley attributed this to the fact that they were packed in sacks and not in cases, and were unsuitably stored on the boats.

National Herbarium.—Dr. Phillips is revising the group of plants known as the Red Pear, Thorn Pear, etc. (*Scolopia*); Miss Davison is busy on the descriptions of the various species of Cape "Saffrons" (*Elaeondendron* spp.); Miss Verdoorn is completing her account of the native "Ironwoods" (*Olea* spp.); and Miss Hofmeyr is studying the genus *Cyclopia*, which is the source of many of the commercial bush-teas; she has also completed an account of the so-called Knysna and Mountain Hard Pears (*Olinia* spp.), and has established the fact that three species occur in South Africa. Hitherto only two species were known to foresters.

Mr. Putterill, Government Mycologist at Capetown, furnishes the following notes on plant diseases in the Western Province:—

Plant Inspection at Capetown Docks.—This Division and that of Entomology are working in active co-operation. Potatoes come in

by almost every mail, chiefly the varieties Up-to-Date and Early Rose from France. Five per cent. of a mark are examined. The quality on the whole has been good—the percentage of affected tubers being very small.

Pear Scab or Fusicladium.—Scab (*Venturia pyrina*) is fairly common this season, especially on varieties which are known to be susceptible. Beurre Bosc, Jargonelle, and Clapp's Favourite are varieties suffering rather severely, with a little on William's Bon Chretien, and the Christmas Pear at French Hoek, but none on the Keiffer. The Beurre Bosc crop seems to be poor; this is ascribed to the cold spring. Spraying experiments on the control of this disease are being carried out at Mr. P. R. Malleson's farm, Ida's Valley, Stellenbosch, in collaboration with Capt. W. H. Larmuth.

Apple Scab.—I have not yet seen a single specimen of Fusicladium on apples; this is contrary to expectation, as the season seemed to be ideal for it. The reason is perhaps delayed blossoming, which is about two weeks later than usual in some parts. I was told by a prominent grower in French Hoek that the varieties White Winter Pearmain, Red New Year, and Wemmers Hoek are more susceptible than others in that locality.

Oak Mildew.—Many inquiries have been received lately about a mildew on the leaves of oaks throughout the Peninsula. There seems to be quite an epidemic of this disease this season, owing to the unusually favourable conditions. Only the *Oidium* stage has been found so far.

Peach Leaf Curl and *Shothole in apricot leaves* have been particularly prevalent this year. Owing to the sporadic nature of many diseases growers are apt to get lulled into a false sense of security, and think only of control very often when a disease is beyond control.

Flag Smut of Wheat.—This disease caused by the fungus *Urocystis tritici* Keorn. has been known in the Western Province for about 15 years, though no great loss is attributed to it. I should not be surprised, however, if the total loss caused by it for this period is very much greater than is supposed. A short account of this disease and of its occurrence in the Zeerust District, is given in the June number of the *Journal*. A common name for this disease in South Africa is *Tulp Brand*. I should be very grateful for any information from wheat growers in the Western Province on this disease, such as when it was first noticed, extent of damage caused by it, etc.

Any one in the Western Province interested in the growing of plants, whether it be on a large scale or only in the flower or the kitchen garden, who is troubled by unknown plant diseases, is requested to communicate with and send specimens for identification to the Government Mycologist, Department of Agriculture, 71 Parliament Street, Capetown.

TOBACCO AND COTTON.

On account of the early rains of this summer most tobacco and cotton crops were planted or in course of planting by October and November, and early plantings are making good growth. Work at the various centres of the Division was in full swing during the month, and a great deal of instruction was given in the culture of the crops. Spraying experiments were carried out at the Piet Retief Experiment Station in connection with the tobacco beetle.

VETERINARY EDUCATION AND RESEARCH.

Some interesting experiments have just been concluded on a disease in cattle known to the farmers as *Snotsiekte*. This disease was present in South Africa before the time that rinderpest made its appearance, and when the latter disease broke out many farmers concluded from the fact that there were many symptoms common to the two diseases that they had to deal with snotsiekte. It was a general belief amongst farmers that snotsiekte was in some way connected with the black wildebeest. As the big game receded from the Union outbreaks of snotsiekte became less frequent, until at the present time it has almost entirely disappeared.

The disease was recently brought to the notice of this Division by a Free State farmer, who has a herd of some 200 head of black wildebeest running on his farm. In the first outbreak, which occurred several years ago, a black wildebeest cow died and left a calf, which was put with a domestic cow. The foster-mother promptly contracted snotsiekte, and this case formed the nucleus of a serious outbreak amongst the cattle on the farm.

A second outbreak occurred about a year ago. During the drought the black wildebeest and the cattle were forced to drink water from the same pool. This circumstance seems to have been the cause of another outbreak of the disease amongst the cattle.

A sick cow was then sent to Onderstepoort and the disease reproduced by the inoculation of blood or serum of the sick animal into healthy cattle. Later on a few apparently healthy black wildebeest were shot on the farm, and again it was possible to produce the disease by inoculating their blood into healthy cattle. The fact was thus conclusively established that the black wildebeest acts as a host for the virus of the disease. The remarkable part is that the wildebeest itself does not appear to be affected at all by the virus.

In the course of our experiments it was established that the cause of snotsiekte is an invisible virus, but will not pass through a bacterial filter (the same as in the case of rinderpest). We do not know yet how the disease is spread; it is certainly not contagious; healthy animals can remain in close contact with diseased ones without ever contracting the disease. It is very probable that some insect acts as transmitter of the virus. The disease seems to be transmissible to cattle only.

The chief symptoms are high fever and changes in the mucous membranes. Lacrymation sets in, the eyelids become swollen, and complete blindness may result. There is a profuse discharge from the nose; the nostrils may be closed up almost entirely. Ulcers and diphtheroid deposits are generally present on the mucous membranes of the mouth, pharynx, larynx, etc. The animal finally refuses to eat, lies down, and dies. It is of importance to note that the profuse diarrhœa, which is a main symptom of rinderpest, is generally completely absent in snotsiekte.

On post-mortem examination the mucous membranes of some of the internal organs show similar lesions to those in the mouth and throat. The most characteristic change in the body is the tremendous enlargement of the lymph glands and the swelling of all lymphatic tissue (for instance, in the spleen).

The disease is almost invariably fatal for cattle. No cure is known, but the prevention would seem to be simple, inasmuch as it is merely necessary to keep the black wildebeest away from the cattle and no snotsiekte will occur.

DAIRYING.

For some time past the grading of cheese for local consumption has been undertaken only through the East Griqualand Cheese Manufacturers' Association, the Government paying half the salary of the grader and the balance being paid by the members of the association, who, in addition, supply the necessary transport from factory to factory. This scheme in itself served a very useful purpose, but since its inauguration other bodies of cheesemakers, with no such organization, also required their cheese graded for the local markets. Authority has now been obtained, however, to engage extra graders, and the Division of Dairying is prepared to undertake grading for local consumption, in any part of the Union, at a charge of ¼d. per lb. for all cheese graded. This is considered a move in the right direction, and, as all officers engaged in the work will be under the direct supervision of the Dairy Division, it is anticipated that the dissatisfaction which has prevailed during the past twelve months or so will disappear entirely.

It should, however, be borne in mind, that grading for the export trade will be, as in the past, absolutely compulsory, and the question as to whether cheese graded for local consumption will be accepted for export depends entirely on the period at which it was graded, before application for export is made. For example, it is intended to grade cheese for the local markets on similar lines to those adopted for the export trade, so that if cheese has been graded for local consumption within three weeks (or, if the report of the grader is satisfactory, within five weeks) of the date on which it is desired to export same, such grading will be accepted; on the other hand, if regrading is deemed necessary, a further charge of ¼d. per lb. for grading for export will be made.

The following are the present headquarters of the staff of the Division: Orange Free State: Dairy Inspectors Veenstra and Allison, Bloemfontein; Eastern Division of the Cape: Dairy Inspector Wilkinson, Queenstown; Natal and East Griqualand, Dairy Inspector Gow, Pietermaritzburg; Transvaal: Dairy Inspector Oosterlaak, Pretoria, assisted from time to time by other officers, when available. The staff of the Division is not at full strength at present, but when it is these arrangements may be subject to alteration, and it is quite possible that an extra officer will be stationed in the Cape Province.

SHEEP.

Mr. McCall, Senior Sheep and Wool Expert of the Eastern Province of the Cape reports that the drought there is very severe, causing great loss to the farmers. The mortality amongst sheep in the Port Elizabeth and Uitenhage districts is very high, notwithstanding the fact that food and water were never really scarce There seems to be no particular specific disease, but a kind of fever and lung trouble (including nasal catarrh) seem to be the outstanding causes of loss. He states that as one travels from the coast towards the midlands the country becomes increasingly dry, and the areas surrounding Albany resemble a parched desert. The district of Bedford is a little better, but still very dry. Owing to scarcity of grazing and water some farmers have been obliged to move their stock to the coast, East London way, and others to the Sneeuwberg. The situation is very grave, and, unless rain falls early, farmers will suffer severely in those parts of the Union.

THE SCHOOLS OF AGRICULTURE AND EXPERIMENT STATIONS.

ELSENBURG, MULDERS VLEI.

The first consignment of codling-moth larvae from Italy, in connection with the attempted introduction of codling parasites from Italy into South Africa, has arrived. Eighteen hundred codling larvae have already been collected from orchards in the district, and these, as well as others, will be exposed to parasites which may be successfully reared from the imported material in the first endeavour to establish more parasites of codling-moth in the country. Owing to the small amount of material which arrived, however, it is feared that few parasites will be obtained.

Insect pests are especially abundant in the Cape this year, because the long period of cold weather has doubtless prevented parasites from breeding as rapidly as normally. *Heliothis obsoleta*, the risper caterpillar, is particularly numerous, and has caused much damage to rape, vetches, and tobacco. Advantage is being taken of the large numbers to collect hundreds of the larvae for the purpose of determining the parasites. Considerable work was done in spraying for control of codling-moth and Fusicladium.

Cereal crops are still showing up exceptionally well on the farm lands. Harvesting of early-maturing wheats was commenced during the middle of the month. The condition of all live stock at present is highly satisfactory. There is a further falling off in egg production this month, due partly to the approaching end of the laying season and also to the large amount of broodiness in the laying-house.

On the 15th a demonstration was given at Elsenburg in the use of the "Holt" caterpillar motor-tractor. The attendance was somewhat smaller than expected. Close upon eighty visitors were present and were conducted over the various areas on which the ploughing was carried out.

During the month the senior students were taken over the National Botanical Gardens at Kirstenbosch, the Viticultural Station and Tobacco Warehouse at Paarl, also the Royal Dairies at Worcester, and the students obtained very useful instruction.

GLEN, ORANGE FREE STATE.

School.—The first students completing their diploma course leave about the middle of December. Last year only 22.4 per cent. of the total students came from the Orange Free State. Applications from intending students for next year are now being received and considered. It is hoped that a larger percentage of Free State students will take up residence when the new year begins.

General.—Activities both in the farming operations and experimental and research work are extending. This is due mainly to considerable increases in the staff. The two officers recently appointed for extension work in the Orange Free State, viz., Miss. R. Oosthuizen for domestic science and Mr. Oliver for poultry are engaged in travelling round the country districts giving lectures and advice. The effect of their activities is already being felt, and has resulted in a substantial increase in correspondence on these two subjects. Associations or groups of individuals requiring the services of these officers should apply to the Principal of the school.

GROOTFONTEIN, MIDDELBURG (CAPE).

Special Sheep and Wool Course.—Mr. E. N. S. Warren, Lecturer in Sheep and Wool, reports that the second sheep and wool course was, if anything, even more successful than that of the previous year. Like the former, it started in April and finished in November. The number of students was limited to thirteen (13) and two (2) apprentices, all of whom completed the course, while the number of applicants for the course numbered seventy-eight (78). The thirteen elected were those who passed highest in the entrance examination.

The course was conducted in the main by Messrs. Warren and Mellet, who gave all the sheep and wool lectures, demonstrations, and judging lessons; and those pertaining to animal nutrition, sheep dips and their properties were given by Mr. A. Stead. The course included also the histology of the wool and other textile fibres, external and internal parasites affecting sheep, by Mr. Wahl; the principles of breeding, and foods and feeding, by Mr. Cooke; sheep diseases, by Mr. Fourie; and fodder crops, by Mr. Donkin.

Whenever either Messrs. Mellet or Warren visited sheep breeders to class or mate sheep, a few students accompanied them; in this way every student was given an opportunity of seeing other studs and flocks.

During July all the students were taken by Mr. Mellet on a circular tour among some of the leading stud breeders of the district, where much useful knowledge was gained, as the students were given every opportunity by the breeders to inspect their studs. The places visited were: Onbekend (Max Von Below), Gordonville (R. P. Kingwell), Haartebeestefontein (H. A. Peterson), and Sunnydell (E. Staples). Later on in the course the students were shown over those well-known stud farms Hillmoor (F. W. Southey) and Waterfall (H. L. Southey), in the Steynsburg district, and Grassdale (J. S. Minnaar), in the Graaff-Reinet district. The value of such visits is very great, and we are indebted to all these breeders for their kind hospitality and assistance in helping forward the education of the special sheep students. Roderick's Bloemfontein ram sales were also attended during the term.

Towards the end of the course, first-hand knowledge was gained of wool-selling conditions and methods of arriving at valuations, among the wool brokers of Port Elizabeth, and one of the first stages of manufacture was seen at Richardson's Wool Washeries (Port Elizabeth). The Produce Association of Port Elizabeth did everything to ensure the success of the visit, both from the educational and social aspect, and this under very different circumstances to those during the "boom" prices of last year.

The final examinations were held early in November. Mr. G. J. Schuurman examined the students in sheep judging, and set a written paper in the theory of the subject. The results were most satisfactory, as shown below:—

First-class Diploma.—Wyche, C. R., Grahamstown; Dirck, A. E., East London; Rider, J. F. V., Graaff-Reinet; Wessels, N. G., Winburg, Orange Free State; Du Toit, T. A., Belfast, Transvaal; De Wet, J. F., Cradock.

Second-class Diploma.—De Zwaan, C., Pretoria; Lipschitz, J., Oudtshoorn; Hensley, A. E., Graaff-Reinet; Connock, C. O., East

London; Bartmann, A., Johannesburg; Badenhorst, I. P. J., Graaff-Reinet.

The following students have been recommended for scholarships: Messrs. Wyche, Rider, and Du Toit for further study of sheep and wool; Mr. Wessels for Angora goats and mohair. These students showed great promise and much benefit is expected to result from their further studies.

It is intended to hold a similar course in 1921, commencing immediately after Easter, which will again be limited to twelve (12) students. All candidates will be required to pass an entrance examination before being admitted. There is no doubt that this special sheep course occupies a unique position, and it is very much doubted if there is any other institution in existence in the world which gives students so good an opportunity of gaining special and general knowledge so suitable to sheep farming in South Africa.

Lucerne.—In the Hankey area, Hunter River and French Provence have both, up to the present, given 2¼ ton per cutting per acre. Spanish lucerne has been attacked by rust. In the Uitenhage area, Chinese lucerne which was sown on the 28th May, 1920, was cut for the fourth time on the 9th of November; the foliage was remarkably good, and the cuts throughout the winter gave heavy yields. There is no doubt that this lucerne, which has now been under test at Grootfontein for the past ten years is the finest variety that has ever been imported into the country.

The experiments in the Sundays River Valley are progressing slowly, due to the lack of water.

POTCHEFSTROOM, TRANSVAAL.

An investigation in the use of charcoal, made from different varieties of eucalyptus woods, for producing gas in the suction gas-engine has been begun by the Lecturer in Engineering. Tests in duplicate have now been carried out, using as a fuel charcoal from five different varieties of eucalypts during a 6-hour run at slightly over 7 brake-horsepower The results of these duplicate tests have been consistent. The fuel consumption showed no further difference than 3 per cent. in any duplicate test. Gas analysis and test for the volatile matter in each charcoal were made.

Most of the experiments in summer crops have been laid down. Winter cereals have been harvested. The wheat crosses developed satisfactorily, and selections have been made for the continuation of this work, which has for its principal objct the production of a rust-resistant wheat. Breeding plots of Potchefstroom Pearl and Chester County maize have been planted on the "ear to row" plan. In the orchard, cherries have proved a failure. Apricots, some varieties of peaches, Japanese plums, and pears promise a good crop, but the fruits will be small, due to the lack of rain.

Live stock are in good condition. The drop of spring calves has not been very satisfactory, due to the drought of last year. A calf-feeding experiment in the hand-feeding of calves, using different substitutes for the fat in milk, has been got under way.

Shearing has just been completed. The Wanganella flock, of approximately 150 head, averaged 11¾ lb. wool per sheep. The Romney Marsh flock yielded an average of 10 lb. The Romneys are proving shy breeders, only 16 lambs being obtained from 26 ewes.

CEDARA, NATAL.

Chemical Laboratory.—Some dip fluid from a tank in the neighbourhood was analysed. This tank has not been used regularly during the past year. Although either some arsenite of soda or fresh raw dip has been added to the tank several times during this period, a large proportion of the arsenic present in this tank when analysed was always in the oxidized state, as shown by the following table:—

	Unoxidized Arsenic. Per cent.	Total Arsenic. Per cent.
28th October, 1919	.055	.098
1st November, 1919	.084	.143
23rd January, 1920	.081	.146
12th March, 1920	.054	.105
3rd June, 1920	.061	.162
26th August, 1920	.101	.201
8th November, 1920	.091	.147

The above figures prove that very often in practice a large proportion of the arsenic in the dipping tank has become oxidized, and the presence of this oxidized arsenic is not shown when testing with an isometer or similar instrument. It is estimated that the oxidized arsenic (in the form of arsenate of soda) has about half the killing and scalding effect of unoxidized arsenic (in the form of arsenite of soda). It is therefore very important that farmers should periodically forward a sample of their dip fluid to one of the laboratories of the department to be analysed as a check on their own tests.

Apiculture.—Studies of the life-history of the common bee louse (*Braula caeca*) made during the month have cleared up some long-standing errors in connection with our knowledge of this minute parasite of the bee. In the textbooks this louse is said to be nearly allied to the sheep ked and to have a similar life-history. But this is not so; the eggs do not hatch inside the body of the female louse, but are deposited on the brood combs where they are easily visible as minute white specks. The eggs hatch out into minute maggots very similar in general form to the common housefly maggot. The maggots make their way into cells containing bee larvae and feed on the food supplied to the bee larvae. Beyond robbing the brood of a little of their food they do no harm. The Braula maggots change into chrysalids inside the cells beside the bee pupae. In a few days the adult bee louse leaves the chrysalis and makes its way on to a young bee. The adult louse feeds on honey. Unless they become very numerous in a hive, their presence may be disregarded.

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AGRICULTURAL ADVISORY BOARD.

Important Proposals regarding Disease Eradication, Citrus Canker, the Anthrax Danger, Proposed Poultry Division, Agricultural Co-operation, etc.

THE Agricultural Advisory Board met at Pretoria on the 2nd and 3rd December, 1920, the Minister of Agriculture (Hon. F. S. Malan) presiding, and the members present being Messrs. C. H. Mackay, P. R. Malleson, T. T. Hoole, R. A. Hockley, Jno. Venter (Cape Province); Major R. D. Doyle, Major E. W. Hunt, Messrs. D. Allam, H. van der Merwe (Transvaal Province); Messrs. G. A. Kolbe, C. H. Olivier (Orange Free State); Mr. G. H. Bridson (Natal Province); with the Secretary of the Board (Mr. D. M. Eadie).

The Secretary for Agriculture (Mr. P. J. du Toit) was present, and other officers of the Department attended as required.

The Minister welcomed the members of the Board, and on the first item of the agenda, i.e. resolutions passed at the Durban Congress, raised the question of procedure in connection with resolutions passed by Provincial Unions. His attention had been called to this by the fact that a few days before the Transvaal Agricultural Union had met him, and placed certain resolutions before him. He felt that the delegates were speaking for the Transvaal, whereas he was Minister for the Union, and what applied to the Transvaal must apply to other parts of the Union. There was a distinct difference between having these resolutions presented by a Provincial union and a body which could guarantee that it could deal with them from a Union point of view. He asked the Board to suggest some principles by which work could be co-ordinated and sent through the Board as the executive of the South African Agricultural Union. At a later stage of the conference the Board brought up the following resolution covering this matter:—

1. All resolutions passed by agricultural organizations, which affect more than one Province, or the Union as a whole, must be presented to the Government through the medium of the executive of the South African Agricultural Union.

2. All delegations presenting resolutions to the Government of a purely Provincial nature must be accompanied by at least one member of the executive of the South African Agricultural Union and Provincial secretaries must send to the secretary of the S.A.A.U. copies of such resolutions prior to presentation, also copies of decisions arrived at.

3. The Board considers that in order to provide the necessary continuity and cohesion, it is desirable that the Advisory Board should meet at least four times in the year.

Compulsory Dipping.—Resolutions passed at the Durban Congress were then taken *seriatim*, the first dealing with compulsory dipping and the second with the method of putting compulsory dipping into effect.

The Minister pointed out that the resolutions brought forward for the first time the policy of dealing with ticks instead of with tick

diseases, and the question arose: who was to pay for it? If the Board favoured this policy, were they prepared to recommend means by which it could be financed?

Discussion turned upon the eradication of scab, the Secretary for Agriculture describing the additional services which the Department was asked to give, involving a considerable increase in the vote for scab control, and drawing attention to a recommendation which had been made by the Public Accounts Committee of Parliament for defraying the expenditure on scab eradication.

The Minister asked the Board to go into the question raised in so far as it affected scab and East Coast fever in order to see if a feasible scheme could be devised on the lines suggested, and at a later stage an important resolution was accordingly presented, which will be dealt with in a later issue of the *Journal*.

Citrus Canker.—The Board discussed very fully the position of citrus canker, the position being that three farms were infected, that Government was being urged to spend a large sum in destroying the infected orchards, and that Government hesitated to do this, because there was no guarantee that with this destruction there would be an end to expenditure of this nature. In this case also the Board postponed a decision, and at a later stage brought up the following resolution:—

1. That Government be asked to immediately destroy all infected or suspected orchards, the estimated cost being based at £4 per tree, the total cost being estimated at about £70,000.

2. On condition that Government agrees to immediate destruction the growers and exporters of the Union shall contribute one-half the cost by one or other of the following means—

(*a*) That a tax be levied on all citrus and deciduous trees per 1000, the tax on deciduous to be half that on citrus.

(*b*) If Government considers this method too cumbersome, it is proposed that a tax be levied on all fruit exported per ton in the same proportions as in (*a*).

3. That the tax be spread over a period of two or three years.

Branding Laws.—On a resolution dealing with branding the questions stated were (1) whether it was advisable to bring in a uniform law, (2) whether it ought to be compulsory, and (3) whether it should be laid down by law or regulation the place where a brand should be put. The last point arose out of complaints of deterioration of value of hides on account of brands being put on the more valuable parts. On this subject the Board was informed that a Draft Bill was in existence, and copies are to be circulated among the members.

Veterinary Surgeons.—The need for an increased number of veterinary surgeons raised the question of public expenditure again, and a suggestion being made to make the profession in South Africa more attractive by allowing private practice, the Board confirmed a proposal to appoint as an experiment Government veterinary surgeons in two or three districts, who would be allowed to attend to non-scheduled diseases when called upon by private individuals on a schedule of fees to be fixed, the fees to be paid into revenue.

East Coast Fever.—A resolution requesting further investigation into the tick as a carrier of East Coast fever, curative measures

for the disease, and the effectivity of modern methods of dipping was discussed, and brought the information that these things were being done.

Pirbright Testing Station.—In reply to a resolution urging more accommodation at Pirbright Station and another station in the north of the United Kingdom, it was stated that congestion took place because of the habit of importers wanting their animals passed through at the same time, and to assist in remedying this the good offices of the breed societies are to be requested.

Spread of Anthrax.—The Board discussed proposed measures for dealing with this disease which is now being recognized as a serious danger not only on account of animal mortality, but also on account of the threat to hide, skin, and wool export. It was stated that it was proposed to bring about disinfection before exportation, but this was a very difficult matter, and the co-operation of exporters and Chambers of Commerce had been asked. So far as farmers were concerned, the Veterinary Department would lose no opportunities of impressing the danger of the disease, and the urgent necessity of burning or deep burying of carcasses.

Nagana.—A resolution requesting investigation into Nagana and condemning the action of the Government in placing settlers on farms subject to this disease, elicited the information that the settlement was made by the Lands Department; the Agricultural Department had nothing to do with it. The Minister explained what was being done about killing off game and double fencing the northern boundary of the settlement. In regard to investigation, the life-history of the tsetse was comparatively unknown, and they were appointing an officer of the Entomological Section to go down to Zululand and investigate this. The Imperial Government had a scheme in hand for investigating tropical diseases, to which the Union was asked to contribute. The Union Government was taking up this work of the tsetse fly, and that would be their contribution to that investigation. They also wanted a man who would investigate the disease. That was a matter for the Research Department, and he was arranging with that Department to send down a man. They wanted also a veterinary surgeon to advise the farmers, but they had not been able to place one nearer than Eshowe. They had appointed a good stock inspector to go to the settlement at frequent intervals, and the veterinary surgeon would also proceed there when requested. The Minister promised to make inquiries whether the settlers had been warned about the fly before taking up the lands.

Among other resolutions of the Durban Congress dealt with were: Advertising of South African products, regarding which the Minister explained the Government's forward programme; the limitation of prices, which, the Minister thought, was over; the appointment of an agricultural economist, about which the Minister said they would be guided by the circumstances arising out of increasing necessity for scientific knowledge in the country; the wool position, on which subject the information already made public was given; banking facilities, in speaking about which the Minister explained that the alleged financial support given by Government to a manufacturing industry merely amounted to a contract with the Pretoria Iron Works that the Railways would take half its requirements from them

provided their prices were no higher than those for similar imported goods; weights and measures, about which the Minister said that a Bill was prepared; grain elevators, in connection with which it was explained that these were being proceeded with, and that Mr. Littlejohn Philips had been engaged as consulting engineer; and a promise was made to consider a suggestion to send officers to America to become familiar with the practical working of grain elevators.

Co-operative Societies.—The Board having had placed before them by the Secretary for Agriculture the Department's estimates for next year, a discussion arose on the position of agricultural co-operation as affected by non-limited co-operative societies, and a proposal to take them out of the control of the Agricultural Department and place them under the Land Bank. It was pointed out that the Agricultural Department acted as advisers and guides to these societies, and not merely as inspectors. The Board took the view that the original bargain under which these societies were started placed an obligation on the Agricultural Department to see them through, and passed a resolution in the following terms:—

> That this Board is of opinion that while the present system obtains, it is essential that the Agricultural Co-operative Division of the Department should be maintained.

Training Farms.—The Secretary for Agriculture announced that Government proposed to establish three training farms in connection with land settlement, one at Indwe, one at Standerton, and one at Oakdale (south Cape Province). These would rank as agricultural schools for a type of men who wanted practical training for about a year. Hartebeestpoort, which had been used as a farm for returned soldiers, would be transferred to the Phthisis Board.

Conference of Departmental Officers.—The Secretary for Agriculture explained that a system had been established of holding monthly meetings of the principal officers of the Department, with a view to informing each other what they were doing.

Poultry Division.—Considerable discussion arose regarding a suggestion to create a Poultry Division. While recognizing the growing importance of the poultry industry, it was made apparent that to establish an effective Division would require the appointment of a man with scientific as well as practical attainments in poultry culture, and such a man was not available. However, the Board recommended that with the staff available, and without creating a special Division, organization could be commenced and steps taken to provide for the suitable training of a young man for ultimate control of this particular class of agriculture.

Geneva Conference.—By resolution of the Board and on the invitation of the Minister to recommend a delegate to the Geneva Conference on Labour, Major R. D. Doyle was nominated to represent employers. Going fully into the agenda of the Conference, it was apparent that 75 per cent. of the items bore directly on agricultural labour, and therefore it was important that some one well acquainted with South African conditions should be appointed.

(*Note.*—The question relating to veterinary surgeons will be elaborated in a later issue.—*Editor.*)

THE TOBACCO SLUG (*LEMA BILINEATA* GERMAR).

By C. P. VAN DER MERWE, Division of Entomology, Durban.

TOBACCO, an introduced plant, has until recently been considered free from particularly serious pests in the field. Our native insects have not been found to give much attention to it, probably because no plants of the genus to which tobacco belongs are indigenous to South Africa; but now a beetle has come to the front which may have to be taken very seriously into account. It is given the popular name of Tobacco Leaf Slug, from the appearance of the larvae. It appears to have its native home in South America, and the probabilities are that it was introduced into South Africa during the Boer war, when large quantities of forage and other such military supplies were shipped from the Argentine. The adults of the tobacco slug rest during the winter for several months, and bales of produce or other articles from infested countries might transport beetles which had gone into them to hibernate.

The insect was first observed by the writer in Durban in 1916 feeding on *Physalis lobata*, an introduced plant and a common weed. When it was recognized as a potentially dangerous pest, he undertook to make it a subject of special study, and is still engaged upon the question of control.

The determination of the species as *Lema bilineata* was made by the Imperial Bureau of Entomology, London.

OCCURRENCE IN SOUTH AFRICA.

As far as is known, the insect was first observed during 1911 at the Cedara Agricultural School, Natal, and was brought to the notice of the Natal Entomologist of the time, Mr. Claude Fuller, to whom it did not then appear more than a potential pest of tobacco. In January, 1913, it was again reported from Cedara, and the following year brought to the notice of Mr. W. B. Wilson, Tobacco and Cotton Expert, from Richmond, Natal. In the beginning of 1915 it was reported to the editor of "Izindabu Zabantu" by a native correspondent from the Ixopo Division, Natal, who stated it to be new to the natives of the district. The pest was also reported from Swinburne, Orange Free State, in February, 1915, and in April a report received showed that it had been injurious to tobacco at Tarkastad, Cape Province. About the same time the beetle was collected by Mr. C. Barker, of the Durban Museum, at Malvern, near Durban; and it is likely that it has been there for a much longer period. During 1917 the insect was reported from Rietvlei, Mooi River District, Natal, where, it was said, it had been injurious five years previously. Towards the beginning of 1919 the manager of the Piet Retief Government Tobacco Station reported the pest; but from inquiries afterwards made it appeared that it had been known in the district two or three years before. It was first noticed, as far as could be determined, on two farms about 21 miles apart, which indicates that it was then widely distributed in the district but not present in

great numbers, and, therefore, not drawing attention. In 1919 it was further reported by the Magistrate of Paulpietersburg, Natal, and its presence in the adjoining district of Wakkerstroom, and in Swaziland, became known.

In 1920 it was located by officers of the Division of Entomology near Bathurst, and also near East London, Cape Province, and at Verulam and Umkomaas, Natal.

Farmers and others who may observe the insect in new localities, whether feeding on tobacco or other plants, are requested to communicate with the Division of Entomology.

NATURE OF INJURY.

The damage done to tobacco in the field is thus described by Mr. G. C. Haines, of this Division: "At first the lower leaves of the plant are attacked. The eggs are laid almost invariably on the under-sides of the leaves in close masses of 15 to about 40. The slugs, on hatching, start to feed near the old egg mass, feeding in an enlarging circle, and lined up side by side. At first they are gregarious and attack only the lower surface of the leaf. Later they separate and eat large ragged holes through the leaf. If many larvae are present on a leaf in a short time only the midrib and a few large side ribs will be left. In the seed-beds the mode of attack is similar, the centre plants, which are close together, being attacked first. In some seed-beds half the plants were destroyed, dozens of larvae being found on every leaf, and I was told that, at other places, the plants, both in the seed-beds and in the fields, were completely destroyed." Mr. Haines was informed that tobacco in the curing-sheds, and even in the bales, was also attacked; but, as was suspected by him, and afterwards confirmed by Mr. J. C. Faure, of the Division, this only takes place whilst the tobacco is still green.

The method of harvesting tobacco in the Piet Retief District is to cut the whole plant and hang it up in the shed to dry. The drying takes more than a month, and there is time for larvae brought in on the plants to develop to maturity. The damage done in sheds is very great, and, perhaps, relatively greater than in the field, as the insects are better protected from natural enemies and unfavourable climatic conditions. Such damage can be prevented by other methods of drying the tobacco, but it is thought that the damage in the shed will be trifling if the pest is properly controlled in the field.

DESCRIPTION OF STAGES.

The Egg.—The eggs are oval in shape, about one-twentieth of an inch long and half of that in width. They are dirty white to yellow in colour, the latter colour being more prevalent. They are covered with slime, which does not dry but remains a long time sticky, though it may change to a dark colour. In appearance the eggs somewhat resemble those of ladybirds, but they often show black tips. This may be due to either of two causes. Sometimes there is at the tip a little excess of the slime with which the eggs are covered, and, when this turns dark, the tips appear black. Then, again, when the eggs are ready to hatch, the black heads of the larvae inside show through the shells at the tips.

The Slug and Cocoon.—When hatched the slug-like larva is about as long as the egg from which it emerged. It is also sticky, though it has not yet a visible slime upon it. It is greenish in

colour, with a shining black head. It is full grown when it is about three-tenths of an inch long, and ready to enter the soil to pupate. It constructs a papery cocoon almost as long as its body, white in colour, but usually appearing of the colour of the soil which clings to it.

The Adult.—The adult is a small black and white beetle, about one-fourth inch long. The females are, as a rule, slightly larger than the males, and can usually be recognized by their more distended abdomens. The pale markings of the beetles are not pure white; they are more or less a creamy colour on the wing cases and a light lemon on the other part of the body.

The most conspicuous character is found in the two pale stripes on the wing cases. These run parallel down the back, bending outwards, before they reach the end, to join a narrow white margin on the outside edge, and thus leaving the tips black.

There are two black spots on either side of the thorax. These vary in size, and beetles are not uncommon which have the thorax all black. The bases of the antennae and of the thighs, and certain areas on the under-side of the body, are usually light coloured; but specimens are found which have these all black. Some, again, have pale wing cases, the black only showing slightly or not at all.

LIFE-HISTORY AND HABITS.

The Egg.—The eggs are laid standing up close together in clusters, usually on the under-side of the leaves; but, in breeding jars, eggs may be laid also on the upper surface, or on the stems, fruit, or flowers, and sometimes on the sides of the jar. Up to as many as 57 have been found together; but clusters of 10 to 30 are more common than larger ones. Rarely are eggs found singly.

The beetles under observation in Durban in 1919 laid their last eggs on the 10th of April. In 1920, beetles kept in jars on the north side of the room, where the temperature was higher, continued active much longer. On a visit paid to Piet Retief, 15th April, 1920, only one full-grown larva could be found, and the conclusion was arrived at that there the latest eggs deposited were laid about the end of March. Some beetles were already in hiding; but others were still present on the tobacco plants, no doubt recently emerged beetles feeding preparatory to going into winter quarters.

At Durban the period during which the beetles did not feed was about four months. Eggs were found again from the 4th September, and beetles were observed to be feeding two days before any eggs were seen.

The egg stage varies in Durban from four to seven days. At the beginning of the season the period was seven days, and as the season advanced it diminished, though not regularly, as at times it somewhat lengthened again, till in the middle of summer the eggs took only four or five days to hatch. Climatic conditions evidently govern the length of the egg stage to a great extent; but other factors are also concerned, as shown by the fact that eggs from different beetles varied in their periods of incubation, a difference of as much as two days having been observed in the times of hatching of eggs laid by different females at the same time. As will be pointed out later the duration of the egg stage is of some practical interest.

Some eggs do not hatch, and it was observed that certain beetles

laid more eggs that failed to hatch than others. Under natural conditions it may be expected that the number of eggs laid and their vitality will be greater than in breeding jars. We have, therefore, no reason to discount the egg-laying powers of the beetles.

When the female has started egg-laying, she lays practically every day. The greatest number of eggs found for one day was 69, and the average for the whole egg-laying period 22. The greatest number of eggs obtained from one female was 2421, and the average number 1225. The egg-laying period lasted from fifteen to one hundred and twenty-four days, with an average of sixty-five, the time spent in hibernation not included.

The Larva.—The larva, on hatching, starts feeding at once, and grows rapidly. The first moult takes place when it is two to four days old and about one-tenth of an inch long. The second when it is from four to seven days old and about an eighth of an inch long, and the last moult when it is from six to ten days old and about a quarter of an inch long. The larva is ready to enter the ground two to four days later. The actual period of larval life before entering the soil was found to be from seven to fourteen days. In summer eight to ten days was the general rule.

The larva collects its excrement in a soft mass on its back, and from time to time the excess drops off. The excrement is moved forward from behind by undulating motions of the body. The mass appears to be kept moist by a liquid from the anus. The slimy covering increases the slug-like appearance of the larva. When disturbed the larva flings back its head, and a greenish liquid issues from its mouth. When the disturbance has passed off, it slowly sucks this liquid back, moving its jaws during the process.

The Cocoon.—When ready to pupate the slug enters the soil and forms a cocoon with a white froth from its mouth. It must be more or less covered to be able to construct its cocoon, as on the surface, or when only slightly covered, it wastes much of the foam without succeeding in surrounding itself therewith. If it cannot form a cocoon, the larva may pupate naked.

In the field cocoons occur at the base of the tobacco plants, from one-half inch to one inch down in the soil. Larvae maturing in the tobacco sheds usually drop to the ground, and their cocoons have been found in loose soil on the floor. Some may form their cocoons in the hanging tobacco. Cocoons have been observed in cracks in a rafter of a tobacco shed, but this is an unusual position, and probably at some time infested tobacco had been hanging in contact with the rafter.

The Pupa.—Pupae were found in the cocoons three days after these were constructed. The pupal stage of naked insects was found to be from six to eight days. Beetles which develop in cocoons apparently wait a few days before they emerge, if undisturbed. The time from when the slug enters the soil to the emergence of the beetle has been found to be from ten to nineteen days, and the full period from the hatching of the egg to the emergence of the beetle from seventeen to thirty days, the longer developments being those early in the season and the shorter those in summer.

The Adult.—The beetles are comparatively long lived, but occasionally an exceptional one is found dead after a few days. Under observation the longest lived females were those which hibernated.

They were observed to live from 194 to 284 days, with an average of 230 days. Females, emerged in spring, lived up to 131 days, with an average of 80 days. Males under observation lived up to 219 days, with an average of 87 days. No males have been carried alive through the winter; but it is considered that some also hibernate. It must be borne in mind that the observations were made in Durban, which has a comparatively hot climate, and that the periods may be more protracted where the climate is cooler. It is quite probable that the life-history on our high veld is considerably longer.

Females were found to lay their last eggs from one to nine days before dying. Except in the case of those which emerged late in the season and hibernated before egg-laying, the females usually started to lay from the fourth to the seventh day after emerging; but in some cases the first eggs were laid from the eighth to the fourteenth day.

Beetles copulate before any food has been taken, often on the first day after emerging, but, apparently, no eggs are laid before the female has fed. Unmated females may lay eggs. Their eggs are fewer in number and laid more scattered, and more single eggs are laid. No unfertilized eggs have been found to hatch. A female which laid only unfertile eggs after hibernation, was put with a male six months after emerging, and was then fertilized. Fertile females may hibernate and then, without having mated again, lay eggs which will hatch. This is of some importance, as it shows it is possible that hibernating females may set up new centres of infestation.

When hibernating, the beetles may rest for months on the same spot, and in cold situations they probably remain in one place all the time; but in Durban they have been observed to move about occasionally, although not to feed, even when placed on their food-plant. They must feed first to be able to hibernate. Beetles emerging late in the season, when others were already hibernating, died after two to four days when not supplied with food, while those which were fed hibernated successfully.

The kind of situation chosen by the beetles as hiding-places for the winter is indicated by Mr. David Gunn, of the Division, in these words:—

"When at Bathurst District a few days ago (June, 1920), I visited the farm where I had found *L. bilineata* last summer, and was informed by the owner that the insect was hibernating in thousands in his cupboards, wardrobes, clothes, in bedrooms, and in every available place where warmth could be obtained. I was able to confirm his statements."

At Piet Retief hibernating beetles were found under stones and in the sheds amongst both loose and baled tobacco.

When handled, the beetles give off a rather offensive odour. Sometimes they make a cheeping noise. They can fly well, but, when disturbed, they usually drop to the ground and often feign death. Occasionally, however, they at once take flight. In the early morning and on dull days they are more sluggish, and are then more easily collected. The males are more active than the females.

NUMBER OF GENERATIONS.

In Durban the possible maximum number of generations in the year appears to be eight; but the average number from one

overwintered female will be smaller, owing to the extended egg-laying period, it being possible for a female to be still laying long after her first progeny have become parents. In cooler climates, too, the number of generations will be less. In Durban the time from the laying of an egg till the resulting beetle that egg develops lays its first eggs has been found to vary from twenty-eight days in summer to thirty-six days in September.

FIG. 1.—The Tobacco Slug. *a. b.* Injured tobacco leaves. *c.* The beetle enlarged; *d.* the same, natural size. *e.* The cocoon, enlarged. *f. f.* Beetles escaping from cocoons. *g.* An assassin bug, an enemy of the pest.

During the last winter some beetles in a jar near a window on the north side, where they were warmed up during the day, continued egg-laying up to the 22nd of June, and started again on the

20th of July. The eggs in the cold weather took up to nine days to hatch, the larvae up to five days to the first moult, up to five for the second moult, four days to the third moult, eight more days to the time of entering the soil, and twenty-eight days before the adult emerged. The conditions were abnormal; but the observations are interesting as showing the maximum periods for the different stages so far recorded.

FOOD-PLANTS.

Besides on tobacco, the slugs have been observed either in the field or in the laboratory to feed on Cape gooseberry (*Physalis peruviana*), the wild Cape gooseberry (*Nicandra physaloides*), *Physalis minima*, *Physalis lobata*, and on other species of *Physalis*, and thorn-apple, or stinkblaar (*Datura stramonium*) and *D. tatula*; while *Salpichroa rhomboidea* is reported from the Argentine as a food-plant. All these are solanaceous plants, and none of them known as natives of South Africa.

The insect seems to be somewhat restricted in its range of food-plants, as not all solanaceous plants can serve as food. Tomato, potato, capsicum, brinjal (*Solanum melongena*), inkberry (*Cestrum aculeata*), *Solanum aculeatissimum*, *S. auriculatum*, and two other solanums were tried as food-plants and found not suitable. A few plants, not belonging to the solanaceae, including sweet potato and lucerne, were also tried, and were refused.

However, speaking of the insect at Cedara, Mr. S. H. Skaife, Lecturer in Entomology there, says: "The beetle occurs on potatoes, although the damage it does is slight. I notice that in the potato fields *Datura stramonium* is almost defoliated, whilst the surrounding potatoes are hardly touched."

Some food-plants seem to be much preferred to others. In Piet Retief serious damage to tobacco is being done, but Mr. Faure found *Datura* and *Physalis* growing close to infested tobacco, practically free, while *Nicandra physaloides* was more infested than the other two weeds growing in the same garden.

The adults appear to have the same food-plants as the larvae, but they are not so voracious and do not do so much damage.

MEANS OF DISTRIBUTION.

The beetle must have been artificially transported from South America, but we do not yet know enough of its distribution in South Africa to say whether its range has been extended by natural spread or whether it has also been carried by traffic from one place to another. That the beetles will enter mine-props, bales of wattle bark, and tobacco, or other produce, is quite likely. The greatest danger would appear to lie in bales of tobacco. Beetles emerging in a tobacco-shed and finding there tobacco still green, would feed and hibernate in the shed, and possibly enter the tobacco bales. Beetles have been found in bales brought from farms into Piet Retief. The greatest danger of transporting beetles is no doubt during the time they are hibernating. In the summer, it has been observed, the beetles may also enter a resting stage for as long as two weeks, but such resting periods are exceptional; and, further, tobacco bales then shipped would most likely be from the previous season's crop. Hibernating beetles would have gone from them, and no fresh beetles would yet have emerged in the sheds.

EFFECT OF DROUGHT.

According to certain reports, the pest is greatly favoured in Piet Retief by wet weather, and during dry spells it is said to do little damage. It was also observed at Umkomaas by Mr. R. H. Harris that over moist soil the pest was much worse than on dry. The explanation at the latter place might have been that ants were numerous on the dry soil but not where the ground was wet. In the laboratory at Durban there was no greater mortality of the slugs during hot dry weather than at other times; but heat and evaporation are greater in the open than under a roof; and it is drier in most inland tobacco areas than at Durban. There remains a hope that the pest will not thrive in the drier parts of the country.

NATURAL ENEMIES.

The insect being an introduced species and the larva being protected by an offensive excretion and the beetle by an offensive smell, probably accounts for the small number of natural enemies which as yet have been observed attacking it; but it belongs to a genus which is well represented in South Africa, and it is therefore likely that we shall find native parasites taking to it in increasing numbers. However, they may never keep it down sufficiently to make control measures unnecessary.

The most effective enemy observed is the "Bighead" ant (*Pheidole punctulata*), and in Durban no infestation by larvae of the insect has been found on dry friable soils, which this ant seems to prefer. Larvae put amongst these ants were soon destroyed. Another ant, *Myrmecaria eumenoides*, has also been found to carry off the slugs, but not so readily as *P. punctulata*, and it may not be an effective enemy. The common "Malmier" (*Plagiolepis custodiens*) is apparently useless against the pest. Sometimes one of these ants has been seen to touch a slug, but to recoil from it with actions expressive of the utmost disgust. Other ants, no doubt, will attack the pest; but the question whether ants can be profitably encouraged in tobacco fields has not been investigated.

At Piet Retief, and also near Durban, assassin (Reduviid) bugs of different species have been seen attacking both beetles and slugs. A spider was once observed carrying off a young larva, and at another time a spider got into a breeding jar, and was found spinning up a beetle. Droppings of a bird were seen with what appeared to be elytra of this beetle, and an aphis lion has been observed attacking the larva. Chickens and turkeys are reported to feed on the slugs, and may prove useful in keeping the pest down. Cocoons exposed outside to attract possible parasites were found eaten out, apparently by a rat or a mouse.

CONTROL MEASURES.

Though many experiments have not yet been carried out on the control of this insect, it is considered sufficiently proved that it can be kept down successfully.

Hand-crushing.—The crop at the Piet Retief Experiment Station was kept free this year entirely by hand-crushing. This method is expensive; but that it can be effective is shown by the fact that the shoots which sprung from the stumps, though not attended to, grew up uninjured. This would seem to show that thorough control early in the season may prevent later trouble, providing there

be no nearby sources from which a heavy reinfestation may come. The question of the weeds, on which the insect lives, may, therefore, be of importance. It is necessary to go over the plants frequently. I was told that at the Experiment Station the examination was made every three days. Apparently only the slugs and beetles were destroyed. As the eggs take from four to seven days to hatch, and the larvae from two to four days before they moult the first time, and become seriously destructive, it will be seen that if the eggs could be destroyed too, an examination once a week or once in ten days should be sufficient.

It seems worth while to try and kill as many of the beetles as possible when searching through a field, though it is not yet known what proportion of those present can thus be destroyed. In sunny weather some are likely to take flight; but it is said that if the beetle is shaded with the hand it can be easily secured.

FIG. 2.—The Tobacco Slug.
Slugs on leaf of datura.

Spraying.—As the insect is a leaf-feeder it may be killed by applying a stomach poison, like arsenate of lead, to its food-plant, and this method of controlling it will probably become more and more popular. Arsenate of lead is recommended, because it is safe for the plant, sticks well, and its readily procurable. It is also now manufactured in the country. It is obtainable in paste form and as a dry powder, and is applied as a spray, used at the rate of 2 lb. of paste or 1 lb. of dry powder in 50 gallons of water. The powder is double the strength of the paste, and is generally preferable, except when the paste is relatively cheaper.

Some people have tried arsenite solution from the cattle-dipping tank. Usually one trial was enough to prevent another, but, as it has been stated that good results have been obtained with weak dilutions, it may be that others may still be led to experiment with it. It is, therefore, necessary to utter a warning against the use of cattle dip. A poison like arsenite of soda should stop in the dipping tank

and not be carried about the farm, where either the poison itself or the vessels in which it was contained may be a danger to animals and men. When put on plants it causes severe injury, if not complete destruction. Arsenate of lead is also an animal poison, but it is much less virulent; of course, it must not be used carelessly. It is insoluble in water, and, therefore, the mixture must be frequently stirred during its application to plants. The simplest method of applying the spray is probably that of sprinkling by means of a small broom, as carried out by Mr. Geo. Reid, of Piet Retief. He states that when the plants are about a foot high, in his experience the most important time to spray, two plants can be treated with one dip of the broom, and the method is effective and comparatively rapid and economical of material. It seems doubtful whether this method can be recommended for large plants.

Knapsack pumps should prove to be the most popular under our conditions. Bucket pumps are rather slow and laborious for field work. A garden syringe should not be used, as a spray cannot be properly applied with it.

FIG. 3.—A field sprayer for treating tobacco. The attachments for spraying the undersides of the leaves, although desirable, are not absolutely necessary when spraying for the tobacco slug, and may be omitted.

The most economical apparatus in time and labour will no doubt be a proper field sprayer. As far as is known, such an implement is not at present for sale in South Africa; but it is possible to have one made by fixing nozzles at suitable intervals along a length of metal pipe and attaching this to a barrel pump mounted on wheels. For all the pumps used it would be necessary to have nozzles which throw a fine spray to get the poison evenly distributed.

Dusting.—The dry application of arsenate of lead powder may prove good practice on the tobacco crop, the leaves of which are sticky and hold the poison well. A simple appliance for dusting the plants is a tin and bag as is used for sulphuring vines. It is made by taking a tin of suitable size, such as a 1 lb. coffee tin; numerous small holes are made in the bottom; a small bag is made of some loosely woven material, and tied over the bottom of the tin, allowing a few inches to hang free. The tin is closed with a lid after the dry insecticide is put inside, and the poison is sifted through the holes and shaken through the bag on to the plants. The application should be made when the air is still, and, if possible, when the plants are moist with dew or after rains. Only a very little of the poison should be used to a plant, but the distribution should be as uniform as possible.

Sulphuring bellows and hand-dusters, as used for vines, are obtainable, and they work far more rapidly than the tin. Large machines on wheels for applying powders have been tried with success in the cotton fields in America, but are not yet obtainable here.

For dusting it is an advantage to mix the arsenate powder with its own bulk or more of some other fine dry material, like wood-ash or lime. The dilute poison may be applied more liberally to secure a more even distribution. Great care should be taken to mix the materials thoroughly.

Dusting with fine sifted lime or fine dry earth has been recommended where other insecticides are not obtainable. Experiments in the laboratory have shown that the number of larvae can be reduced by these means, but whether the results in the field will be good enough, and whether there would be any advantage over hand-crushing has not yet been determined.

Dipping Transplants.—The young tobacco plants, before they are set out in the field, may be dipped in arsenate of lead and water of the strength recommended for spraying. The tops of the plants only should be dipped. The protection enables the plants to get a good start.

Dairying in the Union.

Our dairying industry has emerged from its infancy, and with its advance has to face broadening issues. There are certain phases of the industry which call for special attention at the present juncture which is pregnant with possibilities, though displaying symptoms of danger. Mr. Challis, the Superintendent of Dairying, who, as is well known, has for many years guided the destinies of the industry, makes a number of observations, published elsewhere in this issue, which should carefully be studied by all concerned in the supply of the raw material and in the manufacture of butter and cheese.

The Wool Market.

In view of the stagnant state of the wool market, producers will read with interest a report on the subject, published in this issue, by Mr. Canham, our Trade Commissioner in London, who briefly summarizes the position as appearing a few weeks ago and holds out promise of improvement.

RYE.

A brief statement regarding the use of rye in the Union in relation to wheat conservation, together with a note on the subject by H. S. du Toit, Government Agronomist.

Although the Union produces insufficient wheat to meet its total requirements, we have hitherto had no difficulty in making good the shortage by importation from other countries. Once only in our history, and that only recently, have we been compelled to resort to the expediency of modifying our consumption of wheat because of a deficient supply. This happened, it will be remembered, when the Wheat Conservation Act of 1918 was enacted, which required an admixture of maize or certain other cereals with wheaten flour in order to conserve our supply of wheat. Apart from this incident, our experience shows that under normal conditions we need fear no difficulty in obtaining from other countries the wheat necessary to make good the shortage of production in our country. But the necessity of watching our wheat supplies with extreme care was again in evidence a few months ago and much anxiety was felt, for circumstances arose which threatened to cut off, in a large measure, the usual oversea sources of our wheat supply, and the position became so acute that the Government had to obtain supplies which otherwise should have come into the country in the ordinary course of trade.

That a large country which claims to be an agricultural one should be dependent on other lands (economic reasons notwithstanding) for the bread of its small population, is most unsatisfactory, and even with a return to normal conditions and a free supply of oversea wheat and flour, it is a matter for serious consideration whether we should ever be open to the necessity of depending on producers in other countries to help us supply our daily bread. And the trouble need not exist. The question is not one of short supply but of habit. We produce sufficient cereal crops, notably maize, to meet not only the bread requirements of our population but have a surplus for export. But South Africa demands a wheaten loaf, and the need, moreover, for any change in the composition of our loaf has, until recently, not been seriously questioned. In the light of past events, however, can we not, with advantage, now consider the introduction into our daily loaf of a cereal in addition to wheat? If this were done we could produce all we require and be in that independent position which can view with equanimity circumstances which to-day would make us anxious. Another point worthy of thought is that we should also be relieved of sending large sums of money out of the Union to pay for the products of other countries. The solution of our trouble is simple: it can be brought about by a change of habit. Once create the habit or custom of using a bread not necessarily all of wheaten flour, the demand will follow, and production in the Union will respond and supply the cereals required.

The recent Departmental Committee on Wheat Growing shows that greater wheat production in the Union cannot, for various

reasons, be expected in any marked degree. On the other hand we have large areas unsuitable for wheat, oats, and barley, but on which rye can with profit be grown. This is the cereal we advocate for supplementing our defficient wheat supply, for it makes a wholesome and palatable bread, either as a rye loaf or as an admixture with wheaten flour. But in this country the value of rye as an article of human diet is practically unknown; yet its use, even to a moderate degree, would solve our difficulty.

While wheat is undeniably the best bread cereal, other cereals are often undervalued. Rye is little inferior to wheat; indeed many people who have the choice between wheat and rye bread take the latter in preference. Thousands of people in Europe depend on rye bread as their staple form of sustenance.

We know what was done in other countries to conserve their wheat supplies at a time of universal shortage. In this connection the work of the United States Food Administration affords a valuable lesson in the practical use of cereals other than wheat. This Government body was charged, among other duties, with the reducing of wheat consumption in the United States for the purpose of supplying the Allies with as much wheat as could possibly be spared. In the course of their duty the question arose as to what extent the wheat to which the people of the United States were accustomed in their diet could be reduced without injury to the individuals of the nation. The matter was laid before a committee composed of the highest physiological authorities in the country and their answer, as follows, to the question was direct and unequivocal. "It is the scientific opinion of the committee that in a mixed diet wheat may be entirely replaced, without harm, by other available cereals, namely, rice, barley, oats, and corn (maize). However, we should not recommend this except as an emergency measure." This pronouncement should dispel the fear which many people may have as to possible ill-health or malnutrition following any disturbance in the composition of their wonted daily loaf. But we do not need to consider such drastic action as entirely replacing our wheaten loaf; the position is amply met by a moderate use of other cereals, in particular rye, which, under local conditions, is the one most closely resembling wheat that can profitably be produced in the Union. To attain this end the old habit of demanding the pure wheaten loaf will need to be modified. It is merely a matter of what we are accustomed to. We affirm, therefore, that we can with advantage introduce an article of diet which hitherto has not been placed before us, by popularizing the use of rye meal in our bread. The matter lies primarily in the hands of the consumer.

This suggested means of making good the shortage of our wheat supply, was one, it will be observed, recommended to a hundred million people of the United States after careful consideration by the Government of that country, for in their campaign the United States Food Administration advocated the following means of conserving wheat:—

"(1) By eliminating waste in the use of all breads and cereal products.

(2) By eating more vegetables in place of other foods, especially during the summer months.

(3) By substituting for wheat breads which, whether made at home or by the baker, combine with wheat flour from 10 to 25 per cent. of other cereal products or suitable flours or meals, as peanut flour, soy-bean flour, or with potato or sweet potato.

(4) By using other cereals for bread-making—for instance, rye, which will make a yeast-raised bread, and others, like corn, oatmeal, kaffir, and buckwheat, which can be used without flour to make quick breads. . . ."

While an extended local market for rye and rye meal depends in the first instance on the consumer, we recommend to the earnest consideration of producers the statement hereunder by the Government Agronomist who urges farmers of the Union seriously to consider the advisability of giving greater attention to the growing of rye than they have hitherto done. Experiments with rye conducted at the Potchefstroom School of Agriculture have shown that very favourable yields are obtainable. In this connection it is pointed out that the Mammoth is a winter type and of slow growth, requiring early planting, say, in April. Early Rye is to be preferred as it can be sown as late as the end of June with good prospects of a full crop, or if the ground is ready for early planting the seed may be sown in May and the crop matured before affected by dry, hot weather in November. In the Potchefstroom trials of 1919, Early Rye returned 1450 lb. grain per acre. A new variety, O.A.C. 61, has proved a good cropper and is also early in reaching maturity; the yield has amounted to 1720 lb. seed per acre. In addition to the value of its grain, rye is one of the hardiest winter feed crops for grazing, and it may also be allowed to come into ear and be cut and drawn to the stable, where it may be used very successfully as a green feed, especially for dairy cows.

When it is considered therefore that rye can be cultivated profitably in areas not so suitable to wheat, oats, or barley, that it is a greater drought and rust resister than wheat and is less open to the attacks of birds (a serious pest in parts of the country), that rye both green and as a meal is also an excellent feed for stock, and that it is one of the best crops for soiling purposes on the poorer soils, it seems strange that it has not yet come into greater favour. Sowings of rye in the Union are comparatively small. The 1918 Census shows that in 1917-18 our total production of rye was only 260,428 muids (200 lb.) compared with wheat 3,044,856 muids, maize 12,640,091 muids, kaffir corn 1,801,415 muids, oats (grain) 2,296,657 muids.

NOTE BY H. S. DU TOIT, GOVERNMENT AGRONOMIST.

RYE (SCALE CEREALE).

De Candolle says that the original home of rye was between the Caspian Sea and the Austrian Alps and that it is doubtful whether it now exists in the wild state. He further maintains that the wild rye reported by travellers was either plants which were self-sown or a rye-like grass of an allied genus. According to Hackel, however, the original form of rye (*Sereale montanum*) grows wild in mountains of the Mediterranean countries and as far east as Central Asia. The

wild rye is perennial with a jointed rachis, both of which characters have disappeared in cultivation. It is further said that the culture of rye, while more than two thousand years old, is not as ancient as that of wheat and barley. It would seem that the Greeks were not acquainted with it, and Roman writers in the time of Pliny spoke of it as a new plant grown by certain barbarian tribes. No rye remains are found in the middens of the Swiss lake-dwellers, while wheat, barley and spelt occur.

BOTANICAL AND AGRICULTURAL CHARACTERS.

In its botanical relationship, physiological characters, manner of growth, and method of cultivation, rye is closely comparable with wheat.

Percentage Composition of Rye and Wheat Grain.—The following are averages of many analyses taken from different reliable sources:—

	Water.	Ash.	Protein.	Fiber.	Nitrogen (Free Extract).	Fat.
Rye	11.6	1.9	10.6	1.7	72.5	1.7
Spring wheat .	10.4	1.9	12.5	1.8	71.2	2.2

The composition of rye-straw is almost identical with that of wheat-straw, with the exception that the former is much tougher in fiber, which gives it a special value for papermaking, thatching, bedding and packing purposes.

Culture and Soil.—The preparation of the seed-bed, rate of sowing, harvesting, etc., is nearly the same as for wheat. Rye will make a fair growth on soils which are too light and poor for the successful growing of wheat, barley, oats, or maize. It thrives best on lighter fertile loams and does not grow so well on wet or heavy clay soils.

The yields are according to fertility of soil and climatic conditions. Eight to fifteen bags of grain (200 lb.) per morgen is not uncommon. Rye also resists more drought and rust than most of the softer types of wheat and its value as green pasturage during autumn, winter, or spring is well known in this country.

Varieties.—Rye, unlike most other cereals, has developed very few varieties. "White" rye, "Common" rye, "Winter" rye, "Mammoth White Winter" and "Spring" rye, etc., often figure in catalogues of seedsmen, but the distinction between the so-called varieties is not at all well marked, and the writer is inclined to believe that there are, at the most, only two varieties, and that soil and climatic conditions are really responsible for the rest.

Bread.—Rye grain, mixed with wheaten or other chaff, is often used in certain parts of this country as a feed for horses and mules, but never, to my knowledge, has the rye berry, even to a limited degree, been regularly used for bread-making purposes in South Africa. In Europe, according to statistics, rye constitutes the main bread grain of considerably more than one-third of the inhabitants. Rye flour carries some of its protein in the form of gluten, and unlike maize, makes a nice porous, but rather dark-coloured bread. In oversea countries rye flour is now also made by the roller process similar to the methods employed in wheat milling, and it is said that

rye bread made from flour so treated is not so dark in colour as that of the old milling system.

The writer and many of his compatriots, while on the Continent of Europe, learned to eat rye bread, and ultimately liked it even better than bread made from pure wheaten flour. Rye meal used as an admixture with wheaten flour certainly makes a very palatable loaf. Rye can be grown in the drier parts of the Union with more safety and less care than wheat. Before the world war, wheat and flour from oversea countries were comparatively cheap, and that is perhaps why the preaching (on the subject under review) of the writer and of other South Africans has not, in the past, received the attention it should have had. The position of the Union in regard to its wheat supply is well known; part of our requirements has to be imported, a circumstance attended by difficulties which could be removed by the use of rye, and it is to be hoped that our farmers throughout the Union will now take up this rye problem in all earnestness.

Locusts in Asiatic Turkey.

The Union Department of Agriculture has carried out some extensive campaigns against locusts, but its work seems small in comparison with work carried out against locusts under German supervision in parts of Asiatic Turkey during the war. A German publication reviewed in a recent issue of *Review of Applied Entomology*, states that in 1915 Anatolia, Syria, and Palestine suffered greatly from locusts. An anti-locust campaign was then organized, with a staff of 14 directors, 72 officers, 2000 supervisors, and about 11,000 men from labour battalions and compulsory levies from the population. An average of 450,000 to 500,000 workers, it is stated, were employed daily from March to May, 1916, in western Anatolia, and 6000 tons of locust eggs and 11,000 tons of locusts were actually collected. The barrier and pit system of trapping was the chief measure used against the voetgangers. Poisoning was also resorted to with success, but no practical results were obtained with fungoid and bacterial diseases. For work in the following season 250 non-commissioned officers and 2500 men were detailed as instructors, while provision was made for the supply of about 300 miles of zinc strips to serve as barriers and 50 tons of arsenic and paris green for use in preparing poison baits.

Treating Turkish Tobacco.

THE NODULAR WORM AND THE LESIONS CAUSED BY IT.

(*Oesophagostomum columbianum*, Curtice.)

By Sir ARNOLD THEILER, K.C.M.G., Director of Veterinary Education and Research.

IN the course of the past winter a condition of lambs was brought to the notice of the Division of Veterinary Education and Research, which is caused by the presence of a nematode in the caecum and the first portions of the colon. Many farmers have seen this worm and drawn our attention to it. Some of them were particularly struck by the fact that this parasite was present, notwithstanding the regular and systematic dosing with the drug recommended and issued by this Division, all the more so, because at the same time they had also noted the entire absence of wireworms in the fourth stomach of the sheep. Some farmers emphasized this fact, stating that although our remedy was very effective against the wireworm, it was not so against this particular worm in the large intestines. This, of course, we knew already at the time of the first issue of the drug, and we claimed only efficacy for wireworm and some effect against tapeworm, which effect was noted quite incidentally during the course of our investigations. As far as the nodular disease is concerned the statement was made that sheep suffering from it, when dosed regularly with the wireworm remedy, are less subject to the effects of worm infection generally, viz., become less debilitated. This still holds good as far as the ordinary course of events is concerned. It stands to reason that after removal of the more important invasion of wireworms, a sheep will stand other parasitic infection much better.

Not all farmers have, however, connected the wasting condition and death of their lambs with the presence of this nodular worm, nor have they noticed the lesions produced by it, although the statement was made by some that wireworms were absent in the stomachs. Probably they had not been making the post-mortem examination with sufficient care.

The effects of the nodular worm infection show themselves both in lambs and sheep, but more acutely in lambs than in adults. This observation has already been made in previous years and again this year in various parts of South Africa, but more particularly in the Western Transvaal and in Bechuanaland, also in certain parts of the Cape Province, viz., the south-eastern. There seem to be certain years in which this worm causes more damage than in others, and it is possible that the climatic conditions of those years favour the evolution of the worms. It is most likely that the distribution and amount of rainfall are responsible. It is generally stated that lambs under one year of age are most susceptible and that adults running under identical conditions thrive well.

The disease may be described to be of a wasting nature; lambs simply do not thrive, they lose condition, look thin and miserable, and die in great numbers. On post-mortem the presence of an anaemia and hydraemia is markedly pronounced, the carcases are bloodless, the organs and tissues pale, and the fat has completely disappeared, and its place is taken by watery substance. The collection of liquid is also pronounced in the connective tissue of the muscle. The cause of the trouble is found in the alimentary canal, both in the end of the small intestines and the commencing portion of the large ones (caecum and the first part of the colon). In the walls of the small intestines nodules are present which are more numerous towards the end. They are not always equally frequent; sometimes they are fairly scanty, in other cases they occupy practically the whole wall. Invariably, however, the lesions are most pronounced in the caecum. The wall of this intestine is thickened and is almost rigid. The mucous membrane has a corrugated rough appearance; the different layers are infiltrated with watery liquid, which is most pronounced in the submucous portion of the wall. On closer observation it will be found that the thickening of the wall is caused by the presence of nodules sometimes so closely packed that frequently they touch each other. The surface of the mucosa is covered with a viscid, sometimes milky deposit, occasionally tinged with blood. Attached to the mucosa are small conspicuously white worms which are usually curved and reach about half an inch in length.

Different types and sizes of nodules are noted, their characters are most easily recognized in the small intestines, where they are more frequently solitary, although a number of them may be crowded together.

Arbitrarily we may distinguish three principal and pronounced types, viz., the reddish nodule, the greenish nodule, and the hard nodule. They vary in size from a kaffir corn seed to that of a pea or more. They are sometimes quite hidden under the mucosa and can only be found on palpation or else stand out prominently over the surface forming a small hemisphere; others bulge out into the outer wall of the intestines, the serosa, and are easily recognized. All the nodules show on or near the summit, bulging into the intestinal lumen, a small pit. It is through this pit that the entry of one of the larval stages of the worm in the mucosa has taken place which led to the formation of the nodule. The red nodules are the initial stages and still show injection of the vessels of the areas involved, on section they are moist and glistening. The larvae being very small, cannot be seen by the naked eye. Their presence produces the accumulation of white corpuscles (*Eosinophile leucocytes*) which undergo disintegration around the larva and so form a greenish abscess. Pus in this stage escapes through the pit when a slight pressure is applied to the nodule. The hard nodules are calcified, they have an irregular shape. They are most frequently seen bulging out in the outer wall. They are the old nodules, from which the larvae have escaped at an earlier stage or in which the larvae have succumbed. The oldest nodules are the hardest ones and have a tendency to decrease in size and become angular the older they are, but they will never entirely disappear. The content is a hard concrement resistant to the knife, sometimes it is as hard as a stone. In the caecum of lambs the nodules are rarely found in this last stage, they are usually in the first and second

stages; the whole wall being involved in the inflammatory process they do not stand out in relief and the whole organ becomes uniformly thickened and rigid. In the adjoining colon these lesions gradually vanish, when crowded, and solitary nodules then appear again.

SEQUELS OF THE NODULAR WORM INFECTION.

There are two complications, which may result from the infection with nodular worms, mostly in the adult stage. One is the rekziekte or knopderms, the other one is a septic infection of the serous cavities (peritoneum, pleura, pericardium). In rekziekte or knopderms we find that a portion of the end part of the small intestines (ileum) has slipped into its own lumen and is secured there and cannot return. This happens most frequently within the last two yards of the intestines. The invaginated portion swells and so blocks the passage. Invariably we find in the telescoped portion the presence of the nodules, and it is thought that these form a mechanical obstacle to the proper peristaltic action of this section of the bowels. It is

Plate 1.
Nodules in the bowel wall (portion of ileum)

from the serosa of the one portion of the intestine on to the serosa of the other, both lying in intimate contact and are soldered together. The invaginated bowels are described by the farmer as a knot, hence the Dutch name "Knopziekte." During life the sheep affected take up a stretching position, the forelegs are brought well forward, the possible that the inflammatory process associated with a nodule creeps neck extended, the hindlegs placed backwards, and the back hollowed, hence also the name "Rekziekte." The sheep is disinclined to move and either stands or lies. The head is sometimes turned towards the flank. A complete stoppage of the intestines takes place, at certain times black or blood mixed faeces are passed. Recoveries are rare. Rekziekte may sometimes cause considerable losses. Its presence in South Africa has been recorded since 1894, and its increase has been

explained with the increase of the nodular worm infection. It is of interest to mention that the parasite causing the nodules in the intestines of sheep has first been described by American investigators, yet the intestinal invagination has not been recorded from that country so far as the writer is aware. One is therefore justified in thinking that the presence of the nodules is not the only cause of the trouble, although it may be a contributory one. This view has some support in the fact that knop or rekziekte is not observed throughout South Africa, whereas a moderate nodular worm infection is found practically everywhere. Very few sheep pass our post-mortem table in which they are absent. Knopziekte is found in sheep of all ages and of all conditions, although some farmers record its frequency mainly in two-tooth sheep. The youngest animal noted by us was a fifteen-months-old lamb.

The septic infection apparently has been overlooked by farmers, at least it was not brought to our notice by them. We have frequently observed it amongst sheep sent to us from the Karroo, utilized for the production of blue-tongue vaccine. For this purpose the sheep were placed in stables and the temperatures taken regularly. We then found some abnormally high temperatures, reaching 106° F. and more, and extending over a number of days. When the daily records were plotted on paper a curve was obtained of quite an irregular type. The animals during life showed no, or very few, symptoms. Most frequently they were found dead in their stable, having given no warning whatever; sometimes they were dull and lying down; their flanks appeared empty. The disease could not be diagnosed with certainty during life.

On post-mortem the striking lesions were those of a fibrinous or purulent inflammation of the serous membranes of the abdominal pleural and pericardial cavities. A turbid exudate was present and a fibrinous to purulent deposit on the abdominal wall, the intestines, and all other organs. The pleural cavity contained sometimes a considerable quantity of turbid liquid, with threads of fibrin, and the lining of both the costal as well as the pulmonary pleura was covered with a membrane of fibrin, that could easily be removed. The pleura underneath was roughened and injected, sometimes diffusely, sometimes the larger vessels most distinctly. The lung tissue below the inflamed parts in its superficial portions was sometimes collapsed and had a bluish purple appearance. The pericardium also contained fibrinous exudate which was deposited on the heart itself. The deposit in most cases could be scraped off. It was also found on the inner and outer wall of the pericardium, whose vessels then were injected, the surface roughened and opaque. In other cases the deposit could no longer be removed, it was adherent to the surface, and partial organization had taken place. This also applied to the exudate in the pleural and abdominal cavities. These cases represented a more chronic course of the infection. In addition to these striking changes other less striking ones were found in the parenchymatous organs, which showed degenerative changes. Invariably in cases of septic infection the presence of parasitic nodules was recorded in both the small and large intestines, and amongst these some were found that were nothing less than a small abscess that had burst into the peritoneal cavity. This abscess could usually be found by careful

examination of the intestinal walls, it was broken and pus was still protruding through the opening, the circumference was much injected, much more than in the case of a nodule in its early stage after the invasion of the larvae. Microscopical examination of pus had shown the presence of cocci, which could be obtained in pure culture, and they probably were the cause of the infection. Cocci may be found at any time and in any sheep, but so long as they are within the intestines they are harmless and only become so when outside their proper place. Since, however, the septic infection has been noted in some batches of sheep very frequently and even alarmingly, less so in others and not at all in the majority of sheep that show nodules, one is forced to conclude that they represent a specific infection, which is present on some farms and not on others. The infection is quite an accidental one, the bacteria find their way into the nodules, perhaps at the time the larva has bored its hole to enter the mucosa or subsequently after it has left it. It then produces a local inflammation, so to say, a pimple, that ends as an abscess, penetrating either the inner or outer surface of the intestines, in which latter case it spreads into the peritoneal cavity and from there into the other serous cavities.

Septic infection has been found in sheep of all ages, but more frequently in adults than in lambs, and in sheep of all conditions.

Nodular worm infection is accordingly a very serious trouble and not affecting lambs alone, although in these the disease is most striking. So far three pathological conditions, that at first sight appear to have no connection with each other, may be distinguished, viz.: (1) The parasitic inflammation of intestines in lambs with the sequel of anaemia and cachexia; (2) the invagination of the ileum; (3) the septic infection of the serous cavities.

We must make it clear that we have no cure for any of these. Experience has shown that the worms are present in sheep regularly dosed with the wireworm remedy, the explanation simply is that the arsenic or sulphate of copper does not reach the place where the worms are situated. Experiments undertaken by Dr. Green of this Division, in connection with the absorption of arsenic, distinctly show that this drug is absorbed in the first part of the intestines and only traces reach the large intestines, but not sufficient to kill the worms. A series of other drugs have been tried, all so far with equally unsatisfactory results. The experiments, however, will be continued. In Knopziekte a surgical operation might be thought of, but its application is out of the question. The septic infection cannot be diagnosed with certainty and, a priori, treatment appears hopeless and impractical. Under such conditions and for general scientific reasons prevention must be thought of. In order to suggest such measures the life-history of the responsible worm must be known when deductions for a possible interference can be made, which must aim at preventing the entry of the worm into the sheep.

THE LIFE-HISTORY OF THE NODULAR WORM.

The adult worms are found, as already stated, attached to the surface of the mucous membrane in the places mentioned. Male and female worms can be recognized, the latter being slightly larger than the former. The period the worm in the adult stage remains in the intestines has not been determined yet, but to judge from sheep that came on the post-mortem table at Onderstepoort which

had been under observation without having had a chance of reinfection, this period must be of considerable length. It is during this period that the female is fertilized by the male and then begins to lay eggs. The life-history has partly been worked out by Dr. Veglia of this Division, and the data given here are taken from his observations made as a corollary to his investigation into the life-history of the wireworm (*Haemonchus contortus*). The eggs leave the sheep with the faeces and can easily be brought to hatch when put up under suitable conditions in a glass jar. In the life-history of a parasitic nematode, such as the one under discussion, we can distinguish four different larval stages through which the worm has to go before it reaches maturity, two of these stages are passed outside the final hosts and two inside. The larva which hatches out of the egg soon surrounds itself with an envelope which it casts and a second one is formed. It is now called a mature larva. Its destiny is to reach the sheep, and since it has to wait for its chance to be eaten in by the sheep, it possesses certain qualities that achieve it. The larva is

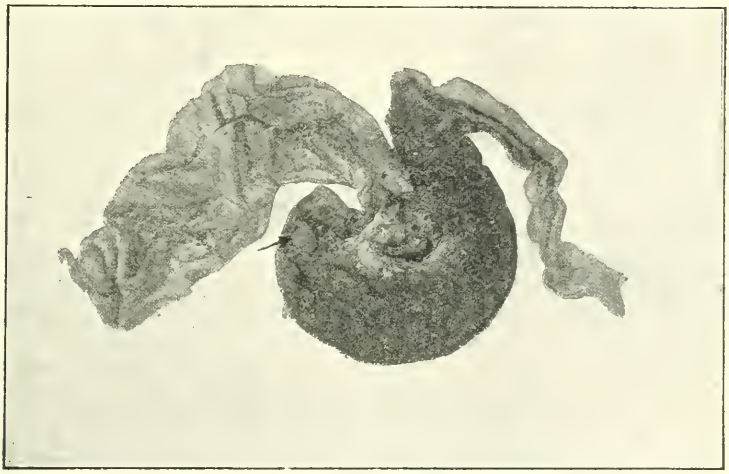


Plate II.
REKZIEKTE.—Small intestines (ileum) cut in half; the arrow indicates a nodule.

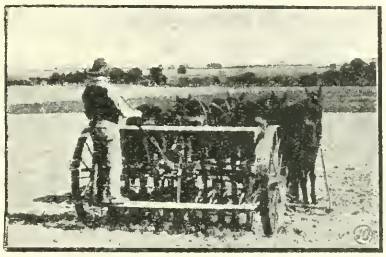
endowed with longevity. It may safely be stated that it can live at least one year under favourable outside conditions. It is able to crawl about and does so mainly in two directions; one is the upward one by which it reaches the tufts and grasses, the other one is the downward one, which enables it to return to the ground. The larvae can only crawl on a moist surface; this is, of course, the case during rain and at a time of heavy dew when the blades of grass are wet. Furthermore, the larvae cannot stand the action of the direct sunlight and try to escape from it without delay. Hence the migration of the larvae on the grass can only take place under certain conditions, viz., when moisture enables them to do so, in the summer and in the absence of sunlight, during night, the early morning, and when the sky is overcast, particularly on rainy days. Moisture, of course, is retained in the portion of grass tufts near the soil, and sheep feeding very close to the ground are thus exposed all through the summer to infection

and particularly on places where moisture is more or less permanent, viz., vleis, along springs, rivers, etc. In the winter, however, the surface moisture disappears and the larvae crawl into the ground. They have been found as deep as one foot and more. With the new rains in springtime, they return to the surface and again find their way on to the grass. Furthermore, below a certain temperature the larvae cease their activity and remain dormant. A temperature of 10° C. arrests their activity, hence this activity in winter cannot be great.

There are thus two important facts to be noted, viz.: (1) The longevity of the larvae in the veld, and (2) their absence from the grass during the winter. Based on these two facts a method of sheep rearing could be arranged by which lambs would escape the nodular worm infection and incidentally the infection of any worm with an identical life-history. It would be wise to begin by cleaning a piece of pasture (preferably one fenced in) of the infection, by simply keeping the sheep away for at least one year, preferably longer; probably fifteen months will be sufficient. This piece of pasture could be utilized for the grazing of cattle. Cattle do not harbour the nodular worm and hence would not maintain the infection. Cattle, however, harbour wireworms, and this fact must be borne in mind. Into this cleaned area no old sheep should be allowed to enter, as with their faeces they would spread the eggs of the nodular worms and in due time the ground would be infected again. The ewes must lamb outside the clean area, but, of course, not during the period when the larvae can infect the lambs, i.e. not during the spring or summer. The lambing season must be arranged for during the winter when the infection is at a minimum or absent. It is the experience of many sheep farmers that winter lambs do well where summer lambs will not thrive, and when the ewes at the end of the summer are in good condition and winter grazing is good no fear need be entertained about rearing lambs. In order to escape the infection arising out of the spring rains the lambs should be weaned about that time and then placed into the clean paddocks until they have reached an age when the sheep will stand the infection better. This age is not less than one year. In applying this measure systematically and in a definite rotation a sheep farmer should be able to clean his whole farm of the infection, or at least reduce it to a minimum. The lambs in the clean paddocks should be treated for wireworms in case cattle have been grazing there, and also because other parasites, such as tapeworm, will still be present. The wireworm remedy is recommended for this purpose. Until he has obtained a clean paddock a farmer cannot entirely protect his sheep from the nodular worm infection, but he can reduce the danger considerably. The infection is only present in moist places and on wet grass, accordingly he should not allow the sheep to graze on such places, but should water them from a place with a dry approach; he should not allow them into the pasture before the dew has dried up, and during rainy days he should keep them on the highest ground he possibly can find. Where a farmer grows crops for his sheep he should arrange his feeding so that the sheep receive their supplementary rations at such times, when otherwise they should subsist on wet grass and so take up the infection. Winter feeding may also be arranged for, but if green crops, from irrigated lands, are intended to be fed to lambs, they should only be cut when no moisture

is on them. Green crops should not be fed to lambs when wet. A farmer will have to arrange his plans to meet the particular local and seasonal conditions of his farm. The underlying principles as set forth are, however, always the same.

Once the larva has reached the stomach of the sheep it passes down the intestinal canal, and it has to go through two more larval stages in order to reach the final adult one, when it will either be a male or a female. These stages, or one of them at least, are passed in the intestinal nodules, but accurate information is not yet at our disposal. The damage to the sheep is thus not so much done by the adult worm as in the case of the wireworms, which may be present in thousands and after the removal of which the effects cease, but by the larvae in producing the nodules and the inflammatory condition of the caecum and colon. It is evident that no drug will reach these larvae well hidden within the nodule, and any attempt to reach them there by dosing will be futile at the present stage of our knowledge concerning vermicides. It is evident also that a vermifuge killing the adult worms in the caecum would hardly bring about an immediate improvement in the condition of the sheep. The adults probably cause the least trouble, the damage being done by the larvae. The idea might be conceived to get at the larvae before they burrow into the intestinal wall, but no information is at hand how long they will remain in the intestinal lumen, and even if there would be such a stage, the locality is entirely out of reach as already explained. Even if we should succeed in finding a drug which kills the adult worms in the large intestines, the sheep will still suffer from the effects of the larvae until such time as, by killing off the adults, no more eggs and larvae are produced and the farm becomes clean. Theoretically such a state of affairs might be reached one day, practically it will be difficult or almost impossible. The only effective way to deal with the nodular worm infection is therefore to prevent the entry of the worm into the sheep.



Drilling Oats.

Export of Grain.

The exports of grain, etc., for the month of November were as follows: Maize, 145,622 bags; maize meal, 96,471 bags; maize flour, 300 bags; maize grit (rice), 3061 bags; hominy chop, 14,708 bags; Kaffir corn, 154 bags; oats, 99 bags; beans, 1075 bags. The total number of bags exported from 1st July last to 30th November was: Maize, 204,289 bags; maize meal, 135,325 bags; maize flour, 300 bags; maize grit, 3061 bags; hominy chop, 32,220 bags; Kaffir corn, 164 bags; oats, 1054 bags; beans, 1213 bags; lucerne seed, 366 bags. Stocks on hand at all ports on 30th November, 1920, were in bags: Maize, 49,488; maize meal, 71,001; hominy chop, 3650; beans, 70.

SUCCESSFUL FARMING ON GOVERNMENT SMALL HOLDINGS.

An Object-lesson from the High Veld.

THE history of South Africa's agricultural progress conjures in the mind a picture of vast areas and isolated homesteads. After two hundred and sixty years of occupation we still find a sparse population and extensive farming, and generations of these conditions have imbued the idea that it is the big proposition only which is likely to afford financial success in this country. But the country is slowly and surely being taken up by a growing community of farmers and, as surely, the days of the early pioneer whose huge farm "farmed itself" are passing. The value of good farm land is rising and the man content with a small return from his numerous acres is gradually retreating to the remoter parts, impelled by the irresistible approach of the intensive farmer whose every acre gives its carefully calculated return. And with the approach of the intensive farmer comes the need of greater attention to the economy of farming. It is in this field that there is a dearth of information, yet, as in all enterprise, the first essential is knowledge as to the payability or otherwise of the proposition. No matter how sound our theories may appear or how attractive the picture we paint of the many opportunities open to the agriculturist in the Union, the prospective farmer wants practical demonstration in the shape of a reliable profit and loss account. It is, therefore, with much pleasure that we publish the following figures obtained by Mr. Mason, of this Department, who, as Director of Training Farms, has had the opportunity of going closely into the matter. The data he furnishes will serve a valuable lesson to the man already on the land and illustrate to those who wish to take up farming what can be done, not on the large farm usually associated with South African agriculture, but on the small holding and with a modest capital.

The illustration we give concerns a settler on the Government Settlement at Strypan, in the Pretoria District, who owns a holding of 94 morgen situated between the Germiston-Witbank and the Germiston-Breyten railways, land typical of thousands of acres suitable for the same class of farming in the high veld portions of the country. The soil is a greyish loam varying in depth from 5 inches to 11 inches and is underlaid by an ironstone gravel. On this holding certain improvements have been effected; there are a house, store, borehole, and windmill, and the lands and grazing camp have been fenced. The farm was purchased just over two years ago, and the price is set down as follows:—

Paid to previous owner for goodwill	£300
Paid to Government to liquidate previous owner's liabilities for loose assets and accrued rent and interest	116
Purchase price of ground (including cost of borehole and windmill, under Land Settlement Act, 1912)	361
	£777

The *loose assets* on the farm consist of 2 mowers, 2 rakes, 4 ridging ploughs, 1 disc harrow, 2 planters, 4 cultivators, baling press with horse gear, 2 harrows, wagon and trek gear, 2 bucksails, 1 cart and harness, spades, picks, shovels, etc., and the live stock are 20 oxen, 4 cows, 1 bull, 6 heifers, and 2 horses. The value of these assets is placed at £1000.

The area under cultivation during the 1919-1920 season was 75 morgen, and the *income* from the farm that season was as follows:—

960 bags mealies at 23s.*	£1104	0	0
90 bags kaffir corn at 23s.	103	10	0
1800 bales teff at 9s. per 100 lb.	810	0	0
600 bales manna at 9s. per 100 lb.	270	0	0
800 bales mealie hay at 4s. 6d. per 100 lb. ...	180	0	0
700 bales mealie leaves (kept for feeding oxen, but could have been sold)	—		
Green mealies, no account kept, but say	20	0	0
Poultry, eggs, milk, butter, etc., consumed on farm—not valued	—		
	£2487	10	0

The expenses incurred in obtaining the above income are given as follows:—

Two boys kept throughout the year at £3 per month	£72	0	0
Cost of extra labour, harvesting, threshing, baling wire, bags, etc.	194	10	0
	£266	10	0

In addition to these expenses there was the farmer's labour for the whole year, which is not included. The out-of-pocket expenses are remarkably low, and in most cases would be 20 per cent. higher, so the total expenses, not allowing for depreciation, may be placed at, say, £320.

The 1919-1920 season on the Transvaal high veld was not exceptional; indeed, the rainfall was below the average, though it fell nicely over Strypan and its immediate vicinity, as shown in the following returns, viz.:—

September, 1919, .01 inch (2 days).
October, 1919, 2.70 inches (3 days).
November, 1919, 4.00 inches (9 days).
December, 1919, 2.66 inches (3 days).
January, 1920, 4.16 inches (10 days).
February, 1920, 2.77 inches (5 days).
March, 1920, 1.58 inch (7 days).
April, 1920, .40 inch (2 days).
May, 1920, .46 inch (2 days).

* NOTE.—600 bags of mealies had not been sold but as the other had realized 27s. and 25s. 6d., the price taken seems reasonable.

The satisfactory returns disclosed cannot, of course, be expected year after year unless the soil is replenished; the statement does not include any specific item in this respect, so that in drawing our conclusions an allowance must be made under this head in calculating future returns.

Thus we see what can be produced in one season on a small farm under high veld conditions with a capital of £2000. And the only complaint the owner made was as to the ground available for grazing being too limited. Even allowing for interest on capital, depreciation, the high value of produce, etc., by *halving* the gain, we still are faced by a return of £1000 over actual working expenses from a 94-morgen proposition. There are some 40 settlers on the same settlement, and whilst the above may be the best return there are at least seven or eight others who could show very similar returns for the season.

Here are actual figures; what are the lessons? Every profession has its advantages and disabilities, its successes and failures. No doubt some of the failures are due to overwhelming ill fortune, but, given reasonably propitious conditions, the outstanding factor is the man himself. He must know his calling and apply his knowledge; without this knowledge and application he must be content with such reward as he may get here and there, a precarious existence.

But however energetic and well equipped with knowledge of farming the man may be, the handicap is severe and often insurmountable if he does not possess the needful capital and material (capital goods) for his operations. A small team of weak oxen and a shortage of implements limit the acreage which can be handled, render deep ploughing difficult, and make thorough cultivation at the right season almost impossible. All operations are inefficiently performed. Thus it follows that the risk of farming under such conditions is considerably increased and the result is a diminished return. Inadequate capital is not fair to the man nor to the reputation of farming as a sound, business proposition.

While energy, thrift, and sufficiency of capital are, therefore, essentials to success, the equipment is not complete unless a knowledge of good farming is added. Agriculture is the most ancient of sciences, and there are certain principles which centuries of practice have shown to be inseparable from good and successful farming. The bounty of virgin nature is soon exhausted. And so in the older countries of the world the millions of people who depend upon the fruits of a soil, limited in extent, have learned that continued sustenance for themselves and their fellow-men can only be won by the most scrupulous attention to the fertility of the soil. This is a subject which demands the first consideration of every farmer, and its preaching in this country becomes more necessary as time passes and the richness of the unreplenished soil is squandered. On many high veld farms the result of continuous cropping is becoming evident. Unless other methods are introduced, disaster will follow a system aptly termed "land robbery." This Department insistently publishes information as to the most approved methods of maintaining soil fertility by means of rotation, leguminous crops, and manure; to this end it advocates the more general introduction of live stock and the conservation of all farmyard manures as a prime necessity. The soil lives, and just as we see to

the well-being of our live stock, so the life and fruitfulness of our soil must be maintained by judicious feeding.

Farming conditions are never uniformly propitious, and the marketable value of farm produce is not constant. There are good and bad seasons, and returns must be averaged. Nevertheless, we give the above example of what can be done in a season which was not exceptionally favourable. It is clear that the very satisfactory result of the year's operations was due not so much to a happy combination of circumstances, but to real, honest toil, common sense methods and sufficient though modest capital. It is an example worthy and capable of emulation by all settlers similarly situated.

Spraying an Orchard.

Plant Removals to Portuguese East Africa.

Nurserymen and others who have occasion to dispatch plants, cotton seed, etc., from the Union to Portuguese East Africa, are reminded that the Portuguese regulations prohibit any introduction unless accompanied by a permit which must be obtained from the Entomological Section of the Department of Agriculture, Lourenco Marques. All consignments should be addressed via Lourenco Marques for inspection and any fruit or ornamental trees from a nursery must be fumigated immediately before dispatch.

PEST REMEDIES AND STOCK DIPS.

THE following regulations (under Act No. 21 of 1917), which it is proposed to introduce in connection with the sale of stock dips are published for the information of all concerned.

It is proposed that these regulations shall come into force as from the 1st April, 1921. In the meantime the Department of Agriculture will be prepared to give consideration to any representations which may be put forward in regard to any clause or clauses embodied in these draft regulations.

REGISTRATION.

1. "Stock dip" shall mean any substance sold or intended or offered for sale for the prevention or destruction of any parasitic pest of animals.

Every importer of a stock dip and every proprietor or manufacturer of a stock dip made in the Union shall register such dip with the Department of Agriculture in the manner required by these regulations, and no person shall sell, keep for sale, or offer for sale, any stock dip not so registered.

On registration, a certificate shall be delivered to the person registering.

Each certificate shall in every case expire on the 31st December, if not renewed on application made after the 1st December, but may, in special circumstances, be renewed as from the date of expiry, if application for such renewal is made before the 31st January.

2. Every person required to register a stock dip in accordance with these regulations shall make application on the form following:—

FORM OF APPLICATION FOR REGISTRATION OF STOCK DIPS.

(1) Name of person or firm registering.....
(2) Address of person registering.....
(3) Whether applicant is importer or manufacturer.....
(4) Name under which the dip is to be sold.....
(5) Brand and any special designation of dip.....
(6) Guaranteed composition.....
(7) Directions to the consumer for use, if any.....
(8) Under this heading shall be stated fully specifically what preventive or remedial properties are claimed for the stock dip
.....
.....
.....
.....

Signature of person or firm registering.....

Date of registration.....

.....
Secretary for Agriculture.

3. Under "composition," item (6) of the form of registration, Clause 2 of these regulations, shall be stated the names of each and every ingredient for which efficacy is claimed, together with the minimum percentage amounts in which they are guaranteed to be present, and the form in which they are claimed to occur.

4. In making a statement of composition or analysis under Clause 2 of these regulations, recognized analytical terms shall be employed wherever possible. A considerable degree of latitude in expression may be recognized, but the Department shall reserve the right to refuse registration on grounds of inadequate description of the dip.

5. In the case of dips containing arsenic, there shall be stated under Clause 2 of these regulations, in addition to any other form the vendor may choose to adopt:—

(*a*) The percentage amount of total arsenic expressed in terms of the element arsenic, and

(*b*) the percentage amount of arsenic in water-soluble form expressed in terms of the element arsenic.

The term "water-soluble" shall be understood to mean freely soluble under the conditions prescribed for making up the tank fluid; that is to be such as to be present wholly in solution in the finished dip.

6. In the case of tobacco dips, tobacco extracts, and nicotine products, there shall be stated under Clause 2 of these regulations a guaranteed minimum percentage of nicotine.

7. In the case of dips in which sulphur is combined with calcium, sodium, potassium, or other basic element, and forming therewith a water-soluble sulphide, there shall be stated, under Clause 2 of these regulations:—

(*a*) The percentage amount of sulphur present in the form of water-soluble sulphide, and

(*b*) the percentage amount of the basic element or elements with which sulphur in the form of water-soluble sulphide is combined; or alternatively, the ratio of mono-sulphur equivalent to total suphide sulphur.

8. In the case of dips in which terms such as cresols, creosote, tar-oils, and the like, are claimed as active ingredients, there shall be given, under Clause 2 of these regulations, either the true chemical designation or the range of boiling points of the mixed tar distillates, or such other specifications as shall be acceptable to the Department.

9. In the case of solid dips declaration of guaranteed percentage composition, under Clause 2 of these regulations, shall be by weight, and in the case of liquid dips declaration shall be by volume, i.e. grammes of constituents per hundred cubic centimetres. A semi-fluid dip shall be regarded as a liquid dip if recommended by the vendor for use in a volumetric basis, and as a solid dip if recommended for use on a gravimetric basis.

10. In the case of sulphur sold for dipping purposes, there shall be declared, under Clause 2 of these regulations, the minimum degree of fineness by Chancel's test.

11. The acceptance for registration of any proposed *brand* or *brands* shall be subject to the approval of the Department, and no brand shall in any case be accepted for registration, if deemed by the Department to be similar to one already registered or to be of an insufficiently distinctive nature.

RECEPTACLES.

12. All receptacles in which any stock dips are sold or offered for sale shall in addition to the markings otherwise prescribed be legibly and durably marked with the registered "brand."

13. All receptacles in which any stock dips are sold or offered for sale shall be legibly and durably labelled to show:—

(*a*) The minimum net weight or, alternatively in the case of liquid dips, the minimum volume of the dip contained in such receptacles.

(*b*) The chemical composition of the contained dip as registered.

(*c*) The information required under (8) of Clause 2 of the regulations.

Provided that where the nature of the receptacle is such that it cannot be satisfactorily labelled as provided under this regulation, the person who sells any stock dip shall give or send to the purchaser at the time of delivery an invoice stating the quantity sold, together with a printed form of guarantee, giving the name or brand under which the dip is sold, the information required under (8) and also the chemical composition as registered in terms of that regulation.

SALE OF STOCK DIPS.

14. Whenever any stock dip analysed in accordance with the provisions of the Act is certified to contain less than any essential constituent, or more of any inert constituent, than the quantity or proportion thereof stated in the guaranteed composition as registered or to disagree therewith, the importer, proprietor, manufacturer, or vendor thereof shall be liable, upon conviction, to the penalties provided.

15. No person shall tamper with any parcel of stock dip with intent that any sample thereof taken in pursuance of the Act shall not correctly represent the contents of such parcel.

GENERAL.

16. Any person who sells, keeps, or offers for sale, a stock dip not registered under his own name or brand, shall when required by an officer authorized by the Department produce for inspection a statement of the composition guaranteed under these regulations or other satisfactory proof of registration.

17. Any person contravening any of these regulations shall be liable to a fine not exceeding £10.

18. The prescribed tariff for the analysis of stock dips referred to in Section 24 of the Act shall be £1. 1s. for a determination of any constituent with a maximum of £5. 5s. per sample.

THE MANURING OF VINEYARDS.

By J. C. Ross, Ph.D., Research Chemist, Elsenburg School of Agriculture, and S. W. van Niekerk, Government Viticulturist.

The Requirements of the Vine.

The vine, in common with all farm crops, takes from the soil certain chemical substances termed plant-foods, which are indispensable to its proper growth and development. The average soil contains all the essential plant-foods, though not always in sufficient amount or in proper form for the production of the best crops. The problem of manuring consists in adding to the soil, in a form which is easily available to the crop, those plant-foods of which it shows a deficiency, or which are present in a form not suitable for the use of the crop. Fortunately, there are only a few plant-foods whose supply is liable to be insufficient to meet the requirements of the crop. These are *nitrogen*, *phosphoric oxide*, and *potash*, and occasionally *lime*.

It is obvious that the ideal system of manuring will be one in which provision is made for returning to the soil at least as much of each of the important plant-foods as is removed by the crop. In this way the fertility of the soil will be maintained from year to year, and may even be gradually increased. If adequate provision is not made, the store of plant-foods in the soil becomes less and less, until finally a point is reached where it fails to produce a profitable crop. To improve such a depleted soil will be a far more costly business than the taking of proper precautions in the first place to keep up its fertility from year to year.

In order to maintain fertility, there are two important factors to be considered:—

(1) The plant-foods removed by the crop.

(2) The plant-food content of the soil.

Unfortunately we have no local data as to the plant foods removed by the vine, but the following figures are stated by Dr. A. I. Perold to represent the average per morgen for the vineyards of France (according to M. Müntz in his "Les Vignes," 1895):—

	Nitrogen.	Phosphoric Oxide.	Potash.
Vine leaves	55 lb.	9.5 lb.	48 lb.
Vine shoots	13 lb.	3.7 lb.	22 lb.
Grape crop	18 lb.	5.8 lb.	24 lb.
Whole vineyard	86 lb.	19 lb.	94 lb.
Wine produced from the grapes	2 lb.	2 lb.	5.5 lb.

The most striking features of this table are the very small amounts of plant-food in the wine and the very large amounts in the leaves. If it were practicable to return to the vineyard soil, the leaves, shoots, and husks of the grapes, very little plant-food would be lost from the soil, because these materials, when ploughed in, would soon decay and yield their plant-food to the growing vines. The coarser woody portions pruned off could even be burned and the ash returned to the soil—the nitrogen would be burned off but the phosphoric oxide and potash would remain in the ash. In the natural course of events a portion of the plant-food in the leaves does ultimately find its way back to the soil, but it is possible that this aspect of the matter might with benefit receive more attention. However, in ordinary farm practice, the vineyard undoubtedly loses a large amount of plant-food annually. For this reason, and also because we wish to increase the fertility of our naturally poor soils, and thereby improve our vineyards in respect of both quantity and quality of yield, manuring will always be necessary.

Taking the figures which indicate the plant-food removed by the whole vineyard, we obtain an idea regarding the quantities of the different plant-foods which should be returned to the soil, and it would seem that the manure used should contain four to five times as much of both nitrogen and potash as of phosphoric oxide. But various other factors have to be taken into consideration, and these will modify our decision in regard to the best type of fertilizer.

As far as the plant-food content of the soil is concerned, in general the soils of the south-west Cape, derived largely from rocks of the Table Mountain series, Malmesbury series, and granite, are of rather poor fertility. According to the 1918 Census, the most important viticultural districts are Paarl, Worcester, Stellenbosch, Robertson (including Montagu), and Malmesbury. In 1911 these districts produced over 80 per cent. of the total crop of the Union Among the larger producing districts, Worcester and Robertson have soils of greater fertility than Paarl, Stellenbosch, Malmesbury, and the Cape. However, with very few exceptions, the soils of all these districts show a marked deficiency in phosphoric oxide, and the supplies of nitrogen and potash are also low on the whole. In parts of Robertson and Worcester areas there is abundance of lime in the soils, but the soils of the other four districts mentioned are very deficient in lime.

With regard to the maintenance of fertility, it is necessary at this point to make a distinction between vineyard lands on one hand and grain lands on the other. In the case of grain farming we are dealing with crops whose demands upon the plant-foods in the soil are considerably smaller than those of the vine. A wheat crop giving a return of 20 bags of grain per bag of seed (i.e. 8 bags per morgen) will remove from the soil per morgen, approximately:—

	Nitrogen.	Phosphoric Oxide.	Potash.
Grain (25 bushels)... ...	36 lb.	14 lb.	8 lb.
Straw (1¼ tons)	12 lb.	5 lb.	27 lb.
Entire crop	48 lb.	19 lb.	35 lb.

Moreover, we practise a rotation, and thus do not have the same crop making the same demands year after year; and, usually, there is a period of fallow in each rotation, when the soil has a rest. The

soil will actually lose only the plant-foods contained in the grain, as either the straw or its equivalent in animal manure will be returned to the soil.

On account of these facts, it is found in the case of grain farming that the composition of the soil is the most important factor upon which to base the composition of the fertilizer used. The chief requirement of a grain fertilizer is phosphoric oxide, and in most cases nitrogen is also needed, but to a less extent. With regard to potash, though the average grain soil does not contain an abundance of this plant-food, its supply is very easily maintained in the soil, since the grain itself contains very little potash. Thus, as a rule, we find it is not necessary to use a "complete" artificial fertilizer (i.e. one containing nitrogen, phosphoric oxide, and potash), but rather an essentially phosphatic fertilizer, containing also more or less nitrogen.

In the vineyard, however, we have an extremely exhaustive crop growing year after year on the same soil and always drawing heavily upon the same plant-foods. The problem of maintaining the productiveness of the soil in this case is different from the above, and needs careful consideration. Experience in this country and in France seems to indicate that a "complete" fertilizer or manure is necessary in order to obtain the best results.

In order to decide how much of each plant-food should be applied to the vineyard per morgen, perhaps the safest general guide in regard to nitrogen and potash is the amount of each of these removed by the crop, viz., approximately 86 lb. per morgen of nitrogen and 94 lb. per morgen of potash. The composition of the soil should also be taken into account, for in some cases the supply of either nitrogen or potash, or both, may be so abundant that the quantity used in the manure could with benefit be considerably reduced, at least for a number of years. In other cases the soil may be so impoverished that it will be necessary to apply more than the quantities suggested above.

A word or two concerning the special functions of nitrogen and potash in relation to the growth of the vine might not be out of place. Nitrogen appears to be actively associated with the rate of growth of the leaf and vine. A strong vigorous growth of leaves and shoots invariably indicates a good supply of nitrogen. An important point to observe is that an excess of nitrogen must be avoided. Large and rapid early growth of leaf and vine is to be encouraged, and the nitrogen supply should be adequate for this purpose. But this rapid growth should not be extended through the ripening season, because it is the fruit, not the leaves and wood which constitutes the crop. Too rank a growth and too extended a growing period will render the vines more liable to disease and will produce fruit which does not ripen well. Thus the nitrogenous fertilizer should be such as will be available during the early growing period of the vine. Dark brown and black soils, which owe their colour to the presence of humus in the soil, generally contain a fair supply of nitrogen. Caution should be exercised in applying nitrogen to such soils, as the supply may already be adequate or very nearly so.

Potash, while absolutely essential, and though taken up by the vine in large quantities, appears to be of relatively less importance than either nitrogen or phosphoric oxide. It is supposed to play a significant part in the formation of sugar in the plant, and it also forms the base of the fruit acids.

With regard to the amount of phosphoric oxide to be applied, the case is somewhat different. With the exception of a few rare cases, all our vineyard soils are deficient in this plant-food, most of them very markedly so. Thus we should aim to supply an excess of phosphoric oxide over what the crop requires, in order to grade up the soil in this respect. Further, it seems to be the opinion of certain French authorities that a large amount of phosphoric oxide in the manure insures a good quality of wine, a more regular production, makes the vines more resistant to disease, and causes the grapes to be of good standard and to ripen well.

These considerations and a study of the manurial practice of the French viticultural areas led Dr. Perold ("The Manuring of Vineyards," *Union Agricultural Journal*, July, 1911), to recommend an application of 120-130 lb. phosphoric oxide per morgen annually.

Thus we have as our general manurial standard for vineyards the following, approximately:—

Nitrogen, 85 lb.; phosphoric oxide, 120-130 lb.; potash, 90 lb. per morgen per annum.

It must be admitted, however, that this standard is somewhat arbitrary. Whether or not the proportions and quantities of the plant-foods are the best and most economical is a matter which can be decided only by experiment, and, unfortunately, our local experimental data are very scanty. The proportion of phosphoric oxide to nitrogen and potash is rather low, and it is possible that better results may be obtained by increasing the phosphoric oxide still further. In any case there is, of course, liable to be some variation according to the nature and fertility of the particular soil concerned. Farmers who are wine producers on a large scale are strongly advised to obtain their own experimental evidence by carrying out tests as described at the end of this article.

MANURES OR FERTILIZERS.

We can now proceed to discuss briefly the various fertilizer materials which are available to the farmer, and which he can use in making mixtures of the required composition.

In the practice of manuring we must consider the effect upon the mechanical condition of the soil as well as the plant foods added. The use of artificial fertilizers alone year after year is unsatisfactory for several reasons. In the first place it is very costly to maintain fertility in this way, and secondly continued use of artificial fertilizers as a rule does not improve the mechanical condition of the soil; in fact, some of them may have a definite injurious effect upon the soil. Artificial fertilizers generally contain little or no *humus* (i.e. organic matter), and humus is a most important factor in the problem of keeping up the fertility of the vineyard. If the soil is inclined to be somewhat heavy, humus helps to open it up, while in the case of light sandy soils it gives body. It also supplies to the vines the most expensive of all plant-foods, nitrogen, in a most economical form. Light coloured soils in particular are in need of humus as a rule.

The two main ways of adding humus to the vineyard are by liberal use of kraal or stable manure, and by green manuring.

Kraal or Stable Manure.

This material, produced on the farm, is the most economical and, perhaps, the best of all manures. Every farmer should produce as much manure on his farm as possible.

The composition and value of farmyard manure is affected by several factors, such as the composition of the materials used for feed and bedding, the kind of animals producing the manure, the amount of water in the manure (the drier the richer), and the age and treatment of the manure.

American authorities state, as a general average, that fresh mixed cattle and horse manure contains about 10 lb. nitrogen, 6 lb. phosphoric oxide, and 10 to 12 lb. potash per ton.

The keeping of live stock to consume products and convert them into manure has long been recognized as one of the easiest and most efficient methods of maintaining the fertility of the soil. A large proportion of the plant-foods eaten by the animals is recovered in the manure, and is returned to the soil in a readily available form for crops; further, it adds a great deal of valuable humus to the soil.

It is impossible to discuss the subject fully here, and for more detailed information the reader is referred to the bulletin, "Farmyard Manures," Local Series No. 79, by T. D. Hall (obtainable from the Department of Agriculture, Pretoria, at 1d.).

The outstanding points to be borne in mind are, firstly, that the liquid excrement of farm animals contains more valuable plant-food than the solid, so that great care should be observed to prevent loss of the liquid. Liberal amounts of straw and little or other absorbent material should be used for bedding, so that the liquid will be absorbed. Secondly, the handling and storage of the manure before it is carried to the lands is of great importance.

If it is carelessly thrown into a heap and left exposed to the weather, very serious losses take place, due to fermentation and leaching. In an experiment at Cornell University, it was found that 4000 lb. of manure (horse) after five months exposure lost 2230 lb. weight, and the material left was worth but little more than one-third of its original value. Many other investigations have confirmed this. To avoid such losses, the manure should be allowed to accumulate in covered sheds in compact and moist condition, and carefully watched to see that it does not heat and ferment. In the case of kraals, abundance of straw, chaff, vine shoots, etc., should be carted into the kraal, and a cement pit should be built near the lowest point, so that any liquid which drains off will be collected in the pit, and can be baled out and spread over the surface of the kraal again.

The farmer should take every possible precaution to get the most out of his manure. The money value of the annual loss throughout the country due to improper methods of handling runs into millions of pounds.

It should be noted that manure is not a "complete" or properly balance fertilizer when used alone, but requires additional phosphoric oxide to balance it up (see the formulae below).

Eight to nine tons per morgen will supply as much nitrogen and potash as we require, but less than half as much phosphoric oxide.

Assuming that the manure contains 10 lb. nitrogen, 6 lb. phosphoric oxide, and 10 lb. potash per ton, its plant-food value to-day is approximately 15s. to 16s. per ton, and it has a great additional value due to the humus it contains.

It is said that for mature vineyards *well rotted manure* is preferable to fresh manure, as the latter causes too rank a growth of leaves and shoots. Rotted manure will usually contain more plant-food per ton than fresh manure, though in the process of rotting a considerable amount of humus and plant-food is lost (2 tons of fresh manure yield approximately 1 ton of rotted manure). Fresh manure is said to be very useful for young nursery stock.

Green Manure.

A green manure is a crop seeded in between the vines, and subsequently ploughed under. It is grown purely for the purpose of improving the soil, not for obtaining any harvested product. Green manuring should find a place in all kinds of farming, whether grain, fruit, or wine, especially where the soils are light, of poor fertility, and deficient in humus. In this country, as far as vineyard lands are concerned, the practice is as yet almost untried.

Any kind of crop may be used for green manuring, but the best crops for this purpose are the legumes, such as peas, beans, lupins, clover, etc. Legumes contain relatively more nitrogen than other crops, and they obtain a considerable portion of this nitrogen from the atmosphere, through the agency of bacteria which live in the nodules on the roots of the plants. The poorer the nitrogen-content of the soil is the greater will be the proportion of nitrogen taken from the atmosphere. Thus we have a ready means of adding nitrogen to the soil in an inexpensive, yet very useful form, and at the same time a large amount of valuable humus is also added.

In the main viticultural areas, field peas would probably form the best green manure, as the crop is succulent, not too fibrous, and decays rapidly in the soil. A good growth of peas in the vineyard would probably contain at least 100 lb. nitrogen per morgen (roots included). This would correspond roughly to a green growth of about 5½-6 tons per morgen. It has been estimated that the crop obtains from two-thirds to three-fourths or more of its total nitrogen from the air (provided the soil is deficient in nitrogen), i.e. in the above case, say, 75 lb. of nitrogen. Thus by ploughing under this crop we enrich the soil to the extent of 75 lb. of nitrogen and several tons of humus per morgen. The market value of the nitrogen alone to-day would be over £4. 10s.

Where green manuring is practised, the crop must be ploughed under as *early* as practicable, so that it will not interfere with the growth of the vines, and also that it may have a chance to decay in time to yield nitrogen to the vine roots.

The seed must be sown as early as possible after the first rains in April, so that the crop may be ploughed under at the end of July or early in August. If the ordinary green or white field-pea be sown early in April, it will be in full bloom toward the end of July, and can then be turned under. After two to three weeks the crop as a rule will have rotted to such an extent that the vineyard can be cross-ploughed or cultivated (i.e. the rotting material will not impede the implements). The best time for ploughing the crop under is when it is in full bloom; but should the rains be late so that the peas cannot be sown until May it may be advisable to turn the crop under before it is in full bloom. Unless the season is exceptionally late, the green manure crop should never be ploughed under later

than the middle of August. Towards the end of August all ploughing operations should have been completed and the vineyard ready for summer cultivation.

It is probable that one of the chief reasons why green manuring of vineyards is not more generally practised is because the ploughing under of the crop presents certain difficulties, especially when the vines are planted 5 feet by 5 feet, or even closer together, for then the farmer cannot use a disk-plough or a disk-coulter attached to a big plough. In such vineyards the following procedure is recommended: Draw a furrow down the centre of each row by means of a double mouldboard plough and sow the peas in this furrow. A small 5-tooth cultivator, set as narrow as possible and with the back arm removed, leaving only the two front and middle arms, is now run in the furrow, thus covering the seed without closing up the furrow too much. When ready to be turned under, the peas are simply trampled into the furrow by labourers and then covered in by running the plough along each side of the furrow. If the growth of peas is not very vigorous, it may not be necessary to tramp them down before ploughing.

When the vines are planted further apart, it is advisable to broadcast the seed and then plough it in, leaving a furrow down the centre of each row. The furrow will be of great help when the crop is to be turned under, as the growing peas can be worked into it and easily covered in by the plough.

If the farmer has sufficient farm manure for his vineyards, he will probably not trouble about green manuring, but if he has only a small supply, or no manure, he is advised to try green manuring, especially if his soil is light and deficient in humus.

When it is used it will be necessary to supplement with fertilizers containing the required amounts of phosphoric oxide and potash.

ARTIFICIAL FERTILIZERS.

With regard to the purchase of fertilizers for vineyards, the farmer will always need to purchase phosphates, and in most cases also nitrogen and potash fertilizers. It will be as well to consider the available sources of each of these three plant-foods separately.

(*a*) *Nitrogenous Fertilizers.*

Government Guano takes first place among these (though strictly a "mixed" fertilizer, containing phosphoric oxide and a little potash in addition to nitrogen), as it is the cheapest and one of the best sources of artificial nitrogen. The supplies are controlled by Government, and, unfortunately, there is only a limited quantity available each year. Failing farm manure and green manure, the farmer is strongly advised to purchase all his nitrogen in the form of guano, if he can get it. A good sample of guano will contain about 10 per cent. nitrogen, 11 per cent. phosphoric oxide, and 1-2 per cent. potash, all in a readily available form, and it is sold at £10 per ton to-day. If we value the phosphoric oxide and potash at current market rates, we find that the nitrogen costs the farmer just about one-half the price he would have to pay for it on the open market.

Blood-meal is a fairly popular nitrogen fertilizer at present. It consists simply of the dried and ground blood of animals, and contains about 12 per cent. nitrogen in a fairly quickly available form, and practically no phosphoric oxide or potash. The demand for nitrogen fertilizers in this country during the war period sent its

price up rapidly, and to-day it sells at about £15 per ton. This makes it rather an expensive source of nitrogen, viz., 25s. for 1 per cent. of nitrogen per ton, or 25s. per "unit" of nitrogen. In guano the nitrogen costs to-day not more than 12s. per unit. (1 unit = 1 per cent. per ton = 20 lb.)

Meat-meal, Whale Meat, Whale "Guano," Fish "Guano," Crayfish "Guano," are all products appearing on the market from time to time in limited quantities, and contain varying percentages of nitrogen and phosphoric oxide. Their nitrogen is usually somewhat slower acting than guano or blood nitrogen, but if their cost is reasonable they might well be used in making up fertilizer mixtures. The intending purchaser should always obtain a guaranteed analysis, give the phosphoric oxide a value of about 7s. per unit (at to-day's market rates), and calculate the price per unit of nitrogen. In this way he can judge if he is getting good value for his money.

Nitrate of Soda is a "mineral" fertilizer found in enormous deposits in Chili (South America). It contains about 15 per cent. nitrogen, and has the advantage of being soluble in water and immediately available to the vine roots. On the other hand, it is easily washed out of the soil by rains, and is, therefore, usually applied somewhat later than other forms of nitrogen. Prior to the war it was sold at about £14. 10s. per ton, but in recent years has been practically unobtainable. Limited quantities are now obtainable at about £25 per ton, i.e. over 30s. per unit of nitrogen.

Sulphate of Ammonia is another mineral fertilizer obtained as a by-product in the coal-gas, coke, and coal-tar industries. It contains 20-21 per cent. of nitrogen, and is also soluble in water, but somewhat slower than nitrate of soda. Prior to the war it cost about £18 per ton (imported), but in recent years has also been practically unobtainable. At present we understand this material is being manufactured locally. If the price is reasonable it may well have a place in the fertilizing of our vineyards. Sulphate of ammonia shows its best effect on soils which contain a good supply of lime, or which have previously received an adequate dressing of lime. At present the quoted price is £35-£36 per ton, i.e. about 35s. per unit of nitrogen.

Nitrate of Lime and *Calcium Cyanamide* (*Lime Nitrogen*) are manufactured fertilizers whose nitrogen is obtained from the atmosphere. The former contains about 13 per cent. nitrogen, readily available, and the latter about 18 per cent. nitrogen, rather slower in its action. These have been used very little as yet in this country. Nitrate of lime was recently quoted at £22. 6s. 5d. per ton at Capetown, i.e. about 34s. per unit of nitrogen.

(*b*) *Phosphatic Fertilizers.*

Superphosphate or *Acid Phosphate* is manufactured from finely ground rock phosphate of lime, or bone-ash by the action of sulphuric acid. The good grade article should contain from 17 per cent. to 22 per cent. of phosphoric oxide, of which practically all is water-soluble, and, therefore, quickly available. This, however, is not such an important consideration for vineyards as in the case of grain crops, and slower-acting phosphates may give quite as good results as superphosphate. Prior to the war large quantities were imported from overseas and the price was as low as £5 per ton.

During the war the price soared up to an enormous figure, but at present it is gradually coming down again. Towards the end of 1919 the lowest quotation received was about £15 per ton for superphosphate containing 19 per cent. water-soluble phosphoric oxide, i.e. about 15s. 9d. per unit. This price is still much higher than that of other forms of phosphate available to the farmer. There is every likelihood that superphosphate will be manufactured locally in considerable quantities in the near future, and the price will then probably be much lower. Superphosphate is a strongly acid fertilizer, and should be used on soils which either contain sufficient lime or which have previously received a dressing of lime.

Double Superphosphate is a concentrated form of superphosphate, containing about twice as much phosphoric oxide as ordinary superphosphate, and usually costing twice as much. Its only advantage over superphosphate is its smaller bulk and the consequent saving of freight.

Bone-dust is one of the best and safest of phosphatic fertilizers. It consists of finely ground sterilized animal bones. The fineness is a most important factor. Under the Fertilizer Act at least 50 per cent. must pass through a sieve of 1/25-inch mesh. It contains 3½ to 4½ per cent. nitrogen and 23 to 25 per cent. phosphoric oxide in a fairly available form. During the war period there was a very great demand for local bone fertilizers, and, as was the case with all fertilizers, its price rose considerably. Recent quotations for bone-dust range from £11 to £13 per ton, whereas the pre-war price was about £7 per ton. We assume that the nitrogen in bone-dust is slower acting than the other common forms, and give it an arbitrary value of 20s. per unit. This means that phosphoric oxide in bone-dust to-day costs about 7s. per unit. In general the finer the bone the quicker it acts. Bone-meal is very coarse and, therefore, slow in its action. Bone-flour is even finer than bone-dust, thus more rapid in its action.

"*Dissolved Bones*" is a form of superphosphate prepared from bones. It contains from 2 to 3 per cent. nitrogen and 15 to 16 per cent. phosphoric oxide, most of which is water-soluble. Its market value will be regulated according to the market value of superphosphate and nitrogen.

Basic Slag (*Thomas Phosphate*) is a phosphatic fertilizer obtained as a by-product in the manufacture of steel. Before the war large quantities were imported into this country, and the trade will probably be re-established in the near future. It is an extremely fine grey-black powder, containing, if of good quality, 15 to 20 per cent. phosphoric oxide and about 40 per cent. of free lime. It is slow in its action and therefore applied early. It is especially suitable for acid soils and for heavy, wet soils. Prior to the war its price was about £4 per ton; to-day, of course, the price is greatly inflated. In order to decide what price he should pay for slag to-day, the farmer is advised to give the phosphoric oxide a value at most equal to that of bone-dust phosphoric oxide, i.e. 7s. per unit, and to allow about 10s. to 15s. per ton for the lime present. Thus 20 per cent. slag to-day is worth not more than £7. 15s. per ton, and 15 per cent. slag £6 per ton.

Cape Cross Phosphate is a material which has been put on the market recently in limited quantities, and a good sample may contain about 2 per cent. nitrogen and 22 to 23 per cent. phosphoric oxide. both in a good form apparently. At the present market value of bone-dust, this material is worth about £10 per ton (if of good grade, as above).

(*c*) *Potash Fertilizers.*

Karroo Sheep Manure or *Karroo Kraal Manure* is the material dug out of the old kraals in the sheep areas. Most of it is many years old, so that a large part of the organic matter has decayed, and the material left is generally mixed with more or less earthy matter. It is much richer than ordinary farm manure, and contains on an average 20 to 30 lb. nitrogen, 15 lb. phosphoric oxide, and 60 to 100 lb. potash per ton. It also contains a good deal of organic matter, but usually in a rather inactive form, in the case of very old kraals. Karroo sheep manure is essentially a potash fertilizer, and still a very cheap form of potash in spite of the fact that its price has advanced considerably of late. It can be purchased to-day at £5 per truck load of about 8 tons f.o.r. at various Karroo stations, and railage to stations near Capetown will cost about £4 to £5 per truck. Thus it will cost the farmer at most 25s. per ton, which is probably not more than the value of the nitrogen and phosphoric oxide alone, even allowing a reduced value for nitrogen. This means that the potash costs nothing.

The coarse, lumpy material should be broken down to a finer condition before applying to the soil. This will pay the farmer better than purchasing fine sifted Karroo manure in bags.

Kraal Ash is obtained by burning Karroo sheep manure. Most of the organic matter and all the nitrogen is lost in burning, and the ash remaining contains on an average 2 per cent. phosphoric oxide and 12 per cent. potash, as well as a certain amount of carbonate of lime. It seems to us that the burning of the manure is an unfortunate practice, and one not to be recommended, for it amounts to a deliberate destruction of a considerable portion of its plant-food value.

It is, however, an economical source of potash, as it costs only £2 per ton f.o.r. at stations near Capetown. Thus the cost of the potash, after allowing for the phosphoric oxide, is 2s. 3d. per unit. Kraal ash is probably best used on acid soils. Its continued use on soils well provided with lime may have a harmful effect in the end, on account of the alkaline salts of potash and soda present.

Sulphate of Potash, Muriate of Potash, and *Kainit* are potash fertilizers obtained from the huge salt deposit at Stassfurt, in Germany. They contain respectively about 50 per cent., 45 per cent., and 12 per cent. of readily available potash, but even at pre-war rates are much more expensive forms of potash than our local products. Of the three, the sulphate is the most preferred.

[To be concluded in next month's *Journal,* when systems of manuring, time and methods of applying manures, use of lime, and manurial experiments in the vineyard will be discussed.—EDITOR.]

CO-OPERATIVE AGRICULTURAL SOCIETIES.

THE SEVENTH CONGRESS OF CO-OPERATIVE AGRICULTURAL SOCIETIES IN THE TRANSVAAL AND ORANGE FREE STATE, HELD AT PRETORIA ON THE 17TH JUNE, 1920.

Minutes of Proceedings.

THE Seventh Congress of representatives of Co-operative Agricultural Societies operating in the Transvaal and Orange Free State Provinces met in the Provincial Council Chamber, Pretoria, on Thursday, 17th June, 1920.

Mr. Johs. Retief (Registrar of Co-operative Agricultural Societies) was elected chairman, and, in addition to the delegates, there were also present: Mr. G. N. Williams (Acting Under-Secretary for Agriculture), Mr. Louis Esselen (Land Bank), Mr. John Dougall (Land Bank), Mr. J. Webb (Land Bank), Mr. G. Oettle (South African Railways), Mr. J. F. Muller (Secretary to the Congress).

The following societies were represented:—

Bethlehem Ko-operatiewe Landbouw Vereniging.
Centraal Westelijke Co-operatieve Landbouw Vereeniging.
Clocolan Ko-operatieve Landbouw Vereniging.
Ermelo Co-operatieve Vereeniging.
Frankfort Ko-operatieve Landbouw Vereniging.
Heidelberg Co-operatieve Landbouw Vereeniging.
Hoogeveld-Eendracht Boeren Ko-operatieve Vereeniging.
De Kestell Ko-operatieve Zuivel Vereeniging.
Koster Co-operatieve Landbouw Vereeniging.
Ladybrand Ko-operatieve Landbouw Vereniging.
Lichtenburg Ko-operatieve Landbouw Vereniging.
Lindley Boeren Ko-operatieve Vereniging.
Lijdenburg Ko-operatieve Landbouw Vereniging.
Magaliesberg Ko-operatieve Tabakplanters Vereniging.
Middelburg Landbouwers Co-operatieve Vereeniging.
Pretoria Landbouw Ko-operatieve Vereeniging.
Reitz Ko-operatieve Landbouw Vereniging.
Rustenburg Boeren Ko-operatieve Vereniging.
Senekal Ko-operatieve Landbouw Vereniging.
Standerton Co-operatieve Boeren Vereeniging.
Vrede Ko-operatieve Landbouw Vereniging.
Waterberg Landbouwers Ko-operatieve Vereniging.
Wepener Ko-operatieve Landbouw Vereniging.
Wolmaransstad Co-operatieve Landbouw Vereeniging.
Central Agency for Co-operative Societies.

In opening the proceedings the Acting Under-Secretary for Agriculture drew attention to three important points which were of special interest to co-operative societies, namely, the publication of the report on elevators by Mr. Littlejohn Philip, the progress made during the past year in respect of the federation of co-operative

societies, and the estimated maize surplus of 600,000 bags of the current season's crop.

From a brief report submitted by the Registrar of Co-operative Societies, it appeared that 8 new societies had been registered since the holding of the last Congress—5 in the Orange Free State and 3 in the Transvaal. Three societies were dissolved, without occasioning any financial loss to the members, and 2 were not yet actively engaged in the transaction of business. The total number of active societies at date was 37, as compared with 18 four years previous, and the total membership 10,122. The turnover of the societies during 1918 and 1919 was as follows:—

	1918.	1919.
Maize sold	784,615 bags.	739,595 bags.
Tobacco sold...	1,534,621 lb.	2,795,641 lb.
Dairy products	—	£4,384
Other produce	£142,537	£153,317
Farming implements and machinery supplied to members...	£172,356	£152,268
Cattle supplied to members ...	£16,473	£3,950

At the present rate of expansion the turnover is likely to be considerably more next year.

The total reserve fund of the societies (exclusive of the reserve for bad debts) amounted to £94,844, as compared with £81,300 in the previous year.

The first item on the agenda was:—

1. (*a*) *That resolution No.* 6, *passed by the last Co-operative Congress, be again discussed, viz.*:—

   That the Railway Administration be held responsible for the number of bags of grain delivered to it for transport to the mills as well as to the ports.

Several delegates complained that the attitude of the Railway Administration in regard to this matter was most unreasonable, and cited instances of unfair treatment on the part of the Administration. The societies were constantly suffering heavy losses as the result of maize being lost in transit, but the Railway Administration refused to accept any responsibility in regard to such losses unless an extra charge of 1d. per bag was paid. In consideration of the fact that the societies built stores and undertook the loading of their maize themselves—whereby the Administration was being spared a good deal of trouble and expense—the societies contended that the Administration should provide a checker and accept responsibility for losses without any extra charge being paid. Even in cases where the extra penny per bag had been paid, the Administration had refused to entertain the claims of some societies for compensation. The attitude of the Administration generally, while not actually hostile, was most unsympathetic towards an organization which had always proved a considerable source of income to the railways by reason of the large volume of business provided by the societies.

In reply, the representative of the Railway Administration (Mr. Oettle) said that, far from placing obstacles in their way, the Administration was only too eager to assist the societies in every possible manner. If the societies could not obtain redress of their grievances from the local station staff, let them communicate with

the head office, and the matter would be thoroughly investigated. The Railway Administration, after all, was bound to carry out the Railway Act, which had been formulated, not by the Administration, but by Parliament. The Administration's attitude in regard to losses on the railways was simply this, that it was carrying the goods at such a low rate that it could not possibly undertake responsibility for losses without an extra charge being paid. Such losses were due, not only to bags dropping off the trucks, but also to thefts, which the Administration had done its best to prevent, but without success. He would suggest that each of the societies furnish the Administration with a statement indicating the number of bags lost in transit during the past year, so that it could be seen what ground there was for their complaint. The charges made by some of the delegates regarding the non-payment of compensation in cases where the extra 1d. per bag had been paid, etc., would be investigated by him upon his return to headquarters.

Item No. 1 (*b*).—*Lower railway tariffs for agricultural machinery and requirements.*

The delegates expressed the view that the existing railway tariff for agricultural machinery and requirements was excessive. The transport on a consignment of 17 bales of grain bags from Port Elizabth to Leeuwdoorns amounted to £28, and on 1500 rolls of wire from Delagoa Bay £44, while on wood the transport charges were more than the market value of the wood itself. Such a state of affairs did not tend to encourage production, and a reduced tariff was highly necessary.

Mr. Oettle pointed out that agricultural implements took up about five times as much room as other articles, and were being conveyed at an exceptionally low rate. The expenses of the railways had increased to such an extent that it had been found necessary to increase the tariff charges by 33⅓ per cent., and he could not hold out much hope of a reduction.

The following resolution was then passed unanimously:—

"That the Railway Administration be requested to make provision for a lower tariff in respect of agricultural implements."

Item No. 1 (*c*) *and* (*d*).—

(*c*) *The provision of more facilities by the railways to co-operative societies.*

(*d*) *Discussion of the report of the Central Agency in connection with the resolution passed by a previous congress concerning the hiring of stands by co-operative societies on railway ground, the construction of railway lines to the stands, and the payment therefor.*

The report of the Central Agency was, briefly, to the effect that a deputation from the agency interviewed the General Manager of Railways in connection with this matter. Figures were submitted to them to prove that co-operative societies were being treated much more leniently than the general public as regards rent for railway stands, and the Railway did not see its way clear to reduce the rent. As far as the construction, maintenance, and repair charges of the sidings were concerned, only the actual costs incurred by the Administration were recovered from the societies, and the Administration would not be able to reduce the charges without incurring a loss itself.

In discussion of the report a number of grievances against the railways, such as lack of shunting facilities at the societies' private sidings, preferential treatment to merchants in the matter of allocation of stands, the raising of the rent of railway stands in cases where the status of the station was raised, etc., were brought forward by the delegates, who maintained that co-operative societies should at least be afforded the same privileges as those allowed by the Administration to the shopkeepers.

The Administration's representative pointed out that the difficulties of the societies in these respects were mostly due to the fact that the societies usually came into the field after the station ground had been allocated to other persons, and the Railway consequently very often found it difficult to meet the societies, who, as a rule, required a larger piece of ground than the merchants did. In the matter of rent the societies were being treated much more leniently than the shopkeepers. The specific grievances voiced by the delegates would be carefully investigated.

The following resolution was passed unanimously:—

"That more facilities be granted by the Railway Administration to co-operative societies, in conformity with the discussions of the Congress."

Item No. 1 (*e*).—*That permits for the export of mealies be furnished to co-operative societies direct.*

In view of the large surplus of maize which would probably be available for export, the delegates urged that the societies should not have any difficulty in obtaining the necessary permits.

The Administration's representative replied that the permit system had been introduced owing to the limited accommodation at the coast and the shortage of railway trucks. Where an exporter could prove that he had sufficient accommodation at the coast, the Department issued a permit, but the maize could not be consigned before the station master had received orders to that effect. Permits were being issued only to exporters.

The Congress resolved:—

"That before issuing permits for the export of maize, the Government should satisfy itself that the persons applying for such permits are actually in possession of the maize."

Item 1 (*f*).—*That the railways be requested to apply a lower tariff in respect of produce received at branch stores and which must be reconsigned to the main store for treatment.*

It was pointed out that raw material consigned from stations for treatment at the societies' main store, as well as maize delivered at sidings where there was no store, had, when sold, frequently to pass over the same line twice, in consequence of which the societies were required to pay double transport charges. The Congress resolved:—

"That the Railway Administration be asked to apply a lower tariff in respect of produce passing twice over the same railway line."

Item No. 2.—*That the legislation in connection with the liability of resigned members of co-operative societies for Land Bank loan be clearly explained.*

A good deal of discussion took place on this point. In accordance with a resolution passed by the previous Congress, the Registrar read the legal opinion obtained by the Agricultural Department regarding

the liability of resigned members for Land Bank loans. This was briefly to the effect that a resigned member remained liable for all loans raised by his society from the Land Bank on any authority granted during the period of his membership until such time as that authority was cancelled. One of the delegates referred to the difficulty this would entail in closing off the estate of a deceased member, as it would prevent creditors from filing their claims within the required time. The Registrar also explained to the delegates that the provisions of the Co-operative Act, to the effect that a resigned member was free from liability as soon as the society's balance-sheet showed a profit, were specially over-ruled by the Land Bank Act as regards societies obtaining their funds from the bank. Finally it was resolved that a committee be appointed out of the Congress to confer with the Land Bank with a view to the elucidation of Section 32 of the Land Bank Act.

Item No. 3.—The desirability of making provision in the Co-operative Act to the effect that a member, upon relinquishing active farming operations, will be allowed to transfer his entire share or interest in the society to one of his sons, subject to the approval of the Board of Directors; and that, in the event of a member's death, the amount to which his heirs are entitled and which must be determined by the Board of Directors, but which in no case shall exceed 75 per cent. of such share, shall only be fixed at the end of the financial year, when the books shall have been audited.

In regard to the first portion of the motion, the delegates appeared to be divided in their opinion as to the desirability of adopting such a measure. It was pointed out by some delegates that a member who had assisted in building up his society's reserve fund should, upon retirement from farming operations, have the right to transfer his share therein to one of his sons, without the latter having to pay entrance fee. In the opinion of other delegates, however, the fact that any one member had done much for the society should not entitle his son to the privileges of membership free of charge. The son might not prove a desirable member, and all sorts of difficulties might arise.

The Registrar pointed out that from a legal point of view, if it was merely desired to transfer a member's share in the reserve fund, this could perhaps be effected by altering the regulations of the society to that effect; if it was the intention also to transfer a member's liability to his son, the Act would have to be altered. But he thought that creditors would undoubtedly object to such transfer. Finally it was resolved that the matter be left to the discretion of the boards of the different societies.

As regards the second portion of the motion, the proposer said that in the event of the death of a member it was impracticable to determine his legitimate share in the reserve fund as at date of death without a proper audit, and for that reason it was thought advisable that such share should only be paid out at the end of the financial year, when the books would ordinarily be audited. Mr. Retief explained that in the case of resignations, the resigned members' liability ceased only at the end of the financial year, but it was obviously impossible to apply the same principle in respect of deceased members, whose estates would in that case remain liable for obligations incurred after a member's death. If this was contemplated,

then an amendment of the Act would be necessary, but if it was merely desired to defer payment of a deceased member's share until the end of the financial year, this could be done by an alteration of the regulations. The Congress thereupon resolved:—

"That the estate of a deceased member shall not have the right to claim payment of his share until after the expiration of one month after the close of the financial year."

Item No. 4 (*a*) *and* (*b*).—*Necessity of appointing additional inspectors for the Co-operative Division of the Agricultural Department, to ensure more frequent and more searching inspections of the books of co-operative societies.*

(*b*) *That arrangements be made for the appointment of more inspectors for the Co-operative Division, and that a larger sum be granted for organization purposes.*

These motions were adopted by the Congress without discussion.

Item No. 4 (*c*).—*That the Minister of Agriculture be requested as early as possible to submit to Parliament an amendment of the Co-operative Act, whereby societies which so desire will be enabled to appoint the Inspector of the Registrar of Co-operative Societies as their Auditor.*

The delegates referred to the vital importance of efficient book-keeping and to the difficulty experienced by some societies in getting suitable auditors with a thorough understanding of the business methods of co-operative societies. Even if such men could be secured, the costs involved frequently proved a serious drawback to newly established societies. It was thought that the inspectors of the Co-operative Division, who were thoroughly versed in the business conducted by the societies, would be best suited to act as auditors, and the Congress resolved:—

"That the Minister of Agriculture be requested to introduce to Parliament at the earliest possible date an amendment of the Co-operative Act enabling societies, who so desire, to appoint the inspectors of the Registrar of Co-operative Societies as their auditors, and that co-operative societies are willing to pay half of the fees."

Item No. 5 (*a*).—*Desirability of making provision in future for the sale of all grain at gross weights and not at net weights, as the prevailing custom provides for, whereby no payment is made for the container in which the grain, wool, or other produce of the farmer is delivered.*

(*b*) *That it is desirable in future that a bag of maize, wheat, etc., shall be understood to weigh* 200 *lb. gross, and of oats and lighter grain* 150 *lb. gross.*

(*c*) *That the law be so amended that the present weight of a bag of mealies be decreased to* 200 *lb.*

(*d*) *That the desirability be discussed of taking steps to introduce the principle that when grain is sold the bag shall not be included but shall be returned by the buyer, or the value thereof shall be refunded.*

(*e*) *That farmers should obtain some payment (if not in full) for the bags in which ther grain and wool are delivered, as in the case of most other kinds of goods.*

After discussion, the following resolution was adopted unanimously:—

"This Congress approves of the principle laid down in items 5 (*a*) to (*e*), and refers the matter to the Maize Conference for consideration."

Item No. 6.—The necessity for strict compliance with the provisions of the Co-operative Act, in connection with notification to the Registrar of any changes in the membership.

The Registrar complained that this important matter was being very lightly treated by several societies. Although the law provided a heavy penalty for non-compliance with this provision, considerable laxity existed in many societies in regard to notifying him of the changes in their membership. It had frequently happened that he had been informed of such changes only after a lapse of two or three years, and in some cases not at all.

Lists sent to societies for certification were sometimes only returned after months had passed, which caused delay in the publication of the names in the *Gazette*. All changes in the membership should be reported to him immediately they take place, and particulars of resignations should not be kept over until the end of the financial year before being submitted to him. The books of the societies should at all times indicate who was a member and who was not. Very grave consequences could result from neglect of this important duty on the part of societies. The delegates agreed with the views expressed by Mr. Retief, and the following resolution was passed:—

"That each delegate undertakes to urge upon his society to take such steps as will ensure that changes in the membership will immediately be dealt with by the Directors, and the Registrar be notified thereof without any delay."

Item No. 7.—Collection of outstanding accounts of members and non-members.

The Registrar pointed out that this matter had already been discussed by previous Congresses, and, although an improvement was noticeable, the position left much to be desired. The practice of some societies of giving long credit to non-members was also very undesirable. It was a matter which deserved the earnest attention of the Directors.

The item was duly noted.

Item No. 8.—Retaining Land Bank loans for longer periods than they are actually required.

The Registrar explained the two kinds of Land Bank loans, viz.: (1) Fixed loans, in respect of which interest was paid on the amount granted, and (2) cash credit loans, on which interest was paid on the daily balance outstanding. As soon as the societies received the money for members' produce sold, they should immediately repay the instalment on the cash credit loan, otherwise unnecessary interest charges would be incurred. The representative of the Land Bank fully endorsed Mr. Retief's recommendation, and pointed out that in the previous week the societies owed the Land Bank £109,000 in respect of cash credit loans, the interest on which amounted to about £100 per week—which must all be subtracted from the price of the societies' produce.

The point was duly noted.

Item No. 9.—*The appointment of efficient graders for co-operative maize societies.*

The Registrar informed the delegates that the Department had agreed to give effect to the resolution passed by last year's Congress to conduct a yearly course of instruction in the grading of maize for the storemen of societies. The course would be held at the coast during the months of June, July, and August, when the storemen would have ample opportunity of making themselves familiar with dry as well as damp maize; the instruction would be given free of charge, but travelling and subsistence expenses would have to be borne by the societies concerned. The months suggested would probably be an inopportune time for the societies to do without their storemen, but this was the most suitable time for the course. The delegates were unanimous in the view that during the months of June, July, and August the societies could not possibly release their storemen for this purpose, and it was suggested that the Department should send graders to the societies to give the storemen the required instruction. The Congress accordingly resolved:—

"That the Department be requested to send efficient graders up-country to instruct the storemen of co-operative societies in the grading of maize, the work to commence during the months of July and August."

The Acting Under-Secretary assured the delegates that the Department would make every effort to meet the societies in this matter.

Item No. 10.—*Stocktaking at the end of the financial year, and the transfer of mealies to the new pool accounts.*

Mr. Retief touched upon the necessity of taking stock at the end of the financial year, the only time when the stock of maize was sufficiently low to permit of its being counted. It was very necessary that this should be done before the maize was transferred to the new "pool" account. Some years ago it was arranged that such stocktaking should take place under supervision of the inspectors of the Department, but owing to the rapid increase in the number of societies this had to be discontinued, with the result that some of the societies were not giving this matter proper attention.

The point was duly noted.

Item No. 11.—*Discussion of the Report of the Central Agency in connection with the resolutions of the previous Congress regarding—*

(*a*) *Treatment of Wool* (*Resolution No.* 11, 1919);

(*b*) *Importation of Agricultural Implements* (*Resolution No.* 13, 1919).

The report submitted by the representative of the Central Agency was to the following effect:—

(*a*) *Treatment of Wool.*—This has received the very serious consideration of the Board. As the result of its efforts, the wool of co-operative societies was being handled at Durban since September last under the supervision of the Agency's own expert, with the result that the societies' wool had fetched almost the same price in Europe as Australian wool. Within a short time the Central Agency would

be in possession of its own warehouse at the coast, which would undoubtedly prove a great advantage. In order to ensure concerted action by all wool-growers in this matter, it had been decided to float a large wool company, the prospectus of which would shortly be issued. The Agency itself was going to subscribe for 10,000 shares in the company, and support had been promised by persons outside the Agency. There was not the slightest intention to establish a "ring" of wool-growers, but to ensure that the farmer secured the world's market price for his product.

(*b*) *Importation of Agricultural Implements.*—Owing to the abnormal conditions caused by the war, the Central Agency had not yet been successful in establishing the necessary agencies for the direct importation of the requirements of farmers; it has, nevertheless, been able to procure some articles direct from the manufacturers at very reasonable prices. It had been decided to send a deputation from the Central Agency to Europe in connection with this matter, and this deputation would depart on its errand as soon as conditions overseas became a little more settled than at present.

Item No. 12.—*That the words "during the last preceding three years" in Section* 24 (2) *of Act No.* 17 *of* 1908 *and in Section* 25 (2) *of Act No.* 1 *of* 1910, *be deleted.*

The proposer of the motion pointed out that the present law provided that in the event of a society liquidating, the reserve fund was to be distributed among the members in proportion to the turnover of each member during the last preceding three years. The effect of this provision was that the member who had loyally supported his organization for many years would, upon liquidation thereof, receive exactly the same share of the reserve fund as the member who had only belonged to the society for the three years immediately preceding such dissolution. Moreover, such a member's turnover might be very small during those particular three years through adverse circumstances, and a large turnover during the previous period of the society's existence would not count when the reserve was being distributed. This matter had been brought up at the 1918 and 1919 Congresses, and it had been decided to have the law altered in the manner indicated, but it had not yet been found possible to introduce the necessary amending legislation. This should be done at the earliest possible date. The motion was unanimously passed.

Item No. 13 (*a*) *and* (*b*).—*That this Congress expresses its disapproval of the fixing of prices of the produce delivered by the farmer, and requests the Government not to stop the export of maize.*

(*b*) *Disapproval of Government interference in connection with the grain trade.*

The Acting Under-Secretary for Agriculture, in reply to a question, informed the Congress that no permits were being granted at the present time for the export of maize, and that it was difficult to say whether any portion of the coming season's crop would be exported. The consensus of opinion, as expressed by the delegates, was strongly against the stopping of the export of maize and any interference on the part of the Government with the grain trade. One delegate contended that Government interference in regard to wool had resulted in heavy losses to farmers, while the restrictions placed on the export of grain had occasioned the farmers a loss of

3s. per bag. An open market was desired, not only for our surplus products, but for the whole crop. Finally the following resolution was passed by the Congress:—

"Seeing that the export of maize has been stopped by the refusal of the Government to issue permits, the Congress resolves to request the Government to issue permits for the export of maize and other products; the Congress further requests the Government not to fix the prices of grain and other products."

Item No. 14.—*Better co-operation between all co-operative societies in South Africa in connection with import and export.*

The representative of the Central Agency explained that the motion referred to the proposed federation of co-operative societies in the various Provinces. The proposed deputation to Europe would carry more weight if it could proceed on its mission as representing the whole Union.

The Congress resolved:—

"That an endeavour be made to secure better co-operation between all co-operative societies in South Africa in connection with import and export."

Item No. 15.—*Discussion of the rate of exchange.*

Several delegates attributed the losses incurred annually by their societies in connection with the export of hides, wool, etc., to the existing rate of exchange. A deputation from the Central Agency had interviewed the Minister as well as the General Manager of the National Bank, and it appeared as if the rate of exchange was improving. A delegate suggested that the trouble could possibly be overcome by the introduction of a system of barter with other countries. The Congress resolved unanimously:—

"That this matter be referred to the Government for earnest consideration, and that the Government's attention be drawn to the fact that the present rate of exchange is seriously handicapping the export of produce."

Item No. 16 (*a*).—*Discussion of the desirability of the establishment of a pension fund for officials of co-operative societies, and the appointment of a committee to draft a scheme for this purpose.*

The majority of the delegates expressed themselves in favour of the establishment of a pension fund for the officials of co-operative societies, and argued that this would attract the right class of man, and induce the present officials to remain with their societies. Other delegates were opposed to the motion, as they feared it would involve too much extra expense and tend to discourage ideas of thrift on the part of the officials; if they could not make ends meet with their present salaries they should be paid more; a reasonable remuneration, and not the prospect of a pension, was the best attraction for men who proposed joining the staffs of the societies. After a lengthy discussion the following resolution was passed:—

"As this Congress realizes that the time has arrived to secure the services of the best officials for co-operative societies, it recommends that the Central Agency draft a scheme making better provision for such officials, such scheme to be submitted to the various societies for consideration."

Item No. 16 (*b*).—*With a view to securing uniformity of action stimulating the co-operative movement in South Africa and ensuring the future of co-operative officials, this Congress expresses itself in favour of technical examinations for all secretaries, embracing the three following subjects at least:* (a) *book-keeping,* (b) *secretarial practice, and* (c) *co-operative legislation and principles, equivalent to the senior grade of the National Commercial Examinations; the administration thereof to be vested in the Registrar of Co-operative Societies and not in the Advisory Board for Technical Education.*

In introducing the motion, a delegate said that the failure of some societies could be directly attributed to maladministration, due to the appointment of incompetent officials. Very often directors were not in a position to judge as to whether an applicant for the secretaryship of their societies possessed the necessary qualifications. The introduction of a test such as was indicated in the motion would not only result in societies getting qualified and capable men, but would ensure uniformity of administration. The Congress resolved:

"To adopt Item No. 16 (*b*) and to request the Registrar to ascertain whether the proposal can be carried out."

Item No. 17.—*The desirability of the Government's fostering to the best of its ability the manufacture of maize into foodstuffs, as carried out in America, as the export of maize foods should be of greater benefit to the country than the export of the grain itself. This also applies to wool and hides.*

Accepted without discussion.

Item No. 18.—*That the Central Agency should open an office for fire and general insurance business on behalf of all co-operative societies.*

The representative of the Central Agency informed the Congress that his Agency had been appointed as agent of the London and Liverpool Assurance Company and had secured a discount of 5 per cent. for societies doing business with that company. Other delegates were opposed to the societies starting an insurance business themselves, as the premiums would, as yet, be too little to enable the undertaking being conducted with success.

The item was noted.

This concluded the agenda.

The following motion was then proposed by one of the delegates and accepted *nem. con.*:—

"That this Congress resolves to send a telegram to the Minister of Finance requesting him to increase by £1,000,000 the funds of the Land Bank, whose functions have lately been greatly extended."

In reply to a question, Mr. Retief informed the Congress that it had been decided to establish a federation of the central agencies of the different Provinces. Some trouble had been experienced owing to the articles of association of some of the central agencies being in conflict with the Act. He had been delegated to draft a set of regulations for the agencies, and until such time as these were accepted by the agencies concerned, the question of the establishment of a federation would have to remain in abeyance.

After the usual motions of thanks had been passed, the Congress closed.

WALNUTS.

Note by I. Tribolet, Chief, Division of Horticulture.

A GOOD, deep, fairly loamy soil, with a certain percentage of lime, and a consistent water content provided either by the heavens or by irrigation, are required to grow the walnut to the best advantage. Drainage must be good, but a uniform and abundant supply of soil moisture is necessary in winter as well as in summer. This is one of the main requirements of the tree. With abundance of water groves are sometimes very successfully grown under sward, or without much cultivation, but if water is not very plentiful good cultivation should be practised. The softer-shelled varieties are somewhat more delicate than the hard-shelled varieties.

When propagating from seed, especially if the trees are to bear as seedlings, only the finest well-matured nuts should be used, and these should be selected from the best and most prolific trees in the grove. About June and July the nuts are spread out in a single layer on a well-drained piece of ground dug out to a depth of 3-4 inches. For good drainage a slope is preferable. After digging out the ground spread a layer of sand an inch or so thick in the hole and put down the first layer of nuts, then another layer of sand a couple of inches thick, then another layer of nuts, and so on until there are three or four layers of nuts; the sand will then be forming a mound some few inches above the general level of the soil. This must be watered now and again to keep the sand fairly moist. As soon as the nuts begin to split and throw out shoots they may be planted out in the nursery rows, 3 feet between the rows and about 1 foot 6 inches apart in the lines, and allowed to grow in this state for a season or two, when they are planted out in orchard form. If seedlings are required for grafting in the nursery rows to other varieties they should be left for another season or two, and then planted in the orchard and tended after the manner of any other standard orchard trees. Although most of our groves now in bearing are seedlings, the tree is much improved by grafting on suitable stocks. One of the best stocks at present known is the Northern Californian Black Root (*Juglans hindsii*). Varieties grafted on selected seedlings of this tree give thrifty vigorous plants, more resistant to excessive moisture and drought than when grafted upon almost any other root. It is not susceptible to root rot, and in every way gives satisfaction. In the case of walnuts grafting is more practised than budding. When budded, the flute or whistle bud is mostly used. A good grafting wax is as follows: 3 to 4 lb. of resin, 1 lb. beeswax, 1 pint boiled linseed-oil. The resin and wax are thoroughly melted and mixed with the oil when in a liquid condition.

Very little pruning is required after the tree is shaped. Pruning out where too thick is about all that is needed. Where the tree does well, the distance when planting should be from 30 to 50 feet apart, and even more under very favourable conditions.

From the rather limited experiments that have been carried out in manuring, the results go to show that ordinary stable manure is as good as anything that can be used. The principal requirements are nitrogen and phosphoric oxide; these are generally supplied by

ploughing under green crops such as peas, beans, or vetches, and using stable manure, dried blood and superphosphate or basic slag. To get any appreciable increase in crop, the manuring requires to be heavy—say, 10 to 15 tons of stable manure, or a ton to a ton and a half of concentrated fertilizer, to the acre.

After washing and drying the nuts they are usually bleached to give them a good bright appearance. The following formula is used: 6 lb. bleaching powder (chloride of lime), 12 lb. washing soda, 50 gallons of water. Dissolve the bleaching powder in about 4 gallons of water. Dissolve the washing soda in about 4 gallons of water. Add one solution to the other and stir well, let sediment settle to the bottom, draw off the clear liquor and add water to make 50 gallons. Put the nuts in a large dipping box, immerse in the fluid, and then add $1\frac{1}{4}$ lb. of 50 per cent. sulphuric acid and agitate by raising and lowering the dipping box. The bleach should be reached in 5 to 10 seconds; the nuts are then washed in clear cold water and put out to dry.

Old Dutch Canal, Elsenburg School of Agriculture.

Outbreaks of Animal Diseases in the Union

During November, 1920, there were reported 11 outbreaks of East Coast fever (6 Transvaal, 5 Natal), 35 of mange (mostly in the Cape), 148 of anthrax (Transvaal 70, Cape 11, Transkei 40, Orange Free State 22), 1 of tuberculosis (Orange Free State), and 2 of lung-sickness in the Transvaal.

Meat Statistics.

During November, 1920, 3909 quarters of beef were exported and 1879 carcasses of pork, while 7047 head of cattle were imported from territories adjoining the Union, 772 being for breeding purposes and the balance for slaughter. Compared with previous years, there is a considerable shortfall in the quantity of beef exported this year, while, on the other hand, there is a large increase in the number of cattle imported.

DAIRYING IN THE UNION.

Report by E. O. Challis, Superintendent of Dairying, on certain matters of interest connected with the year ended 31st March, 1920:—

PRODUCTION OF BUTTER AND CHEESE.

	1918. lb.	1919. lb.
Butter—		
By creameries	13,939,558	9,335,219
Sold on markets	2,781,490	2,453,240
Sold to merchants	2,500,000	2,000,000
Totals	19,221,048	13,788,459
Cheese—		
Factories and cheeseries	6,816,314	3,756,145

There was a very serious reduction of 5,432,589 lb. in the 1919 output of butter, as compared with 1918, and in cheese of 3,060,169 lb. The decrease in butter was due, in a great measure, to the aftermath of influenza and the caterpillar plague, followed by a severe drought in all parts of the Union during the months of November and December.

This, to a certain extent, also applies to the output of cheese, but another factor which mitigated against its greater production was the terms offered by the Imperial Government not being sufficiently attractive to encourage export. The first contract was arranged for 1s. 1d. per lb. f.o.b. and payment after the end of 30 days' storage, whereas the second contract only provided for 10¾d. being paid per lb. f.o.b. and two months' storage at the seller's expense. This, combined with the high price demanded by farmers for their milk, made it almost impossible to produce cheese for export, except at a loss. Consequently most factories curtailed the purchase of milk to the extent of meeting local requirements only, and the balance, which otherwise would have been converted into cheese, was generally separated, and the resulting cream manufactured into butter. By quite a number of cheese producers it was considered that manufacturing butter and the feeding of the skim milk to pigs was a more paying proposition than making cheese at 10¾d. per lb.

IMPORTS AND EXPORTS.

	Imports. 1918. lb.	Imports. 1919. lb.	Imports Re-exported. 1919. lb.	Exports. 1919. lb.
Butter	67,275	356,035	29,503*	493,914
Cheese	197,621	20,334	21,330	1,525,638
Margarine	19,702	102,613	—	—
Ghee	540,858	336,224	—	—

* Including butter substitutes.

The somewhat alarming increase in 1919 in the importation of margarine, viz., 82,911 lb., was largely due to the scarcity of butter during certain months in the period under review, and also the prohibitive price of butter at that time. The decrease in ghee is explained in a measure by the fact that a quantity of this commodity was manufactured locally.

With regard to the export of cheese from the Union, the bulk of cheese exported was, no doubt, that purchased by the Imperial Government in 1918, but not shipped until about February or March, 1919.

FARM BUTTER.

Large quantities of farm butter still continue to be produced, but individual effort is of no assistance to the dairy industry, and had the several millions of pounds manufactured by farmers been handled by the various creameries, a uniform article with far superior keeping qualities would have resulted. It is difficult from a business point of view to understand what advantage the farmer gains by going to the expense and trouble of converting his own cream into butter, and then selling same on the open market at a very unremunerative price as compared with that offered by the creameries for the butter-fat content of his cream. Further, the farmer has to provide his butter-making utensils, butter-boxes, paper, etc., pay railage on his butter as well as market dues, expenses which could all have been avoided if his cream were dispatched to a creamery, which, in addition, pays railage on same. In the pioneer stages of dairying in South Africa farm butter was a necessity, as the creamery movement was at that time in its infancy and practically unorganized, but to-day it is quite different. It is only by co-operation and combined effort that we can possibly hope to hold our own in the open markets of the world.

MILK AND CREAM PRODUCERS' UNIONS.

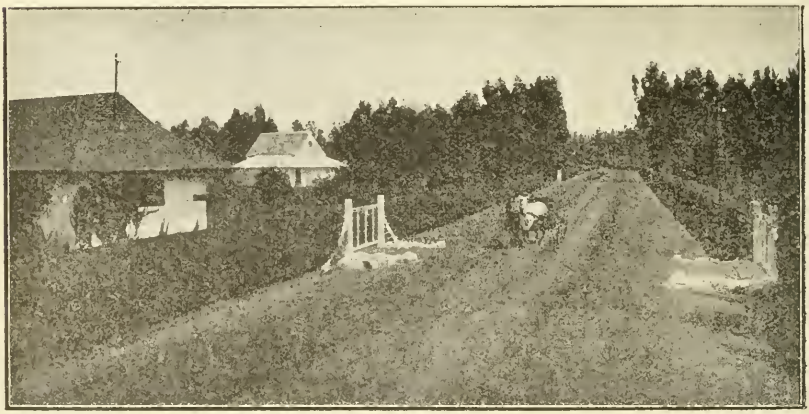
There is a general tendency throughout this country for producers of both milk and cream to form themselves into Unions, with the object of controlling the prices of these commodities. There is no reason why such unions should not exist in the same spirit as chambers of commerce, which are highly organized and useful institutions, but I would utter the warning that producers' unions must be conducted not only on sound business principles, but also on reasonable lines. I am not so concerned with milk producers' unions regarding prices paid for milk for retail purposes as I am with the fixing of definite prices for milk and cream for purposes of cheese and butter. The war being now over, milk and cream producers must realize that prices paid for their raw material are governed entirely by those obtained in the world's markets, and if they insist upon being paid higher prices than the finished article realizes in open competition, it simply means that the dairy industry will be brought to a complete standstill and this country will be flooded with dairy products from overseas; indeed, this, to a certain extent, is now happening. Another point which producers should bear in mind is that the consuming public are only kept supplied all the year round with cheese and butter, owing to factories and creameries conserving large stocks of these commodities for distribution in the "off season," and these stocks have to be paid for at the time of purchase, a big financial strain on the factories and creameries concerned.

GENERAL.

The dairy industry of the Union is in a somewhat peculiar position at the present time, owing to the excessively high prices being paid for both milk and cream for cheese and butter production, and a fall in prices for the manufactured article, which is bound to come sooner or later, will, I am afraid, lead to heavy financial losses. There is also a tendency to erect creameries in districts which are already fully provided for, and a still greater tendency to erect what might be termed "one horse shows," which, in many instances, are badly equipped and still worse managed. Of course, under the Dairy Industry Act of 1918, such premises could be refused registration, but it is extremely difficult to know where to draw the line, and I consider it will be necessary in the near future to define clearly, by Proclamation, what a registered creamery must consist of, requiring all buildings erected thereafter to comply therewith.

In many directions, however, improvements are noticeable, and farmers are paying more attention to winter feeding than was formerly the case. Increased and better shedding accommodation is being provided, and there is a steady improvement in the quality of dairy stock generally. The progress of dairying in the Transvaal Province is perhaps not quite as rapid as that of the other Provinces; there is room for considerable development in winter dairying in the northern Transvaal, which, in my opinion, is one of the best winter-dairying areas in the Union.

The keeping of milk records of pedigree stock continues to make rapid strides, and its benefit is now being fully realized by those who have participated therein. Although the present system of keeping records applies, with one or two exceptions, to Friesland breeders only, it is hoped that before long all pure-breed societies will amalgamate and so considerably reduce the present expenses.



Entrance Drive, Potchefstroom School of Agriculture.

THE OVERSEA MARKET.

PRESENT POSITION OF WOOL MARKET.

Writing under date of 4th November, 1920, the Trade Commissioner in London reports:—

The wool trade is in a most unsatisfactory state. The Continental demand has fallen off owing to difficulties of exchange. As soon as attempts to buy are made it is found impossible to trade owing to exchange. London wool brokers freely express the opinion that wool must come down in price, even below the cost of production. In South America buyers are already purchasing wool below the cost of production. Germany has been purchasing a few coarse crossbreds, but only at a very low price. Australian sales show that best greasy wools have been selling at 10d. per lb. below the London price, and that the only competition which is being experienced there is between American buyers and the local manufacturers for the best class of wool. Generally speaking, wools other than the best are practically unsaleable here. Proposals are now under consideration, as a measure of philanthropy, for sending to Austria about £800,000 worth of wool which is to be worked up there, whilst it is further possible that about 100,000 bales of the poorest quality may be sent to Germany. If these transactions turn out satisfactorily, further supplies of the coarse and poor quality may be disposed of.

As regards the position in Germany, there is at present no scarcity of raw wool in that country. Approximately two-thirds of the looms in the various factories are standing idle, due not so much to the shortage of raw material as to the scarcity of coal, as well as capital, the latter being a very important factor as can well be imagined, having regard to the fact that the German mark is to-day only one-twelfth of its pre-war value. German manufacturers are getting a fair supply of wool locally, and they have no trouble in getting supplies through Holland. My informant, who has recently visited Germany, tells me that he saw piles and piles of raw wool stacked away. He also states that the value in Germany of South African wool, 12-months' growth, is approximately 16d. to 17d. per lb. for the best qualities delivered on board, South African ports.

The position of the trade so far as Bradford is concerned is obviously a very difficult one. At the moment the mills are working only twenty-four hours per week instead of the full forty-eight hours, but the hope is expressed in some quarters, now that there is a possibility of the coal strike ending, that the whole position will be reconsidered with a view of placing more machinery into commission. Although topmakers are turning out large quantities of yarns, they cannot get these yarns taken up, and there are enormous stocks on hand. Manufacturers are in a worse plight, and at least 70 per cent. of the cloth they are making must be taken into stock, whilst they have to find the necessary money to finance it. The financial position, however, is considered to be sound, and it is hoped that in the new year the market will improve. I recently took the opportunity of discussing the position with a Bradford topmaker, who pointed out that South African holders are asking about 46d. per lb. clean scoured basis for 12-months' wool delivered London, 42d. for 10-months, and 38d. for 8 to 10 months' wool. They cannot sell at this price, declared my informant, and would probably have to reduce their limits by at least 1s. per lb., when there would possibly be more chance of a sale being effected. He further contended that the tendency was for prices to go lower in Australia, and that it practically resolved itself into the question as to whether South Africa was going to take the lower price before Australia and to get clear of the accumulated stocks of wool. I mention these statements as indicating the views of certain sections of the Bradford wool industry.

It is freely expressed that the finest wools are still wanted by the Home trade, who will go on to them as soon as conditions improve, but inferior wools and crossbreds will probably have to be sold below cost of production. Excellent crossbreds from South America are said to have quite recently been purchased at 8½d. per lb. in the grease, delivered Liverpool, similar to New Zealand wool which the British Government purchased at 20d. per lb. clean.

To summarize the position, which presents obviously many difficult and even illusive features, it should be borne in mind that at the time of the armistice the general opinion in the wool trade was that the Continent would purchase any quantity of wool which the Allies had to offer, the result being that prices advanced even higher than during the period of the war. Owing to the economic conditions of Germany and Austria and certain parts of Russia and Poland, the demand for wool which was anticipated did not materialize. This fact has been the dominating feature of the market during the past year, and, as the Continent has not been able to purchase either supplies of raw wool or manufactured yarns, the result has been that large stocks of wool have accumulated both in the countries of origin and in the United Kingdom for which there has been practically no demand.

The position to-day is that a good proportion of the stocks of low-class wools cannot be sold to the Continent, either in the form of tops and yarns or in the raw state, and there does not appear to be any likelihood of an immediate demand being created in the absence of some unforeseen development in the political and economic situation. The wool trade, as well as others, is suffering from the effects of over-speculation and fictitious prices, which we shall have to live down, but in the best informed trade quarters it is felt that there is already promise of better things and that, perhaps, the worst of the crisis has been passed.

COMMISSION TO GERMANY.

In view of the serious financial position of the wool farmers, due to the depression in the wool market, the Government, being anxious to render such assistance as can practicably be carried out, has appointed a Commission to investigate the prospects of disposing of South African wool in Germany and other continental countries. The prevailing adverse conditions of exchange has hitherto made it impossible for continental countries to purchase wool to their full requirements, but it is thought possible to establish some arrangement for the exchange of our products for manufactured articles. The Commission, consisting of Mr. E. C. Reynolds, General Manager of the National Bank, and Mr. Chappel, of Johannesburg, left London on the 6th December. They are accompanied by Mr. Canham, Trades Commissioner for the Union, who will also take the opportunity to inquire into the possibilities of trade generally.

Cabled Advices from London during the Month of November, 1920.

Wool.—Extra super scoured 34d. to 45d. per lb; snow whites, 20d. to 33d. per lb.; super long deep grown, 12½d. per lb; super sorted, 12 months, 16½d. per. lb.; super long, 14½d.; long combings, 14d.; Cape long wools, 64d.; tops, 54d. Remainder, greasy combings, range down to: Heavy faulty, 6 to 9 months, 10d. per lb.; crossbreds, 4d. to 10d. per lb. nominal. The postponed 17th series of Government wool sales opened on the 9th and closed on the 20th, the available quantity being 90,000 bales. On the opening day 12,000 bales were catalogued. The attendance was very large, but competition was marked by considerable hesitation, comparatively few lots of Merinos passing the hammer. Judging from the character of the competition superior sorts were 10 per cent., and average and inferior 15 per cent. to 20 per cent., below the close of last sale. Crossbreds declined 20 per cent. to 25 per cent., and there was very little demand for coarser qualities.

At the sales on the 11th and 18th inst., at which about 23,000 bales free wools, including about 10,000 bales Cape wools, were offered, there was a good attendance of buyers, but the demand was poor, a large proportion of the offerings being withdrawn. Compared with the last series prices of all descriptions declined 20 per cent. to 25 per cent., with prospects doubtful.

A cable dated 27th November quotes Cape long wools 64d., tops 54d.

Mohair.—There is no demand, and prices are continuing downwards, with little prospect of any improvement in the tone of the market.

Cape Hides (15th).—Best heavy dry, 15½d. per lb.; dry salted, 14½d. per lb.; wet salted, 11½d. to 12d. per lb. (25th) Sun dried, sound, 15d. per lb.

Sheep Skins (25th).—Sound, 10d. to 11d. per lb.; Cape salted, 120s. per dozen; Cape sun dried, 80s. per dozen; coarse and coloured skins, sound, 10d per lb., prices nominal.

Angora Goat Skins (25th).—Light, 10d. per lb.; heavy and sun dried, 10d. per lb.; bastards, sound, 20d. per lb.; prices nominal.

Goat Skins (25th).—Heavy, 20d. per lb.

Seal Skins (25th).—30s. to 60s. each.

Ostrich Feathers (25th).—Extremely quiet and very little business. Stocks still heavy, and tendency towards lower values. The last receiving date for auction to be held on 7th February next has been fixed for the 24th December, 1920.

Wattle Bark (15th).—Small sales of ground bark lately at £14. 15s. to £15, otherwise no business passing. Some sales to the Continent have been made at £13. 10s. c.i.f., with bids at £12.10s. (25th) Chopped, £13 per ton c.i.f. (nomiual). Extract, £42 per ton (nominal).

Maize (8th).—La Plata November-December shipments, 58s.; cargo of South African yellow (loading) was sold at 61s.; (16th) white flat, grade 2, 60s.; yellow, 53s.; La Plata parcels are quoted at 52s. 3d.; (18th) South African yellow maize, November-December shipments, sold to-day at 55s.; La Plata November-December shipments sold at 47s. 6d.; (23rd) parcels of La Plata November-December shipments sold at 46s.; (27th) La Plata December-January shipments quoted at 44s. 6d., and South African white flat quoted at 53s. afloat and November-December shipments at 54s.; (30th) La Plata December-January shipments, 47s. 6d.

Maize Meal (30th).—No demand. There are sellers at about £16 afloat. The market is depressed.

Sugar.—Since the last report the market has steadily declined. Peru and Brazil sugar 32s. to 34s. f.o.b. The approximate present price of Java sugar is 46s. to 47s. f.o.b. The outlook is uncertain, being dependent upon financial considerations. A rough estimate of the world production in 1921 is 16,000,000 tons, compared with 18,000,000 tons before the war.

Citrus Fruits.—Oranges, 40s. to 55s. per case; lemons, 8s. to 12s. per case.

Raisins and Currants.—Raisins, common, sold at 62s.; fair, 65s. to 67s.; good, 70s. to 73s.; choicest, 95s. Cape raisins were slow of sale: 95s. was asked for large bags. Market quiet. Currants market steady.

Cotton (13th).—American, 14.56d.; East African, 23d.; (20th) American good middlings, 17.43d.; American middling, 12.41d.; Egyptian, 41d.; East African maximum, 30d.; East African good and fair, 20d.

Sisal.—£53 to £54 per ton; prime lots, £56; market firm.

Tobacco.—Market continues lifeless and prices remain unchanged.

Arrowroot.—Petal, 7d. per lb.

Ground Nuts.—Decorticated, £31 per ton.

Gum Animi.—£5 to £20 per cwt. (price nominal).

Kapok.—6d. per lb.; demand is slow.

Sunflower Seed.—£28 per ton (price nominal).

Aloes.—Zanzibar 210s. to 250s. per cwt.; Cape, 60s. to 75s. per cwt.; prices are inflated.

Butter.—No hope of situation improving while article remains under control.

Eggs.—Market quieter and stiff rates ruling. South African eggs realized 42s. to 44s. finest selected, and 30s. to 40s. for poor grades. 3160 cases of South African eggs arrived on the market early in the month.

Read the *Journal*! It acts as a link between you and the Department of Agriculture, which is charged with the furtherance of your interests. It publishes information for the most part of an official nature not otherwise readily accessible. An index will be sent you every six months, so keep the *Journal*. It will prove useful as a book of reference.

STAFF: APPOINTMENTS, TRANSFERS, ETC.

(1) AGRICULTURE.

29/10/20 *E. M. Jarvis, F.R.C.V.S.:* Appointed Temporary District Veterinary Surgeon and stationed at Middelburg, Cape.

27/11/20 *T. G. Hess:* Appointed Technical Assistant, Tobacco and Cotton Division.

(2) AGRICULTURAL EDUCATION.

5/11/20 *Mark Burt, B.Sc.* (Engin., Cape): Appointed Lecturer in Engineering at the School of Agriculture, Elsenburg.

Miss E. Ferguson, who was granted an Oversea Scholarship for the study of Domestic Science in Canada, has returned to South Africa, and been appointed Lecturer in Domestic Science at the School of Agriculture, Elsenburg.

MOVEMENTS OF OFFICERS.

R. T. Falgate, Instructor in Cotton and Tobacco, has returned to duty at Durban from his holiday visit to Europe.

Mr. W. G. Mason, Director of Training Farms, left in the beginning of December on a two-months' visit to St. Helena. His services have been temporarily placed at the disposal of the Imperial authorities for the purpose of inspecting and reporting upon the agricultural potentialities of the island.

Mr. E. N. S. Warren, Lecturer in Sheep and Wool at the Grootfontein School of Agriculture, left about the middle of December on long leave for Australia.

Mr. E. Parish will be engaged during the greater part of January in visiting and discussing with farmers arrangements for compiling statistics in connection with the cost of maize production.

Plant Nurseries in Quarantine as at 1st December, 1920.

Name of Nurseryman.	Address.	Cause of Quarantine.	Extent of Quarantine.
Mrs. A. W. Godwin ...	Durban	Red scale, *Dictyospermi*, *Eriococcus araucariae*	Palms, Araucarias, Roses.
D. A. English & Co. ...	Pietermaritzburg	Red scale ...	Portion of citrus.
W. T. Attwood ...	Capetown ...	" " ...	Whole nursery.
C. F. Marais	Wellington ...	Red scale ...	All citrus.
Municipal Nursery ...	St. George's Park, Port Elizabeth	*C. ficus*	Palms.
F. Grace	Berlin, C.P. ...	Red scale ...	Portion of citrus.
P. Gaylard	" ...	" " ...	" " "
J. Hobson & Co. ...	Kingwilliamstown	" " ...	" " "
J. Clark	Koch Street, Pretoria	*C. rossi* and *C. dictyospermi*	Whole nursery.

NOTES FROM THE "GAZETTE."

Attention is drawn to the following matters of interest which appeared in the *Union Government Gazette*:—

(Abbreviations: "Proc."—Proclamation; "G.N."—Government Notice.)

Gazette. No.	Date.	Items.
1104	12/11/20	A levy of two shillings and one penny has been fixed for each adult male inhabitant of Tyefu's Location in the Peddie district, in respect of the erection of a dividing fence between the farm Gqora Poort and the said location, in terms of Section 3 (2) of the Fencing Act, 1912. (Proc. No. 189.)
1104	12/11/20	Additional regulations relating to the introduction of slaughter cattle into the Union from certain portions of the South-West Protectorate through the port of entry at Nakop, are now published. (G.N. No. 2015.)
1104	12/11/20	Crown Lands in the Molteno Division will be offered for sale at 11 a.m. on Monday, 17th January, in front of the Magistrate's Office, Molteno. (G.N. No. 2019.)
1104	12/11/20	The appointment of Mr. Reenen Jacob van Reenen, B.A.C.E., As.M.Am.Soc.C.E., as an additional member of the Drought Losses Commission is announced. (G.N. No. 2034.)
1104 1105 1107 1108	12/11/20 19/11/20 26/11/20 3/12/30	The compulsory dipping of cattle has been ordered (*a*) every three days (in the three-day dip) for portions of Barberton, Pretoria, and Pietersburg Districts; (*b*) every five days (in the five-day dip) for portions of Richmond, Alfred, Umvoti, Pretoria, Flagstaff, Idutywa, and Pinetown districts; (*c*) every seven days (in the seven-day dip) for portions of the Pretoria District. (G.N. Nos. 2035, 2087, 2130, 2198.)
1105	19/11/20	For the purposes of Section 16 (*a*) of the Diseases of Stock Act, No. 14 of 1911, certain farms have been declared to be in the Witwatersrand District. (G.N. No. 2083.)
1105	19/11/20	Crown Lands in the Division of Gordonia will be offered for sale by public auction in front of the Magistrate's Office, Upington, at 10 a.m., 23rd February, 1921. (G.N. No. 2097.)
1107	26/11/20	The farms Strydfontein (except native portion) and Uitkyk have been declared to be in the Alfred district for the purposes of paragraph (*a*), Section 16, of the Diseases of Stock Act. (G.N. No. 2115.)
1107	26/11/20	Applications for brands, in terms of the Brands Registrations Acts, Nos. 12 of 1890 and 4 of 1897 (Cape of Good Hope), are published in G.N. No. 2133. A list of stock brands is published in terms of Section 5 of the Orange River Colony Brands Registration Ordinance of 1903. (G.N. No. 2156.)
1107	26/11/20	Up to the 7th January, 1921, applications will be received by the Department of Lands, Pretoria, for various holdings in the District of Hoopstad, to be disposed of on conditional purchase lease. (G.N. No. 2158.)
1107	26/11/20	The Districts of Piet Retief and Wakkerstroom have been excised from the Natal Land Board Area, and the Districts of Bloemhof, Wolmaransstad, and Vryburg from the Orange Free State Land Board Area, and have been included in the Transvaal Land Board Area. (G.N. No. 2129.)
1108	3/12/20	For the purposes of the Diseases of Stock Act, the farm The Peak, in the Lions River District, Natal, has been declared to be in the Estcourt District. (G.N. No. 2182.)
1108	3/12/20	A return of brands allotted and registered in the Transvaal during the quarter ended 30th September, 1920, is published in G.N. No. 2200.

RECENT AGRICULTURAL LITERATURE.

I.—UNION GOVERNMENT PUBLICATIONS.

MISCELLANEOUS REPORTS, ETC., OF INTEREST TO FARMERS.

(Obtainable from the Government Printer, Pretoria.)

Price per copy.		*Number of Publication.*
35s.	Evidence taken by the Provincial Administration Commission.	U.G. 8/17.
1s. 9d.	Reports (Majority and Minority) of the Provincial Administration Commission.	U.G. 45/16.

II.—SELECTED LIST OF BOOKS ADDED TO THE DEPARTMENT'S LIBRARY.

[NOTE.—The first number is that of the class to which the book belongs, the last number is that of the book itself.]

GENERAL.

110 Van Gelderen. Duitsch Handwoordenboek, 1ste Deel. Den Haag, 1915. No. 7244.

160 Scherl, von August. Wandkarte von Mittel-Europe. 3 auflage. Berlin, N.D. No. 7245.

240 Bulloek, Ch. Selected Readings in Economics. Boston, 1907. No. 7237.

240 Vanderlip, F. A. Reconstruction. New York, 1918. No. 7300.

270 U.S.A. Department of Labor Bureau of Labor Statistics. Joint Industrial Councils in Great Britain. Reports of Committee on Relations between Employers and Employed, and other Official Documents. Washington, 1919. No. 7290.

350 Searle, A. The Ceramic Industries Pocket-book. London, 1920. No. 7238.

352 Conference Internationale du Froid. L'Institut Internationale du Froid, Paris, 1920. No. 7256.

352 Institut International du Froid. Convention Internationale pour la Creation à Paris d'un Institut International du Froid. No. 7289.

AGRICULTURE, LIVE STOCK, AND ALLIED SUBJECTS.

411 Hummel, W. G. and B. R. Materials and Methods in High School Agriculture. New York, 1913. No 7242.

430.1,68 The Sussex Cattle Breeders' Society of South Africa. Constitution, Rules, and Regulations. The Sussex Cattle Breeders' Society of South Africa. Heidelberg, Transvaal, 1920. No. 7250.

430.2,94 Australia, Parliament of the Commonwealth. Wooltops Agreement between the Commonwealth Government and the Colonial Combing, Spinning, and Weaving Co., Ltd., of 12th March, 1920. Report by the Central Wool Committee in Relation to the Agreement, and the Prime Minister's Reply thereto. Melbourne, 1920. No. 7251.

430.5 Authority of the Council of the Clydesdale Horse Society. The Clydesdale Horse. Glasgow, 1920. No. 7299.

430.7 Jull, M.A. (MacDonald College, McGill University). Farm Poultry, 1915. No. 7252.

430.7 Reliable Poultry Journal Publishing Co. Profitable Culling and Selective Flock Breeding. Quincy, Illinois, 1920. No. 7262.

430.7 Reliable Poultry Journal Publishing Co. (Robinson, J.). How to Feed Poultry for any Purpose with Profit. Quincy, Illinois, 1920. No. 7263.

430.7 Reliable Poultry Journal Publishing Company. Poultry Houses and Fixtures. 8th Edition. Quincy, Illinois, 1920. No. 7264.

431 Roberts, M. Feeding and Management of Dairy Cattle for Official Production. New York, 1920. No. 7297.

450.8 Fritsch, J. The Manufacture of Chemical Manures. London, 1920. No. 7294.

450.8 Van Godtsenhoven, E. M. Recherches sur la valeur Cultrale des Engrais Phosphates. Louvain, 1914. No. 7235.

460 Lecouteux, E. Principes de la Culture Amiliorante. Paris, 1880. No. 7247.

465 Great Britain, Government of. Report to the Board of Trade of the Empire Flax-growing Committee on Substitutes for Flax (Cmd. 672). London, 1920. No. 7302.

467 Buller, R. H. Essays on Wheat. New York, 1919. No. 7265.

468 Knapp, A. W. Cocoa and Chocolate. Their History from Plantation to Consumer. London, 1920. No. 7296.

474 Jekyll, G. Wall and Water Gardens. With Chapters on the Rock Garden and the Heath Garden. London, 1920. No. 7236.

491. Robertson, Wm. Meat and Food Inspection. 2nd Edition. London, 1920. No. 7261.

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THE POULTRY YARD MONTH BY MONTH.

By J. J. JORDAAN, Lecturer and Instructor in Poultry, Orange Free State.

January.

Moulting.—Frequently handle the birds that are being forced through the moult. Do not be alarmed if they are becoming a little thin and poor in condition; if so, stop the epsom salts in the drinking water. If the feathers come out easily when they are caught, or if feathers are seen lying about the runs, lift up some of the old feathers on the saddle or the neck hackle, and if new feathers are showing (which should be the case about the end of the second week) start feeding on the following lines, or do so as soon as the above conditions are noticed. Begin with a small quantity and increase the amount daily until the usual amount is given.

Morning: 4 parts bran, 1 part mealie meal, ⅛ part sunflower meal, ⅛ part linseed-meal, 6 parts lucerne hay or meal, and 1 tablespoonful of sulphur for each twelve birds twice a week. *Midday*: Green food. *Evening*: Above mash and grain on alternate evenings.

Give as large a variety of grain as is obtainable at reasonable prices. Avoid hot or wet mashes and meat meal or other forcing feeds.

Showing.—Birds at this stage of feathering that may be wanted for showing later must be shaded to prevent sun tan. Young birds will want shade to keep their colour, those with white lobes protection from wind, and those of yellow leg colour will want attention. For the last, keep them in a run with plenty of plant undergrowth if available, or during the dry hot weather frequently rub the legs with a little salad oil. If the comb wants to go over in the heavy-combed varieties do not hesitate to put it into a combguard at once. Combguards are obtainable from all poultry appliance dealers. If there is a twist in the comb, it can be much improved by placing warm compressors on it nightly and then gently massaging it in the way desired.

Feeding.—Keep a paraffin tin into which all egg shells, bones, cabbage leaves, potato peelings, etc., are thrown, and every day or two have the lot boiled and mixed with the mash food fed to the chickens. This is generally the cheapest month of the year to buy wheat and oats, so endeavour to get them direct from the farmer, who generally sells this month. Mix your own feeds. It is much more economical than buying those already mixed.

Colonies.—After wheat and oat crops are harvested get all the young stock, turkeys, goslings, and fowls out on to the stubble. They will pick up a large quantity of food. The roaming is good exercise and the fresh soil a tonic. Their manure is also of slight benefit to the lands. Make handy sleeping houses for colony birds, 2 feet 6 inches high, 8 feet long, and 2 feet 6 inches deep, standing on a brick at each corner. There must be a floor in them to ensure that the birds are sleeping dry. The house should be cleaned out daily.

General.—Any hens going broody should be given dummy eggs for a few weeks, as it helps them over the moult. Permanganate of potash should be continued in the drinking water as well as the fortnightly epsom salts, excepting in the case of birds coming through the moult.

Feeding Calves.

THE VEGETABLE GARDEN.

January, 1921.

By H. B. TERRY, Cert. R.H.S. (Lond. and S.A.), Lecturer in Horticulture, School of Agriculture, Potchefstroom.

THIS is recognized as the rainy month inland, whereas at the coast it is one of maximum sunshine and heat; under these peculiar conditions the opportunity should be taken to stock the inland gardens with vegetables for autumn and early winter, and at the coast to wait until February for cooler weather, except for cabbage and cauliflower.

BEANS.—Runner beans, such as Everbearing, St. Fiacre, Scarlet Runners, White Kidney, Italian Runner, Lima Dwarf, or French Beans should be sown largely, as under general conditions it will be the last sowing.

CABBAGE.—Sow Early Savoy, Surehead, Castle, Mammoth for early maturing, also Brunswick, Drumhead Savoy, Spitzkool for late winter supplies.

CAULIFLOWER.—Make a good sowing for late and winter supplies, if not already sown, using Autumn Giant, Late Italian, Reliance, Southern Cross, Large Algiers.

BROCCOLI.—It is a little late for sowing, still, if not already in, sowing should be done; April Queen, Sutton's Winter, and Leamington will be useful now.

CARROT.—Make large sowings to carry over the winter, if there is room; sow Chantenay, Altringham, Scarlet Intermediate, Nantes Improved.

CELERY.—Transplant in trenches or rows for blanching as the plants grow.

SWEET CORN.—Make at least two sowings this month, using Golden Bantam, Early Mammoth, Bothma, Country Gentleman, Stowell's Evergreen in rows three feet apart.

CUCUMBER.—Keep all old plants free from ripening fruits, and make another sowing now. White Spine, Fordhook, Long Green, Cool and Crisp are suitable early sorts. For pickles sow Paris Gherkin; the fruits are only two to three inches long.

LETTUCE.—Continue to sow cabbage varieties, sow thinly where they are to head, and thin out the plants later on; do not transplant now.

MELONS.—Do not allow these to suffer should a dry spell of weather occur anywhere. If the vines are not bearing pinch the growing points out. Too late to sow.

ONIONS.—Too early to sow, but attention to growing crops is essential; weeds prevent the development of good bulbs.

PARSLEY.—Should be sown along edges or in odd places; if possible, throw some long grass over the rows until germinated.

PARSNIPS.—This useful winter stand-by should be sown largely. Sow the seeds thicker than most other seeds, as the percentage of germination is usually about 65 per cent.

PEAS.—Make a sowing of Black-Eyed Susan, as this variety stands heat well; in cooler districts try American Wonder, Gradus.

RADISH.—Continue to sow for quick use, say thirty days.

SPINACH.—New Zealand Spinach should be providing ample supplies where it was planted. Swiss Chard or Spinach Beet is the best to sow now, as it carries through autumn and winter.

MARROWS AND SQUASH.—Make a final sowing of the bush types of Custard Squash and Long Marrows. Where mildew has attacked older plants, have these burned.

TOMATOES.—Plant out any strong plants if available, push them along and thin out side growths; keep plants off the ground, and where necessary spray against leaf blight with bordeaux mixture.

TURNIPS.—A start may be made with Turnips and Swedes, though it is a trifle too hot yet; Snowball, Jersey Six Week, Red Top Globe, and Red Leaf Strap are useful turnips.

POTATOES.—Make main crop planting on high veld; plant good-sized seed; see that only healthy tubers are used. Up-to-date, Factor, Five Towers, Scottish Triumph, German Blues are suitable.

CROP REPORT.

November, 1920.

In the course of his monthly weather report, the Chief Meteorologist states:—Taken as a whole, weather conditions during November were favourable to agriculture over the Transvaal, except in the western section, particularly the District of Lichtenburg, where some farms have had no ploughing rain yet; also parts of Potchefstroom and Rustenburg. In Natal rain is badly needed for ploughing, but growing crops and stock seem generally in good condition, and the veld is looking well; also in Zululand. Although the weather conditions were, generally speaking, not too favourable to ploughing operations in the Orange Free State, the good rains of the previous month, in conjunction with the showers that fell in November, prevented crops from suffering to any serious extent, and stock generally are in good condition, although the veld was getting dry towards the end of the month. In the Cape Province the fruit crop is ripening earlier than usual, whilst the harvest in Namaqualand is described as satisfactory. The unusual heat and strong winds prevented full advantage being taken of the occasional good showers for sowing, and the drought is making itself felt over an increased area; crop prospects poor generally over the summer rainfall area. Cut-worms are attacking the young mealies in the Winburg District of the Orange Free State, whilst insect pests are more troublesome than usual in the Weenen District of Natal.

WHEAT, OATS, AND BARLEY.

The reports received at the end of November from correspondents are the final ones in respect of the wheat, oats, and barley crops, which by this date have generally reached maturity. The season in the south-western districts of the Cape Province, where the greater portion of these cereals is produced, was favourable, and as a rule correspondents reported very little variation from normal, although slight rust has occurred in parts. In the north-west also the season was favourable, but in the other portions of the Cape Province the crops have suffered from the drought, very seriously in some districts. In the Transvaal and Orange Free State some parts received favourable rains, while others were not so favoured, which, combined with damage from hail, birds, and insect pests, has reduced the estimated final yield. The following statement shows the condition of the crops on the 30th November, 1920, indicating the extent to which the yield, which should have been obtained had the season been an ordinary favourable one, has been affected by adverse conditions—

Province.	Wheat.	Percentage below Normal.		
		Oats (Grain).	Oats (Hay).	Barley.
Cape	8	8	16	16
Transvaal	15	12	10	—
Orange Free State ...	22	23	25	—
Average for the Union	10	9	16	16

The estimated crop yields this year which are in excess of that estimated last season, especially in the case of wheat, are as follows:—Wheat, 2,434,000 bags of 200 lb.; oats (grain), 1,662,000 bags of 150 lb.; oats (hay), 38,279,000 bundles of 7 lb.; barley, 364,000 bags of 150 lb.

LOCAL MARKET PRICES.

RATES OF AGRICULTURAL PRODUCE AND STOCK RULING AT THE 15TH DECEMBER, 1920.

CENTRE.	Wheat. Per 200 lb.		Wheat Flour. Per 100 lb.		Boer Meal. Per 200 lb.		Mealies. Per 200 lb.		Mealie Meal. Per 180 lb.		Barley. Per 150 lb.		Oats. Per 150 lb.		Oat-hay. Per 100 lb.		Lucerne Hay. Per 100 lb.		Potatoes. Per 150 lb.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Cape Province—																				
Aliwal North....	32 0	32 0	—	—	—	—	—	—	23 0	23 0	—	—	—	—	—	—	—	—	25 0	25 0
Beaufort West..	45 0	50 0	42 6	45 0	63 0	65 0	20 0	22 0	24 0	25 0	—	—	—	—	—	—	8 0	9 0	32 0	32 6
Capetown.....	32 0	33 0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
East London....	—	—	—	—	—	—	15 0	22 0	—	—	—	—	—	—	—	—	—	—	15 0	52 6
Grahamstown....	—	—	—	—	—	—	20 0	23 0	—	—	—	—	—	—	—	—	5 0	7 6	37 0	45 0
Kimberley.....	35 0	48 0	37 6	42 6	70 0	75 0	16 0	18 0	16 0	18 0	24 0	30 0	15 0	18 0	6 6	7 6	5 9	6 9	10 0	46 0
Kingwilliamstown	—	—	—	—	—	—	8 0	11 3	—	—	—	—	—	—	9 6	12 6	8 6	9 0	10 0	24 0
Port Elizabeth...	—	—	—	—	—	—	19 0	21 0	—	—	12 9	15 9	—	—	7 6	11 6	5 6	9 0	7 6	37 6
Queenstown.....	22 0	53 6	50 0	50 6	61 6	90 0	15 6	16 9	21 3	24 6	24 9	25 6	23 6	26 6	5 0	5 6	6 6	6 9	35 0	40 0
Natal—																				
Durban.....	—	—	—	—	—	—	14 0	18 0	15 0	19 0	—	—	—	—	5 6	12 0	5 0	8 6	10 0	43 0
Pietermaritzburg.	—	—	—	—	—	—	14 0	15 0	—	—	—	—	—	—	6 6	7 0	6 9	7 0	31 6	39 0
Orange Free State—																				
Bloemfontein....	55 0	64 0	30 0	35 0	50 0	75 0	9 6	14 6	14 6	19 0	17 6	22 0	15 0	23 6	5 5	8 6	5 0	8 6	25 0	35 0
Harrismith.....	35 0	40 0	40 0	40 0	75 0	75 0	11 0	12 6	13 6	14 0	25 0	25 0	23 0	25 0	10 6	11 9	—	—	—	—
Transvaal—																				
Pretoria.....	31 0	40 0	—	—	—	—	14 3	15 0	—	—	—	—	—	—	5 6	6 0	5 0	6 1	12 0	31 6
Johannesburg....	22 0	43 0	—	—	43 0	43 0	13 0	15 9	11 10	11 10	16 6	16 6	16 0	18 9	3 3	6 6	4 6	6 0	8 6	25 0

CENTRE.	Onions. Per 120 lb.		Tobacco (Boer Roll). Per lb.		Beans. Per 200 lb.		Beef. Per lb.		Mutton. Per lb.		Fresh Butter. Per lb.		Eggs. Per dozen.		Cattle (Slaughter). Each.		Sheep. Each.		Pigs. Each.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	£ s. d.	£ s. d.	s. d.	s. d.	s. d.	s. d.
Cape Province—																				
Aliwal North....	—	—	—	—	—	—	—	—	6	9	2 0	3 0	2 0	2 9	—	—	—	—	—	—
Beaufort West...	20 0	22 0	1 6	1 6	50 0	90 0	0 10	1 4	0 9	0 11	3 6	3 6	2 3	2 6	10 0 0	15 0 0	21 0	27 0	20 0	60 0
Capetown.....	‡ —	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
East London....	18 0	22 6	—	—	36 0	71 0	—	—	—	—	1 3	4 0	1 6	3 0	—	—	—	—	—	—
Grahamstown....	12 0	18 0	1 6	1 8	50 0	56 0	0 4	1 0	0 10	1 11	2 6	4 3	1 4	2 2	—	—	—	—	—	—
Kimberley.....	12 0	22 6	0 6	1 6	20 0	60 0	0 7	1 0	0 11	1 0	1 10	2 7	1 9	2 9	14 10 0	20 0 0	18 0	24 0	—	—
Kingwilliamstown	10 0	10 0	—	—	21 0	32 0	0 9	1 0	1 0	1 3	2 9	3 2	2 0	2 3	—	—	—	—	—	—
Port Elizabeth...	20 6	26 6	—	—	40 0	94 0	0 8	1 0	0 9	1 0	2 0	3 9	1 10	2 9	—	—	—	—	20 0	160 0
Queenstown.....	—	—	0 9	1 3	—	—	0 6	0 8	0 6	0 9	2 9	3 1	1 6	2 3	17 0 0	17 10 0	37 0	40 0	*0 5½	0 6½
Natal—																				
Durban.....	10 0	22 0	—	—	20 0	63 0	0 4	0 10	0 6	1 5	1 6	3 0	1 6	3 0	—	—	—	—	—	—
Pietermaritzburg.	—	—	—	—	—	—	0 8	0 10	1 0	1 1	1 8	2 3	1 6	2 0	—	—	—	—	—	—
Orange Free State—																				
Bloemfontein....	17 6	26 0	0 9	1 6	40 0	50 0	0 10	1 3	1 0	1 3	1 9	2 6	1 6	2 6	15 0 0	29 0 0	35 0	38 0	*0 11	1 0
Harrismith.....	—	—	—	—	—	—	3	1 3	8	1 2	1 6	2 8	1 3	2 5	8 0 0	16 0 0	15 0	30 0	15 0	50 0
Transvaal—																				
Pretoria.....	5 0	13 0	—	—	—	—	4·8d.	7·4d.	0 7	0 10	1 9	2 0	2 0	3 0	3 0 0	19 15 0	16 6	38 6	*0 6½	0 9
Johannesburg....	7 0	12 6	—	—	19 0	64 3	†40 6	†60 0	0 6½	0 8½	1 7	2 3	1 8	2 3	8 10 0	22 0 0	12 6	37 6	*0 5	1 0

* Live weight per lb. † Dressed weight, including hides, offal, etc., per 100 lb.

NOTE.—The rates quoted for produce sold in bags include, as a general rule, an additional 3 lb. for weight of bag.

THE LOCAL MARKET.

November, 1920.

(NOTE.—The local market prices of certain other agricultural produce and stock are published elsewhere in this issue.

WOOL.

THE depression in the wool market still continues and the latest reports received from London show a further decline in prices of from 20 to 25 per cent. as compared with the October sales. There is no competition amongst buyers, and large quantities of wool at the local markets had to be withdrawn owing to no offers being received. Buyers seem disinclined to purchase wool even at the present low prices as there is no certainty if these will be maintained or if a further decline may be expected.

The following prices are quoted at our local markets :—

	d.	d.		d.	d.
Extra super Kaffrarian skirted combings and similars	17 to	20	Superior Kaffrarian skirted 6 months and similars	9 to	9½
Extra super long skirted	15 „	17	Good shorts 6 to 8 months ...	8 „	8½
Super combing	14 „	16	Average shorts 6 to 8 months ...	6 „	7
Average combing	11 „	13	Inferior shorts	4 „	5½
Inferior 12 months wool	8 „	10	Super Natives	7 „	8
Medium 10 to 12 months skirted...	7 „	9	Medium Natives and Basutos ...	5 „	6½
			Inferior Natives and Basutos ...	4 „	5

MOHAIR.

The mohair market continues weak, but lately there has been a moderate demand for good summer firsts, good mixed summer kid and good mixed hair ; other descriptions are neglected.

The following prices are quoted :—

	d.	d.		d.	d.
Super summer kids	22 to	24	Good mixed hair	9 to	11
Average summer kids	17 „	20	Average mixed hair	7 „	8
Super summer firsts	15 „	16	Winter hair	7 „	8
Good average firsts	12 „	14	Good winter kid	18 „	22

SKINS AND HIDES.

The market is still depressed and the bulk of the offerings show yet lower prices than obtained during previous sales. The cable advices in regard to the skin and hides market are very disappointing, and buyers anticipate a still lower basis of prices being reached.

The following average prices have been realized at the latest sales : —

SHEEPSKINS.

	per lb.		each
Sheepskins, sound	6d.	Capes, salted	69d.
Sheepskins, damaged	3¼d.	Capes, sun-dried	33d.
Pelts, sound	6½d.	Capes, damaged	8d.
Pelts, damaged	1¼d.		per lb.
Coarse woolled skins, sound ...	5¼d.	C. and C. skins, sound	8d.
Coarse woolled skins, damaged ...	1¼d.	C. and C. skins, damaged	1⅝d.

GOATSKINS.

	per lb.		per lb.
Angora, light	6⅝d.	Bastards, damaged	4¾d.
Angora, heavy and sun-dried ...	5½d.	Goatskins, light salted	14¼d.
Angora, shorn	3¾d.	Goatskins, sun-dried	12⅛d.
Angora, damaged	2d.	Goatskins, heavy	11⅛d.
Bastards, sound	9¼d.	Goatskins, damaged...	6⅝d.

HIDES.

	per lb.		per lb.
Sun-dried, sound	10⅜d.	Dry-salted, damaged	7½d.
Sun-dried, damaged	9d.	Fourths	3⅛d.
Dry-salted, sound	10½d.	Horse hides	12d.

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PRINCIPAL CONTENTS.

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CONTENTS.

FEBRUARY, 1921.

AGRICULTURAL SHOW SEASON, 1921.

List of Agricultural Show Dates for 1921, compiled from details furnished by the Agricultural Unions. Dates of further shows will be published as soon as details are available.

CAPE PROVINCE.

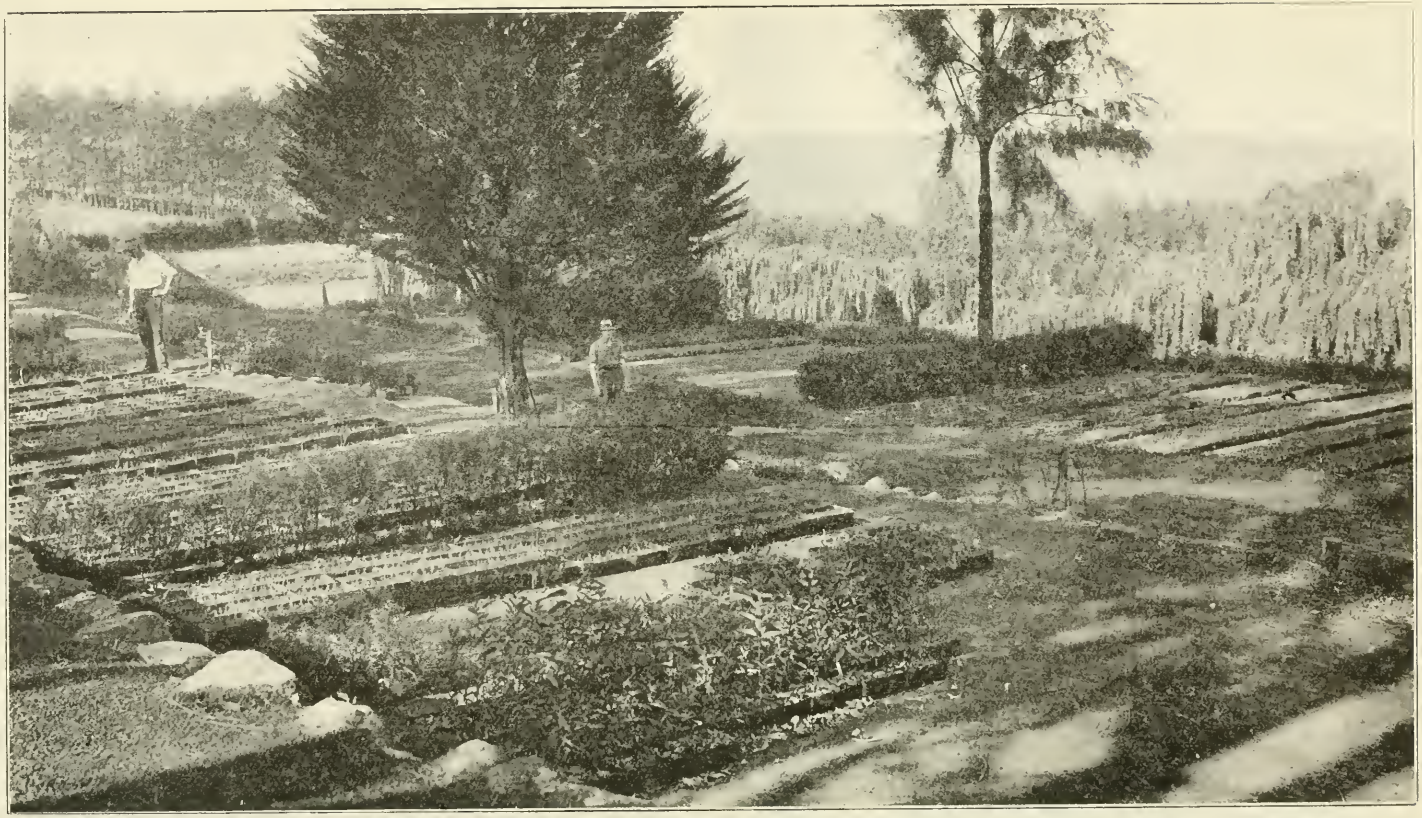
Paarl—2nd February.
Wellington—2nd February.
Stellenbosch—4th February.
Robertson and Montagu—8th and 9th February.
Worcester—10th and 11th February.
Molteno—16th and 17th February.
Caledon—22nd and 23rd February.
Beaufort West—23rd and 24th February.
Middelburg—23rd and 24th February.
Malmesbury—24th February.
Rosebank—1st to 4th March (inclusive).
Graaff-Reinet—2nd and 3rd March.
Humansdorp—2nd and 3rd March.
Aliwal North—2nd to 4th March (inclusive).
Cradock—7th March.
Port Elizabeth—8th to 11th March (inclusive).
Queenstown—9th and 10th March.
Dordrecht—15th and 16th March.
Komgha—1st and 2nd April.
Kingwilliamstown—27th to 29th April (inclusive).
East London—4th and 5th May.

ORANGE FREE STATE.

Smithfield—15th and 16th February.
Marquard—23rd and 24th February.
Ladybrand—1st and 2nd March.
Winburg—1st and 2nd March.
Bethlehem—2nd and 3rd March.
Thaba 'Nchu—8th and 9th March.
Senekal—9th and 10th March.
Vrede—9th and 10th March.
Central Show (B'oemfontein)—16th to 19th March (inclusive).
Harrismith—Early April.

TRANSVAAL.

Middelburg—22nd and 23rd February.
Amersfoort—2nd and 3rd March.
Carolina—8th March.
Ermelo—16th and 17th March.
Johannesburg—23rd to 28th March (inclusive).
Standerton—13th and 14th April.
Heidelberg—27th and 28th April.
Klerksdorp—10th and 11th May.
Pietersburg—24th to 26th May (inclusive).
Pretoria—31st May and 1st June.



FOREST NURSERY: SCHOOL OF AGRICULTURE, CEDARA, NATAL.

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NOTES.

Meeting of Forest Department Officers.

There are many problems connected with forests which can only be solved by the close co-operation of the botanist and the forester, e.g. the correct determination of forest trees, the causes responsible for their distribution, their fungous and bacterial diseases, etc., and the co-operation existing between the Forest Department and the Botany Division was more closely knit on the 6th January last, when the officers attending the Forestry Conference in Pretoria were entertained by Dr. I. B. Pole-Evans and his staff. At the meeting, Dr. Pole-Evans briefly reviewed the work of both scientific and economic importance carried out in co-operation between his Division and the Forest Department. Reference was made to the investigations of Dr. Phillips, Miss Hofmeyr, and Miss Verdoorn at the National Herbarium on important groups of forest trees, which have elucidated some of the confusion which has hitherto existed. A number of interesting lantern slides were shown by Dr. Pole-Evans illustrating the vegetation of the various botanical regions of South Africa. Mr. Legat, Chief Conservator of Forests, referred in the course of a speech to the co-operation and goodwill which has hitherto existed between the two departments and foreshadowed greater assistance still in the future from one to the other. In one direction alone this was assured, and that was in connection with the botanical survey, the speaker having been appointed to the committee to watch forest interests.

The visitors were shown the various laboratories, the Botanical Museum, and the National Herbarium. The meeting was most successful, and it is felt much benefit will ensue from the mutual understanding it has further engendered between the officers of the two departments of the many directions in which they are interdependent.

Services of Government Veterinary Surgeons to the Public.

It is well known that, until comparatively recently, veterinary surgeons were not in any great demand in South Africa, and those that were in practice were nearly all in Government service, dealing with what may be termed the ordinary contagious diseases. But the country is fast leaving behind it the practices which might have suited past conditions, and with the general forward trend and increasing expansion of farming in the Union we need to adopt new methods to keep pace with the requirements of our basic industry. And in no other branch of the industry than that of our live stock does this apply with more force. South Africa is primarily a pastoral country, and the care of our live stock is of paramount importance. During the past years there has been a steady stream into the country of pedigree live stock, and the standard of our herds and flocks is rapidly improving. Combined with this we have the benefit of the investigations of our Veterinary Research Division in the light constantly thrown upon epizootic diseases, together with the rigorous control of contagious diseases by our Veterinary Division, so that as a natural outcome we have most perceptible evidence of the progress of our live stock industry in all branches. And as a consequence the demand becomes more and more insistent for services which veterinary surgeons alone can render. In years gone by the individual animals of our farmers were not of very great value, and the farmer as a rule attended personally to the maladies of his stock, but now that breeding stock have reached a high standard their owners realize the need of the veterinary surgeon and are anxious to be in such a position as to be able to call for his services when required, and to pay for them.

The various ways of meeting the increasing demand for veterinary services have been very carefully considered, and the matter has periodically been discussed by the Agricultural Unions and other farming bodies, the Government being urged to introduce some scheme to meet the changing times. The Acting Principal Veterinary Officer, Mr. Borthwick, has proposed that a scheme by which Government veterinary surgeons will give their services to farmers in connection with work not ordinarily required of them under the Stock Diseases Act, on payment of fees according to a tariff, be given a trial in order to ascertain to what extent the services of Government veterinary surgeons, if charged for, will be made use of by stockowners for veterinary work other than in connection with scheduled diseases. As a beginning, it has been decided to choose one centre in each Province, and for a certain period to allow the Government veterinary surgeon therein to perform outside services for farmers on payment of a fee. The names of the areas in which this trial will operate, the tariff of charges (which will be reasonable), and other particulars of the scheme will be published in a later issue of the *Journal*; but it may now be said that the transport will need to be motor, and must be paid for by the stockowner. The income obtained from the services of our officials will be paid into Revenue.

We hope that farmers in the areas concerned will avail themselves of the facilities provided. Depending on the success of the trial is involved a principle which may have far-reaching results in

directing the policy of Government assistance and control in connection with animal diseases, and we trust that the worth of the system will be demonstrated in no uncertain manner as a result of the coming trial.

Importation of Cattle from Great Britain.

In the May, 1920, number (page 159) we outlined the events which led to the issue of Government Notice No. 1140 of the 27th August, 1919, making it compulsory for all cattle from Great Britain arriving at the Union ports to pass through the Government testing station at Pirbright, Surrey. We referred also to the causes leading to a measure of congestion at Pirbright, and stated that the Department had been approached in the matter by Sir Henry Dundas, a member of the Council of the Highland and Agricultural Society, Scotland, who, on pointing out that difficulties were being experienced by Scottish breeders in sending cattle to Pirbright, was informed that the Union Government was agreeable to such cattle being tested in Scotland provided a station was established there under Government control similar to the one at Pirbright, but that under no circumstances would it be satisfied with tests carried out on the premises of the breeder.

Since the above was written negotiations in the matter have been proceeding, the Ministry of Agriculture and Fisheries being prepared to approve of the establishment in Scotland of a testing station, and having, indeed, instituted inquiries with a view to the acquisition of a suitable site in that country for the station. We are now informed, however, that the proposal has been abandoned by the Ministry owing to the action of the Scottish live stock breeders, who requested the Ministry not to establish such a station in Scotland as they were not in agreement with the principle of requiring animals intended for exportation to pass through a Government testing station.

The reasons which actuate this Government in insisting on the testing of animals for tuberculosis prior to export to South Africa still hold good. The measure is one calculated to protect importers from the loss sustained by them under the old method when cattle from Great Britain were allowed to be tested at the Union ports of entry. This country is still prepared, of course, to accept cattle passed through a duly approved Government testing station in Scotland or the north of England, or anywhere else, but in view of the failure at present to establish one additional to Pirbright it is necessary to make the best of the latter station. In this connection a discussion took place at the last meeting of the Agricultural Advisory Board on the subject of accommodation at Pirbright, when it was stated that congestion took place because of the habit of importers wanting their animals passed through at the same time. Importers are urged, therefore, to assist in remedying this difficulty, as it lies largely in their hands. The Ministry of Agriculture and Fisheries, however, in advising the failure of its negotiations respecting the station in the north of Great Britain, says that it is endeavouring to relieve the existing pressure on the Pirbright testing station by the provision of additional accommodation there. With such accommodation and the co-operation of importers in the Union it is trusted that the inconveniences now being complained of will be reduced to a minimum.

World Crop Results and Prospects.

According to the November, 1920, report of the Statistical Bureau of the International Institute of Agriculture, there is little change, as compared with October, in the position of the 1920 cereal crops.

Wheat and rye show a slight increase on last year's figures [62.3 million metric tons (2200 lb.) in 1920; 61.7 million in 1919]. These totals comprise about three-fourths of the entire yield of wheat and rye in the northern hemisphere, and are exclusive of Russia. The quality of the 1920 wheat crop in the United States is on the average 2 per cent. better than last year's.

The yield of barley is 8 per cent. larger than in 1919, while oats show a substantial increase of 21 per cent. as compared with last year.

The sugar-beet crops of Prussia, Belgium, Spain, Finland, Italy, Netherlands, Sweden, Switzerland, Canada, and the United States amounted in 1920 to 22.2 million tons, which is 36 per cent. more than in 1919.

Turning to the future, the wheat crop prospects, now almost realized, are still reported as very good in Australia. An almost rainless October in the chief wheat areas of British India has delayed sowings for the 1921 crop on unirrigated land, and the growing rice in parts of Northern India has also suffered from the drought. In the United States seeding of winter wheat has been carried on under fairly favourable conditions; in Canada the usual ploughing in preparation for the next crop is very well advanced.

In Argentina offers of new crop wheat have been made at somewhat lower prices than those of mid-October.

Sugar-cane Diseases.

The production of sugar forms an important part of our agricultural wealth, and it is estimated that the sugar output for the season 1919-20 added something like £5,000,000 to the value of our agricultural production. It is fortunate, therefore, that at present there is no very serious cane disease threatening the existence of the industry. There are, however, several sugar-cane diseases found in Natal and Zululand which have to be closely watched. Some of these diseases are of such a nature as to reduce the standard of the cane and so affect the yield; some interfere with or reduce the formation of sugar by the leaves of the cane plant; while others cause the inversion of the sucrose accumulated in the cane stalk, resulting in a loss of sugar, and may also be responsible for troubles with crystallization in the mills. Dr. Paul A. van der Byl, the Mycologist in charge of the Natal Herbarium, Durban, whose investigations into the diseases and other matters connected with the sugar-cane are well known, gives us further valuable information on the subject in an article published elsewhere in this number, entitled "Notes on some Sugar-cane Matters." The article is illustrated and reviews briefly the fungi found by him associated with cane, and indicates the symptoms by which they can be recognized in the field.

Cost of Production of Maize Investigation.

The first stage has now been reached of an investigation undertaken by the Department, at the request of the Maize Breeders' Association, the object of which is to determine the cost of producing maize on representative farms in the chief maize-growing districts of the Union. Mr. E. Parish, B.Sc., Technical Assistant, who is in charge of the investigation, has paid an initial visit to all of the forty odd farmers who are participating in the scheme (except a few in outlying districts). It is hoped that a second and final visit to these farmers will be made at the end of the present maize season in order to collect the information recorded by them regarding their maize crop. In connection with the work already carried out by him Mr. Parish furnishes the following interesting notes:—

The readiness on the part of the farmers to assist in this investigation by keeping detailed records of all the costs concerned in the production of their maize has been most encouraging. For the most part they have been very keen on the work, and have, moreover, made available the information already in their possession in a most gratifying manner. A few have been difficult to convince that there is no ulterior motive behind the investigation—such as the obtaining of information for income tax purposes or for fixing the price of maize—but these, for the most part, have been ready enough to assist when once convinced that the object is solely to obtain information on the economics of maize production in South Africa.

The scheme has been so arranged as to include farms varying in productive capacity from 500 to 20,000 bags of maize, and on which the kind of farming varies from "all maize" to "mixed," and, further, on which the intensity of the farming ranges from the most extensive type of maize growing possible, viz., with land at £2 per acre, with the field operations limited to ploughing, broadcasting, and harvesting, and with no cultivation, rotation, or manure, and a yield of two bags per acre, to the more advanced type of mixed farming with higher costs of production on selected land worth £10 per acre and a yield of ten to twelve bags.

The preliminary inquiries now completed have served to emphasize the diversity of the nature of farming, the climate, the price of land, the pay of labour, and the spirit in which the farming is carried on in the different parts of the country. This diversity may be indicated by reference to the climate and to the spirit animating the farming in the various districts. At the end of November the crops in the eastern Transvaal were looking well and grazing was plentiful. In the western Transvaal many districts were suffering from a shortage of rain, while in the south-west, at Wolmaransstad and Leeuwdoorns, practically no rain had fallen, and the land was still unploughed and the maize unplanted. A belt through the south of the Free State was almost as dry, while in the districts of Ladysmith, in Natal, even up to the middle of December, the season had been one of the driest within memory, and only a very small proportion of the maize crop had been planted. In some districts there is a progressive spirit abroad, and the farmers are keen and eager and ready to consider new ideas and methods. In others, farmers are farming as their fathers farmed—without planter, without cultivator, without rotation, and without manure.

With this diversity in the factors which affect the yield of the maize crop or the cost of producing it there is consequently a great

diversity in its cost of production, and one figure, or even average of figures, cannot adequately represent the cost in all districts and under all conditions.

The investigation is also revealing the number of remarkably good farmers there are in the country, who would compare favourably with those of any country in the world. Some of these, starting with little or nothing, have within twenty years, by dint of energy, intelligence, and hard work, become well-to-do and influential members of the community, and are to-day by their example exerting a most beneficial influence on the farming in their districts.

Everywhere the difficulty of obtaining sufficient satisfactory labour prevails, and the effect of this on maize production has been apparent. In many cases farmers are not planting as much as their land and equipment entitle them to do by reason of their inability to obtain labour. And it is not entirely a question of pay and system of hire and treatment of their native labourers. A few farmers have set themselves against the principle of part-payment in kind and hire only cash-paid labourers, and they, even though paying £3 and providing half a muid of meal per month, find difficulty in obtaining sufficient, while the farmer who pays only from 15s. to 25s. per month in cash and provides land for cultivation—and often the cultivation itself—and grazing for ten or twenty cattle, and maybe twenty or thirty sheep for each native, has also many complaints to make of the unsatisfactory labour supply. The system of contracting the land to natives or whites in return for part of the crop is not likely to disappear while these difficulties remain.

Some points of economic importance are being made evident. Many farmers have farms larger than they can work or have sufficient capital to work, and thus have spare grazing land. This land is frequently not fully stocked or is stocked with cattle owned by natives. In either case the cost of production on the land under crop is higher than it ought to be owing to the high cost of rent or interest on capital and of ox labour. Other farmers again with insufficient capital at their command, and only able to cultivate a comparatively small acreage, have their crops burdened with a high management charge per acre and per bag, in some cases as high as 6s. per bag, even when the salary is placed at the lowest cost of living figure.

Some interesting and valuable farm practices have been observed. In one district kraal manure is powdered and drilled in with the seed. In another, a farmer of a mechanical turn of mind has adapted two cultivators into one, and has thus produced a machine whereby two rows of maize can be cultivated instead of one. This implement, which is set to the two-planter rows, is similar in principle to the horse-hoe used in other parts of the world, in which the hoes are set to correspond to the drill rows, and whereby the risk of cutting up the plants is reduced, the task of manipulation of the implement lightened, and the amount of work performed increased. Other farmers again save time in the planting season—when it is all important—by attaching one section of a harrow to their double-furrow ploughs. Others again, it is gratifying to note, are learning to appreciate the value of cow-peas, both to their land and to their stock, and are planting them with the last cultivation of their maize, thereby improving, in their own words, the value of the after-grazing to a threefold extent.

Pruning of Deciduous Fruit Trees.

A useful, practical article dealing fully with the subject of the pruning of deciduous fruit trees was written by Mr. Terry, our Horticulturist at the Potchefstroom School of Agriculture, and published as a bulletin in 1917. It has met with a large demand and our stock has become exhausted. The nature of the advice Mr. Terry gives is such as to ensure the constant need and call for it, and we propose, therefore, commencing with this number, to publish the article in the *Journal*. It is clearly written and well illustrated, and should be studied not only by the large orchardist but also by every householder who owns a few trees. The art of pruning is not generally known, yet is so essential to the production of full and good crops, and Mr. Terry's article is designed to assist the owner to get the best return from his fruit trees. There are thousands of trees in South Africa whose fruitfulness is sadly diminished by lack of a little care. What an appreciable addition to our fruit production would follow were they given the asisstance which nature requires of their owners!

Diseases, Ticks, and their Eradication.

We publish in the current issue a revised (third) edition of a most interesting and informative article by Sir Arnold Theiler on the subject of tick-borne diseases and their eradication through destruction of the tick. The article appeared originally in the *Transvaal Agricultural Journal* (Vol. VII, No. 28, July, 1909) and subsequently in the *Union Agricultural Journal* (Vol. I, No. 4, May, 1911). Since then our experiments and investigations have continued bringing extended knowledge of the subject, and Sir Arnold Theiler's article in this issue includes the latest data available. The matter is of paramount importance to farmers, and the article should be carefully studied. The author's wide experience enables him to write authoritatively, and his remarks on the best means of removing the cause of our trouble, that is the destruction by dipping of the tick, should be taken to heart by all stock owners, advice summarized in the concluding sentence of the article: "lose no time, but put up a tank and use it."

South African Wines.

We referred in our last issue to the success of our wines in the Colonial Wine Competition at the recent Brewers' Exhibition in London, when South African wines secured eleven first, five second, and two third prizes. We have now seen the published list of awards, which shows that out of fourteen classes our wines were beaten in two only, the red, light Claret type, and the red full-bodied Burgundy type (two years old or more), in which classes South Australian wines were placed first, and South African wines secured second and third prizes. This is most gratifying when it is remembered that at the previous competition in 1919 all the first prizes were carried off by Australian wines, while ours managed to secure only one second and four third prizes.

A South Australian Vineyard Soil.

Dr. Juritz, the Agricultural Research Chemist, furnishes an interesting article, published in this issue, on a sample of vineyard soil obtained by him from the widely famed Chateau Tanunda estate in South Australia. He compares the results of an analytical examination of this soil with those obtained from a large number of samples taken from the Malmesbury, Paarl, Stellenbosch, and other districts, drawing attention to the manurial needs of our vineyard soils. The subject is dealt with, also in this issue, in the article "Manuring of Vineyards," which, together with Dr. Juritz's conclusions, furnishes wine growers with very valuable advice on the important matter of maintaining the fertility of their vineyard soils.

Examination of Proprietary Articles.

In anticipation of any contemplated applications to the Department to carry out tests with any proprietary article, it is notified that the Government cannot undertake the examinaion of proprietary articles except for official purposes. When examined for such purposes a report can only be made available when it is considered necessary to do so in the public interests and in a public manner.

Representative Transvaal Soils.

Another valuable addition to our data of the more important soil types of the country is contained in the article under the above heading published elsewhere in this number. It is written by Mr. B. J. Smit, B.A., of the Division of Chemistry, and deals with Pretoria quartzite sandy soils which occur principally in the Pretoria, Krugersdorp, and Witwatersrand Districts. It contains analyses of several samples of this type of soil and gives practical advice on the fertilizing thereof gathered from experiments.

Cold Storage Conditions for Export Fruit.

It will be remembered that considerable wastage occurred in shipments of citrus fruit exported during the 1919 season, and that a report on the investigations into the cause thereof was published in Bulletin No. 2, 1920 ("Wastage in Citrus Fruit Shipped for Export"), which drew attention, among other things, to an unsatisfactory condition prevailing at the Imperial Cold Storage Company at Capetown. Since the publication of this bulletin the Division of Botany has been engaged in further investigation into the transit of citrus fruit for export from the orchards to the overseas market and, in the course thereof, occasion arose to make use of the cold storage of the Imperial Cold Storage Company, and upon a mycological examination of the chamber formerly reported unsatisfactory, it was found that its condition is now quite satisfactory. A report on the subject appears elsewhere in this issue.

False Codling-Moth.

For some years past the attention of Mr. D. Gunn, of the Division of Entomology, has been devoted to the study and control of the False Codling-Moth, an insect which is often troublesome in the orange orchards of parts of the Union. The results of Mr. Gunn's inquiries have been embodied in a bulletin which is to be printed for the purpose of preserving a record (scientific) thereof, and we give hereunder a summary of Mr. Gunn's findings. For further particulars regarding these experiments inquirers are referred to the Chief, Division of Entomology, who will keep copies of the publication (printed in English only) for office purposes.

1. The False Codling-Moth is a native insect distributed throughout much of the Union, but more prevalent in certain districts than in others.

2. It injures oranges, naartjes, guavas, pomegranates, apricots, peaches, plums, walnuts, olives, and persimmons. It also feeds on a number of native fruit trees such as zuurpruim, wilde mispel, morula, boerboon, etc. Acorns are also commonly infested.

3. The influence of moisture appears important in restraining its increase and in reducing the amount of its injury.

4. Eggs are deposited principally on the rind of the fruit, and hatch in from ten to fifteen days, according to the prevailing temperature.

5. When the larva emerges it feeds for a brief period upon the rind, and then burrows into the tissue of the fruit.

6. Infested fruits ripen prematurely and fall to the ground, and when the larva leave the fallen fruit it makes a cocoon on the surface of the soil.

7. What may be called the spring moths begin to emerge early in September, and continue to do so until about the end of October. They may deposit eggs on any oranges that are still on the trees.

8. The succeeding moths begin to emerge in numbers early in January, and continue to emerge until about the end of February. Eggs are deposited by them within a few days after their emergence.

9. Spraying with arsenate of lead powder in the proportion of one and a half pounds to fifty gallons of water gave good results, and is recommended for the control of this insect.

10. Cloth bands placed around the trunks of infested citrus trees proved to be ineffective in attracting the larvae to spin their cocoons under them.

11. Light traps failed to attract the moths, none being caught by this method.

12. All native food plants should be destroyed as far as possible. Cultivated food plants such as apricot, guava, oak, olive, peach, persimmon, plum, pomegranate, and walnut had better not be grown near citrus orchards. Guava, pomegranate, and oak are the most objectionable.

13. The flooding or heavy irrigation of citrus orchards during the months of July or August is destructive to larvae and chrysalides in cocoons on the surface of the soil.

14. If the flooding of orchards cannot be done on account of lack of water, the thorough cultivation of the soil, especially during July and August, is recommended as an alternative measure.

15. Infested fallen fruit should be collected and buried in deep pits and covered with packed soil to prevent the emergence of moths.

16. By marketing citrus fruit before the end of August much damage to ripe fruit will be avoided.

17. Suitable spraying machinery should be provided for the orchard. If a hand-power spray pump is used it should be fitted with a pressure gauge, and at least one hundred pounds pressure should be maintained when spraying.

18. In order to control the spring infestation of ripe oranges it is recommended that the trees should be sprayed twice, viz., about the middle of September and the middle of October.

19. For the control of the early infestation of the crop the first spraying of citrus trees should be made before the middle of January; the second three weeks later (or the first week of February); and the third during the last week of February. If native food plants are growing nearby, the orchard should be sprayed for the fourth time about the middle of March.

Cotton Growing: Great Possibilities for the Union.

Cotton is an article classed among the primary necessities of civilization, and South Africa is fortunate in possessing vast areas suitable for the cultivation of the crop. The world demand for cotton is far in excess of the supply, and the prospects are that it will so continue for many years to come. There are several factors which justify this view. The needs of the increasing population of the world must be met, and requirements of European countries are growing owing to woollen articles largely being substituted by cotton mixtures on account of the cotton manufactured article being more suitable for wear in warm climates. Civilization and settlement of the remote areas of the world proceed apace, and with the forward movement comes the demand for clothing: when one considers the millions of natives of Central Africa alone it is borne upon one that the market for the product of the cotton plant is an ever-widening one, stretching far ahead into the future. It can be understood that the manufacturers of the world are clamouring for the raw material, and South Africa is faced with an opportunity of becoming a recognized producer of no mean portion of the world's cotton output. Our position is most favourable. In America, where the great bulk of the world's yield is now obtained, the cultivation of the crop is becoming increasingly dependent upon white labour, bringing in its train a mounting cost of production. In the areas of our country destined to be the future cotton fields of the Union there is a teeming native population, eminently suited for the labour requirements of cotton growing, which could be profitably enlisted and employed. Indeed, there is every reason to anticipate that the Union will favourably compete with the present great supplier of the world's cotton.

Looking further ahead it is to be expected that in the course of time, as is now happening in America, the Union will cease to be a producer of raw material only, for wider industry will follow and

delinting, ginning, and ultimately the manufacture of cotton fabrics in South Africa will become established, while from these industries again others would arise in the form of by-products, supplying articles for which both here and in other parts there is a constant demand.

The Department has evidence of a stirring among our agricultural producers occasioned by the hopeful outlook in cotton growing, and, as far as its capacities permit, is making every effort to foster the industry and seize the golden opportunity of procuring a good portion of the world's cotton trade. We have demonstrated that without a shadow of doubt this country has the possibilities of producing great quantities of cotton. We have passed the experimental stage and a bold, forward movement now awaits us. The Division charged with the furtherance of the industry is, under the guidance of its Chief, Mr. W. H. Scherffius, M.S., widening its activities and supplementing its staff by the addition of qualified technical officers. Two have recently been engaged in the United States, the home of modern cotton culture, while two others, Mr. Lloyd Worrall and Mr. Hesse, have now been appointed, both being South Africans trained oversea: the former is an itinerant officer for the eastern Transvaal, being stationed at Barberton, and Mr. Hesse is Technical Assistant, to deal with the commercial side of the industry, being located at headquarters, Pretoria.

Much literature on the various phases, cultural and economic, of cotton growing in South Africa has been published and distributed by the Department, and in this issue we give a few notes of a lecture recently delivered by Mr. Scherffius on the subject. We would emphasize Mr. Scherffius' advice on the necessity of striving after the production of quality before quantity. This is most essential for a country on the eve of a campaign which projects the capture of a goodly portion of the markets of the world. We are alive to the position that good seed, which produces good lint, is difficult to obtain, and that our present supplies are of a mixed type, and arrangements have therefore been made to supply farmers with the best seed available. But in our anxiety to procure the desired seed we must strenuously endeavour to avoid jeopardizing the whole future of an industry for which such high hopes are entertained by importing cotton pests with seed from outside our boundaries. At present we are happy in being free from any of the serious pests which have devastated the cotton fields of other countries. We have referred to this matter in earlier issues of the *Journal*. In view of the great risk which has to be faced from this source the introduction of seed by private persons is limited at present to consignments of 10 lb., and then only where permit has previously been obtained from the Chief, Division of Entomology, while provision is being made for the erection of two vacuum fumigators for the purpose of treating imported seed and guarding against the risk of introducing insect pests.

Cotton is therefore one of the crops which this Department recommends to agriculturists in those parts of the Union suitable for its cultivation. Convinced of a constant demand for the raw material at remunerative prices, and the possibility of suitable labour organization by farmers, we are satisfied that success awaits the cotton grower who studies the subject and is properly equipped for raising one of the primary necessities of the human race.

The Pecan Nut.

Until recently the pecan nut, which is closely allied to the walnut, grew wild in America, being found in the territories adjacent to the Gulf of Mexico, and it is only comparatively recently that it has been cultivated as an ordinary orchard tree. But of late years pecan growing has become increasingly popular in parts of the United States, orange groves being eradicated in some areas in order to plant pecans, and it is now one of the most important nuts grown in America. Mr. Tribolet, the Chief of our Division of Horticulture, describes the pecan as the "finest edible nut grown in any part of the world," being superior in quality and delicacy to the walnut, and states, in an article which we publish in this issue, that at the rate the trees are being put down in the United States their output of the pecan nut will speedily equal and surpass that of the walnut. The pecan tree is found growing here and there in many parts of the Union, but in most cases the name of the tree and its great possibilities are not known by those on whose farms it is found. So far as walnut cultivation in the Union is concerned we have no figures as to local production and consumption, but our importations are not heavy, averaging—for the five years 1915-1919—6625 lb., valued at £258 (not allowing for a large importation from the Argentine Republic in 1918 of 88,866 lb., valued at £3635, the only year during this period in which the nut was imported from that country). Mr. Tribolet's article deals with the cultural aspect of the nut, and is published with a view to awakening the interest of some of our farmers to the possibilities of this wonderful nut, which it is considered should prove highly remunerative in many parts of the Union, and especially in Natal.

Group of Catalonian Donkeys.

Plant Nurseries in Quarantine as at 1st January, 1921.

The nurseries in quarantine remain as published in the January, 1921, *Journal* (page 88), except that the quarantine on Mr. Jas. Clark's nursery has been removed.

DEPARTMENTAL ACTIVITIES

December, 1920.

(NOTE.—The work of the several Divisions and Schools of Agriculture covers a wide range of agricultural industry in the Union, and we give hereunder notes and observations from certain of them treating with matters of special interest coming under their purview during the month. The object of these notes, which are not concerned with general routine work, is to inform the farmer of such matters as are calculated to be of interest and helpful to him at the present time.—EDITOR.)

THE DIVISIONS.

ENTOMOLOGY.

Black Scale Parasites in California.—The black scale (*Saissetia oleae*) is much the worst scale pest of citrus trees in California, and it is primarily for its suppression that most fumigation of citrus trees is carried out in that State. The scale occurs widely in all four Provinces of the Union, but is nowhere a pest and is seldom found in an orchard. Its unimportance in South Africa is attributed by the Division of Entomology to the efficiency of native parasites which, for nearly twenty-five years, official entomologists of this country have made intermittent efforts to get introduced into California. One of the important parasites, *Scutellista cyanea*, was established in the State from a sending of material made twenty years ago, but although it proved a valuable introduction, its good work was soon found to be insufficient materially to obviate the need to fumigate citrus trees. The efforts to get other of the parasites established, through the assistance the Division was able to give, not being successful, the California State Board of Agriculture finally adopted a recommendation long urged by the Division to send a special entomologist to South Africa to collect and forward material. For about eighteen months a California officer has been located in South Africa, with headquarters at the Division's field station at Rosebank, near Capetown, and much is still expected from his work. Meanwhile one of the much-wanted South African parasites has been bred out and colonized in California from some material collected in Australia. In a recent letter to the Division of Entomology, the Chief Entomologist of the Board of Agriculture wrote:—

> "You may be interested to know that the black scale parasite, *Aphycus lounsburyi*, has become established in southern California and is doing a very remarkable work, particularly along the coast. I have visited the orchards near Santa Paula, where we have been colonizing the parasite, and the work of this insect is exceeding my fondest expectations. In my opinion, there is no question but that the black scale is going to be handled by the use of natural enemies in the coast region of California, thus resulting in a saving of a good many hundred thousands of dollars."

Vedalia for Brazil.—The present activity of the Division in connection with beneficial insects brings to mind that in the last year it was successful in having sendings of the Vedalia ladybird reach Ceylon and Brazil in satisfactory condition. In both of these countries outbreaks of the Australian bug were causing apprehension, and South African help in getting the Vedalia was officially requested. Many sendings of the ladybird were sent to Ceylon before any of the insects reached there alive, while success very quickly crowned the Brazil efforts, a sending by the Senior Entomologist at Capetown being reported on by the State of Sao Paulo Chief Entomologist, under date of 7th April, as follows: "We have received the fine large sending of the Vedalia from the captain of the "Samatra Maru." It came in cold storage and reached us in splendid condition—nothing whatever dead, but all alive and in all stages from eggs to adults including every size of larva. There must have been thousands of the Vedalia in all stages. . . . The Secretary and the Director of Agriculture both request me to say that the State of Sao Paulo very deeply appreciates your great kindness and untiring efforts in getting the Vedalia to us in good condition. This shipment is a perfect success from every point of view. . . . We now have a shipment of the Vedalia *en route* here from Florida. . . . We also have an expert in Italy who will make shipments from that country and Portugal later on. . . . We have an inspector in Montevideo now securing material there. Smith, of California, has just sent word that he can make us a sending. So we are literally getting the Vedalia from the four corners of the world, but your shipment is the first to arrive and cannot be surpassed if even equalled by any other."

Pink Boll Worm in Angola.—The menace of pink boll worm, the most feared pest of cotton, has been further emphasized by the finding of the pest by Mr. C. B. Hardenberg, the Portuguese East Africa Entomologist, in a consignment of cotton seed which arrived at Lourenco Marques in the middle of December from Mossamedes (Angola) *en route* for a Mozambique destination. The Division of Entomology is unable to find any record indicating that the pest is recognized in Angola.

Woolly Aphis Parasite.—The arrival of parasitized woolly aphis, sent from the United States by A. E. Lundie, a South African student at Cornell University, was chronicled in the last issue of the *Journal.* The material was at first in charge of C. W. Mally, Senior Entomologist at Capetown. Adult parasites began to emerge on 6th December, 17 days after the material was taken from the cool-room of the vessel by which it arrived. By the 14th about 1870 were out and then, to increase the chances for making the introduction a success, the remaining material was transferred to Pretoria. It was thought that the material was practically spent when it left Capetown, but to the glad surprise of every one concerned, parasites have continued to emerge from it, the total yield to the time of writing being about 8400. Unfortunately woolly aphis is at present uncommonly scarce for it, both in the south-western districts and in the Transvaal, and difficulty has therefore been experienced in finding suitable trees in which to place the parasites. Liberations have been made in an orchard at Stellenbosch and in one near Pretoria and also

in five Pretoria town gardens. Some of the parasites were turned loose in the trees and others confined in long narrow bags of fine muslin drawn over infested branches. Some hundreds were put on infested cuttings being kept standing in water under close cover in the office laboratory at Pretoria. The parasite seems to be quite an important enemy of woolly aphis in America. It is still too early

AMERICAN WOOLLY APHIS PARASITE.

Many specimens were liberated within bags of fine muslin drawn over branches heavily infested with woolly aphis.

to predict whether or not the attempt to establish it in South Africa will succeed, but hope is at present running high, and by the time these lines are printed sufficient time will have elapsed for one South African generation of the insect.

Pernicious Scale at Parys.—A Division of Entomology nursery inspector recently found a single small apple tree infested with pernicious (San José) scale in the course of the ordinary inspection of a new fruit tree nursery at Parys, Orange Free State. A superficial inspection of gardens in different parts of the town has since been made by the Senior Nursery Inspector, and it has been discovered that the pest occurs over a considerable area, and has probably been present in the town unrecognized and unsuspected for quite a number of years. What appeared to be the oldest infestations were found near the centre of the town about a mile and a half from the nursery premises, which are in a suburb. However, no trace of the scale was found in some of the town gardens. It was found in several gardens in the suburb, but not in abundance, while there is reason to suppose that numbers of "diseased" trees said to have been cut out several years ago from gardens in the town were really its victims. Most of the trees in the infested gardens are alleged to have come from Cape nurseries, and some of the owners incline to think that Cape trees brought the scale. But the Division of Entomology has never found nor suspected the scale in any Cape Province nursery, and is of the opinion it must have got to Parys with suspected untraced trees sold in the Orange Free State about ten years ago, or else have been taken in on scions or trees from some one of the numerous infested private gardens and orchards of the northern Transvaal, northern Natal, and northern Free State. Four Orange Free State centres of infestation are now known, namely Viljoen's Drift, Kroonstad, near Harrismith, and Parys. The occurrence near Harrismith illustrates how long a time may elapse before the scale becomes really bad. The Division of Entomology in 1912 learned that the farmer had received some suspected trees, and wrote to him describing the scale and suggesting a careful inspection. The farmer replied that the trees appeared perfectly healthy. Seven years later he found the scale, and then took it for a new thing which killed trees in a few weeks. Sometimes, however, quite large trees get infested and practically killed within two or three years. In general, the less a tree lacks for water and attention, the worse the scale attacks it. Many fruit trees in Pretoria that were known to be infested eight to nine years ago still live on little the worse for the infestation, while others of the same kind have died to the roots in a few years. Difference in care is the explanation. The scale is fairly easily controlled by winter spraying, but quite commonly trees die of its attack without the cause being discovered. Fruit-growers are warned to be careful where they get trees and scions.

Locust Poison.—At the time of writing, 29th December, voetgangers have not been reported in any further districts. The swarms were most numerous in the Graaff-Reinet district, where, in addition to the town commonages of Graaff-Reinet and Adendorp, twenty-five farms were infested. The farms in the area are particularly large. The District Locust Officer, J. H. Smith, reported under date of 22nd December, that about 382 swarms had been destroyed. He classed these as 5 very large, 28 large, 131 medium, and 218 small. He goes on to state: "The north, west, and south of the Graaff-Reinet district was infested, and the outbreak was quite serious.

Fortunately most of the farmers were very keen in operating, and the few that treated the matter of destroying as of no great importance, after having been warned and matters explained to them by myself, got busy at once with good results. The position is very favourable, and all swarms of hoppers have been destroyed. A small percentage of stragglers got to the wing stage, these being chiefly on farms where guinea fowls are scarce. Yet I have to report that there are quite a lot of scattered fliers on most of the Graaff-Reinet farms, as well as in the eastern Aberdeen and northern Jansenville. These must have hatched from the light showers that fell on 6th October or before, because they were seen as early as 1st December. They took on a greyish colour and never gathered into swarms. On 10th December it was reported to me that these odd fliers were mating, and on the 15th December I myself saw the same, so they must have hatched out before the 25th October rains. They escaped notice by farmers on account of their grey colour and their being widely spread in ones, twos, and threes. It was impossible to operate on them. During my visits I also noticed scattered hoppers of grey and green colour in all stages of life, from very small to almost wing stage, and often I found these off-coloured forms mixed up and trekking with a swarm of voetgangers

"There is an increase of pauws in this district. I also notice a lot of hawks of a dark grey colour, about the size of a well-grown homing pigeon. They are seen mostly amongst the odd fliers. There are also large locust birds (European stork), but not very many. I saw a few days ago about 25 together along the river. Mr. Walter Rubidge, of Dalham, reported having a few thousand small locust birds (starling) on his farm. Guinea-fowl also seem to leave their usual bush-veld and take to the open flat country during the day to get amongst these fliers. The scattered fliers in this district, if they could gather together, are enough to form a very big swarm. In some places you find them in greater numbers than in others, but they seem to be content to stay where they are, and will only fly up when approached, and will soon sit down again. The supplies on hand are enough in case another outbreak occurs."

Tobacco Slug in Bathurst.—The tobacco slug (*Lema bilineata*), the small yellow and black striped South American beetle, that with its slug-like larva has caused extensive damage to growing tobacco in the Piet Retief District, Transvaal Province, is now causing uneasiness amongst growers of Cape gooseberries in the Bathurst district, Cape Province. Entomologist David Gunn, who has his headquarters at Port Elizabeth, recently addressed a meeting of the growers at Scottsbottom on the subject of the insect and its control. The insect feeds on Cape gooseberry in common with tobacco and also a number of weeds of the same family as these plants. Entomologist Van der Merwe, working from Durban, is conducting demonstrations in various parts of the Piet Retief District to show that spraying with arsenate of lead is an efficient means for controlling the insect in tobacco lands.

HORTICULTURE.

The citrus industry is rapidly developing, especially in the Transvaal, and orchards of thousands of trees will soon come into bearing, considerably increasing the quantity of export fruit. During his recent tour of the principal fruit-growing districts of the Transvaal and Cape Provinces, Mr. Roworth, the Fruit Inspector at the Table Bay Docks, made special note of the anticipated expansion of the citrus export trade, and reports, as an instance, that the increased production next year from two estates alone in the north-eastern Transvaal will be equal to half the total quantity of citrus fruit exported in 1920. Exports of South African citrus fruit totalled 50,000 boxes in 1919 and 120,000 in 1920, and Mr. Roworth estimates that 250,000 boxes will be available for export this coming season, while it is expected that during the next few years the increase will continue, though not, perhaps, at the same rate as during the 1919 to 1921 seasons. In the eastern districts of the Cape the drought has greatly affected the position and, apart from pines, it is not anticipated that there will be any appreciable increase in fruit export from that portion of the country for some years to come. But pine-growing is going ahead. In the Bathurst district the Langholm Estates have 27 million pines just coming into bearing, producing something like 100 tons of pines per week for shipment.

Mr Roworth did not find this season's soft fruit crops of the western Cape districts too good and classed them as "fair average." It is expected that grapes will be exported in large quantities.

During his tour Mr. Roworth gave instruction in fruit-packing. While packing last season showed a great advance on that of previous years, there is room for more improvement. Packing is one of the essentials in an overseas trade, and grade must be strictly adhered to. Growers must aim at reaching an excellence in their packing, and must remember that the first necessity of successful fruit export is standardization.

VETERINARY EDUCATION AND RESEARCH.

The new *Anthrax Spore Vaccine* that was referred to in the December issue of this journal has now been issued to farmers for some considerable time in the place of the old Pasteur Vaccine. It is too early yet to give a definite verdict on the result of these inoculations. In the meantime, however, an extensive test has been carried out in the Boshof District by an officer of this division, and has given complete satisfaction. Over 1000 animals were inoculated without any untoward results. Any outbreaks of anthrax seemed to be effectively checked by the inoculation. Some of the inoculated horses showed rather large swellings, extending in some instances from the neck to the chest. This was particularly the case on farms where the disease was actually present at the time the inoculation was carried out. Animals showing such swellings should, of course, be given a complete rest for a few days, but otherwise there is no cause for any alarm. The swellings will disappear in a few days. As a matter of

fact some farmers are pleased to see the swellings, because they contend (and very probably they are correct) that animals developing swellings will possess a stronger degree of immunity than others.

Up to the end of the old year the issue of *Blue-Tongue* Vaccine and *Wire-Worm* Remedy was smaller than has been the case in recent years. This fact proves that these diseases were not very prevalent up to that time, and must be ascribed to the drought that prevailed in many parts of the country. As soon as the heavy rains set in these diseases, as well as horse-sickness, will appear and the demand for vaccines will increase.

The *inoculation of private horses against horse-sickness* has now been restarted at the Laboratory. About 100 horses arrived about the middle of January and are now undergoing treatment. Owners are advised, in the order in which their applications were received, of the possibility of getting a limited number of horses inoculated. It is, of course, inevitable that many farmers will be disappointed over this matter. It should be borne in mind, however, that the stabling accommodation at the Laboratory is very limited, and even the inoculation of 100 horses at a time entails a large amount of extra work. We are only accepting a small number of animals from each owner so as to give as many people as possible a chance of getting a few of their horses immunized.

Farmers who make application after the publication of these notes will probably have to wait until July before their horses can be received.

DAIRYING.

With regard to the note appearing in January's issue of the *Journal*, we are pleased to state that Mr. J. F. Stephenson has been appointed as the first official grader under the scheme of grading cheese for local consumption throughout the Union, and will be stationed in East Griqualand with headquarters at Kokstad. Mr. Stephenson was formerly attached to this Division as grader to the East Griqualand Cheese Manufacturers' Association, and although under the supervision of the Division, received half salary from the association, the balance being paid by Government. He is now a whole-time officer of the Division of Dairying, and will undertake grading for the public generally. Mr. Stephenson is fully acquainted with the conditions and requirements of East Griqualand and with all cheese factories in that area.

Mr. Rae, who succeeded Mr. Stephenson in 1919, now leaves to take up an appointment as lecturer in dairying at the School of Agriculture, Elsenburg, Cape. Mr. Rae has done excellent work, especially as the country and conditions were entirely new to him.

Dairy Inspector Wilkinson, stationed at Queenstown, Cape Province, reports as follows: Speaking generally, the outlook of the dairy industry in the Cape Province is at the time of writing not too bright. Lack of seasonal rains in the Midlands and Border district has its reflection in a restricted butter and cheese output. Those creameries and cheese factories depending upon supplies from the Cape Midlands are, almost without exception, either closed down for the present or working at a loss; as instance, at one small creamery,

visited a few days ago, the total supply did not exceed 10 cans cream per week, each can of roughly 10 lb. butter-fat, whereas in a good season the output is 5000 lb. butter per week. On the other hand, the north-eastern districts of the Cape give every promise of a record output, and this has been verified by recent reports from these areas. Another interesting feature is that the slump in the wool market has been the means of inducing farmers, who have hitherto been in the habit of practically confining all their energies to the production of wool, to now giving serious attention to the development of the dairying industry, no doubt with the object in view that it is not advisable to have "all eggs in one basket."

With regard to the cheese industry, owing to the fact that the cheese market in England has been decontrolled, our surplus cheese from here must now compete with that from the other Dominions and the open market, consequently cheesemakers are somewhat dubious as to what price they will pay for milk.

The butter market is still under control, and creameries which have a firm offer from the Imperial Government for their surplus supplies of butter are in a more favourable position to know exactly what they can afford to pay to their cream suppliers for the raw material.

THE SCHOOLS OF AGRICULTURE AND EXPERIMENT STATIONS.

ELSENBURG, MULDERS VLEI.

SEED WHEAT IN THE WESTERN PROVINCE.

Change of Seed.—It is a mistaken theory that a change of seed from one locality to another is conducive to higher returns or that it is necessary in order to prevent degeneration. So far no evidence is available to show that wheat necessarily degenerates or "runs out" when grown continuously on the same ground, and on the other hand, numerous cases are known where the same variety has been grown for twenty and more years with excellent results.

Pure Seed.—A common practice to-day is that of mixing two or more varieties of wheat when planting, irrespective of whether the varieties have similar maturity, quality, and colour of grain. Several reasons are advanced in support of this practice. The most usual explanation is that this system provides the best insurance against loss from infection with rust. Another explanation is that it facilitates harvesting operations in varieties such as Gluyas Early, which are liable to lodge if these be sown together with a wheat that has a strong erect straw.

Provided the varieties are properly chosen, no advantage is to be gained by mixing the seed. Pure seed of the right variety will yield as well as mixed seed, and the resulting crop will moreover command

a better price than mixed wheat when sold for milling purposes. Millers have often expressed a preference for imported wheat because of its uniformity and superior grading.

Grading Wheat for Seed Purposes.—It is highly essential that wheat be winnowed and graded for seed purposes. Not only does this operation free the seed of all weed impurities, but it also segregates all the small pinched kernels from the plump grains—a matter of vital importance in securing a good stand of wheat.

Importance of Wheat being True to Name.—Endless trouble is caused by the variety of names under which the same wheat is known in different parts of the country. Considerable progress has been made at this institution in the naming of wheats, and farmers in the Western Province are urged to send samples for identification purposes whenever they have any doubt in regard to any variety. All that is necessary is to address a 1-lb. sample of grain and a small bunch of ears to the Principal, Elsenburg School of Agriculture, Mulders Vlei, when the variety will be identified.

Varieties Recommended by the Elsenburg School of Agriculture.—Early to medium early varieties:—

Florence.—Very early, beardless wheat, white grain, tillers well, but is liable to shatter.

Gluyas Early.—Medium early, beardless wheat, white grain, tillers well, but is liable to lodge.

Primrose.—Medium early, beardless wheat, white grain, tillers well.

Union Selections Nos. 17, 33, 28, 52, 81, 94-1, and 116.—Medium early white wheats. Nos. 17, 28, and 52 are about ten to fourteen days earlier. All these Union wheats tiller well, have strong erect straw, and are beardless.

Mid-season varieties:—

Spring Early.—Bearded wheat with dark coloured kernel. Tillers well. The straw, however, is weak.

Red Egyptian or Rooi-beentje.—Bearded with soft dark grain. Tillers very well.

Kleintrouw.—Tip-bearded with small white grain. Tillers exceedingly well.

Darlvan.—Tip-bearded with plump white grain. Tillers exceedingly well.

Rieti × Gluyas Cross No. 81.—Bearded with large white grain. Tillers well and holds the grain well.

Late varieties:—

Rieti.—Bearded, large dark grain. Tillers very well, but is liable to shatter.

Bobs × Rieti Cross No. 10.—Bearded grain. Tillers very well and holds the grain better than Rieti, and is also about ten days earlier.

GROOTFONTEIN, MIDDELBURG (CAPE).

Wheat.—"Yeoman," a wheat produced by Professor Biffen at Cambridge, combining the heavy cropping powers of certain English wheats with the high-milling qualities of Canadian wheats, and having, moreover, valuable rust-resistant characters, is considered to be one of the heaviest cropping wheats generally known. It is, however, late maturing, and is therefore somewhat at a disadvantage when planted in the Karroo, owing to the necessity for late irrigation, and its liability to attack by birds. An attempt has been made at Grootfontein to combine its valuable cropping and rust-resistant characters with earlier maturity by crossing it with early maturing varieties. Some of the crosses obtained have given good promise, which, it is hoped, will be fully justified by the results of further trial.

Reports from farmers, who are using the Bird Proof variety of wheat obtained from this institution are to the effect that it is proving very satisfactory.

Lucerne.—From the Chinese Lucerne, which after several years' trial continues to give more satisfaction generally than other varieties at this institution, some 1700 root selections have been made and planted out. In September last a few selections were made and transplanted, and on these seed is now setting well.

Poultry.—At each of the Schools of Agriculture attempts are being made to build up high producing strains of birds of the various breeds of poultry by selection and careful mating and testing of the progeny in single pens. At Grootfontein a nine-months' egg-laying test of the first generation of the birds selected at this institution for building up good egg-laying strains was recently completed. The numbers of birds, breeds represented, average monthly records, and order of merit, were as follows:—

Number of Hens in Test.	Breed.	Average Monthly Record.
13	White Leghorns	14.7
13	Brown Leghorns	13.5
17	White Wyandottes	12.3
6	Buff Orpingtons	8.7
7	White Orpingtons	8.6
6	Speckled Sussex	5.1

The White Leghorns scored all along the line, the best and poorest layers of this breed being better than the best and poorest respectively of any of the other breeds. Both the Brown Leghorns and the White Wyandottes, except for two birds in each group, also gave consistent results. The numbers of eggs laid by the birds of these three breeds were satisfactory, but the grade of eggs left much to be desired, the greater proportion not attaining first grade. Attempts will be made by judicious mating to rectify this under-grade character, and the result of this mating to be seen in the next generation will be awaited with interest.

POTCHEFSTROOM, TRANSVAAL.

The School.—The school closed on the 14th December. Out of the 30 second-year students, 28 secured the diploma, and among these 20 secured one or more distinctions. The two failed by a small margin only, and were given the choice of re-examination. Twenty-nine of the 31 first-year students passed, and of the 6 one-year students only one failed in one subject. Almost all the successful candidates are already engaged to take up farming for themselves or with others as managers, foremen, and assistants in agricultural propositions.

Live Stock.—The continued drought is beginning to tell on crops and stock. The amount of rain that fell during the month amounted to only 1.68. The grazing is getting very poor and additional feeding with hay and other farm foods is given to dairy heifers and cows with calf at foot.

It should be a farmer's greatest care to save valuable young stock during such periods; any stunting of their development now is a permanent setback; a little lucerne hay, silage, or other farm-grown feeds goes a long way in assisting growth. On no account should dairy heifers be allowed to fall into poor condition. Under present conditions the price of milk is increased and dairy calves are given gruels as substitute for the butter fat lacking in skim milk.

Calf-feeding experiments are now being conducted with two different gruels; No. 1, 2 parts pollards, 1 part linseed; No. 2, 2 parts mealie meal, 2 parts oatmeal, 1 part linseed meal.

The calves run on pasture in the day time and are given a feed of dry lucerne hay in the evenings. In addition to the gruel they receive a ration of dry meal, consisting of 3 parts mealie meal, 3 parts oatmeal, 1 part bran. Approximately ¾ lb. of meal per 100 lb. live weight is fed.

The calves are given portions of the gruels above mentioned with skim milk according to age, and seem to thrive well. They lose in body fat, but have sufficient material in their rations (gruel and skim milk, dry meal, and hay) to grow all the bone and muscle necessary for proper development.

The grading experiment in Sussex and Hereford cattle has also been started. It is proposed to grade all culled cows with bulls of these breeds and to study very carefully each grade of successive generations.

In spite of the drought, the stock keeps remarkably well owing to the proper use of grazing paddocks, pastures, and all kinds of feeds available on the farm.

Stock intended for show purposes are taken in hand now. The pastures are too poor to improve their condition much or even to keep them going. A good feed, consisting mostly of good hay (lucerne, teff, etc.), some succulents (silage, green lucerne, etc.), and a fair grain ration, consisting mostly of mealie meal, will get them on to stall-feeding the first week.

Crops.—Wheat and oat crops have been harvested. Some varieties suffered heavily from birds, but on the whole the yields are very satisfactory. A fair amount of seed of different varieties is

available for distribution and will be advertized shortly. Owing to the drought it was impossible to establish teff and it will be necessary to re-sow after the next rains. Most of the maize for silage has been planted, while ground is being prepared for potatoes and mangels.

Experimental Section.—Favourable reports on the American No. 8 wheat distributed last autumn are coming to hand. This wheat has so far proved to be the best bird-resistant variety and yields very well. A breeding plot of Eureka maize was planted; also miscellaneous crops. Lack of rainfall has been a serious drawback this month.

Poultry.—A large number of White Leghorns and White Wyandottes are available for disposal.

The 100 Bird Intensive House, which was fitted up during November, has now been filled with 40 White Leghorns and White Wyandotte pullets; the remaining birds are to be put in when the weather is cooler.

Horticulture.—A good deal of fruit-drying will be done to prevent waste in the orchards. Where fruits have been damaged by hail or growers consider that prices realized on the markets do not compensate them, the dried article has much to commend it.

Spraying trees against fruit-fly (using Mally fruit-fly remedy) should be continued, particularly with late-ripening peaches, nectarines, and plums. At this time of the year the greatest danger is that of side-injury. Budding over undesirable varieties to more suitable ones may now be done. Suckers should be removed from all trees (i.e. those growths which spring from the root below the bud or graft). They are of no value and retard growth in the tree itself. All fallen fruit should be picked up and destroyed by boiling or burning, to assist in controlling pests. Cultivation of the orchard should be practised as often as possible to check weeds and conserve moisture.

GLEN, ORANGE FREE STATE.

All the senior students, thirteen in number, passed their final examinations, and were awarded the Diploma in Agriculture. This is the first batch of students to complete their two years' course at this institution. On the eve of their departure a farewell was given to them by the members of the lecturing staff, at which the newly-appointed Secretary for Agriculture was present. Mr. H. A. Curling was presented with a gold medal by the Technical Officers' Association for being the best all-round student, while Mr. E. Kemm was awarded a gold medal by the Friesland Breeders' Association for being the best Friesland judge at the inter-school contest which was held at the Bloemfontein Show in March last. Next year's senior class will number about thirty.

Numerous applications are being received for the special course in dairying which will be conducted here instead of at Grootfontein as heretofore. The course will commence on 15th February.

CEDARA NATAL.

Winter Feeding.—The opportunity is taken of reminding farmers that during the month of February attention should be devoted to the planting of root crops for stock food during the winter months. For these crops lands should be chosen which are handy to the homestead in order to facilitate transport of stable manure to the fields, and also the green crops from the land back to the homestead. The importance of the provision of green succulent food material for all classes of farm stock through the winter months cannot be over estimated, and is an absolute essential where pedigree cattle are raised. It is a little late at present to commence ploughing up land for this purpose. The selection and ploughing of the soil should have taken place about September or October last, so that now there should be a stale furrow. The class of land to select is fresh land, or land which has not been under crop, save grass, for several years. Roots are much healthier on fresh ground than on land which has been cultivated for a number of years. Prior to the ploughing, which should be as deep as circumstances will permit, the land should have been heavily manured with rotted farmyard manure, as root crops are gross feeders, and a large growth of leafy succulent bulky food is required. Ploughed in September or October, the land will be ready for a cross-ploughing in February and harrowing, etc., to bring the soil into a proper tilth for the sowing of the various seeds.

The following crops can be sown:—Potatoes, rape, kale, turnips, swedes, and mangolds.

Students Working on Grafted Vines.

Outbreaks of Animal Diseases in the Union.

During the month of December, 1920, there were reported 5 outbreaks of East Coast fever (3 Natal, 1 Transvaal, 1 Transkei), 31 of mange (9 Transvaal, 22 Cape), 182 of anthrax (86 Transvaal, 36 Orange Free State, 30 Transkei, 22 Cape, 8 Natal), 2 of dourine (Cape), 2 of glanders (1 Transvaal, 1 Cape), and 2 of tuberculosis (Cape).

NOTES ON SOME SUGAR-CANE MATTERS.

By PAUL A. VAN DER BIJL, M.A., D.Sc., F.L.S., Mycologist, Natal Herbarium, Durban.

1.—THE FUNGI OF CANE.

THE statement is often heard that there are no diseases in cane in Natal and Zululand. True, we have at present no disease threatening the extermination of the sugar industry, but there are here, nevertheless, several diseases in cane. According to their nature some reduce the stand of the cane and thus indirectly the yield per acre, others interfere or reduce the formation of sugar by the leaves of the cane plant, while others are responsible for the inversion of the sucrose accumulated in the cane stalk, resulting in a loss of sugar. These latter may also be responsible for troubles with crystallization in the mills.

It is our intention in this caption to briefly review the fungi we have found associated with cane and, through illustrations, to indicate the symptoms by which they can be recognized in cane fields.

Root Disease (Fig. 1).

A soil fungus common in cane fields is *Himantia stellifera*, "the stellate-crystal fungus." This fungus is evident at the base of the cane, cementing the basal leaves together, and when the cane stool is opened interwoven white threads of the fungus are also seen in the ground between the cane roots.

In smothering the young buds the fungus lessens the stand in ratoon crops, and it has also been observed to prevent the growth of planted cuttings.

It is responsible for killing the rootlets of the cane, and it thus weakens the plants and makes them more liable to attacks by other fungi; and with a diminished root system the plants are in periods of drought not in the best position to obtain from the soil the water it still contains. Plants having their roots attacked by this fungus invariably suffer more from the effects of drought.

Under the microscope this fungus is easily distinguished from all others by the stellate crystals which are borne on branches of the vegetative threads of the fungus. These crystals have given the fungus the popular name of "Stellate Crystal fungus."

In addition to cane, the fungus has been observed on the "umthente" grass (*Imperata arundinacea*), and it probably occurs and vegetates on other grasses as well.

On cane the fungus is of the nature of a weak parasite and control methods should aim at thorough cultivation to ensure a vigorous growth of cane, conservation of soil moisture, and aeration of the root system.

Needless to say, cuttings with leaves cemented together by this fungus should not be used for planting purposes.

Leaf Diseases.

Leaves of the sugar-cane are subject to a number of leaf spot diseases caused by fungi. The two most commonly met with here are the "ring-spot" (Fig. 2), caused by the fungus *Leptosphaeria sacchari*, and the "eye-spot" caused by the fungus *Helminthosporium sacchari*.

These diseases are especially bad during moist, cool seasons and

FIG. 1.—Root disease of cane. The fungus is evident on the cutting and on the basal leaves of the young shoots.

in moist, cool localities. A *Phoma* fungus is usually associated with the *Leptosphaeria*, and is only a stage in the life-cycle of the latter.

Killing areas of the leaf tissues, these fungi interfere with the normal function of leaves as builders up of starch and of sugar from the carbonic acid gas of the atmosphere.

In bad infections the plants are seriously affected and even the leaves wither.

As a general rule treatment for these two diseases is not found necessary, but observations should be given to the different cane varieties in cultivation here to see which are the less susceptible to these leaf fungi.

FIG. 2.—"Eye-spot" disease of cane leaves.

Stalk Diseases.

The stalk of the cane is the region from which sugar is manufactured and fungi occurring on or in it should be viewed from two aspects: (1) their effect on the plant as such, (2) their effect on the sugar stored up in the cane, any loss in sugar which may be caused by their presence, or products formed by them which may later cause trouble in the mills.

Stalks suffering from fungoid attacks usually show their diseased condition by a reddening of the internal tissues. Stalks red inside should be viewed with suspicion, should be sent preferably to a plant pathologist for examination and report and should most certainly not be used for planting purposes.

In Natal and Zululand we have two widely distributed fungi which are responsible among other symptoms for a reddening of the interior of the stalks and the inversion of the sugar stored there.

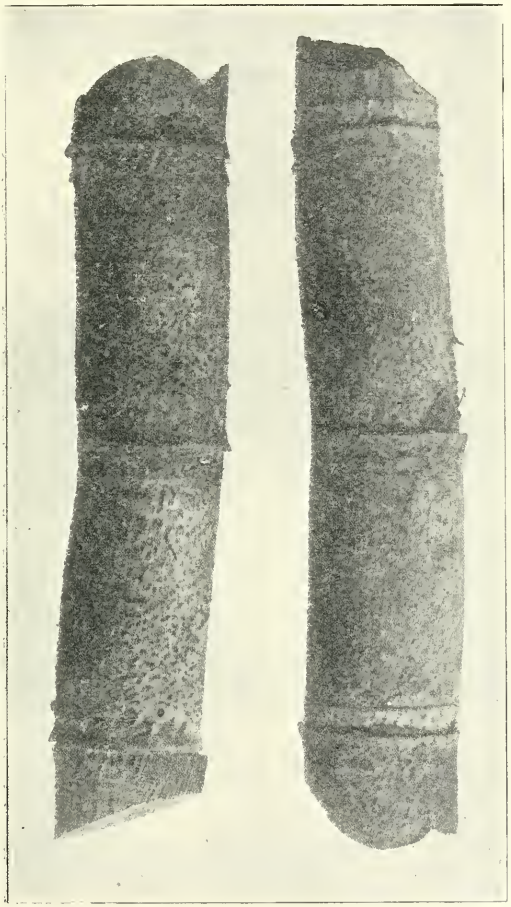


FIG. 3.—The fruiting postules of the "Rind Disease" fungus breaking through the rind of attacked stalks.

They are *Melanconium sacchari*—the "rind disease" fungus—and *Cephalosporium sacchari*.

The former fungus is easily recognized by the way the spores break through the rind of the cane (Fig. 3) and form either long kinky, black threads or velvety black patches, depending on moisture conditions prevailing at the time.

The second fungus has not been observed to fruit on standing cane, but its spores probably form in abundance when infected cane decays.

Cane is a crop which, owing to the long period it remains on the ground, often not under the best conditions for growth, is very susceptible to drought and other adverse conditions when the cane is weakened and the stalks are especially susceptible to attacks by fungi. We have also noted that the root disease, by weakening the plants, makes them more liable to fall a prey to other fungi.

Practically in no other plant crop is it as necessary, in considering the diseases to which it is subject, to take into careful consideration external influences and conditions of growth. Any one fungus weakening the cane may make it more liable to attack by another and, perhaps, more serious one. Instead, therefore, of considering the individual fungus only a wider view should be taken, and the influence on the plant of the fungi individually and in combination with others, and the various conditions in which the plant may occur at the time of infection, should be taken into account.

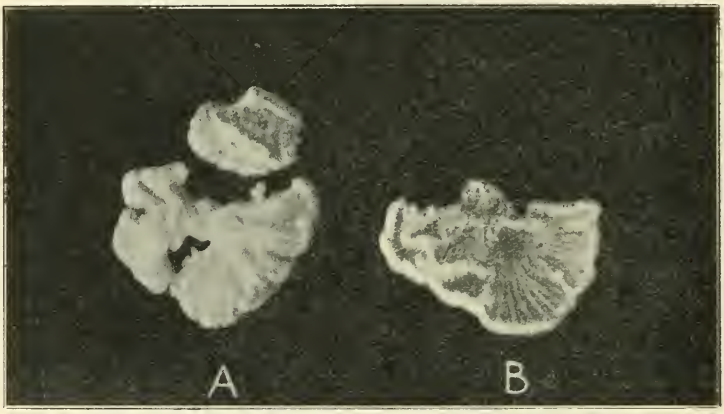


FIG. 4.—A fungus (*Schizophyllum commune*) common on old cane stalks. A. seen from above; B. from below and showing the gills.

It will readily be admitted that fungus which attacks a cane stalk and, while not being deadly to the plant, inverts the sucrose or causes other undesirable disintegration products, is of serious consequence to the sugar industry. Therefore the presence of fungi in stalks of cane is of the greatest economic importance to the industry.

The yearly loss in sucrose caused by stalk fungi is not easily estimated, but it is probably considerably higher than the majority will imagine, and an inspection of cane arriving at the mills would soon reveal a fair percentage of stalks with these fungi in them and the sucrose inverted.

When cane is allowed to over-mature the stalks become less resistant to attacks by fungi.

It is remarkable that thus far we have not observed the fungus *Colletotrichum falcatum* here, since it has been recorded from nearly all the cane-growing countries.

A fungus known by the name *Schizophyllum commune* is illustrated in Fig 4. I have commonly found this fungus in Zululand on

FIG. 5.—A physiological trouble of cane stalks. The centre has strips of spongy tissue or cavities surrounded by spongy tissue.

old cane stalks lying on the ground, but never on standing cane. It is, however, mentioned here because it has been recorded as a wound parasite of cane from Java and the West Indies. The fungus is common everywhere on old stumps and logs of various trees, and occur also as a wound parasite of fruit trees.

2.—A Physiological Trouble.

Plants, like animals, are subject to constitutional derangements brought on by external influences and conditions of growth. One such derangement in sugar-cane is the occurrence in the internodes of strips of spongy tissue or cavities surrounded by spongy tissue (Fig 5).

This condition is also recorded from Java, and is found in cane in which for some reason the growth has been irregular, such as a set back followed by a subsequent rapid growth.

The cells in the spongy tissue are dead, filled with air, and no sucrose can collect in them. It is hence readily evident that a stalk composed largely of this tissue has less sucrose than a normal stalk. Such spongy stalks readily fall a prey to the attacks of fungi.

3.—The Non-Setting of Seed in Uba and Other Cane Varieties in South Africa.

Not long ago I listened to a most interesting lecture, when the full details for cross-pollinating the flowers of cane were minutely described, and the desirability of raising seeds of cane here were carefully entered into. Unfortunately with our present knowledge not much success can be expected in this direction with the varieties which have arrowed here. The reason is evident when the anthers and pollen of the Uba or some of our other varieties are examined. It can be summarized as follows:—

(1) The anthers appear to have lost the power to open, and such pollen as they may contain is not liberated.

(2) The pollen is remarkably scanty in the anthers.

(3) Such pollen as is present differs from normal pollen in the following aspects, which lead to the conclusion that they are sterile:—

(*a*) The pollen grains are irregular in size (normal pollen of cane is circular).

(*b*) The pollen grains are devoid of starch and, compared with normal grains, appear like empty shells (normal pollen of cane is rich in starch).

Until such time as we procure a variety with normal, viable pollen not much success (if any) can be expected from attempts at either cross-pollinating or selfing.

It will be evident that making a microscopic examination of the flowers of any cane variety, with the object of determining whether the essential parts are fertile or sterile, is essential before the variety is used for attempts at seed production. Such an examination will give an idea of the degree of success that may be expected and will save much time.

THE PECAN NUT.

By I. TRIBOLET, Chief, Division of Horticulture.

THE pecan nut is closely allied to the walnut, in fact it belongs to the same natural order (*Juglandacea*). It is one of the hickories and the generally accepted botanical name is *Hicoria pecan*. It grows wild in Texas, Mississippi, Alabama, Florida, and other adjacent territories around the Gulf of Mexico. Until quite recently this fruit tree was not cultivated as an ordinary orchard tree, the whole of the pecan output being obtained from the trees growing wild in forests. Of late years pecan growing has become increasingly popular in parts of the United States, to such an extent that orange groves are being eradicated in order to plant pecans, and consequently it is now one of the most important nuts grown in America. The trees being put down from year to year will soon bring the yield of pecan nuts up to that of the walnut, which it will, as things are at present progressing, soon surpass in output, as it does in quality and delicacy.

These few notes are not intended as a treatise on this wonderful nut, but are simply written to awake an interest in some of our more progressive fruit growers who may see fit to take up the culture of the finest edible nut grown in any part of the world.

The pecan tree is not altogether foreign to this country as it is found growing here and there in a great many parts of the Union. The history of the first introduction of the tree into South Africa is obscure, but it is known that a few years ago introductions were made by the late Mr. Watkinson, of Cairn, Transvaal, mostly seedling types, and since then several good varieties of trees have been introduced by different growers, one being Mr. J. Bell, of Krantzkloof, Natal. One comes across odd trees in Natal, Drakenstein, Oudtshoorn, Potchefstroom, Nelspruit, and other places. In some, if not most cases, the name of the tree is not even known by those on whose farms it is found.

Propagation.—The propagation of this tree from the seed is not difficult, and is similar to that of the walnut, except that as soon as the nuts are ripe those required for seed should be stratified in beds of slightly moist sand mixed with a little wood-ash; should they become very dry, it is advisable to soak them for two or three days in water before placing them in beds to germinate. As soon as the nuts start to show life by splitting, they are planted out in nursery rows, about 3 to 4 feet apart and a foot in the lines. The ground should be well worked and must be naturally fertile or made so by the addition of manure, well rotted, and worked into the soil. The rows in which the nuts stand are usually sunk to the depth of 2 to 3 inches, and, after setting out the embryo plants around which the soil must be well pressed, a layer of ash or weak stable manure is spread in the hollowed out rows.

When the seedling is about a foot above ground, the tap root, which is enormous, will be found to be from 2½ to 3 feet long; during the season, when the tree is dormant, this root may be severed at about 1½ foot below the surface, and the tree allowed to remain in the ground for another year and then planted out in the orchard at distances of from 30 to 60 feet apart, according to the type of soil in which the tree is to remain. It reaches in 10 to 15 years under favourable conditions a height of 50 to 70 feet, and specimens are in existence 9 feet in diameter and 100 to 170 feet high. Although a few nuts are borne after 4 to 5 years of growth, anything like a crop is not expected till the tree reaches the age of from 8 to 12 years, when the yield may reach anything from one to three bushels of fruit, increasing as the tree gets older, up to say 20 bushels.

The pecan, like the walnut, is very long lived, and in deep fertile soil will grow and bear for a century or so.

Soil.—It thrives best in deep fertile sandy or clayey loams, bottom lands near river-beds and on alluvial deposits. But although it favours this type of country, it has a fairly big range of growth, and fine specimens are found where the soil is deep and of such a nature as to admit the roots easily, on foot hills, and even up the sides of what may be termed mountains. Though partial to fairly moist, the soil must be well drained and the water-content always kept on the move. The tap root has the reputation of seeking water at great depths.

Planting.—If the rainfall is not abundant, moisture must be supplied by irrigation. In planting out, a hole 3 feet square and about the same depth should be dug, the best soil being placed in contact with the roots and well stamped throughout, except the few inches of the uppermost layer. Care must be taken that the trees are not planted too shallow. The nursery mark should even be a little below the general surface of the ground and the soil piled somewhat up the stem and allowed to remain so.

Grafting and Budding.—As with most other trees, the product of seedlings, however carefully selected, is variable, so that the working over of proved varieties is resorted to. In the infancy of what might be called the domestication of the pecan, great difficulty was experienced in obtaining a fair percentage of "takes" in either the grafting or budding method of working over varieties to seedling stocks. This difficulty has now been practically overcome, and with a little extra care good results are obtainable. After some study and experimentation it was found that bud-wood should be taken from the previous year's growth, that the bud should be surrounded by a large area of bark and that the plate or patch bud gave better results than almost any other kind of bud, and instead of the T slit, as used for shield budding, the H or side H gave the best results. The old annular ring or flute bud is also good. The science and art of the whole operation consists in cutting the buds exactly to fit the incision made on the stocks. The "Metrogréffe" or bud-cutting calipers might be used effectively in this operation. The patch or plate bud is simply a square or parallelogram of bark cut from the stock, and a similar piece cut from the scion, with the bud in the centre and fitted exactly into the wound made by removing the piece of bark from the stock. In the upright H bud the flaps of bark from the

transverse cut are turned upwards and downwards and the bud inserted, the upper and lower edges of the bark surrounding the bud being levelled down with a sharp knife. In the side ⊐ bud the flaps are turned from the transverse cut, the one to the right and the other to the left, the side edges being levelled. It is understood that all this has to be done rapidly, so that no drying out takes place in either stock or scion, that a very sharp and clean knife is used, and that the flaps in both the upright and side slits are pulled over the bark portion of the bud and firmly tied with raffia or some such material; and, further, that a certain amount of cold mastic (grafting wax) is pressed over all parts of the incisions. As a further precaution gum-edged paper is bound, starting from the bottom and working to the top, in a spiral fashion, covering the whole of the part operated on; this forms a sort of frilled petticoat that carries off any drip of rain or dew that might injure the bud, and also protects from cold winds or glaring sun. Over and above that, a sheet of paper is sometimes tied tightly round the stem of the stock three or four inches above the bud, which is thus covered by the loose lower part of the paper, assuming somewht the shape of a crinolene or inverted funnel. There are various other types of budding practised that need only be mentioned here, such as the "chip bud" and the "triangle bud," but if success is not attained by using those already described it is not likely that it will be with other types of buds.

Grafting.—Various kinds of grafts are used, but one of the most successful and popular is the "rind or bark" graft. The "whip tongue" is also largely used in top grafting old trees. It is unnecessary to describe the operations of grafting, which are the same as for other fruit trees.

The one important point is that both buds and scions for grafting are taken from wood of the previous season. A terminal bud, that is, the fruiting bud, should not be used as a scion, as from the habit of the tree's growth the bud or the second bud below the terminal takes up and continues the main vertical growth of the tree, and becomes a leader for the time being.

Stocks.—The stocks on which to work selected pecans are varieties of hickories or seedling pecans. The affinity of pecans with many of the hickories is good, and the range of adaptability to various soils may be somewhat greater than that of the pecan seedling itself, although, taking all things into consideration, pecan on pecan seedlings are probably better than those on hickories.

Varieties.—There are somewhat over 100 varieties of selected pecans, some, as in other trees, doing better in certain soils and situations than others. A few of the most approved and tested varieties are Stuart, Mantusa, Van Deman, Money-maker, Achley Pabst, James, President, Carmen, and Sovereign.

Up to about 50 nuts to the pound is considered a fair-sized sample, although as few as 25 to the pound of some varieties may be selected. The tree is monœscious, as is the walnut in its flowering habit, that is, the staminate and pistilate blossoms are borne separately upon the same tree. The staminate blossoms appear in clusters of catkins upon the last season's growth, somewhat in advance of the pistilate blossoms, which are found only at the terminals of the new branches.

The tree may be expected to thrive in most of the regions adapted to the culture of ordinary tree fruits of the temperate zones. As a rule, if left to grow at will, it does not stand up well against strong winds; no doubt pruning to give a better scaffolding and greater stability to a certain extent will modify this defect.

Owing to the trees being planted at so great a distance apart, cultures of different sorts are carried on between them during the early period of the orchard's development.

Like all other cultivated plants, the pecan tree has its enemies in the shape of insect pests and fungoid diseases, but as yet probably not as many as most orchard trees have.

There is no reason why the growing of the pecan should not prove highly remunerative in many parts of this country and especially in Natal.

In the Cow Byre, Cedara School of Agriculture.

Export of Grain, etc.

The exports of grain, etc., for the month of December, 1920, were as follows, in bags:—Maize, 92,213; maize meal, 85,709, maize flour, 899; maize grit (rice), 50; hominy chop, 16,096; oats, 83; and kaffir corn, 500; total, 195,550 bags.

The total number of bags exported for the six months ended 31st December, 1920, was maize, 296,502; maize meal, 221,034; maize grit (rice), 3111; maize flour, 1199; hominy chop, 48,316; oats, 1137; kaffir corn, 664; beans, 1213; lucerne seed, 366; total, 573,542 bags.

Stocks on hand at all ports on 31st December, 1920, were in bags:—Maize, 36,644; maize meal, 22,440; oats, 1139; beans, 70; kaffir corn, 302; and millet, 11; total, 60,606 bags.

COLD STORAGE CONDITIONS FOR EXPORT FRUIT.

Report, dated 28th December, 1920, by the Chief, Division of Botany, to the Secretary for Agriculture.

LAST year a report dealing with the channels through which export fruit passed was published as Bulletin No. 2 of 1920 ("Wastage in Citrus Fruit shipped for Export"). Since then the matter has been gone into more fully as regards the transit of citrus fruit for export from the orchards to the overseas market, and a detailed report on the same is at present in the printer's hand.

Recently, however, the Government cool chambers, owing to reconstruction, were not available for the storage of fruit, and use was made of Chamber No. 20 of the Imperial Cold Storage Company for the storage of export fruit.

In response to requests from the Government Fruit Inspector, Mr. Roworth, and various fruit-growers' societies, that periodical examination should be made by this Division of the chambers used for export fruit, arrangements were made, with permission of the manager, to make a mycological examination of the atmosphere in the cool chamber of the Imperial Cold Storage Company at Capetown during the early part of December. The examination was carried out by Mr. V. A. Putterill, M.A., Government Mycologist, Capetown, and Miss M. R. H. Thompson, B.A. M.Sc., F.L.S., Mycologist, Pretoria, in the presence of Dr. Marloth, consulting chemist and bacteriologist to the Imperial Cold Storage Company.

The following report has been furnished by Miss Thompson, who subsequently took charge of the work as Acting Government Mycologist at Capetown during the absence on leave of Mr. Putterill:—

> "Chamber No. 20, in which the culture plates were exposed, is large with a floor-space of 2632 square feet. It is cooled by means of ammonia. The pipes containing this ammonia are exposed and cover the roof of the chamber; an electric fan keeps a constant current of air circulating throughout. The temperature is maintained at 36° F. A mycological examination of the atmosphere of Cool Chamber No. 20 was made on the 13th December. The appearance of the chamber then left little to be desired. It was tidy and clean; the walls were white-washed, and there was a thick layer of clean sawdust on the floor. A faint smell of ammonia could be detected. Fruit boxes were stacked along the wall on the left of the door.
>
> "During a visit to this chamber a few days previously there was no sawdust and the floor was then damp owing to leakage from the overhead pipes. The odour of ammonia was

very distinct. Plates were exposed at four points in the chamber for 5 and 15 seconds, and these after incubation showed an almost negligible amount of contamination. Five out of the eight plates showed no infection whatsoever, while only two growths of *Penicillium italicum* were obtained.

"Two plates exposed just outside the chamber door, however, were very heavily infected. The one exposed for 5 seconds showed some 26 bacterial and fungus growths, while that exposed for 15 seconds showed 54 growths. Of these there were two growths of *Aspergillus niger*, six growths of *Penicillium italicum*, and several other species of *Penicillium*, some bacteria, and some yeasts.

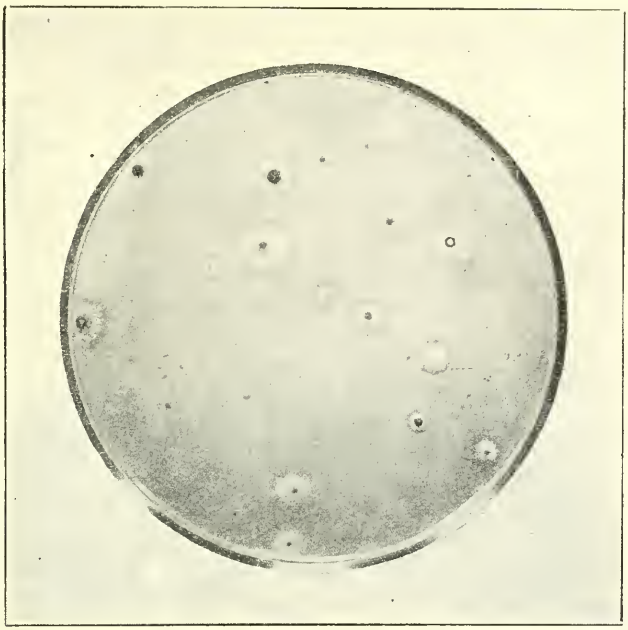
"Plates exposed in Parliament Street showed practically nothing.

"On the whole, therefore, judging from the appearance of the chamber and the condition of the atmosphere as revealed by the culture plates, the state of affairs in Chamber No. 20 of the Imperial Cold Storage Company is quite satisfactory. With proper precautions this necessary condition can be maintained, but attention in particular will need to be directed to conditions prevailing outside the chamber, otherwise constant opening and closing of the door will be the means of permitting ingress of this air, and thereby bring about contamination of the chamber.

"The following table shows the amount and nature of the contamination found:—

3 *p.m.*, 13*th December*, 1920.

Locality.	Length of Exposure.	Total Number of Colonies.	Nature of Colonies.
Centre of chamber ...	5 sec.	0	—
Floor level	15 sec.	1	1 mixed colony of *P. italicum* and Bacteria. Bacterial colony forming centre.
Far corner	5 sec.	0	—
Floor level	15 sec.	0	—
On step at door ...	5 sec.	1	*P. italicum.*
—	15 sec.	0	—
On pile of fruit boxes 3 feet high	5 sec.	4	4 Yeast.
—	15 sec.	0	—
Outside chamber, floor level, near door	5 sec. (fig. 1)	26	4 Bacteria, 1 Hormodendron. 4 *P. italicum.* Rest other species of *Penicillium.* Certainly no *P. digitatum.*
—	15 sec. (fig. 2)	54	2 *Aspergillus niger.* 5 Yeast. 4 Bacteria. 1 mixed colony of *Penicillium* and Bacteria. 1 mixed colony of *Penicillium* and yeast. 2 *P. italicum.* Rest *Penicillium* other species. Certainly no *P. digitatum.* 1 *Sphaeronema.*
On curb Parliament Street	5 sec.	0	—
—	15 sec.	1	1 Sterile mycelium.



[*Photo M. R. H. Thomson.*

FIG. 1.—Contamination on plate exposed for 5 seconds at floor level near door outside cool chamber No. 20.

[*Photo M. R. H. Thomson.*

FIG. 2.—Contamination on plate exposed for 15 seconds at floor level near door outside cool chamber No. 20.

It is clear from the results of the examination made that the Imperial Cold Storage Company at Capetown have spared no pains to put their cold storage accommodation for export fruit in perfect order and under as sanitary conditions as it is possible to obtain.

If this state of affairs is maintained and attention is also directed to conditions outside and in the immediate vicinity of the cool chambers, fruit growers and fruit merchants can have no complaints to make with regard to the conditions under which export fruit is stored at Capetown.

Students Packing Oat Sheaves.

Students Threshing Oats.

Bulletins for Distribution.

This office holds a stock of bulletins dealing with various branches of agriculture. A list of them will be posted to any one applying therefor to the Editor, *Journal of the Department of Agriculture*, Pretoria. According to the list it will be seen that certain of the bulletins are priced, and in applying for such the payment must accompany the application. Postage stamps, postal orders, etc., are accepted in payment.

A SOUTH AUSTRALIAN VINEYARD SOIL.

By Chas. F. Juritz, M.A., D.Sc., F.I.C., Agricultural Research Chemist, Capetown.

During my brief tour in Australia in the latter half of 1914, I had the opportunity of visiting, amongst other localities of interest, the district of Angaston, about 40 miles north-east of Adelaide, South Australia. The State of South Australia has about 20,000 acres under vines. Some of these are situated on the slopes of the Mount Lofty Ranges, and others at the foot of the Barossa Ranges. To the latter belong the vineyards around the town of Angaston and the estates of the widely-famed Chateau Tanunda. The late F. T. Bullen, the well-known author and lecturer, after visiting these South Australian vineyards wrote: "This strong, red soil, bearing evidence of abundance of iron on every hand, seems to be the natural home of the grape, and to be free in an amazing degree from those insect pests which have made the lot of the French and Italian vignerons such a weary one. Every variety of grape seems to flourish here in such wonderful luxuriance and fecundity, and withal in such healthfulness of foliage and fruit, that the eye wearies of admiring their prolific masses."

Not far from Angaston and Tanunda is the Seppeltsfield estate, which has some 700 acres of vineyards and the largest winery in the world. The Chateau Tanunda Company, on the other hand, lays itself out for the distillation of brandy rather than the production of wine, but the feature that claimed my attention while walking across the Company's vineyards was the character of the soil, and it seemed to me desirable to obtain some of it for comparison with the soils of South African vineyards.

Geologically the Angaston district belongs to what is known as the lower members of the Cambrian series, with pre-Cambrian schists and igneous intrusions in places. The lowest limestones of the Cambrian rocks of South Australia also occur in this district in the form of highly crystalline marbles. The estates of the Chateau Tanunda, from which I procured a soil sample, are on the Cambrian formation, comprising clay-slate, shale, sandstone, grit, and conglomerate, with limestone and dolomite. The Barossa Range, to the east, consists of pre-Cambrian boulder beds, with slate, quartzite, and quartzitic conglomerate.

"One of the most important discoveries yet to be made in South African geology," said Dr. Rogers nine years ago (presidential address to Section B of the S. A. Association, Capetown, 1910, p. 31), "is the position of the stratigraphical succession of the equivalent of

the Cambrian system of other continents. Until Cambrian beds are recognized there can be no thorough comparison of the ancient rocks with the pre-Cambrian of other countries."

Moulle in 1885 correlated the Malmesbury geological series with the Cambrian formation, and, like E. J. Dunn and others, looked upon the Table Mountain series as lower Devonian. This would mean that the vineyards of the south-western Cape have been established mainly upon soils derived from Cambrian and pre-Cambrian rocks.

The Manager of the Government Wine Farm, Groot Constantia (which lies partly on granite and partly on Table Mountain sandstone), pronounced the South Australian soil to be totally different in character from the soils of the Constantia Estate, being very much lighter. It compared very favourably, he said, with the soils further away from the mountain slopes, such as some of those at Berg Vliet and Sillery, but as these form only a small area, his general summary was that the Constantia soils are far heavier than that from Chateau Tanunda and nearer to clay in character.

Some of the Australian soil was sent by me to Dr. A. I. Perold, Professor of Viticulture at the University of Stellenbosch. Dr. Perold applied some physical tests to the soil and said that he considered it very sandy, fine-grained, and containing a fair amount of silt. "If the elements of plant food are present in fair amount," he wrote, "it should be a productive soil under favourable conditions." But he added that under suitable conditions vines grow in almost any soil.

I sent a quantity of small stones sifted off from the Australian soil by means of a 3 mm. sieve to Dr. A. L. du Toit, geologist to the Irrigation Department, for an expression of his opinion. He replied as follows:—

"The sample that you forwarded contains 'large' fragments of quartz, lumps of a ferruginous material rather like that known as the laterite of the Cape, e.g. small grains of quartz sand cemented with a little ferric oxide, and small pieces of a recent calcareous sandstone or impure limestone, like those found in the Van Rhynsdorp district, or in the northern Karroo. I think the sample could be matched with soils found in the coastal part of Clanwilliam or Van Rhynsdorp."

Many of the Cape vineyards are situated on granitic soil, for instance, in the Paarl district and at the base of Table Mountain. The old settlers did wisely when they selected the granite soils for constituting their vineyards; instinctively they selected a geological formation capable of supplying potash to the potash-loving grape. It is, however, not with such soils that the Angaston soil is to be compared, as the sequel will show, but with the sandier and poorer soils derived from the Table Mountain sandstone and quartzite.

The weight of the entire sample brought from Angaston was 28.8 lb., and it consisted of:—

	Per cent.
Stones (larger than 3 mm.)	.51
Coarse gravel (3 to 2 mm.)	1.25
Soil (below 2 mm.)	98.24

After sifting off the stones and coarse gravel the residual soil, upon mechanical analysis, was found to be composed as follows:—

	Per cent.
Fine gravel (2-1 mm.)	.60
Coarse sand (1-.5 mm.)	.75
Medium sand (.5-.25 mm.)	25.97
Fine sand (.25-.1 mm.)	43.35
Very fine sand (.1-.05 mm.)...	15.58
Silt (.05-.01 mm.)...	6.33
Fine silt (01-.005 mm.)...	5.26
Clay (below .005 mm.)	2.16

The soil may be classed as a medium sand, light brown in colour. It is very uniform in texture, about 85 per cent. consisting of particles between one-half and one-twentieth of a millimetre in diameter. There is practically no coarse material and but little silt and clay in its make up. The general appearance of the soil and also its character, as shown by the mechanical analysis, is not unlike that derived from Table Mountain sandstone, and, like the latter, it is made up very largely of fragments of quartz from .1 to .5 mm. in diameter.

As regards the chemical composition of the Angaston soil, it is indicated in the following table:—

In 1 mm. product—	*Per cent.*
Moisture	.63
Loss on ignition (organic matter)...	1.47
Nitrogen	.082
In ½ mm. product—	
Lime	.163
Magnesia	.040
Potash	.069
Phosphoric oxide—	
soluble in cold hydrochloric acid	.017
soluble in strong boiling acids...	.030

Here, except for a somewhat larger proportion of lime, there is a great similarity to the soils of the Table Mountain and Malmesbury series in the neighbourhood of the Cape Peninsula. The moisture content—as may be expected in so sandy a soil—is low, and so is the proportion of organic matter. The soil has consequently but little nitrogen. It is not more than fairly provided with potash and is decidedly poor in phosphates. The only plant food constituent present in satisfactory amount is lime.

By way of comparison the following tables of averages are appended. The Malmesbury averages represent 14 soils from the Paarl and Stellenbosch Divisions; those of the Table Mountain series represent 46 analyses of soils taken from 12 districts of the south-west Cape Province.

	Malmesbury Series.	Table Mountain Series.
Nitrogen	.087	.132
Lime	.039	.034
Potash	.039	.031
Phosphoric oxide	.039	.036

Soils such as these want all-round manuring if grapes are to be successfully cultivated, and especially is there a need for potash, a form of plant food required by all sugar or starch-containing crops. They also need to be well supplied with stable or kraal manure, which would add to the deficient humus content of the soil, and increase its water-retaining power in a manner that the bare addition of artificials can never do.

General View from Vineyard, Elsenburg School of Agriculture.
Stables on right. Classrooms and Laboratories on left.

The Value of Winter Feed for Stock.

The following information, which has been brought to the notice of the Department, provides a striking instance of the value of winter feed for stock:—

In an eastern district of the Orange Free State were two farmers on adjoining farms, each cultivating 500 morgen of land. In the season 1919 the one spent £120 in growing winter feed for his stock. During the severe drought of 1919 he lost no stock, and further had a good crop of calves in the following year. The other farmer grew no winter feed, and owing to the scarcity of grazing due to the drought had to trek with his cattle. He had to pay £87 in grazing fees, and moreover lost forty head of cattle, and obtained in the following season only half a normal crop of calves from those cows which survived. By losses through death and by grazing charges the drought cost this farmer £487 (if the animals which died be valued at £10 per head), which is £367 in excess of the cost to the other farmer of growing winter feed. In addition to this, there was considerable loss through not getting a good calving season in 1920.

DISEASES, TICKS, AND THEIR ERADICATION.

By Sir ARNOLD THEILER, K.C.M.G., Director of Veterinary Education and Research.

ONE of the results of scientific investigation into the cause of stock diseases contracted in the veld of South Africa was the cognizance that ticks play an important rôle in their maintenance and propagation. It is advisable to review our knowledge concerning these diseases, as well as that of the life-history of the ticks which transmit them. Such a review will illustrate the utility and necessity of eradicating ticks; it will guide us in our recommendations of methods to be adopted for their control and eradication. It will further be demonstrated that it is possible to prevent disease and save cattle by transferring the stock from an infected area into a clean one, according to a carefully worked out method, based on accurate knowledge of the life-history of the tick.

All tick-borne diseases are caused by micro-organisms present in the blood stream. These organisms belong to different groups of blood parasites, and are all visible under the microscope with the exception of one, the causal agent of heartwater in ruminants, which belongs to the group of ultra-visible viruses.

BILIARY FEVER OF HORSES.

The cause of this disease in South Africa is *Nuttallia equi* (formerly called *Piroplasma equi*). A similar disease caused by an allied parasite, *Babesia caballi*, is found in Europe. It has not yet been definitely demonstrated whether the allied parasite is present in South Africa, but it may be expected to be found at any time. Our biliary fever affects all equines. The disease, however, varies somewhat in severity of symptoms in the horse on the one side and the donkey and its hybrids on the other. It is known over the greater portion of South Africa; certain areas, however, i.e. parts of the Karroo, seem to be exempt. Animals born and bred on the veld of the infected parts, once they are grown up, are not so liable to suffer from the disease, and they do so only under special conditions. This observation is due to the fact that young equines (foals), although they contract the infection as soon as they are turned into the veld, do not readily die from the disease. They recover and acquire a considerable amount of immunity. The chief sufferer is the animal bred either on uninfected farms or in stables, or imported from oversea. The parasite that causes the biliary fever lives within the red corpuscles of the blood, where it multiplies and subsequently invades a smaller or greater number of other corpuscles. Its action is the destruction of the red corpuscles, and the more parasites present or the quicker they multiply the more dangerous becomes the disease. The destruction of the corpuscles becomes apparent in the anaemia which follows. In the horse, however, this anaemia is hidden, so to say, by a bilious condition. The destruction of the red corpuscles leads to

the separation of the colouring matter from the corpuscles, which is deposited in the liver, and there undergoes a change into bile stain. An over-production of bile takes place, which is carried into the blood stream and absorption into the tissue follows. Hence we recognize biliary fever in the horse principally by the yellow discoloration of the mucous membranes. It is very rarely that the destruction of the red corpuscles leads to colouring of the blood plasma and to subsequent red urine. In the mule and in the donkey the jaundice is not pronounced, and the white membranes indicating anaemia are typical of the disease.

The remarkable fact has been established that an animal, say a horse, which has recovered from this disease retains the infection in its blood. We cannot see the organism microscopically in the blood of such an animal. The corpuscles have an absolutely normal aspect and the animal to all appearances is healthy, but when we inject its blood into a susceptible imported horse, mule, or donkey, we promptly produce the disease, which can end fatally and be of such a virulent character that it differs in no way from that contracted naturally. This fact has been made use of to prove that the various piroplasms of the horse and the donkey and of the hybrids are identical.

In our experiments we have proved that the blood of an animal which has recovered, and which for eighteen months has been kept in a stable, still proved to be infective; and it can be concluded that once an animal has recovered its blood remains infective for the remainder of its life, at least if such an animal remains exposed in the veld.

This disease is carried by ticks, the ticks being the real hosts of the parasites. Our experiments show that the common blue tick (*Boophilus decoloratus*) is not implicated in the propagation of the disease, but that the red tick (*Rhipicephalus evertsi*) acts as a transmitter.

We have transmitted the disease with ticks which have been feeding on sick animals and on animals which had recovered. The incubation time of the disease, when contracted from ticks, averages about three weeks.

REDWATER IN CATTLE.

South African redwater is due to the presence of *Babesia bigemina* (formerly called *Piroplasma bigeminum*), a parasite similar to that of the horse, which invades the red corpuscles, multiplies and increases in numbers, and causes the destruction of the corpuscles. Whereas in biliary fever of the horse discoloured urine, due to the breaking down of the red corpuscles, but rarely occurs, it is almost an invariable symptom of redwater in cattle.

As regards susceptibility, the conditions are similar to those referred to above under biliary fever in horses. Cattle born and bred on redwater-infected veld become immune. The animals bred in stables and imported from areas free of redwater contract the disease easily and in many cases die. The calf is susceptible, but it usually contracts the disease in a mild form and recovers comparatively easily. It is then immune. Only under special conditions are breakdowns of immunity noticed.

American investigators were the first to prove in a convincing way that Texas fever, i.e. redwater, is a tick-transmitted disease,

and we in South Africa have repeated the experiment on imported stock and with ticks sent to Paris and London. It is the blue tick which carries the disease, although subsequent experiments have shown that the brown and the red ticks can also act as hosts of *Babesia bigemina.* These two form the exception rather than the rule, whereas practically every one of the blue ticks can transmit the infection.

We can also show from experiments that blue ticks collected from horses can occasionally transmit redwater to cattle, a fact previously noticed in the transmission of human tick fever, where the progeny of an infected tick remained infective for several generations.

We have stated that the animal born and bred in South Africa is immune, and what we have said about immunity in biliary fever of the horse applies to redwater in cattle. The immune animal retains the infection in its blood. This has been proved by tapping an animal born on the veld and injecting an imported susceptible one. An animal which recovered from redwater in 1902 proved still to possess virulent blood in 1909. American investigators have even proved that the blood of a cow which had recovered from Texas fever, and had remained for twelve years out of the infected area, still produced the disease. This observation does not, however, apply to all recovered animals which are subsequently stabled; it has been experienced that blood of immune cattle, when used for inoculation, is not always virulent, at least when used in quantities of 5 c.c. per dose.

The incubation period of this disease, when naturally contracted by ticks, is about seventeen or eighteen days.

The progeny of blue ticks collected from cattle recovered from redwater, and of ticks collected at random from any full-grown cattle born in the infected veld of South Africa transmit redwater when placed on susceptible imported cattle.

Redwater is a curable disease, and an injection of 100-150 c.c. of a 1 per cent. solution of trypan blue in the early stage of the disease is most effective.

GALL-SICKNESS IN CATTLE.

Gall-sickness is a term for a disease in cattle, the chief symptoms of which, on post-mortem, are an abnormal bile, usually of a viscid, thick crimson and yellow to dark green colour, and a jaundiced condition of the body. This jaundiced condition can frequently be recognized during life in examining non-pigmented parts of the skin, particularly the ears. In other cases jaundice is absent and an acute anaemia is noted, revealing itself by white mucous membranes, particularly a white tongue. In addition to these symptoms a disturbance of the digestive organs is present. During life, symptoms indicating such a disturbance are frequently found. In the absence of other changes they are interpreted as those of gall-sickness. Accordingly, under the term "gall-sickness" a number of ailments are understood. Many conditions caused by plant poisons are included under the same term. The disease very frequently taken for gall-sickness is redwater, or rather the sequel to redwater, when the urine is no longer noted to be coloured red. In this sequel the lesions of jaundice during life and on post-mortem may be very pronounced, and if the disease is of some standing the causative micro-organism

may no longer be present. The first outbreaks of East Coast fever on a farm are also very frequently mistaken for gall-sickness. Although gall-sickness resembles in many respects the redwater under discussion, it is a definite disease caused by a micro-organism. In the blood corpuscles of sick animals small chromatic dots are found, situated usually on the margin which are interpreted by us to be of parasitic origin and were called *Anaplasma marginale;* the scientific name for the disease would then be anaplasmosis. The main difference between anaplasmosis and redwater is the absence of red urine in the former, otherwise it resembles it in many details, and the two diseases are frequently maintained by farmers to be sister diseases. It has been experimentally transmitted by blue ticks (the same batch of ticks were capable of transmitting both redwater and gall-sickness), but there are other ticks also responsible, probably some or all of the genus Rhipicephalus, which includes the brown and red ticks. At least the black-pitted tick has transmitted the disease in experiments. When the ticks are infected, both with redwater and gall-sickness, the organism of redwater appears first, the incubation period being about seventeen to twenty-one days; gall-sickness, with a long incubative period, from sixty to eighty days, appears later. Recovery from gall-sickness does not protect against redwater or vice versa. This fact proves the non-identity of the two diseases. As in the case of redwater in cattle or biliary fever in horses, the animal which has recovered from the disease retains the infection in the blood, and such blood when injected into susceptible cattle produces the disease. The progeny of ticks which drop off immune cattle also propagate the disease; in this way a farm becomes permanently infected. The young calves, suffering less from the disease than adults, "salt" in the greatest number of cases.

FEVERS CAUSED BY *Gonderia mutans* (FORMERLY *Piroplasma mutans*).

Cattle born on the veld of South Africa sometimes show in their blood a small parasite in the red corpuscles belonging to the Piroplasma group. The scientific name is now *Gonderia mutans* (previously *Piroplasma mutans*). Morphologically it so much resembles the East Coast fever parasite that its identification in a blood-smear occasionally causes difficulties. When a susceptible animal becomes freshly infected with this parasite it will show a slight irregular fever of varying duration and anaemia may become markedly pronounced, and symptoms of illness with loss of appetite and condition may show themselves during its course. Death is only rarely noted. The disease was experimentally transmitted by means of red and brown ticks. It appeared after a prolonged incubation period lasting from twenty to fifty days. Similarly to what is known in redwater and gall-sickness, the parasite is present in the blood of a recovered animal, but contrary to the former diseases it can be found microscopically in quite a number of cases long after recovery. This parasite may reappear in considerable numbers when an animal is suffering from an inter-current disease and so mask the original ailment. The disease caused by *Gonderia mutans* may conveniently be called the "benign" or "mild form" of gall-sickness.

FEVERS CAUSED BY SPIROCHAETES (*Spirochaeta theileri*).

Spirochaetes are blood parasites in the shape of small curves, looking like a corkscrew, swimming in between the red corpuscles of

the blood. They have been found in horses, cattle, and sheep in South Africa. Their injection into a susceptible animal gives rise to a high fever which, however, has never been noted to end fatally, yet symptoms which point to the destruction of the red corpuscles are present and are easily recognized miscroscopically. We have transmitted the parasite artificially by inoculation. The fact interests us that not only the animal which is suffering from such a fever, but also the recovered animal, retains the infection in its blood, and such blood proves infective at any time.

The disease is transmitted by the blue tick. We have proved this beyond doubt in several instances, and it has been verified by Laveran, of the Pasteur Institute in Paris, to whom we sent a number of the ticks, which promptly produced the disease in Paris. This parasite does not play an important rôle as a cause of disease, but may occasionally be responsible for fever and loss of condition in any of the mentioned animals. We have met with this parasite occasionally in smears sent to us from cattle supposed to be suffering from gall-sickness.

EAST COAST FEVER.

This formidable disease has, since its introduction into South Africa, played considerable havoc. It is still prevalent and threatens to spread. It is due to a parasite resembling the group of Piroplasms. It multiplies within the lymphatic system of the body; from there it invades the blood in such enormous numbers that finally almost every corpuscle contains one or more parasites. Unlike the other Piroplasms which we have described, it causes the destruction of the red corpuscles to a slight degree only, and the cause of death of an animal is due not to an acute anaemia as in the other diseases, but to intoxication by the metabolic products of the parasite. The disease differs in various respects from the before-described piroplasmosis and anaplasmosis. It cannot be transmitted by inoculation of blood, but only by intrajugular and intralymphatic injection of the juice of lymph glands and spleen tissue taken from a sick animal which contains the evolutionary stages of the parasite. The striking difference, however, is that the animal which has recovered from East Coast fever, although immune, does not retain the infection in its blood, hence the immune animal does not spread the disease. In East Africa, where East Coast fever has become enzootic, a chronic form of the disease has been noticed, characterized by the enlargement of the lymphatic glands, which have been found to contain the evolutionary stages of the parasite (the so-called blue or Kochs bodies). It is thus probable that chronic cases may maintain the infection of the tick, which, as many experiments have shown us, is not maintained by the immune animal. The presence of evolutionary stages, Kochs bodies, are the chief distinguishing factor between *Gonderia mutans*, the benign form of gall-sickness, and East Coast fever, the parasites found in the blood being otherwise morphologically identical. The parasite of East Coast fever represents a different genus (and family) which received the name of *Theileria* (family *Theileridae*), and the parasite is called *Theileria parva*. The disease is transmitted by ticks, namely the red tick, the brown tick, and the black-pitted tick, as Mr. Lounsbury, Chief of the Division of Entomology, and I have proved in numerous experiments. The incubation period when transmitted by ticks varies from six to eighteen

days and averages about thirteen days. The disease, which is characterized by high fever, lasts from six to about twenty days, and averages about twelve days, hence an animal may die as soon as twelve days or as late as thirty-seven days after it was bitten by ticks, the usual period being about twenty-five days. A typical symptom of this disease is the enlargement of all lymphatic glands which stand out markedly, loss of condition may be rapid, and in the dead animal froth is frequently exuded from the nostrils.

HEARTWATER IN CATTLE, SHEEP, AND GOATS.

This is a disease caused by a non-visible organism. We prove its existence by the inoculation of the blood of a sick into a susceptible animal, which promptly produces the disease. The action of the parasite must be interpreted as an intoxication, as a result of which the animal may die.

The disease is tick-transmitted, as Lounsbury first proved. The experiments undertaken for this purpose have shown that the bont ticks (*Amblyomma hebraeum*) play an active rôle in the propagation of it, but only when they have been sucking blood from an animal suffering from the disease and not from an immune animal. The incubation period varies from five to fifteen days in goats and about twenty to twenty-five days in cattle. It is of special interest to us that immune animals do not retain the virus in their blood.

BILIARY FEVER IN DOGS.

This disease is caused by *Babesia canis* (formerly *Piroplasma canis*), a parasite very closely allied to *Babesia bigemina*, the cause of ordinary redwater. Like this species it lives in and destroys the red corpuscles of the blood, and so causes the jaundiced discoloration and anaemic condition, frequently accompanied with brown, yellow, or reddish staining of the urine. This disease, like redwater, can be cured by the injection of a 1 per cent. solution of trypan blue. The disease is transmitted by the dog tick (*Haemaphysalis leachi*), as Lounsbury demonstrated. The first symptom to appear is the fever, which is noted after a typical incubation period. One of the brown ticks (the European brown tick) has also been found to be a carrier, viz., *Rh. sanguineus*. In this country it is the common tick of the kennels, whereas the dog tick is picked up in the veld.

PARALYSIS IN SHEEP.

In the Cape Province, and also in the Orange Free State, a paralysis of sheep and lambs is known to occur which is connected by farmers with the presence of a tick, *Ixodes pilosus*, and it is stated that after removal of the tick recovery is soon effected. These statements have not yet been experimentally verified and accordingly no explanation as yet can be given—if the observation is correct—as to what the real action of the tick would be. *A priori* it would look as if some toxic action is produced through the bite of the tick.

RESERVOIR OF VIRUS.

The diseases which are tick-transmitted in South Africa may be classified into two groups. The first one, in which the immune animal retains the infection in the blood, in other words in which the recovered animal acts as a constant reservoir for the virus, and the second group where the blood of a recovered animal becomes sterile

and therefore harmless. The former condition explains the reason of the constant infection of African veld by redwater, biliary fever, and gall-sickness. The animal which recovers from the disease continues to act as a host for the ticks. The ticks become infected with the parasites, and in turn carry them back to the animal. In this way a circle is formed between the animal, the micro-organism of the disease, and the tick. The tick and micro-organism are dependent on the animal; without it their life-cycle would come to an end. They require the hosts for the multiplication of the species. Accidentally, through the invasion of a great number of parasites such an animal becomes sick and may die. An adaptation between the host and the micro-organism has resulted. The hosts act as virus reservoirs. Both seem to benefit from this infection—the animal with its immunity and the parasite with a permanent home. It is evident that diseases caused by blood parasites and transmitted by ticks would disappear if we were able to break the life-cycle of the parasite. It must reasonably be expected that the easiest way to achieve this is to attack the tick; to attack it successfully the method to be adopted must be based on its life-history, which has to be explained.

LIFE-HISTORY OF THE TICKS.

The ticks belonging to the order of Acarina are easily recognized by the naked eye. They possess flat bodies when not engorged, or they are more or less swollen when engorged with blood. We distinguish males and females in the adult stages. The body of the male is always flat, whereas the female engorges and grows in size; in this country the latter is usually known as the tick proper. Male and female meet on an animal for copulation, and as soon as the fertilization has taken place the female engorges. Underneath this engorged female the male can usually be found. Before repletion the female is about the same size as the male. The presence of the small tick underneath the female, especially in the case of the blue tick, has led to the popular opinion that this is a young one. After the female has repleted herself she drops and hides in the grass or in the sand, and soon after begins to lay eggs. The process of oviposition varies in length of time according to the season in which the ticks drop. After a lapse of a certain period the eggs begin to hatch and the young larvae, commonly known as seed ticks, appear. They seek their way to the top of the grass or bushes, from which they attach themselves to a suitable host which may be passing. So far the ticks with which we have to deal behave similarly, but the various species differ in their habits, and according to these habits we can divide them into three groups.

Firstly.—The ticks which, for the completion of their life-cycle, require only one host. To this group belongs the blue tick (*Boophilus decoloratus*). It reaches the host as a larva; it moults (changes its skin) on the animal from the larval into the nymphal stage, and again from the nymphal to the adult stage. In the adult stage the sexes meet again and the life-cycle begins afresh.

Secondly.—Ticks which require two hosts for the completion of their life-cycle. To this group belongs the red-legged tick (*Rhipicephalus evertsi*). It comes as a larva, it moults into the nymphal stage, and leaves the animal as an engorged nympha. The moulting

process from the nymphal to the adult stage takes place in the ground, and the sexes meet again on the host.

Thirdly.—Ticks which require three hosts for the completion of their life-cycle. To this group belong the brown ticks (*Rhipicephalus appendiculatus*), the black-pitted tick (*R. simus*), the Cape brown tick (*R. capensis*), the European brown tick (*R. sanguineus*), the bont tick (*Amblyomma hebraeum*), and the dog tick (*Haemaphysalis leachi*). The larva reaches the animal and engorges, and as soon as it has done so drops to the ground, where it moults (after a lapse of a certain time) into the nymphal stage. The nympha seeks a second host, also engorges, and after repletion drops to moult into the adult on the ground. The sexes seek a third host, where they meet and the whole life-cycle begins again.

Of interest to us from our point of view are the dates required—

(1) for laying the eggs and hatching into larvae;
(2) for the completion of the life-cycle on the host in the case of the one-host tick (the blue tick);
(3) the time the larvae and nymphae require to replete on a host;
(4) the length of time the engorged larvae and nymphae require to moult on the ground;
(5) the length of time the adult females remain on the host before they drop; and
(6) the length of time these various ticks and stages of ticks may live.

Concerning these the following facts are known:—

Blue Tick.—The whole length of time this tick requires from larval to adult stage averages three weeks. From the third week the engorged blue females begin to drop, and about the end of the fourth week the greater number has left the host. In other words, when we remove an ox or a horse out of the veld and place it in a stable we must constantly expect, during the four following weeks, the appearance of blue ticks which have attached themselves up to the day when the animal left the veld. This applies to the summer season only; in the winter it is delayed. The eggs hatch in the warmer season in about three to six weeks, and on an average after about thirty-six days; in the winter it will take longer. The young larvae kept in glass bottles have been known to live six months. If they do not reach a host they die; on reaching the host they continue the life-cycle. During this time they sit on the grass. No food is obtained from the plant (as the popular belief is), therefore it follows that the blue tick must finally die if no host is found after the above-stated lapse of time.

The Red-leg Tick.—The hatching period of the eggs of this tick is (in summer) about thirty days on an average. We have known the young larvae to live for a period of seven months. The young larvae which find a host generally hide themselves in the interior of the ear, rarely in the flanks, and soon begin to replete. They undergo the change from larvae to nymphae on the host. The nymphae attach themselves near the place where the larvae were and replete themselves quickly, so that as early as ten days after attachment of the larvae the nymphae may be replete and drop, but

generally this period averages fifteen days. The second moulting process takes place in the ground, and requires an average period of twenty-four days. In our experiments adult red-leg ticks have lived up to a year, and have after that time attached themselves to a beast. Such longevity seems, however, to be the exception, and the usual period is less.

The Brown Tick.—Under this name we include the common brown tick (*Rh. appendiculatus*) and the Cape brown tick (*Rh. capensis*). The European brown tick (*Rhipicephalus sanguineus*) of the dog also belongs to this group; they all have a similar life-history. The female brown tick, after it has been placed on a host, may be observed to drop already fully engorged on the fourth day, and by the end of a week it has usually left the host. The laying of eggs usually begins after six days. The hatching period averages in the warm season twenty-eight days; in the winter time the hatching takes several months. The young larvae readily attach themselves to cattle and engorge rapidly, and may drop off the host in as brief a time as three days; after a lapse of eight days all engorged larvae have dropped. The moulting process takes place in the ground and averages twenty-one days. The shortest period recorded was sixteen days. The larvae have in our experiments lived up to a period of seven months, and the nymphae to six and a half months. For some days after moulting these creatures are not able to feed. They are colourless and weak, and refuse to bite if placed on animals. About a week later they eagerly seek attachment when placed on the skin of a host. The nymphae also require a period of about three days to engorge, and within a week have dropped off the animal. In summer time these nymphae moult into adult ticks after an average period of eighteen days. Like larvae and nymphae, they are almost colourless and very weak. A few days later they assume the characteristic colour, become more vigorous, but require some time before they will readily attach themselves to a host. In our experiments the adults have been known to live up to a period of fourteen months; this is, however, an exception.

The Blackpitted Tick (Rhipicephalus simus).—The hatching period of this tick averages thirty days. The larvae do not attach themselves readily to cattle or horses but to other animals, in particular the dog, and the intermediate stages are found on smaller animals. The first moulting usually takes place after twenty days, and the second one, from nymphae to adult, after twenty-five days.

The Bont Tick (Amblyomma hebraeum).—The female begins the laying of eggs in summer time about two weeks after dropping from the host, but under certain conditions over three months may sometimes elapse before eggs are deposited. The shortest hatching period is about ten weeks, but it may last as many months; it averages from four to six months. In our experiments larvae have been known to live seven months. The young larvae replete themselves on a host in from four to twenty days, and the majority always drop between the fifth and seventh day. The first moulting takes place after twenty-five days, but sometimes four months may pass. The nymphae replete themselves on a new host in from four to twenty days. Unengorged nymphae have been known in our experiments to live six months. The last moulting process takes place after an interval of

about twenty-five days as a minimum and 160 days as a maximum. The adult female drops from about the tenth to the twentieth day after attaching. Adults have been known in our experiment to live up to a period of seven months. This tick is known to produce severe ulcerating sores on the place of its attachment, and is frequently responsible for the loss of one or more teats.

The Dog Tick (Haemaphysalis leachi).—The female begins to lay eggs three to seven days after it has left the host. The period varies according to the season in which it drops. The eggs require about a month to hatch. The young larvae remain on their host for a period of two to seven days. When engorged they drop to the ground and moult into nymphae. In about a month's time the nymphae seek a host and remain on it for two to seven days, and then drop engorged to the ground; they change into adults in about ten to fifteen days. The female adult requires about ten to fifteen days for repletion.

The Striped-leg Tick (Bontpoot) (Hyalomma aegyptium).—Though not a disease-transmitting tick, it frequently is the cause of lameness in sheep and goats, the adult attaching itself between the hoofs; it is sometimes known to produce ulcerating sores in cattle. Only adults are found on domesticated animals, the larval and nymphal stage are passed on different smaller wild animals, including birds.

The Sheep Paralysis Tick (Ixodes pilosus).—The life-history of this tick has not yet been studied.

The Spinose Ear-tick.—It has been known in South Africa since 1910, and was probably introduced from America. It is a tick which thrives best in dry areas, hence its prevalence is recorded in the Karroo and western South Africa. It is not known to transmit a definite disease, but its presence is decidedly harmful. The death of calves, sheep, and goats has been put down to its effects. The female ticks lay their eggs in sheltered places. The eggs hatch out in twenty-four to fifty-six days. The young larvae after reaching a suitable host settle in the ears. A larva can live about two to four months without feeding. The larvae engorge in five to seven days and then moult into nymphae. These engorge themselves after about one week, but they can remain for many weeks and months before they finally engorge and leave the host. The engorged nymphae drop off the host, crawl into a sheltered place, where they moult into adults after from seven to thirty-five days. They are then fertilized by the males and subsequently lay eggs. The adults can live for a long time. Megnin states that he kept some alive for two years.

TRANSMISSION OF THE DISEASE.

From the life-history, as outlined above, the following possibilities may be observed in the transmission of a disease:—

Firstly.—The transmission is effected by means of young larvae whose mothers have been sucking blood from infected animals. This has been known to be the case in redwater, spirochaetosis, and anaplasmosis. It is the principal mode of propagation of redwater by the blue tick; the larvae of the brown tick may transmit redwater, and the larvae of the red tick have proved to be hosts of spirochaetosis.

Secondly.—The transmission is effected by one of the succeeding stages, either by the nymphae which infected themselves as larvae or

by adults which infected themselves as nymphae. The adult red tick has been proved to transmit biliary fever of horses, spirochaetosis, benign gall-sickness, and East Coast fever, after it had been sucking blood of an infected animal in the previous two stages. The group of brown ticks and the black-pitted tick transmit East Coast fever. It has been proved that this group of ticks transmits the disease in their nymphal stage after sucking blood in the larval stage from a sick animal. Further, the brown ticks and the red-leg tick have been proved to transmit the disease in the adult stage after feeding in the nymphal stage on an infected animal. The adult brown tick has also been proved to transmit redwater and benign gall-sickness in this way. The bont tick has been shown by Lounsbury to transmit heartwater in the nymphal and in the adult stage after the respective larval and nymphal stages had fed on sick animals. It has further been proved that the bont tick can pass its nymphal stage on an animal not susceptible to heartwater without losing the infection it acquired in the larval stage, and can transmit it in the adult stage to a susceptible animal. This is not the case in East Coast fever, where experience has shown that after a tick has bitten and discharged the infection it can no longer transmit the disease.

Thirdly.—The transmission is effected by the adult tick only, viz., as male or female, the mother of which became infected. The infection then passes from the adult female through the egg, the larval and the nymphal stage into the adult. The larval and nymphal stages when attached to susceptible animals do not discharge the infection, and only the adult is capable of infecting animals. The dog tick also transmits the disease in this manner. It must be emphasized here that this is also the case with the European brown tick, which can infect in the following three ways, viz., from the adult to nymphae, from nymphae to adult, and from adult to adult stage. The popular opinion that ticks pass from one animal to another and communicate the disease in this way is wrong. The destiny of females is to lay eggs, and of engorged larvae and nymphae to moult, and this process makes it impossible for them to reach new hosts before they have reached the next stage; therefore only males could pass from animal to animal. Indeed, males of any species of ticks which we have mentioned can live for many weeks on a host, but their peculiarity is to remain on that host, which they only leave accidentally, e.g. when rubbed off. A most important and far-reaching fact must be recorded here, which was first noted by Pitchford and subsequently verified by us, that the adult brown tick which transmits East Coast fever does so only after it has been biting for a period of not less than sixty hours, and is only then infective for a period of sixty hours, so that after the lapse of 120 hours it no longer transmits the disease. An infected tick removed from any animal during the period of five days after its first attachment and placed on susceptible cattle will, therefore, transmit the disease if it is able to bite and to attach itself again. Such removal may accidentally happen in saddling and inspanning horses and mules. Of its own will a tick once attached does not let loose, and if it does will not leave its host except by accident. When the animal is dead ticks have been noted to crawl off the carcass. It is most likely that the ticks also which transmit redwater, biliary fever, and gall-sickness

require first a period of attachment before they discharge the infection.

THE HOSTS OF THE TICKS.

From our point of view it is very important to know which animal, in addition to those which we have considered to be subject to the diseases, may act as hosts for the ticks, and the following notes have accordingly been recorded:—

The Blue Tick has been found on equines, cattle, sheep, goats, dogs, and antelopes.

The Red Tick has been found to occur on equines, cattle, sheep, and goats; the reedbuck, other antelopes, and the Cape hare.

The Brown Tick has been found on cattle, equines, sheep, goats, dogs, various antelopes, the Cape hare, and the lion.

The European Brown Tick has been found mainly on dogs, but also on cattle, sheep, cats, hares, etc.

The Black-pitted Tick has been found on cattle, horses, sheep, goats, dogs, the wild dog, the jackal, bushpig, and the hedgehog.

The Bont Tick has been found on cattle, horses, sheep, goats, dogs, the wild dog, antelopes, and the ostrich.

The Dog Tick is found on dogs, cats, and wild canines.

The Spinose Ear-tick is found on cattle, calves, sheep, goats; also horses, donkeys, dogs, cats, ostriches, and occasionally on man.

The Striped-leg Tick is found on all domesticated animals; also on antelopes, hares, pigs, and birds. The nymphal stage is frequently found on birds.

THE PREVALENCE OF TICKS IN THE VARIOUS REGIONS OF THE COUNTRY AND IN THE DIFFERENT SEASONS.

Generally speaking, ticks are more frequent in summer than winter. This stands to reason, since a certain moisture and warm temperature are required for the process of hatching and moulting. The spinose ear-tick is an exception to this rule as it prefers dry countries. The striped-leg tick is frequently found in the dry parts of South Africa. The various species are, however, not equally distributed throughout the country. We may state that the higher the altitude and the barer the veld the less frequent are the ticks, hence the bushveld is practically the home of the tick, and the name "bosluis," as given by the Dutch farmer, indicates this. The red tick may be considered as the most cosmopolitan tick of South Africa, and is found at all altitudes and in all climates. Next to it is the blue tick, which is more frequently met with in the low and middle veld, but also goes to the high veld. It is absent in the driest parts of South Africa. The group of the brown ticks, especially the brown tick proper, is not frequent on the plateau of the high veld, but it may be found there in protected valleys where the vegetation is higher. The same applies to the black-pitted tick. The European brown tick is found in many parts of South Africa. Its main abode is the dog kennel. The sheep paralysis tick is found in the eastern part of the Cape and the south of the Orange Free State.

THE NUMBER OF TICKS IN PROPORTION TO THE NUMBER OF CATTLE.

Under the most favourable conditions the number of ticks increase in direct proportion to the number of hosts found on a farm. Thus the more stock and wild animals there are the more the ticks

will increase, and under such conditions may become so troublesome that, apart from their rôle as carriers of disease, they do an enormous amount of damage by the withdrawal of blood from the stock and by the irritation they cause, generally known as "tick worry." Indeed, the ticks can kill an animal without even transmitting a disease. This we have seen in an experiment in which a horse was infested with blue ticks. It died from acute anaemia as a result of this infestation owing to the withdrawal of blood. Within three days 14 lb. weight of blue ticks were collected which had dropped off this horse, and this amount only represented about half of the ticks which engorged themselves on it. A similar observation was made on a heifer that died of acute anaemia, being bled white by ticks.

INFLUENCE OF CLIMATE.

We have stated that ticks are unequally distributed over high and low veld, and it may be expected that this fact finds an explanation in the unequal temperature to which ticks are exposed. It is generally thought that cold kills the ticks. This is to a certain extent true. Ticks which thrive best in the low veld, when brought to the high veld by the removal of animals, will not develop there. Experience has proved that the cold in itself is not a barrier for the development of the blue and red ticks in the high veld. At freezing point the moulting of the red nymphae into adults is only retarded, but the ticks are not killed. This temperature did not affect the blue larvae at all; these latter only died when exposed for some time to a temperature considerably below freezing point. A droughty condition is probably the inhibiting factor for the development of some species of ticks.

ERADICATION OF TICKS AND DISEASE.

From a practical point of view we shall consider the two points separately, the eradication of ticks and consequently the eradication of disease.

The eradication of ticks can be attempted in several ways:—

1. *Burning of Grass.*—Up to the present time the burning of grass has always been considered to be of great help for the destruction of ticks. Farmers have always distinguished burning of grass in season and out of season. If burning is not carried out at the proper time the farmers hold this fact to be responsible for various diseases, such as redwater and gall-sickness. These observations have probably a certain foundation. Nevertheless the great importance attached to it from the point of view of tick destruction is generally exaggerated. Burning of grass, undertaken at a time when most of the ticks have hatched and moulted and are sitting on the top of the grass, must undoubtedly destroy them. We note that the principal tick season is the summer, and with the cold tick-life is more or less at a standstill. The ticks which up to the end of the summer have moulted and are sitting on the top of the grass will still fasten themselves on to a passing host, and they are responsible for the tick-life which we notice during the winter months. During the cold weather the laying of eggs and hatching are retarded, or even absent. If, therefore, burning is undertaken at the beginning of the cold weather we would only reach those ticks sitting on the

grass, and not those which sit underneath. The latter would, under the influence of the sun on the bare veld, probably hatch quicker, and when the young grass shoots up they will be found on the top of this grass. When, however, the burning of the grass is undertaken later in the season it would probably destroy the majority of the ticks, and the later the burning is undertaken the better the results would be. Grass burning alone, although carried out in the proper season, will not eradicate ticks; it only reduces their number. Cattle which graze over the same veld maintain tick-life, and ticks buried in the ground and not affected by fire continue the cycle.

2. *Dipping.*—Dipping has been made use of and continues to be a very efficient means of destroying ticks, and undoubtedly it is so wherever it is carried out properly with a good dip. But dipping can only be effective when the dip reaches the tick. This is not the case with the spinose ear-tick, which on account of its seat in the ear is not reached by the dip. For our purpose we can assume that all ticks will be killed after the dip has reached them. One point must be emphasized, namely, that the death of the ticks as a result of dipping is not always immediate. Female ticks can even continue to lay eggs, although the eggs do not hatch. In arranging the method of dipping the life-cycle of the species of tick with which we wish to deal must be taken into consideration, in order to determine the intervals of the process.

The blue tick requires three to four weeks for the completion of its life-cycle on an animal. It follows therefore that one dipping within that time, say every third week, is quite sufficient to destroy the crop of ticks collected during that period. The blue-tick larvae on the veld can only live for a certain number of months, hardly exceeding eight; within these eight months an animal would constantly pick up these ticks, and by dipping at three-week intervals these would be destroyed. Finally the time would arrive when an animal no longer picks up blue ticks, and the young larvae which have not reached a host will in the meantime have died. Thus dipping every third week to destroy blue ticks will have a certain successful issue, always providing that no tick escapes wetting by the dip.

Referring to the red tick, we find that in its life-cycle it seeks the host twice—once as larva, from which it moults into a nympha and remains on the host for about sixteen to twenty-one days before dropping; the second time as an adult, the female remaining on the host from six to ten days. It follows from this that a three-weekly dipping would not reach all the stages. In order to accomplish this it would be necessary to dip at least every eighth day. Dipping continued in this way during the period the nymphae, larvae, and adults live in the grass would finally lead to their eradication. Destroying the red tick is very difficult because of its place of attachment; a nympha in the ear or an adult under the tail is protected against dips. Hand-dressing, in addition to dipping, is essential in order to eradicate them completely.

The Group of the Brown Ticks.—For the completion of their life-cycle they seek the host three times; as larvae they replete in from three to five days. The same period is required as nymphae, and the adult female requires about a week before it drops engorged to the ground. The quickest results can be expected when dipping is

repeated every third day and is continued as long as the different stages can live in the grass, viz., at least a year.

In the case of the bont tick, which also requires three different feedings on an animal, the case is very similar to that of the brown tick. The larvae remain on the animal from about four to five days, the nymphae about the same period, and the adult about a fortnight. To be most effective, therefore, dipping would have to be done at least about every four days.

From the above notes it will be seen that dipping at long intervals is not effective in the destruction of the red, brown, and bont ticks. If dipping is adopted to eradicate a disease transmitted by brown or bont ticks it must be repeated at short intervals. The intervals between dippings should not exceed the periods of attachment of the ticks on the animal; in order to catch all ticks intervals would have to be as short as three days. In practice it has been proved that dipping at intervals of five days is effective when supplemented by hand-dressing of the depths of the ear, the sheath, anus, and brush.

Once dipping is commenced it will have the effect of destroying most ticks during the first few months. It is advisable to continue the dippings energetically during the summer time. All changes in tick-life take place more rapidly during this season, and ticks eagerly seek attachment on the cattle. This season ought to be selected for the dippings at short intervals. Lounsbury and Dixon were the first to observe that arsenite of soda can advantageously be used for the eradication of ticks. The dips which were subsequently more frequently used are known as "laboratory dips." They were introduced by Pitchford in Natal, who designed dips for an interval of three days, seven days, and fourteen days.

The formulae are as follows:—

	3 Days' Interval.	7 Days' Interval.	14 Days' Interval.
Arsenite of soda, 80 per cent. ...	4 lb.	8 lb.	12 lb.
Soft soap	3 lb.	6 lb.	6 lb.
Paraffin	1 gal.	2 gal.	2 gal.
Water	400 gal.	400 gal.	400 gal.

The arsenite and soft soap are dissolved separately in sufficient hot water, the soap and paraffin beaten into an emulsion, and the arsenite solution then mixed in. Cold water is then added to make up the 400 gallons and the whole is stirred vigorously. Most farmers now omit the soft soap and paraffin and use a plain aqueous solution of arsenite of soda, adhering to the strength laid down in the Pitchford formula and using 1 lb., 2 lb., or 3 lb. per 100 gallons of water according to whether three-day, five to seven day, or fourteen-day dipping is contemplated.

The reason for the different strengths of dip at different intervals is of course, in the first instance, a consideration for the animal to be dipped, a weaker solution interfering less with its skin and health than a stronger one. The different species of ticks and the various stages show a different resistance to arsenic—some are killed more easily than others. From the point of view of East Coast fever the three-day dip has not always proved to be effective, and instead a seven-day dip strength used in five days' interval, supplemented with hand-dressing, is now frequently made use of, and with success.

In order to maintain a constant strength of the dip the use of a dip-tester, a so-called isometer, is advisable. Instructions for the use of the instrument are sold with it. If the dip is not diluted by rain it generally does not lose much in strength, and the more frequently it is used the less strength it will lose. It is only in dips that are out of use for a long period that a change of arsenite to arsenate may take place, which then has a bad effect on the skin. Therefore a dip which has been out of use for some time should be stirred up before cattle are sent in.

Although dipping can be stated to be generally harmless for cattle, it will be advisable to accustom the cattle to the dip by using first the weaker solution and later on the stronger ones. Such a procedure will prevent cracking of the skin. Oxen appear to be particularly affected by the arsenic dip when worked. The effects show themselves usually three to four days after dipping, and the oxen are noted soon to tire when in wagon or plough and to show dyspnoea, in severe cases stretching out the tongue and finally falling down when not outspanned. These symptoms are particularly noted in hot weather. Apoplectic death has also been seen in such cases.

Dipping has a good effect generally on the animals; it improves their condition and gives them a sleek and glossy skin. It has, of course, also an influence on skin diseases generally, and prevents hair-balls in calves which are the result of licking the tick-infested skin. Wherever it is intended to reduce the ticks to a minimum in the shortest possible time the dipping of horses running on the veld is also advisable. Horses get accustomed to dipping just as cattle do. Neither should goats and the smooth-haired Africander and Persian sheep be omitted. These animals are to a great extent the hosts of the red tick, which, as stated before, it is difficult to reach on cattle. It should therefore be destroyed on all its hosts.

Animals running on the veld that for some reason or other cannot be dipped—such as cows heavy in calf, etc.—should at least be sponged or dressed at short intervals. The use of fatty substances with an addition of tar or resin is recommended for a dressing. It must, however, be borne in mind that the object of dipping is to get rid of ticks from the farm; cattle and other animals act as collectors, the collected ticks are then destroyed by means of the dip. Fatty substances will prevent ticks attaching. It would thus appear that the cleaning of ears, sheath, brush, and anus is better carried out with the dipping liquid itself, care being taken at the same time that the ticks are mechanically removed.

3. *Starving the Ticks.*—The third method of eradicating ticks is the starving process, and this must undoubtedly lead to success in every case where we are able to keep the place, for a sufficient length of time, free of such animals as act as hosts. We note that the blue tick will live about eight months only, therefore keeping a pasture free of animals for this period must starve out the ticks. If it is our intention to rid a farm of red, brown, and bont ticks this period must be extended over a year. From observations made in connection with East Coast fever, where the freeing of an area from the disease is due to starving out the ticks, it can be deduced that a safe period is fifteen months, and we can assume that this period will free any farm from tick-life provided no host has access to it.

Stock brought on to the tick-free piece of ground will naturally bring with them the ticks again, which will increase in the usual manner and after due time be present in great numbers. If it is our intention to completely get rid of the ticks precautions must be taken not to bring ticks with the cattle into the clean veld. This can be done by dipping or spraying the animals and immediately removing them on to the clean farm, but it can also be done without dipping and spraying. For this purpose the cattle should be placed on a smaller piece of tick-free ground, sufficiently large to carry them for about four to six weeks, and should be kept there for this period. We will call this the quarantine paddock. During this time all blue ticks will have dropped off, and if it is only intended to eliminate these the removal of the clean beasts into the final clean area can be done. Within four weeks engorged larvae and nymphae of the brown and red ticks which dropped off during the first days of the removal into the quarantine paddock develop to a succeeding stage (nymphae or adult), in which they seek a new host, and these might be carried by the stock into the clean veld if this removal is done later than four weeks after the introduction of the cattle into the quarantine paddock. It is therefore advisable to transfer the cattle after about eighteen days to an adjoining clean piece, where they must be kept for a further period of eighteen days; there the remainder of the blue ticks will drop off and no new ticks can get on. After this period the stock can safely be moved to a clean area. The quarantine camps are then closed for all stock for at least fifteen months. It is also possible that by the same procedure the bont tick would be got rid of, so that, theoretically speaking, it is within the range of possibility—without the use of dips and sprays—to get rid of all ticks. In practice this would have to be carried out by splitting the farms up into fenced paddocks, which for a period of about fifteen months would have to be kept free of animals. Dipping, however, is a much safer method of clearing a farm of ticks, and should be adopted in preference to other measures.

ERADICATION AND PREVENTION OF DISEASES.

Eradication of diseases in which the animals do not act as a reservoir, viz., East Coast fever and heartwater.—It may be taken as an axiom that destroying ticks means eradicating disease. How this can be done has just been demonstrated. It may safely be said that, as far as the most formidable tick-borne disease—East Coast fever—is concerned, we have no better remedy for saving cattle and eradicating the disease than dipping. It has been pointed out before that an infected tick does not discharge the infection before it has been attached for at least sixty hours, but frequently later than this time and up to 120 hours. Hence if East Coast fever breaks out on a farm and the cattle are immediately put into a dip, and this dipping is repeated every third or fourth day, all cattle that have not been infected on the date of dipping will be safe. The disease can thus be suddenly arrested and only the animals already infected will die off. If the dipping is now systematically carried out in as short an interval as three to five days (in the latter case in a seven-day-strength dip and supplemented by dressing) the disease will be eradicated after the lapse of fifteen months. Since, however, all farms do not yet

possess dipping tanks, and saving the cattle once the disease has broken out is the first and immediate object, another and temporary plan may be adopted by shifting the cattle from the infected to a non-infected area through a quarantine camp where such is obtainable. For this purpose it is advisable to bring the cattle first on a portion of clean ground sufficiently large to contain grazing for about thirty days. This area should be divided into two portions. The cattle are brought on to one portion and the disease will appear in the already infected animals and these will drop ticks—new animals can only become infected after the ticks have moulted. Accordingly we move the cattle into the second clean portion before the ticks have moulted, viz., after eighteen days. The disease will now become less evident and only appear in a few animals; these again will drop infected ticks. Accordingly the movement must be made before they have moulted, viz., after another eighteen days. The cattle can now safely be moved into the clean area. In a period of one month all infected cattle will have developed the disease and can be destroyed or removed back to the infected veld. With the help of a thermometer the disease can be recognized at an early date, infected animals showing high temperatures. By removing sick animals at an early date the risk of infecting the quarantine ground is greatly reduced. It is understood of course that subsequently cattle are not to graze over the infected area for a period of at least fifteen months, during which time the infected ticks will have died out, or if grazing over the infected area is contemplated, the erection of a dipping tank and the introduction of short interval dipping are necessary.

Heartwater.—If we want to trek out of a heartwater-infected area for the purpose of saving the stock not yet infected two ways are open, depending upon what ground is available and whether such ground is infected with bont ticks. Moving out of the infected area into ground where no bont ticks are present means that the disease must stop. This has been the experience of many bushveld farmers who, with their stock, went down to the low country, and when troubled with heartwater simply moved back again to higher-lying ground. The fact was known for a long time, but the explanation could not be given since no connection between tick and disease was surmised. If, however, ground free from bont ticks is available then the same procedure can be resorted to as explained in the case of East Coast fever, i.e. moving on to a place which is known to be free of heartwater, remaining there just over the incubation period of the disease and moving out of it before the ticks which dropped have moulted and are capable of attaching themselves, for which purpose two quarantines of three to four weeks each will be sufficient.

Eradication of diseases in which the animal acts as a virus reservoir.—The diseases which are maintained in the recovered immune animals are biliary fever in horses and dogs, redwater and the gall-sickness in cattle. As already stated the ticks which drop off such animals are infected, both maintain the infection, and new susceptible animals introduced contract the disease in a virulent form. Hence it is not possible to eradicate these diseases without eradicating all tick-life. It is, however, possible to save stock. This can be done by dipping. As pointed out before, in the case of East

Coast fever ticks do not immediately discharge the infection after biting; a short interval is required. Hence by applying short-interval dipping as well further outbreaks of the disease can be arrested, and in maintaining the dipping the ticks will finally be eradicated. Although it would be desirable to eradicate all ticks by concerted measures the day is still far off when it will be achieved. Meanwhile it is necessary to draw attention again to one important fact mentioned before. If, for instance, cattle are bred on a non-tick-infected area they will not acquire immunity against redwater and gall-sickness, and when moved into tick-infected areas will contract the disease. The same is the case with biliary fever in horses. Farmers who adopt dipping and who wish to raise immune stock must take this fact into consideration. Hence, under the present conditions of non-compulsory dipping they should maintain at least a moderate tick infection just enough to ensure the acquisition of immunity. This difficulty can, in the case of redwater and gall-sickness, be overcome by artificial inoculation of the young stock against these two diseases. Since this is possible complete tick destruction should be aimed at.

Saving of cattle from redwater and gall-sickness infection without dipping, once the disease has broken out, is also possible on the lines indicated above for East Coast fever. Since, however, practically the whole of Africa is infected with redwater and gall-sickness such moving is of little use; the movement merely takes place from one infected area into another one. There are, however, different degrees of infection, hence moving of stock may nevertheless be a practical expedient.

For the eradication of the ear-tick, dipping is of little use. In this case hand-dressing has to be applied when the animals are suffering badly from the infection. This dressing is, however, done previously to relieve the animals; as a method of eradicating ticks from the farm it would be too cumbersome. Hence the tick should be attacked in a different way, viz., by destroying the hiding-place of the adults, by putting them out of use until all ticks have died out, which may take as long as three years. The erection of bush kraals—which can be destroyed or simple wire kraals which can be removed—would be a simple expedient. Naturally with the shifting of the kraal a cleaning of the ears must take place as well.

OUTLOOK.

Tick eradication has now been carried out in South Africa for the last twelve years or more, and yet East Coast fever has not been eradicated on all farms where dipping was introduced. This is not due to the inefficiency of the dipping method, but to the human factor that interferes with the regular and systematic procedure. Dipping is such a certain remedy for saving cattle that the fear of East Coast fever has greatly disappeared. Indeed the proverbial familiarity with the disease has produced its results. From the point of view of the State this position is not satisfactory; complete eradication of East Coast fever and all other tick-borne diseases is desirable. It would appear, however, that such destruction is frustrated by this human element. The best advice that can be given to a farmer at the present time is to lose no time, but put up a tank and use it,

COTTON CULTURE.

Practical Advice for the South African Grower.

MR. W. H. SCHERFFIUS, Chief of the Division of Tobacco and Cotton, has furnished the following main notes of his lecture to the Nelspruit Farmers' Association on 11th December, 1920, for the information both of intending growers and those already engaged in the industry:—

Condition of Soil.—Cotton, like every other crop, to give good results must be planted on good ground. I am not prepared to say that the soil cannot be too fertile for cotton, but under average field conditions one will not find the soil too fertile, while on the other hand a soil that has been cropped till the fertility is rather low will give a fair crop of cotton even though it might not pay to grow other crops, such as mealies.

When practicable, I would advise farmers to break their lands in the autumn and allow them to lie fallow during the winter. This procedure has a three-fold advantage: it gives opportunity for earlier planting, reduces insect trouble, and provides a better seed bed for the crop.

Cultural Methods.—Planting should be done as early as possible after the spring rains set in, say 15th October to the 15th November.

The ground should be worked to a good tilth, the rows made 3 ft. 6 in. to 4 ft. apart, and the seed sown at the rate of approximately 25 lb. per acre; at this rate the young plants should stand thick in the drills like beets. Start the cultivator as soon as the rows can be followed, and continue cultivation as long as the cultivator can pass between the rows without damaging the bushes. If weeds or grass appear in the drills they must be removed by hand-hoeing. When the plants attain a height of 6 to 8 inches they should be thinned, leaving only one in a place, and they should be from 12 to 18 inches apart in the drill, depending on the fertility of the soil—the more fertile the soil the greater the distance required. Care should be taken to destroy any blackjacks that may appear, as they will become attached to the cotton and considerably reduce it in value.

Harvesting should begin when the field is fairly white, and continue till the cotton is practically all harvested. It usually takes three or four pickings to complete the harvest, and these pickings will come about ten to twenty days apart, depending on the weather. The day the cotton is picked it should be spread on a bucksail so that it will be thoroughly dry in the evening; then it is ready to tramp into a wool pack; when the wool pack is full it can be shipped to a gin or stored.

Quality, First Consideration.—The tendency of most beginners is to plant more acreage than they can manage. A small acreage

well attended to is far more profitable and satisfactory than a large acreage which has to be neglected. Let your motto be quality rather than quantity. This brings us to the question of good seed. I am quite aware of the fact that there is very little seed in the country which is not more or less mixed, but of this mixed seed there are portions which are better than others. We propose next season to start a vigorous campaign with the object of improving the grade of our cotton by selecting the best strains in the field. No doubt some of the cotton grown in the country is good, but it is rather badly mixed. In my opinion we can materially improve the grade of lint we are producing, and this can be done very quickly, but we must have the hearty co-operation of the growers.

Importation of Seed.—We have found it necessary to severely restrict the importation of fresh seed into the country as there is grave danger of introducing Pink Boll Worm. Several parcels of seed introduced from Egypt have had to be destroyed on account of being infested with this insect, and one parcel from Nyasaland, received in Portuguese East Africa, was found to contain a very suspicious moth—if not Pink Boll Worm Moth it was very similar to it.

I have recently visited the principal ginning plants and found that they were winding up their year's work, after having handled something like 1250 bales at Durban, 600 bales at Rustenburg, and 450 bales at John Jack, Ltd. With the output of the smaller ginning plants we can reckon on 2200 to 2500 bales, or about 1,000,000 lb. of lint, which is an increase of something like 200,000 lb. of lint over last season.

There has been considerable complaint in regard to the lint shipped oversea; this is due to the mixed quality of individual growers' cotton and also on account of the mixed condition of the lint after it passes through the gins, i.e. long and short lint mixed. This is attributable to two causes, first, the mixed condition of the seed sown and, secondly, to the mixing of different crops at the gin. No doubt the mixed seed is largely a fault of our own, as a farmer frequently plants two or three varieties and these are either mixed in the harvesting or get mixed at the gin.

Up to the present too little regard has been given to the length, strength and lustre of the lint by the buyers. I must warn growers that the time is approaching when buyers will look carefully into these qualities, and growers of the poorer grades may expect a reduced price for their cotton.

British Cotton Growing Association's Prizes.—I have received up to the present samples from about fifty of last year's competitors, and there are about ten more to come in. Immediately on receipt they will be dispatched to Manchester for final adjudication.

A second competition has been arranged for the 1920-21 crop along similar lines to those of the last competition. The prize-money will be the same, and as follows:—

For best 50 acres or more, £100; for second best 50 acres or more, £50; for third best 50 acres or more, £25; for best 10 acres or more, but less than 50 acres, £50; for second best 10 acres or more, but less than 50 acres, £25; for third best 10 acres or more, but less than 50 acres, £12 10s.

The scoring has been slightly changed, and will be:—

30 per cent. for cultivation.
30 per cent. for quantity.
40 per cent. for quality.

The entries are coming in now. We hope to have a larger competition this year than we had last year.

A Danger to be Faced.—Farmers, I fear, do not fully realize the importance—or should I say the absolute necessity—of not only district co-operation but of national and international co-operation. South Africa, fortunately, may not have reached the critical stage of other countries, where production is reaching a higher cost than the market or selling price of the produce, but this danger seems to be facing the world to-day, and should it get established we will be faced with serfdom in its worst form. A short while ago Senator Smith, of South Carolina, warned the public of the dangerous position into which the farming public were fast drifting. The following are figures which he gave, and must have been obtained from reliable sources:—

	Average Cost of Production.	Market Price.
	Cents.	Cents.
Cotton	.37½	.18
Bright tobacco	.27	.19
Dark tobacco...	.20	.15
Wheat	2.77	1.65
Monkey nuts...	.09	.04
Beef	.13	.07

In regard to cotton, the above figures converted into British money would be 18¾d. and 9d. in America, and accounting for freight and exchange the Liverpool value of the same figures would be about 1s. 11d. and 1s. 1½d., or an actual loss of about 9½d. per lb. in the production of cotton.

Friesland Herd.

THE MANURING OF VINEYARDS.

By J. C. Ross, Ph.D., Research Chemist, Elsenburg School of Agriculture, and S. W. van Niekerk, Government Viticulturist.

[The first part of this article appeared in last month's *Journal*.—Editor.]

Systems of Manuring.

Keeping in mind the requirements of our vine fertilizer (approximately 85 lb. nitrogen, 120 to 130 lb. phosphoric oxide, and 90 lb. potash per morgen), we can make up a suitable mixture in many different ways. It must again be pointed out, however, that a mixture of the above composition can hardly be expected to be the best and most economical for all vineyards. For instance, there may be cases where the amount of nitrogen should be reduced, as in the case of vines which are found to make an exceptionally rank and vigorous growth. Then the nitrogen might be reduced by one-half or two-thirds for the first few years, and this will mean a great reduction in the cost of manuring. It may also be found that the quantity of potash used need not be so great. As stated before, the only way to settle these points is by carrying out manurial trials in the vineyards, as described later in this article.

For a definite working basis we assume that the fertilizers mentioned have the following composition and prices:—

	Nitrogen.	Phosphoric Oxide.	Potash.	Valuation Basis.
	Per cent.	Per cent.	Per cent.	£ s. d.
Stable or kraal manure ...	0·5	0·3	0·6	*0 3 6 per ton.
Karroo sheep manure ...	1·5	0·75	4·0	1 5 0 „ „
Kraal ash	—	2·0	12·0	2 0 0 „ „
Government guano ...	10·0	11·0	2·0	10 0 0 „ „
Bone dust	4·0	24·0	—	12 0 0 „ „
Superphosphate	—	20·0	—	0 0 0 „ „
Basic slag	—	15·0	—	0 0 0 „ „
Cape cross...	2·0	22·0	—	0 0 0 „ „
Blood meal	12·0	—	—	15 0 0 „ „
Sulphate of ammonia ...	20·0	—	—	0 0 0 „ „
Nitrate of soda	15·0	—	—	0 0 0 „ „
Sulphate of potash ...	—	—	50·0	†18 0 0 , „
Green manure (peas) ...	(?)	—	—	‡0 19 6 per morgen.

* This is calculated as the approximate cost of production on the average farm, and includes cost of cartage to the vineyard and spreading, at a liberal estimate. The manure is, however, worth considerably more to the farmer.

† This is the pre-war price. Very little obtainable during or since the war, and then at a greatly increased price.

‡ This includes cost of the seed and the seeding, including one ploughing and one cultivation. Value of seed alone taken at 13s., 80 lb. per morgen.

The following mixtures, in quantities per morgen, will conform approximately to the requirements:—

1. (*a*) Green Manure—
   450 lb. bone-dust (or 550 lb. superphosphate, or 700 lb. slag, or 500 lb. Cape Cross).
   750 lb. kraal ash.

   (*b*) Green Manure—
   500 lb. bone-dust, or 600 lb. superphosphate, or 800 lb. slag, or 550 lb. Cape Cross).
   180 lb. sulphate of potash.

2. 7½ tons stable or kraal manure.
   350 lb. bone-dust (or 400 lb. superphosphate, or 550 lb. slag, or 370 lb. Cape Cross—but when these are used, the manure should be increased to about 8 or 9 tons. If the manure is of inferior quality, more should be applied).

3. (*a*) 800 lb. Government guano.
   100 lb. bone-dust (or 120 lb. superphosphate, or 150 lb. slag, or 110 lb. Cape Cross).
   600 lb. kraal ash.

   (*b*) 450 lb. Government guano.
   250 lb. bone-dust (or 270 lb. superphosphate, or 360 lb. slag, or 250 lb. Cape Cross—but when these are used the guano should be increased to 500 lb.).
   2000 lb. Karroo sheep manure.

   (*c*) 800 lb. Government guano.
   150 lb. bone-dust (or 175 lb. superphosphate, or 240 lb. slag, or 165 lb. Cape Cross).
   150 lb. sulphate of potash.

4. 500 lb. blood-meal (or 300 lb. sulphate of ammonia, or 400 lb. nitrate of soda).
   500 lb. bone-dust.
   180 lb. sulphate of potash.

(Other forms of phosphate can be used here, but then the amount of blood or other nitrogen fertilizer will have to be increased. If kraal ash is used to supply potash, the amount of phosphate will be slightly reduced; and if sheep manure is used the amount of nitrogen fertilizer will be considerably reduced, and the amount of phosphate slightly reduced.)

It will readily be seen that a great number of different systems of fertilizing can be adopted, depending on the raw materials at the disposal of the farmer. Economy, of course, is a most important factor. Bone-dust has been taken throughout as the source of phosphate, as it is probably the most economical form to-day. But market values are liable to fluctuate, and alternative quantities of other forms of phosphate are given, in case they should, in the future, prove more economical than bone-dust. In the following table the

composition and cost per morgen of each of the above formulae is listed:—

	Nitrogen.	Phosphoric Oxide.	Potash.	Cost.
	lb.	lb.	lb.	£ s. d.
No. 1 (*a*)	(?)	123	90	4 8 6
„ 1 (*b*)	(?)	120	90	5 12 0
„ 2	approximate 89	approximate 129	approximate 90	3 8 3
„ 3 (*a*)	84	124	88	5 4 0
„ 3 (*b*)	85	124	89	5 0 0
„ 3 (*c*)	86	124	90	6 5 0
„ 4	80	120	90	8 7 6

(The costs are, of course, liable to variation according to market conditions.)

The cost of formula No. 4 shows clearly that where artificial fertilizers alone are used the expense is by far the greatest. Note also in formulae Nos. 1 (*b*) and 3 (*c*) the increased cost due to using sulphate of potash as the source of potash instead of kraal ash or Karroo sheep manure. Formula No. 2, where stable manure is used, is outstandingly the most economical, and then follows No. 1 (*a*), where green manure is used and potash is supplied in the form of kraal ash. After these, formulae Nos. 3 (*a*) and 3 (*b*), where guano is used, are the cheapest.

Systems 2 and 1 (*a*) are strongly recommended, for they add a great deal of humus to the soil, and are also economical. If it is impossible to use one or other of these every year, they should at least be used as frequently as possible. Failing these, Nos. 3 (*b*) and 3 (*a*) are recommended. The formulae where kraal ash is used are especially suitable for acid soils, as the ash contains a fair amount of lime. Basic slag is also a useful kind of phosphate for acid soils on account of the lime it contains—but its price must be favourable. If the farmer should decide to use superphosphate or sulphate of ammonia, he should see that his vineyard receives a dressing of lime, unless it is already well provided with lime.

TIME AND METHODS OF APPLYING MANURES.

Attention must be drawn to the fact that certain fertilizer materials must never be mixed before applying to the soil. Lime, basic slag, or kraal ash should never be mixed with guano, manure, or sulphate of ammonia, as this would cause a loss of valuable nitrogen in the form of ammonia gas (the loss can be detected by the smell of ammonia). These fertilizers can, however, be used on the same soil, for the soil holds the ammonia and prevents it from escaping—but they must be applied separately.

Similarly, superphosphate must not be mixed with lime or basic slag, or kraal ash, because the water-soluble phosphoric oxide will be changed to an insoluble form, and thus made less quickly available. This, however, is not as important a consideration in fertilizing vineyards as in the case of grain lands, where a quick acting fertilizer is desirable.

With regard to the method of applying manures, the custom of burying it in holes or in furrows between the vine rows is not a good one, for then the vine roots do not develop evenly in every direction

in the soil and are not able to use to best advantage the plant-food and moisture distributed throughout the soil. If possible all manures should be spread evenly over the soil and ploughed, cultivated, or dug under.

Formulae 1 (*a*) and 1 (*b*).—Bone-dust and kraal ash or sulphate of potash mixed and applied in April to manure the pea crop. Peas sown in April (as early as possible) and ploughed under towards the end of July, or early in August.

Formula 2.—Spread manure in April-May, bone-dust over this, and plough under immediately.

Formulae 3 (*a*), 3 (*b*), and 3 (*c*).—Bone-dust and kraal ash. Karroo sheep manure or sulphate of potash mixed and applied in April-May, guano in July-August.

Formula 4.—All mixed and applied in April-May, or part of the blood-meal can be held over and applied in July-August. If sulphate of ammonia is used it should be applied over the surface in July. Nitrate of soda should not be applied before August (spread over surface).

USE OF LIME IN VINEYARDS.

Vineyard soils which are acid or sour should receive occasional dressings of lime. Though lime is one of the essential plant-foods it is not applied as a fertilizer or manure in the correct sense of the word, and it is important to bear in mind that it cannot take the place of other fertilizers. If the soil should be deficient in lime as a plant-food (which very rarely occurs), the crop will obtain sufficient lime in the various phosphatic fertilizers used.

Lime is a soil improver rather than a fertilizer, and its useful functions are as follows:—

1. It neutralizes acidity and keeps the soil sweet. When humus decays in the soil, a considerable amount of acid substances is produced and these afterwards interfere with the bacterial activities which bring about the decay of humus and the production of available nitrogen for the crop. But if lime is present it destroys the acidity and encourages the bacterial activities in the soil. Thus an application is especially necessary when large amounts of humus (stable or kraal manure, and green manure) are ploughed into the soil. Dark brown or black soils which are rich in humus are generally greatly improved by applying lime.

2. It loosens up heavy, compact soils, making them easier to work and more porous, so that air and water can penetrate more easily.

3. It increases the availability of the mineral plant-foods in the soil, especially potash and phosphoric oxide. Thus it is a stimulant, and unless phosphatic and potash fertilizers are used along with the lime it will cause the soil to become rapidly depleted of these plant-foods.

Lime can be obtained in the following forms:—

1. Burnt or quick lime (lumps).
2. Slaked lime (fine powder).
3. Finely ground limestone, or carbonate of lime, or "agricultural" lime.

By adding water to quicklime we get slaked lime, and if this is exposed to the atmosphere for a long time it is changed almost entirely to carbonate of lime in a very fine form. One ton (2000 lb. of pure quicklime contains as much lime as 2642 lb. of pure slaked lime, or as much as 3571 lb. of pure limestone.

Limestone or carbonate of lime is the mildest form, and is recommended for all ordinary soils, especially light soils. The limestone should be very finely ground, and spread at the rate of 2 to 4 tons per morgen every fourth or fifth year. It should be applied early (April-May), and either ploughed in or cultivated in on the ploughed land. Failing this, it may be applied later, at the time of the second ploughing in August, but it will not have much action in the soil until the following winter.

Slaked lime should be used only in the case of very heavy soils, or soils containing abundance of humus (as indicated by a black colour). In this case it is generally more economical to purchase quicklime (in lumps) and slake it (by adding water) on the farm. Or it may be carted direct to the vineyard, placed in small heaps at regular intervals at the rate of 2 tons per morgen, and allowed to slake of its own accord when the rains come. When the lumps are all fine it should be spread by means of spades and cultivated or ploughed in.

Where limestone, or lime which has already been slaked, is to be applied, a lime-spreader may be used if the rows are not too close together. Otherwise the lime may be placed in a basket suspended from a pole carried between two men. By gently shaking the basket as the men walk along a fairly even distribution of the lime is obtained.

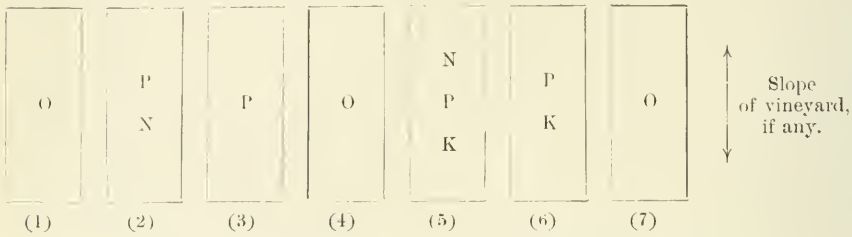
Liming is particularly necessary in connection with the use of large quantities of kraal or stable manure, and with the practice of green manuring. In the former case it should be applied shortly after the manure has been ploughed in, and the vineyard then cultivated. In the case of green manuring, several alternatives are open. Where convenient, it is an excellent plan to spread the lime before sowing the peas, as this will encourage a more luxuriant growth of green manure. Otherwise the lime may be applied at the time of ploughing under the green crop, either immediately before, when it will be spread over the pea crop and ploughed in together with the latter, or shortly after turning under the peas.

MANURIAL EXPERIMENTS IN THE VINEYARD.

As previously pointed out, our vineyard soils are of many different types in the different districts. For this reason it is very likely that the system of fertilizing which gives the best results in Paarl district, say, will not be the best or most enconomical in Robertson district, and so on.

Analysis of the vineyard soils will help us to decide upon the most suitable fertilizer for a particular soil, but the only really reliable method is by means of actual manurial experiments. Such experiments are very easily carried out and do not involve much extra trouble. Every vinegrower should devote a portion of his

vineyard to such experiments. The following is a simple plan which might be adopted:—



O Indicates no treatment. P Indicates phosphoric oxide.
N Indicates nitrogen. K Indicates potash.

This choice or arrangement of plots is based upon the fact that we know that the prime requirement of all vineyards is phosphoric oxide.

The average of the yields of Plots (1), (4), and (7) will give us the yield without fertilizer, i.e. the check. The increased yield of Plot (3) over this check shows the effect of phosphoric oxide alone. The effect of nitrogen we derive in two ways. Plot (2)-Plot (3) shows whether nitrogen gives any increased yield over P alone, and Plots (5)-(6) show the additional increase due to N when both P and K are added.

The effect of potash is also obtained in two ways. Plot (6)-Plot (3) shows the increase over P alone due to using K, and Plot (5)-Plot (2) shows whether K produces a further increase over P plus N.

If Plot (5) gives the highest yield of all, evidently the "complete" mixture is best. Whether it pays or not can be ascertained by subtracting the check yield and calculating the money value of the increase.

If Plots (5) and (2) are practically the same, it is evident that a complete mixture is not necessary at present, though it may be in future as the soil becomes poorer in potash.

If Plots (5) and (6) are practically the same, nitrogen is evidently not necessary at present, and so on.

The size of the plots will be a matter of convenience, but ordinarily the larger the better. About 100 vines per plot would be a good number, i.e. each plot about 1/36 morgen where the vines are planted 5 feet by 5 feet. The most important point is to select as uniform a strip of vineyard as possible, and, if the vineyard is on a slope, the strip chosen should cut evenly across the slope (not up and down). The strip is then divided cross-wise into seven plots as shown in the illustration, each containing, say, 100 vines (10 × 10) or 96 vines (8 × 12 or 6 × 16), or any other suitable number.

Between each plot and the next one should be left at least one row of vines, preferably two, so that the vines in one plot cannot get food from the plot next door.

Apart from the manures added, the treatment of all the plots must be identical. Observations should be made as to growth, and, finally, the weight of grapes from each plot carefully recorded. If a good site has been chosen, the growth and yields of the three untreated plots should be about the same.

The separate fertilizers used should not contain more than one plant-food each. The following are suitable:—

For nitrogen: Blood-meal or sulphate of ammonia.

For phosphoric oxide: Superphosphate or basic slag (preferably superphosphate, because slag contains free lime, which may have an effect of its own).

For potash: Sulphate or muriate of potash.

The quantities applied per plot will, of course, depend upon the size of the plots. Assuming the vines are planted 5 feet apart, and each plot contains 96 or 100 vines, the quantities applied should be:

Nitrogen: 20 lb. blood-meal (12 per cent.) or 12 lb. sulphate of ammonia (20 per cent.).

Phosphoric oxide: 18 lb. superphosphate (20 per cent.) or 24 lb. basic slag (15 per cent.).

Potash: 5 lb. sulphate or muriate of potash (50 per cent.).

Such an experiment is capable of a large number of variations. If the plots are large enough, one-half of each plot might receive a dressing of lime in order to determine the beneficial effect of liming. Or the entire series might be duplicated and lime added to each plot. Green manure could be used as a source of nitrogen and compared with blood or sulphate of ammonia, but then extra plots will be needed. The proportions of the plant-foods added might be varied. An extra plot, No. (8), could be added with NPK, using twice as much phosphoric oxide as in the other plots. Or it may be found that results equally as good as that of Plot (5) can be obtained on certain soils by cutting down either the nitrogen or potash, or both, to half quantities.

Whatever the plan of the experiment, it should be carried on for a number of years. The results of the first year or two will indicate the nature of the immediate requirements of the soil, but after a few years these may be quite different.

In conclusion the writers wish to acknowledge the use made of Dr. A. I. Perold's publication on "The Manuring of Vineyards" (1911), which is now out of print. In fact, the present article was undertaken with a view to replacing Dr. Perold's original publication.

Fruit for Japan: A Prohibition.

The Japanese Government has issued an Ordinance by which the importation from South Africa (and other countries) into Japan of apples, pears, quinces, peaches, plums, apricots, and nuts, and materials used for packing them, is prohibited, the object of the Government being to prevent the introduction into Japan of the codling-moth.

REPRESENTATIVE TRANSVAAL SOILS.

II.

Pretoria Quartzite Sandy Soils.

By B. J. SMIT, B.A., Division of Chemistry.

Occurrence.—The soils classed under the above heading occur in the Pretoria, Krugersdorp, and Witwatersrand Districts, and probably wherever outcrops of the beds of the Magaliesberg, Daspoort, and Timeball Hill quartzites appear.

The outcrops of these three quartzites of the Pretoria series form three distinct ranges of hills in the Pretoria District, south and north of the town. On the south is the Timeball Hill range, immediately north the Daspoort range, and further north the Magaliesberg range. The intervening hollows consist chiefly of shales and intrusive igneous rocks. The Pretoria series with these quartzites run through many districts in the Transvaal, and generally speaking the Magaliesberg and Daspoort quartzites are the most important as regards the formation of the typical quartzite soils, since the beds are thicker than is the case with the Timeball Hill beds, presenting a larger area from which the soil type under discussion is formed. The Magaliesberg quartzites form, almost wherever the Pretoria series occur, the broadest quartzite outcrop of the three. The Timeball Hill outcrops again consist mainly of bands of quartzites with shales and haematite or some other iron ore, so that the true type of quartzite soil is best developed on or near the Magaliesberg quartzites. The soils formed from these beds are often influenced to some extent by the neighbouring shales and diabase. The actual samples discussed in this paper were obtained from the three districts mentioned above, and the analysis of at least one sample from each of the three quartzite horizons, Magaliesberg, Daspoort, and Timeball Hill is quoted.

Nature and Origin.—The quartzite soil is a red or brown to light-grey very sandy soil, and is derived from the quartzite rocks which consist chiefly of quartz grains cemented together with silica. These rocks sometimes contain muscovite and nearly always some iron ore to which the red colour of many of the quartzite soils is due. Some quartzite rocks are almost white, and give rise to a light-grey soil, which may gradually, with the accumulation of organic matter, become a darker colour. The quartzite being a sedementary rock consists of particles which have previously to being cemented together undergone denudation, and with the subsequent disintegration of the rock, and formation of the soil, they suffer a further reduction in size, giving finally a soil in which there are hardly any stones (by stones are meant those particles which are larger than 3 mm. in diameter) and only a very small proportion of fine gravel (particles greater than 1 and less than 3 mm. in diameter). On dividing the sand and fine gravel into grades it is found that the soil consists for the greater part of particles between 1 and $\frac{1}{4}$ mm. in diameter. The average of 12 quartzite soils gave 69 per cent. of particles between 1 and $\frac{1}{4}$ mm. in diameter.

The sand and fine gravel divided into grades:—

No. of Soil.	1267.	1485.	2554.	1620.
Diameter of particles in m.m.—	per cent.	per cent.	per cent.	per cent.
Less than 3 and greater than 2 ...	0·9	trace	0·2	trace
" " 2 " " " 1 ...	3·5	0·1	0·9	0·3
" " 1 " " " ½ ...	11·0	5·1	1·9	8·4
" " ½ " " " ¼ ...	50·2	76·6	63·9	68·5

Soils Nos. 1267 and 1620 are from the Magaliesberg quartzites, No. 1485 is derived from the Daspoort, and No. 2554 from the Timeball Hill quartzites.

These sand particles on being washed clear of the finer soil particles appear as more or less rounded quartz grains with peculiar little red and yellowish pits. The pits are probably due to the removal of part of the iron ore. On the whole the soil is much too open and sandy, but its texture may vary somewhat, when the true type is influenced by the adjacent diabase rocks or beds of shales, or, continuous cultivation and the incorporation of organic matter have improved and altered its physical properties.

Mechanical Composition.—Below are given the complete mechanical analyses of two of these quartzite soils:—

No. of Sample	1901.	2179.
	per cent.	per cent.
Stones	Nil	Nil
Moisture	0·47	0·66
Loss on ignition (organic matter)	2·78	2·85
Fine gravel 1 to 3 m.m. in diameter	9·17	0·61
Sand 0·2 to 1·0 m.m. in diameter	68·01	69·33
Fine sand 0·04 to 0·2 m.m. in diameter	9·43	10·46
Silt 0·01 to 0·04 m.m. in diameter	1·95	3·02
Fine silt 0·004 to 0·01 m.m. in diameter	0·93	2·02
Very fine silt 0·002 to 0·004 m.m. in diameter	0·29	2·06
Clay smaller than 0·002 m.m. in diameter containing	8·13	9·16
Iron oxide soluble in acid	1·04	1·40
Alumina	3·00	2·35

No. 1901 is a sample of red sandy soil from Zuurplaats No. 822, Rustenburg District, and is derived from the Magaliesberg quartzites.

No. 2179 is a brown sandy soil from Koedoespoort No. 299, Pretoria District, and is derived from the Daspoort quartzites.

There is no marked difference in the mechanical analyses of these two soils. They both contain a high percentage of sand, very little clay, and less than 3 per cent. organic matter; consequently their water retaining capacity is very small, the analyses showing them to contain only about ½ per cent. of moisture.

Sample No. 1901 is slightly coarser in texture than is sample No. 2179, since while the former contains 77.2 per cent. of the two coarser fractions fine gravel and sand together, and only 8.4 per cent. of very fine silt and clay, the latter contains less than 70 per cent.,

fine gravel and sand put together, and 11.2 per cent. clay and very fine silt.

The greater part of the total amount of iron oxide and alumina present in these soils is contained in the clay fraction, in sample No. 2179 about 50 per cent. and in sample No. 1901 practically all of it.

In sample No. 1901 the fine gravel fraction is rather high for the quartzite type of soil. From the farmer's point of view these soils are light and easily worked, they will allow water to drain through quite freely.

Chemical Composition.—The following analyses are quoted to illustrate the chemical composition of this type of soil:—

No. of Sample ...	760.	1620.	2179.	1267.	1424.	1818.	1294.	2554.
Farm	Koedoes-poort No. 299.	Hartebeest-poort No. 300.	Koedoes-poort No. 299.	Buffelsfon-tein No. 558.	Bultfontein No. 354.	Rietfontein No. 431.	Pienaars-poort No. 500.	Vlakfon-tein No. 50.
District	Pretoria.	Pretoria.	Pretoria.	Rusten-burg.	Rusten-burg.	Rusten-burg.	Pretoria.	Witwaters-rand.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Stones over 3 m.m. in diameter	0·01	Nil	Nil	0·1	Nil	Nil	Nil	Nil
Moisture	0·56	0·74	0·66	1·44	0·52	0·73	2·19	—
Loss on ignition ...	2·45	2·07	2·85	2·34	1·40	2·91	2·60	—
Insoluble matter ...	91·85	92·90	89·32	91·05	95·41	90·38	89·02	—
Iron oxide and alumina	4·75	1·99	6·77	4·76	2·41	6·20	5·85	—
Lime	0·01	0·16	0·12	0·11	0·07	0·04	0·06	0·08
Magnesia	0·06	0·02	0·07	0·13	0·05	0·18	0·08	—
Potash	0·06	0·08	0·06	0·10	0·04	0·02	0·10	—
Phosphoric oxide ...	0·02	0·05	0·03	0·04	0·02	0·06	0·05	—
Total	99·76	98·01	99·88	99·97	99·92	100·52	99·95	—
Nitrogen	0·057	0·063	0·084	0·056	0·028	0·057	0·046	0·090
"Available" Potash	0·0009	0·0124	0·0002	0·0064	0·0023	0·0048	0·0022	0·0041
"Available" phosphoric oxide	0·0018	0·0026	0·0012	0·0023	0·0015	0·0025	0·0026	0·0010

Soils Nos. 760, 1620, and 2179 are derived from the Daspoort quartzites, and they are practically similar in their chemical composition to samples Nos. 1267, 1424, 1818, and 1294, which are derived from the Magaliesberg quartzites. Sample No. 2554 is from the Timeball Hill quartzites and has unfortunately been only partially analysed, its lime and available potash content is the same as the average for the other quartzite soils, while its nitrogen is slightly higher and available phosphate slightly lower than any of the other soils, the analyses of which are quoted above. From their chemical composition it will be seen that these soils are deficient in all the essential plant foods—in fact they belong to the poorest class of soils in the Transvaal. They are all of them particularly poor in nitrogen and available phosphoric oxide, and with the exception of No. 1620 and possibly No. 1267 their potash content is also very low, they are also in need of organic matter which must be worked into the soil to improve their water retaining capacity. It is obvious from the chemical analysis that in order to grow crops successfully on this type of soil, the farmer would have to increase its plant food content by gradually building up the soil, and in doing this lime would have to be applied occasionally so as to avoid turning the soil acid. It seldom pays on our Transvaal soils to apply a potash fertilizer so that small dressings of this fertilizer are advised only when it becomes clear by manurial experiments that potash is the limiting factor in the particular soil under cultivation. Soils Nos. 760 and 2179 are very low in available potash and would probably need a potash fertilizer, in addition to fertilizers containing the other plant food constituents, before a good yield can be expected. The above statements are made as a result of an interpretation of the chemical composition and a consideration of the mechanical analysis of the soil.

Manurial Experiments.—Particulars as regards the crop returns given by this soil may be gathered from the following manurial experiments which were carried out by Mr. R. D. Watt (1). The experiments were continued for two years and were carried out on the farm Koedoespoort on a soil from which sample No. 760 was taken. The analysis of this sample is given in the above table. The crops were maize (variety Chester County Mammoth) and cowpeas (variety Black-eyed Susan) and were grown on two pieces of land A and B, respectively. The fields A and B were each divided into nine plots, which were manured as is shown in the table.

Unfortunately during the first year the rainfall was very low, and probably quite inadequate for the requirements of the plants on such a sandy porous soil. Plot No. 2 of field A was damaged, but the following yields were obtained from the other plots.

The yield of maize from field A is given in lb. of grain per acre, while in the case of the cowpeas from field B the weight of the green crop as well as the weight of the hay calculated to yield per acre is given :—

Plot	Manurial Treatment on Fields A and B.	Maize on Field A.	Cowpeas on Field B. Green Crop.	Cowpeas on Field B. Hay.
1	No manure	110 lb.	5300 lb.	1840 lb.
2	Nitrate of soda, 200 lb. per acre... ...	spoilt	5600 lb.	2020 lb.
3	Sulphate of ammonia, 160 lb. per acre ...	220 lb.	4920 lb.	1700 lb.
4	Superphosphate, 400 lb. per acre ...	360 lb.	5700 lb.	2160 lb.
5	Basic slag, 400 lb. per acre	280 lb.	4900 lb.	1820 lb.
6	No manure	130 lb.	3940 lb.	1780 lb.
7	Lime, 400 lb. per acre	200 lb.	4680 lb.	1620 lb.
8	Sulphate of potash, 150 lb. per acre ...	545 lb.	5500 lb.	1900 lb.
9	Nitrate of soda, 200 lb. per acre... ... Superphosphate, 400 lb. per acre ...	1345 lb.	6380 lb.	2120 lb.

Field A.—By far the best yield of maize was obtained from plot No. 9, which was manured with a nitrogenous and phosphatic fertilizer. It gave a yield twelve times as great as the yield on unmanured plot No. 1 and eleven times as great as the average yield on unmanured plots Nos. 1 and 6. The plot manured with sulphate of potash gave a good increase over the unmanured plot, but it must be remembered that this soil is exceptionally poor in potash, containing only 0.0009 per cent. of available potash. The soil is so poor that the addition of any of the three plant food constituents will probably show an increase in the crop, and there can be little doubt that had a tenth plot been added, manured with all the three plant food constituents, the yield would have been still greater.

Field B.—The results of the experiment with the cowpeas show very little difference in yield on the various plots. It certainly would not pay to manure cowpeas, even when grown on a very poor soil, if the above results represent the effects of manuring.

In the second year maize was grown on both the fields without the addition of any fertilizer and the yields on the various plots show the residual value of the manures very clearly. The following table gives the yield of maize in the second year on fields A and B as well as the total yield of maize on field A for the two years:—

No. of Plot	Manurial Treatment during first year only.	Yield of Maize on Field A in second year.	Total Yield of Maize on Field A for two years.	Yield of Maize on Field B in second year.
1 and 6	No manure (average)... ...	200	320	360
2	Nitrate of soda	spoilt	—	500
3	Sulphate of ammonia ...	spoilt	—	440
4	Superphosphate	680	1040	1370
5	Basic slag	840	1120	1800
7	Lime	290	490	970
8	Sulphate of potash	360	905	820
9	Nitrate of soda ... ... Superphosphate	1310	2655	1540

These results show that field B on which cowpeas were grown in the first year gave much better results all along in the second year than field A on which maize followed maize. In fact on all, except two plots, namely, No. 8 and 9, there was a greater yield of maize

in one year after cowpeas than in two years in both of which maize was grown. The difference on plot No. 8 in the total yield of maize for two years and the yield of maize in the second year only after cowpeas is very small, and this difference in the last plot (No. 9) is due to the effect of the nitrate of soda which supplied the necessary nitrogen in the first year. The increase in the yield of maize after cowpeas on field B would probably have been still greater had the crop of cowpeas been ploughed under instead of reaped in the first year.

The general conclusions drawn from these experiments are:—

(1) That on very poor soils of this nature, in other words on the quartzite soils, the best fertilizer is one containing phosphates.

(2) That since the soil also requires lime, in order to promote nitrification, basic slag would be the best form in which to supply the necessary phosphates.

(3) That it pays better to enrich the soil with nitrogen by growing a leguminous crop than by applying expensive nitrogenous fertilizers. The leguminous crop also improves the soil by supplying organic matter.

(4) That if a phosphatic fertilizer is used, a greater yield of maize may be obtained after a crop like cowpeas than would be got in two years during which maize is grown continually.

A manurial experiment on wheat was carried out on soil No. 1818, the analysis of which is given elsewhere, with the following results (2):—

Plot.	Manurial Treatment per Acre.	Yield of Grain in lb. per Acre.
1	200 lb. superphosphate	450
2	200 „ superphosphate ... ... 100 „ nitrate of soda ... ... 100 „ sulphate of potash	700
3	200 „ superphosphate ... ... 100 „ nitrate of soda	750
4	200 „ superphosphate ... ... 80 „ calcium cyanamide	770
5	300 „ bonemeal	520
6	200 „ bonemeal ... ... 100 „ superphosphate	730
7	300 „ basic slag	620
8	No manure	260

The soil on which this experiment was carried out contains the same percentage of nitrogen as soil No. 760 on which Mr. Watt carried out maize experiments, it is richer in available phosphoric oxide and contains much more available potash. The results of the experiment again point to the need of phosphatic and nitrogenous manures. Curiously enough the plot manured with superphosphate and nitrate of soda gave a greater yield than the one manured with the same quantity of these two fertilizers, plus 100 lb. of sulphate of potash. On this soil it certainly would mean a waste of money to apply a potassic fertilizer. This soil would have given better results

with maize or potatoes. It is much too open and sandy for the wheat crop, which requires a rather heavy loam. The chemical composition of this class of soil and the results of the manurial experiments point to the fact that the soils are so poor that it is hardly possible to grow a profitable crop in the first year, even with the help of artificial fertilizers. During the first couple of years the object of the farmer should be to improve the texture of his soil and to gradually strengthen it as regards plant food constituents. This can only be done by proper cultivation, crop rotation, and the judicious use of artificial fertilizers. The manurial experiments have given a clue as to the manner in which the soil should be dealt with and the following treatment is suggested for this class of soil:—

First Year.—After having ploughed up the land apply agricultural lime at the rate of about 1000 lb. per acre, then put in a leguminous crop like cowpeas, velvet beans, or kaffir beans. This crop may be harvested or ploughed under. The cowpeas mature in about seventy-seven days from sowing, so that it may be possible to reap two crops in one season provided, however, that there has been a good rainfall.

Second Year.—Apply 300 lb. superphosphate per acre. Then put in maize.

Third Year.—Apply a dressing of well-rotted kraal manure, about 10 tons per acre, and plant potatoes.

Fourth Year.—Sow cowpeas without manure.

Fifth Year.—Apply 300 lb. basic slag per acre. If necessary, a small dressing of sulphate of potash may also be used, say, about 100 lb. per acre. Plant maize.

Or the following four-course rotation may be tried:—

	Manurial Treatment.	Crop.
1st year	1000 lb. lime	Leguminous crop like cowpeas or velvet beans.
2nd year	300 lb. bonemeal ...	Potatoes.
3rd year	10 tons kraal manure ...	Cotton or maize.
4th year	300 lb. superphosphate ...	Maize.

The above rotations are only suggestions of how this class of poor soil should be built up. If the farmer experimented for himself by trying both these rotations he would probably soon be able to work out a more suitable rotation for his particular soil. There are many other factors, such as the depth of the soil, the nature of the subsoil, the situation of the land, the rainfall and climatic conditions generally, which may modify the treatment of a particular soil, and these should be taken into consideration by the farmer himself in order to discover the best and cheapest way by which first of all to improve his soil and finally to grow profitable crops.

REFERENCES.

(1) Watt, R. D., *Transvaal Agricultural Journal*, VI, 24, p. 551, and VII, 28, 628.

(2) Annual Report, Division of Chemistry, 1910-11, p. 404.

PRUNING OF DECIDUOUS FRUIT TREES.*

By H. B. TERRY, Cert. R.H.S., London and South Africa, Lecturer in Horticulture, School of Agriculture, Potchefstroom.

As there exists a pressing need among fruit growers for some information about the pruning of trees, this short article has been prepared. While an endeavour has been made to illustrate and render the text as explicit as possible it must not be regarded as the final word on the subject.

PRUNING TOOLS.

Before commencing operations it is as well to be equipped with implements of good quality and capable of allowing the work to be carried on with the minimum amount of damage to the trees. Many trees are ruined every year by bruising, splitting, etc., and where profit is sought such action by decreasing the output increases relative cost of production. It is possible to secure the best saws, secateurs, and knives at any hardware emporium in the Union, and none other should be used. All tools should be clean and sharp, and kept in this condition whilst the work proceeds.

The California bow-saw possesses a reversible blade, rendering it possible for the operator to sever a branch at any angle close to the stem or main branches; the blade is also detachable and easily replaced. The secateur (shear) should have a removable blade for convenience, as most of the cutting is done with it. A good pruning knife, capable of retaining a keen edge, is necessary for light work and trimming the bark smooth after saw-cuts.

WHEN TO PRUNE.

The correct time to commence winter pruning depends upon the state of the trees and the amount to be done. When only a small area is under cultivation July will be found a suitable month. In large commercial orchards pruning is seldom delayed long after the leaves have fallen, and is continued until the buds begin to swell. It can be said that pruning may be done at any time during the dormant season to assist in shaping and renovating trees, promote wood growth, and equalize sap distribution, thus keeping the trees in a vigorous and healthy condition.

The selection of many types, the tracing of subsequent growth, successful photography, and other factors all tend to delay the production of a complete work on this subject. The pruning of a tree for commercial purposes begins immediately after the tree has been firmly planted in its allotted place in the orchard. The first pruning is usually termed "heading back." In every instance where something is being developed towards its ultimate purpose a proper plan of treatment and procedure is, or should be drawn up, so that chance

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is not allowed to have much share in the process. Yet we see thousands of trees planted throughout the Union that have received little or no attention in the way of pruning at an early and most important stage. Nurserymen, unless otherwise instructed, send out their young trees with the past season's growth uncut, though this cannot always be said of the roots, which usually suffer a little when the trees are dug out. If the trees are planted as received, and not cut back, buds will be called into activity during a warm spell of weather, sustained by the reserve material in the tissues, and, unless new root action is taking place, no sap can be pumped up to support the growth. Under these conditions many trees die every year, whilst the vitality of others is impaired to such a degree that complete recovery is impossible. Sometimes a tree has already formed a head

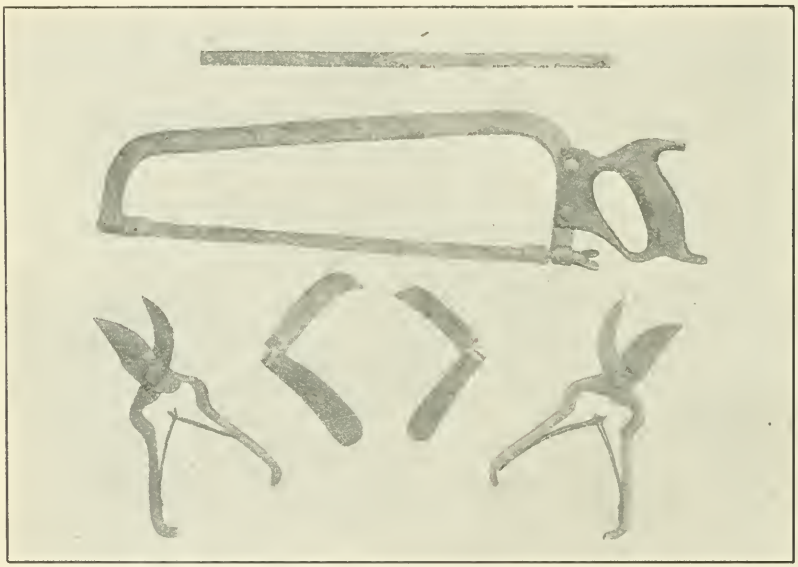

FIG. 1.—Pruning Tools.

in the nursery row, and one is dubious about removing it; in practice the head is removed entirely when the stem is too long or lacking in stability so that new growths may arise lower down and form a more substantial foundation for the future tree. Year-old trees with straight stems are also cut back to the height of one's knee (about 18 to 20 inches), the object being to develop a low head built on short, sturdy main arms, capable of carrying regular heavy crops of fruit without breaking down. The trees are thus prevented from breaking into vigorous growth before the shortened roots have formed a new set of feeders to obtain nourishment necessary for the new growths, and a standard of uniformity is obtained throughout the orchard.

It is generally recognized that the best shape or form for deciduous trees under South African conditions is that known as the "goblet" or "vase" form. To obtain this form it is necessary to

remove the central leader, and this is done when "heading back" at planting time. The advantages claimed for the "lowhead" system are that the branches are strong and well spaced, thus facilitating all cultural operations such as picking, pruning, and spraying: cultiva-

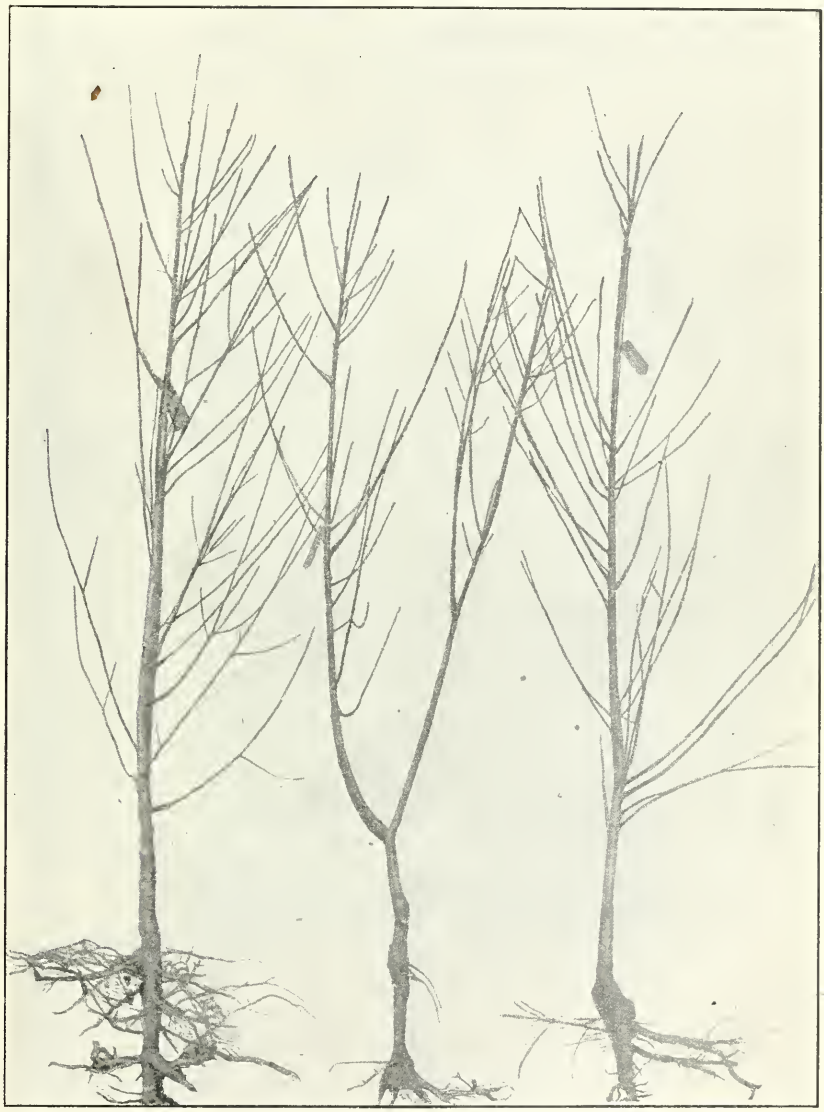

FIG. 2.—Types of year-old trees sent out by nurserymen.

tion is more easily and economically carried on, as animals can be brought closer to the trees than would be the case where horizontal branches are met with. Loss of fruit and damage to trees by strong winds is reduced to a minimum owing to the strength of the main

and secondary arms. The fruit-producing area is doubled, because fruit-bearing wood is encouraged inside as well as on the outside of the trees. Protection from sun is given to the centre by an abundance of healthy foliage due to free circulation of air and light. The stem is short, and, after the second season's growth, sufficient shade has developed around the trees to prevent sun-scald of the stems, thus removing a source of anxiety to which the grower of untrained trees is liable. During the growing season following after planting, it is desirable that the growth of the young trees should be interfered with

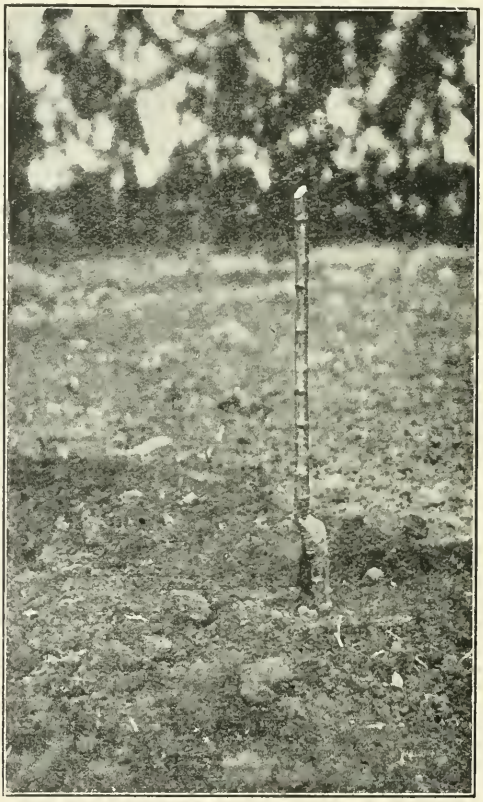

FIG. 3.—"Heading back."

as little as possible. After the three shoots have been selected to form the main arms and other superfluous growths have been rubbed off, an abundance of healthy foliage is necessary for the development of root and top. Suckers, of course, must always be removed, as these rob the tree of nourishment. It is as well to arrange that the selected growths do not start from the stem too close to one another, as weakness would be produced at this point. Some varieties, especially amongst apples and pears, often fail at the outset to push out three well-spaced growths, and in such cases it will be necessary to pinch

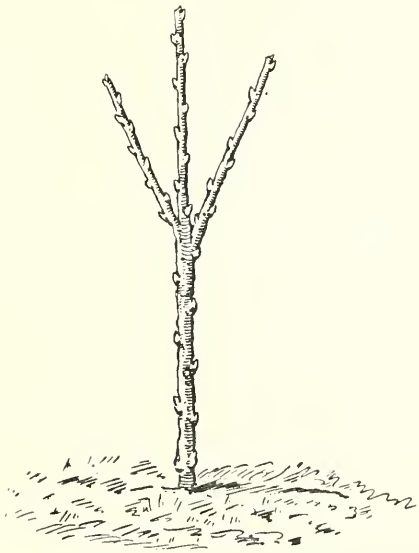

FIG. 4.—Diagram illustrating a tree after the first winter pruning.

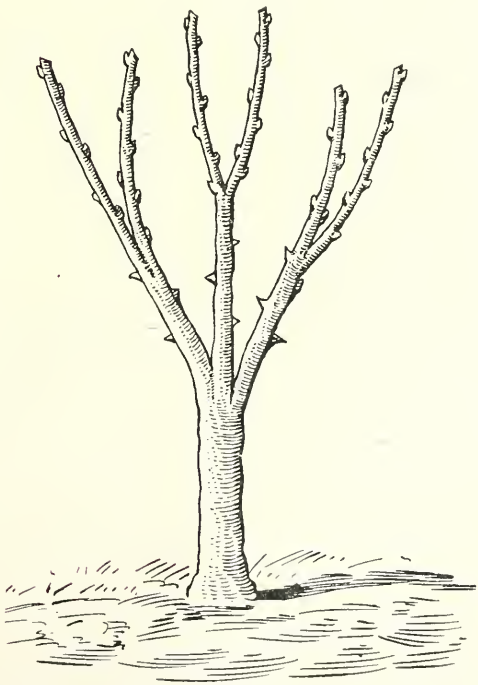

FIG. 5.—Diagram showing a tree after the second winter pruning.

out the growing point of the strongest leader and so put sap pressure on the growth or bud immediately below it; where two strong growths have developed it may be necessary to pinch out both terminals to temporarily check them, then by cutting a notch in the stem immediately over the bud desired, it invariably pushes into growth and, at the end of the season, is equal in length to the others.

FIG. 6.—Diagram showing a tree after the third winter pruning.

During the winter following planting, the young trees will need careful pruning with the object of forming the main arms; this is illustrated in the accompanying diagram. The strong growths are cut back to 9 or 12 inches from their base according to their strength, all other surplus growths being cut away close to the branch or stem. When selecting buds to cut back to, select those on the sides of the leaders with the object of developing two main growths on each

arm, so placed as not to interfere with each other in subsequent growth. By devoting a little time during the growing season which follows to stopping any strong shoots that may break out below the terminal buds, the trees should present the appearance depicted in the plate above after the next or second winter pruning.

The second winter after planting, the bearers, of which there should be six, are again cut back 12 to 15 inches from where their growth began, all side shoots being removed. As in the previous year, select buds on the sides of the leaders which will produce two more growths well spaced. This is considered drastic treatment for young trees, but it cannot be too strongly emphasized that the sole object during the first three years after planting is to encourage growth and build up trees with strong rigid limbs, hence all the energy of the trees should be directed to the formation of wood, so that when the bearing stage is reached the crop is borne without any breaking down of branches.

In the third winter after planting the trees having been carefully attended to, at least twelve strong, evenly spaced growths should be found awaiting treatment, also an abundance of side growths along the arms lower down. Up to this stage no wood has been retained for producing fruit, the sole aim having been to shape the tree. The desired form having been obtained on well-spaced arms and branches, some attention can be directed to securing a crop during the incoming season. The twelve leaders are pruned back to a length compatible with stability, as further growths will arise on these after pruning. The remaining growths should be thinned out, if too crowded, others shortened back to carry a medium crop of fruit. This will only occur in some varieties of stone fruits, as most varieties of apples and pears do not arrive at the fruiting stage until they are much older. From now onward the winter pruning will never be as severe as formerly. The trees are reaching the stage when regular annual crops may be expected; the object then will be to keep the trees in healthy growth so that the shape is maintained and fruiting wood is freely produced or renewed. All trees will increase in size year after year, the leaders will become crowded and prevent the sunlight from ripening the wood and fruit unless annually reduced. It is best not to increase the number of leaders after the third winter pruning, for not only do they prevent light entering, but weaken and spread the tree too much when loaded with fruit. With many varieties of trees—especially vigorous growers—over-production of laterals (side growths) occasionally happens; these may be thinned out, and others cut back or left alone according to their position on the tree. Care must be exercised when cutting, otherwise many laterals are pruned too severely and only vigorous growth results, defeating the aim of the grower who desires regular fruiting.

REASONS FOR PRUNING.

The fundamental principle of pruning demands that an even distribution of foliage shall be maintained, encouraging an even distribution of fruit-bearing wood, so that no one part of the tree will suffer at the expense of the other. Any cutting performed whilst the tree is dormant tends to promote vigorous growth by reason of the same amount of root action expending its energy over a reduced number of branches. New buds, too, possess greater energy than old ones, and where their development is forced direct channels are made

for the flow of sap. It must also be borne in mind that the more upright a shoot is the stronger will be the growth, and the likelihood of it bearing fruit is reduced; the nearer a shoot approaches the horizontal so its vigour diminishes and its fruiting possibilities increase.

Bearing these facts in mind when pruning fruiting trees the risk of cutting away useful wood is minimized. The following reasons are advanced in support of annual winter pruning:—

(*a*) To maintain the shape of trees and prevent overcrowding of branches.

(*b*) To regulate the amount of light throughout the trees. It naturally follows that where leaders are crowded together at the top of trees light is withheld from weaker growths lower down; consequently they never mature, but perish. Fruit inferior in size and colour is due to lack of light; overshadowing is also responsible for barren lengths of wood being retained close to the main stems for the sake of the new wood on them further out.

(*c*) To produce fruiting wood and renew worn-out portions. This is essential if good quality fruit is desired, as in many instances the new wood is the most productive. The removal of old and barren wood to force new growths must always be borne in mind. In spur-bearing trees, spurs often subdivide and lack vigour; these require shortening back. Some apples, such as Jonathan, Rome Beauty, Northern Spy, Cleopatra, and in pears Bon Chretien, produce fruit buds on the terminals of short laterals. If they are left unpruned very little wood growth is made, but spurs are developed closer into the main stem for fruiting during subsequent years.

(*d*) To increase size and regulate production of fruit. It naturally follows that the fewer fruits there are on a tree the better the size and quality will be. Advantage is taken of this fact when reducing the amount of bearing wood at pruning time, and, later on, when the crop has set, "thinning" is resorted to, so that the remaining fruits receive a larger share of the nourishment absorbed by the tree. Exhaustion is prevented and regular crops are secured.

(*e*) To assist in carrying out cultural operations at minimum expense, low-headed trees, whose main arms and branches rise obliquely from the stem, are more easily cultivated than trees with horizontal branches; trees with branches built high enough to permit animals passing underneath sacrifice all the conveniences and economies which determine profit in a commercial orchard. In dealing with the pruning of trees in bearing it may be advisable to draw attention to what appears to be the most common error in this phase of fruit culture, that is, the density of heads of trees. It is a mistake one can easily fall into, especially when the non-setting of fruit has been attributed to frost or other contingencies. However, when trees are built up on the low-head system these corrections are speedily made with practically no loss of symmetry.

(*A further instalment, dealing with certain varieties of fruit trees, will appear in next month's* Journal.)

THE POULTRY YARD MONTH BY MONTH.

By J. J. JORDAAN, Lecturer and Instructor in Poultry, Glen, Orange Free State.

February.

Moulting.—The moulting birds' treatment of feeding, etc., should be continued as advised last month. This is a most trying time for most birds, as they are either heavy in moult or are too fat to get through it readily. Mixing a tablespoonful of sulphur for each twelve birds in the mash twice a week, allowing about one teaspoonful of linseed meal per bird daily in the morning mash, and epsom salts given weekly at this time, will prove of great assistance in getting them over this period. Green food should be fed in abundance.

Runs.—It will be found convenient, especially if the runs are old, to dig the ground over in the breeding pens and to get in a crop that will provide shade and green food for the breeding pens during April and May.

Showing.—In feeding birds intended for show the following hints will be found useful: Linseed meal or crushed sunflowers add lustre to their plumage. Warm soft food produces abundance of long fluff and feather. Beans and peas and iron in the drinking water help towards hard feathering as in game. To improve condition and make birds muscular obtain from the butcher the windpipe of an ox with a small quantity of meat on it, and tie this in the run—the birds pull at it all day long; also dig their grain-food into the ground. White birds should not have iron in their drinking water and, like buff birds, they require shade.

Feeding.—Damaged fruit makes excellent food for poultry.

Egg Production.—Shift pullets as frequently as possible, but keep them in good condition. It is not desirable that they should lay this month if they can be kept back.

Eggs.—Start selling all stored or preserved eggs, as prices generally rise from now on.

General.—Young turkeys grow wonderfully if allowed to run on the lucerne plots and, incidentally, they destroy numbers of insects and grubs. If no lucerne plot is available they should be sent out with a herd-boy, who, by breaking open ant heaps, will provide an excellent food for the turkeys to the benefit of the veld. Young goslings should not be sent out to graze.

Pedigree Cows.

THE VEGETABLE GARDEN.

February.

By H. B. TERRY, Cert. R.H.S. (Lond. and S.A.), Lecturer in Horticulture, School of Agriculture, Potchefstroom.

THIS month is the best to make final preparations to ensure a plentiful supply of vegetables throughout the winter and early spring. February also marks the time for sowing and planting of winter crops in the warmer districts. Try and get every available piece of land in the garden sown to produce some vegetables for winter.

Beetroot.—Sowings should be made for succession, using Eclipse, Egyptian, Turnip-rooted, Half Long.

Beans.—Dwarf beans may be sown in Eastern Province and where no fear of frost exists for the next three months.

Beans, Broad.—Make small sowings only of Long Pod, Johnson's Wonderful, Windsor; generally the weather is too warm.

Brussels Sprouts.—Not very successful as a rule; now is a good time in the colder localities. Treat like cabbage.

Cabbage.—Sow early maturing sorts on ridges where they are to head. Too late to sow generally. In the warmer districts early heading varieties may be sown and transplanted.

Cauliflower.—Where this vegetable succeeds under severe conditions, transplanting should be completed. Broccoli should be grown where cauliflower fails.

Carrot.—Make a large sowing of almost any variety.

Celery.—In Cape Provinces this may be sown for transplanting.

Kohl Rabi.—As a substitute for turnips this is unequalled. In districts where turnips fail this should be tried; White Vienna, Purple Vienna, Goliath are useful.

Lettuce.—Sowings should be made of cabbage or cos varieties, according to desire; of the former, Boston, Iceberg, Continuity, Neapolitan; of the latter, try Green Paris, Trianon, London White.

Leeks.—On the high veld only should these be sown; use Musselburgh, Italian Giant, Large Flag.

Onions.—Make a general early sowing to transplant during April and May. Sow Early Cape Straw, Flat Red, Bermuda White, Red, Italian Tripoli, Extra Early Globe.

Parsley.—A sowing for succession should be made now; this is a little difficult to germinate at times. Shade helps.

Parsnip.—No time should be lost in sowing this on the high veld; sow Hollow Crown, Student, Guernsey, and, for quick grower, Turnip-rooted.

Peas.—In Natal and the high veld sowings may be made. Gradus, Black-Eyed Susan, American Wonder, William Hurst, and Daffodil should be used.

Radish.—Sowings may be general; as a change from small turnip-rooted sorts try half-long varieties. They do not bolt to seed so readily, and are firmer. Sow French Breakfast, Olive Shape, Long Red, White Vienna.

Spinach.—Continue to sow summer varieties for succession. Where a permanent crop is desired sow Swiss Chard in drills 2 feet apart, allowing 18 inches apart in the rows.

Tomatoes.—Too late to sow except under low veld conditions. Growing plants elsewhere should be kept off the soil if possible to prevent disease and to prolong the bearing.

Turnips.—Where this crop can be successfully grown, a large sowing should be made for autumn use. Suitable varieties are Red Top, White Globe, Six Weeks, Strap Leaf, Green Globe.

Swedes may be sown where ample supplies of water are assured.

Potatoes should be kept well cultivated and earthed up as growth proceeds. Early varieties may still be planted at the coast only.

NOTES FROM THE "GAZETTE."

Attention is drawn to the following matters of interest which appeared in the *Union Government Gazette*:—

(Abbreviations: "Proc"—Proclamation; "G.N."—Government Notice.)

Gazette. No.	Date.	Items.
1109	10/12/20	The Schedule to G.N. No. 647, 1920, having reference to the protected area (scab) of Smithfield, is amended by the inclusion of the farm Waterford No. 70, District Rouxville. (G.N. No. 2227.)
1109	10/12/20	For the purposes of the Diseases of Stock Act, the farm Beaulieu (sub-division of the farm Witpoort No. 551), Pretoria District, has been declared to be in the Witwatersrand District. (G.N. No. 2228.)
1109	10/12/20	Tenders are invited by the Secretary for Lands, Pietermaritzburg, for the lease, for grazing or other agricultural purposes for which the ground may be suitable, of portions of land situated in the Divisions of Impendhle and Vryheid, which land is unsuitable for permanent occupation by European settlers. (G.N. No. 2225.)
1110	17/12/20	A list of applications for the registration of brands in the Cape and Orange Free State Provinces is published. (G.N. Nos. 2133 and 2156.)
1110	17/12/20	The Secretary for Lands has notified that Lot No. 316, Empangeni, Zululand, advertised for disposal, is reported to be affected with nagana. (G.N. No. 2265.)
1112 1109 1114	31/12/20 10/12/20 7/1/21	Crown lands will be offered for sale at the Stock Fair Pens, Tarkastad, 9th March, 1921 (G.N. No. 2345), and at Upington on the 23rd February, 1921 (G.N. No. 2097), as amended in terms of G.N. No. 6 of 1921.
1111	24/12/20	Paragraph (2) of G.N. No. 1617, having reference to the declaration of a portion of the Kenhardt District to be a semi-protected area, has been cancelled and an amended area substituted. (G.N. No. 2293.)
1111	24/12/20	Under the Diseases of Stock Act the Minister has ordered that all cattle running within a portion of the Pietersburg District shall be branded. (G.N. No. 2294.)
1111	24/12/20	A portion of the Inconza Forest Reserve has been withdrawn from the demarcated forest area declared by unnumbered Natal G.N. dated 24th August, 1909. (G.N. No. 2301.)
1112	31/12/20	Tenders are invited by the Secretary for Lands, Pietermaritzburg, for the lease of a piece of land near Umhlali Station, Division of Lower Tugela, Natal. (G.N. No. 2346.)
1114	7/1/21	Applications are invited for the purchase of live blesbok and springbok on the Grootkuil Estates, Winburg, Orange Free State (G.N. No. 32.)
1114	7/1/21	G.N. No. 647, 1920, having reference to the Protected Area of Winburg, has been amended by the inclusion of the farms Commandants Pan and Tafelbaai, Kroonstad District. (G.N. No. 26.)
1109 1110 1111 1112 1114	10/12/20 17/12/20 24/12/20 31/12/20 7/1/21	The compulsory dipping of cattle has been ordered (*a*) every three days (in the three-day dip) for portions of Barberton and Pietersburg Districts (G.N. Nos. 2231, 2198, 2342); (*b*) every five days (in the five-day dip) for portions of Weenen, Idutywa, Pinetown, Ngqeleni, Richmond, and Krantzkop Districts (G.N. Nos. 2231, 2198, 2310, 2342, and 16); (*c*) every seven days (in the seven-day dip) for a portion of Pretoria and Richmond Districts (G.N. Nos. 2231, 2198); (*d*) every thirty days in the Municipal Area of Kestell, Orange Free State. (G.N. No. 2342.)

Gazette. No.	Date.	Items.
1109	10/12/20	Compulsory dipping of sheep and goats under the Scab Regulations and the Stock Diseases Act has been ordered in the Districts of Graaff-Reinet, Aberdeen, Willowmore, Albert, Wodehouse, Barkly East, and Elliot within the period 2nd January, 1921, and 28th February, 1921; for the Districts of Stutterheim, Stockenstrom, and Adelaide within the period 2nd January to 31st March, 1921 (G.N. No. 2230); for the Districts of Aliwal North, Herschel, Wolmaransstad, and Lichtenburg within the period 2nd January to 30th April, 1921 (G.N. No. 2255); for the District of Hoopstad within the period 2nd January and 31st March, 1921 (G.N. No. 2255).
1114	7/1/21	Sections 36, 37, and 38 of the Stock and Produce Theft Repression Consolidation Act, 1893, has been put in force in the Division of Calvinia. (Proc. No. 8.)
1114	7/1/21	Under the provisions of Fencing Act, No. 17 of 1912, contributions towards the cost of dividing fences in Ward Palala, District of Waterberg, are declared to be obligatory. (Proc. No. 6.)

THE WEATHER.

Extracts from the Monthly Report of the Chief Meteorologist for the Union.

TAKEN as a whole, the rainfall for December, 1920, was very partial in many districts, the showers being so highly localized in some instances that only portions of a farm benefited from the precipitation. Although rainfall was mostly associated with thunderstorms, which occurred on twenty-six days of the month, showers were comparatively light, with but little run-off. Although some good rains, exceeding one inch, were experienced at a number of stations, the beneficial effect was neutralized to a great extent by succeeding hot days with strong winds. The result of these conditions is that although in most cases crops were able to survive, growth was but slight, whilst a number of insect pests, particularly the mealie-borer, made their appearance in a number of places. In a limited number of cases crops promise a record yield, but, generally, heavy rains are still required for storage purposes. Late ploughing and planting were seriously interfered with owing to droughty conditions, particularly in the neighbourhood of Dundee (Natal) and the Waterberg (Transvaal). Hailstorms, frequently accompanied by very strong winds, caused in some instances not only considerable damage to crops, but also killed sheep, poultry, etc.

The total rainfall for the year was below the average over the greater part of the Transvaal, portion of the north and south-west of the Free State, and the west and north of Natal, and more particularly the south and south-east coastal areas of the Cape Province, where a severe drought was experienced throughout the greater part of the year. The deficiency varied from 3 to about 11 inches between Swellendam and Umtata, and was little short of these amounts over portions of the east and north of the Transvaal. In the western Transvaal, Orange Free State, and Natal, the shortage was mostly between 1 and 2 inches. On the other hand large excesses of 6 to 20 inches were recorded in Natal, 3 to 10 inches at a few places in the south and east of the Transvaal, and 3 to 11 inches at several stations in the central and western portions of the Cape Province. Excesses less than 2 inches were the exception over these areas. The cumulative rainfall since 1st July last was in excess of the normal by 1-4 inches over the greater part of the eastern and central Transvaal, Natal, and west and south-west of the Cape. A shortage of approximately equal amounts occurred over the north and west Transvaal, Orange Free State, and the central, south, and south-eastern portions of the Cape including the Transkei. The deficit was greatest along the south and south-east littoral and part of the north-east section of the Cape Province.

STAFF: APPOINTMENTS, TRANSFERS, ETC.

(1) AGRICULTURE.

1/10/19 *E. G. Hardy*, Senior Dairy Inspector: Appointed Assistant Superintendent of Dairying.

31/12/20 *P. A. Steenekamp*, Senior Sheep Inspector, retired.

1/1/21 *J. L. Coetzee*, Senior Sheep Inspector, transferred from Gordonia to Aliwal North, *vice* P. A. Steenekamp.

1/1/21 *P. L. Swart*, Humansdorp, promoted Senior Sheep Inspector, Gordonia, *vice* J. L. Coetzee.

(2) AGRICULTURAL EDUCATION.

30/11/20 *A. C. Pigott*, Farm Manager, Potchefstroom School, resigned. He is at present manging his estates in Ireland.

31/12/20 *S. H. Skaife*, Entomologist, Cedara: Resigned in order to accept post of Inspector of Technical Education, Cape Province.

15/1/21 *Miss E. Ferguson* (returned Oversea Scholar), appointed Demonstrator in Household Science, Elsenburg.

31/1/21 *J. C. Ross*, Research Chemist, Elsenburg: Resigned in order to accept the Professorship of Chemistry, Transvaal University College.

MOVEMENTS OF OFFICERS.

Mr. Theo. Potgieter, of the Orange Free State Education Department, is acting as Lecturer in Botany at Glen during 1921.

Mr. V. A. Beckley, who has been studying at Cambridge, England, as a Government Oversea Scholar, has returned, and is to be appointed as Lecturer in Chemistry at Grootfontein, *vice* Mr. I. P. J. du Plessis, transferred to an analogous post at Glen.

Mr. C. van Foreest, Live Stock Officer, has engagements at Smithfield, 14th-17th February, and Dewetsdorp, 21st-26th February.

THE OVERSEA MARKET.

Cabled Advices from London during the Month of December, 1920.

Maize (1st).—December-January shipments, African white flat, afloat, sellers, 57s. 6d. (4th) White flat, afloat, 57s., sellers; yellow, November-December shipments, 53s., sellers; loading, 54s. 9d. paid; No. 2 Rhodesian December, steamer, 58s. 6d. quoted. (7th) White flat, afloat, second grade sold at 56s. paid, and third grades 55s. paid; yellow December-January shipments were quoted at 54s. 6d. (11th) Yellow African maize, afloat, sold at 56s. 6d. paid; Rhodesian maize, December shipment, 61s. was quoted. (24th) White flat December shipment, 57s.; yellow, 54s., sellers. (4th January) South African white flat, afloat, 56s.; parcels of yellow, December-January shipments, 52s. sellers: La Plata, January-February shipments, 50s. 6d. paid.

Wool—4200 Bales of South African wool offered at December auctions, and 1400 sold, but poor demand. Greasy quality declined 20 per cent., snow-whites 25 per cent. Present current prices are as follows: Snow-whites, extra superior, 2s. 9d. to 3s.; superior, 2s. to 2s. 8d.; medium, 1s. 7d. to 1s. 11d.; inferior, 1s. 3d. to 1s. 6d.; greasy combing, long, 9½d. to 1s. 6d.; medium, 8d. to 1s. 1d.; clothing, light, 8d. to 1s.; heavy, 5d. to 7d.

Mohair.—Summer kids, 25d. to 30d. per lb.; summer firsts, 15d. per lb.; mixed, 12d.; Basutos, 11d.; winter kids, 17d.; winter hair, 9d.; prices are purely nominal and market remains depressed.

Hides.—Sun dried, sound, 13½d. per lb.; salted, 12½d. per lb.

Sheep Skins.—Sound, 6½d. per lb.; Capes, salted, 80s. per doz.; Capes, sun dried, 60s. per doz.; coarse and coloured skins, sound, 6½d. per lb.

Angora Goat Skins.—Light, 8d. per lb.; heavy and sun dried, 8d.; bastards, sound, 12d.

Goat Skins.—Light, 16d. per lb.; sun dried, 16d.; heavy, 18d.; prices of Angora and ordinary goat skins are nominal.

Ostrich Feathers.—Very little business is passing.

Aloes.—Cape, 50s. to 63s per cwt.; the market is weak.

Tobacco.—Nyasaland, 16d. to 30d. per lb. The stock of Nyasaland tobacco in bond in the United Kingdom at 30th ultimo was 11,000,000 lb.

Wattle Bark.—Chopped, last price £11 per ton c.i.f., Hamburg, for January-February shipments. Ground, small sales at £14, *ex* store. Extract, about £35, c.i.f., quite nominal.

Maize Meal.—White, £12. 10s. per ton; yellow, £12 per ton.

Dried Fruits (4th).—500 Boxes of South African pears were sold at 46s. a box; (18th) 357 packages of Cape sultanas were partly sold for 80s. to 97s.

Eggs (4th).—South African eggs realized 40s. to 44s.; (18th) 2390 cases of eggs arrived from South Africa and were sold at 42s. to 46s.

MEAT STATISTICS.

I.—BEEF INSPECTED AND PASSED FOR EXPORT, DECEMBER, 1920.

534 carcasses inspected, 36 rejected, 498 passed for shipment (Durban).

Beef actually exported: *ex* Durban, 7291 quarters; *ex* Capetown, 430 quarters. Total, 7721 quarters.

Total shipments of Beef in quarters—

1916	...	115,992	1918	...	123,354	1920	...	69,885
1917	...	309,214	1919	...	285,367			

II.—OTHER MEAT EXPORTED DECEMBER, 1920.

Pork—1935 carcasses inspected, 266 rejected, 1669 passed for shipment.

Total shipment of other meat 1st March, 1920, to 31st December, 1920:

Pork—Carcasses, *ex* Capetown, 1464; *ex* Durban, 63. Total, 1527 carcasses.
*Bacon—*Ex* Capetown, 80,637 lb.; *ex* Durban, 435,023 lb. Total, 515,660 lb.

III.—RETURN OF CATTLE IMPORTED INTO THE UNION FROM ADJOINING TERRITORIES.

Calendar Year.	For Slaughter.	For Breeding.	Total.
	No.	No.	No.
†1916	26,580	—	26,580
1917	47,970	5,440	53,410
1918	36,767	13,386	50,053
1919	40,574	16,693	57,267
1920	64,333	24,794	89,135

(NOTE.—All beef exported is under the supervision of the Veterinary Division of this Department, and the above figures show the total quantity of South African Beef exported. Similar supervision was extended to pig products in March, 1920.—EDITOR.)

* Approximate: including shipments in bales taken at 100 lb. per bale.
† 1st July to 31st December only.

LOCAL MARKET PRICES.

Rates of Agricultural Produce and Stock ruling at the 15th January, 1921.

Centre.	Wheat. Per 200 lb.		Wheat Flour. Per 100 lb.		Boer Meal. Per 200 lb.		Mealies. Per 200 lb.		Mealie Meal. Per 180 lb.		Barley. Per 150 lb.		Oats. Per 150 lb.		Oat-hay. Per 100 lb.		Lucerne Hay. Per 100 lb.		Potatoes. Per 150 lb.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Cape Province—																				
Aliwal North....	31 0	31 0	33 0	33 0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Beaufort West...	45 0	55 0	37 6	38 6	60 0	62 6	17 6	20 0	20 0	22 6	21 0	22 6	18 6	19 6	—	—	5 6	5 6	22 6	25 0
Capetown.....	34 0	35 0	—	—	—	—	17 0	18 0	—	—	16 6	17 6	10 6	11 0	4 9	5 0	8 0	8 6	14 0	25 0
East London....	—	—	—	—	—	—	18 0	20 0	—	—	—	—	—	—	—	—	—	—	15 9	39 0
Grahamstown....	—	—	—	—	—	—	18 0	25 0	—	—	—	—	—	—	—	—	4 6	5 6	22 6	30 0
Kimberley.....	30 0	35 0	32 0	35 0	54 0	57 0	14 6	15 6	14 6	15 6	16 6	18 6	12 9	15 0	7 0	8 0	5 9	6 6	6 0	30 0
Kingwilliamstown	—	—	—	—	—	—	9 10	10 0	—	—	19 3	19 3	—	—	9 0	11 0	8 0	8 0	5 0	15 0
Port Elizabeth...	—	—	—	—	—	—	14 0	22 0	—	—	11 3	12 9	—	—	5 9	7 9	6 0	7 6	4 6	24 0
Queenstown.....	60 0	66 0	33 6	35 0	56 0	60 0	15 0	16 6	19 0	24 0	20 0	24 0	12 6	15 0	—	—	4 6	5 0	30 0	35 0
Natal—																				
Durban.....	—	—	—	—	—	—	13 0	17 6	14 0	16 0	—	—	—	—	5 0	7 6	4 6	7 0	10 0	35 0
Pietermaritzburg.	—	—	—	—	—	—	14 0	14 6	—	—	—	—	—	—	5 9	6 6	6 0	6 6	14 0	17 0
Orange Free State—																				
Bloemfontein....	30 0	35 6	40 0	45 0	55 0	65 0	13 6	17 0	17 6	22 0	17 6	25 0	12 6	17 6	5 0	7 6	4 6	6 6	15 0	25 0
Harrismith.....	33 0	34 0	35 0	35 0	62 6	62 6	10 6	11 0	13 6	13 6	15 0	17 6	15 0	16 0	6 0	6 0	—	—	21 0	22 0
Transvaal—																				
Pretoria.....	37 0	41 0	—	—	—	—	18 3	19 9	—	—	—	—	16 0	16 0	2 6	8 0	4 7	5 3	4 0	21 0
Johannesburg....	28 0	31 6	—	—	—	—	12 0	14 0	10 0	11 6	13 0	14 10	14 10	16 6	5 0	8 6	3 9	7 0	4 0	22 6

Centre.	Onions. Per 120 lb.		Tobacco (Boer Roll). Per lb.		Beans. Per 200 lb.		Beef. Per lb.		Mutton. Per lb.		Fresh Butter. Per lb.		Eggs. Per dozen.		Cattle (Slaughter). Each.		Sheep. Each.		Pigs. Each.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	£ s. d.	£ s. d.	s. d.	s. d.	s. d.	s. d.
Cape Province—																				
Aliwal North....	—	—	—	—	—	—	—	—	0 6	0 9	1 9	2 6	1 9	2 3	—	—	—	—	—	—
Beaufort West...	—	—	1 3	1 9	—	—	0 9	1 4	0 9	0 10	3 0	3 6	2 3	2 6	9 0 0	21 0 0	20 0	35 0	50 0	160 0
Capetown.....	8 0	11 0	0 4	1 1	75 0	80 0	0 10	1 3	0 9	1 2	1 3	2 8	2 0	2 6	15 0 0	18 0 0	30 0	35 0	30 0	45 0
East London....	27 6	32 6	—	—	30 0	50 0	—	—	—	—	1 6	3 0	2 0	3 3	—	—	—	—	—	—
Grahamstown....	24 0	27 6	1 6	1 6	40 0	50 0	0 6	1 0	0 10	1 2	1 8	2 7	1 0	2 3	—	—	—	—	—	—
Kimberley.....	10 0	20 0	0 6	1 2	17 6	67 6	0 7	1 0	0 9	1 0	1 10	2 6	1 2	3 6	14 0 0	19 10 0	17 0	23 0	*0 4½	*0 7½
Kingwilliamstown	10 0	15 0	—	—	20 0	30 0	0 9	0 10	0 9	1 3	1 5	1 10	1 4	1 10½	—	—	—	—	—	—
Port Elizabeth...	7 3	15 0	—	—	37 0	82 0	0 8	6 10	0 9	1 0	1 4	2 3	1 10	2 8	—	—	—	—	20 0	85 0
Queenstown.....	—	—	0 5	0 6	—	—	0 9	0 10	0 8	0 11	1 1	1 6	1 6	2 5	16 0 0	17 10 0	30 0	37 6	*0 3½	*0 4
Natal—																				
Durban.....	10 0	25 0	0 4	0 6	25 0	70 0	0 4	0 9	0 6	1 4	1 6	3 3	1 9	3 3	—	—	—	—	—	—
Pietermaritzburg.	—	—	—	—	—	—	0 6	0 9	0 10	1 0	1 6	2 1	2 0	2 6	—	—	—	—	—	—
Orange Free State—																				
Bloemfontein....	15 0	25 0	0 9	1 6	35 0	49 0	0 10	1 3	0 9	1 0	1 6	2 9	1 9	3 0	14 0 0	27 0 0	18 0	28 0	*0 8	*0 9½
Harrismith.....	12 0	12 0	—	—	—	—	0 10	1 0	0 10	1 0	1 3	2 2	1 10	2 5	12 10 0	20 0 0	12 6	25 0	20 0	50 0
Transvaal—																				
Pretoria.....	3 6	15 0	—	—	25 6	25 6	4·2d.	8·4d.	0 5½	0 8	1 4½	1 6	2 3	3 7	4 10 0	25 10 0	15 0	29 0	*0 5½	*0 11½
Johannesburg....	9 0	19 0	0 6	0 6	21 6	62 0	†37 6	†65 0	0 6	0 8	1 4	2 3	1 9	2 9	8 10 0	23 10 0	20 0	35 0	*0 5½	*1 0½

* Live weight per lb. † Dressed weight, including hides, offal, etc., per 100 lb.

NOTE.—The rates quoted for produce sold in bags include, as a general rule, an additional 3 lb. for weight of bag.

THE LOCAL MARKET.

Position at Mid-January, 1921.

(NOTE.—The local market prices of certain other agricultural produce and stock are published elsewhere in this issue.)

WOOL.

THE market continues very inactive, the demand is poor and very few transactions are taking place. Buyers are very particular in their selection and reluctant to make offers on any wools unless they are full-grown twelve months superior combings, well skirted and of uniform length and growth. Heavy and faulty wools are difficult to realize even at very low prices. Since the issue of the previous report a fair amount of business has been done, but the tendency all the way through has been towards a lower basis.

The following quotations may be regarded as the ruling prices as at the 15th January, 1921 :—

	per lb.
1. Extra super combing, 12 months', skirted, choice	15d.
2. Superior combing, 12 months', skirted	13½d.
3. Superior combing, 12 to 14 months' growth, skirted, deep stapled	13½d.
4. Good average combing, 12 months' growth	11½d.
5. Superior combing, 10 to 12 months' growth, skirted	11½d.
6. Average, 10 to 12 months' growth, skirted	9d.
7. Extra super medium, 8 to 10 months' growth, well skirted ...	10d.
8. Super medium, 8 to 10 months' growth, skirted	7½d.
9. Average medium, 8 to 10 months' growth	8½d.
10. Superfine shorts, 8 months' and less, skirted	9d.
12. Average shorts	7½d.

MOHAIR.

The market remains extremely dull and very little business has been done. There are a few buyers, but their orders are small and prices offered are low. Good long Basuto Hair has been sold at 9d. per lb. and good average winter hair at 6d. per lb. The following prices are quoted :—

	per lb.		per lb.
Super summer kids	22d. to 24d.	Mixed hair	8d. to 9½d.
Good super kids	17d. „ 18d.	Winter kids	18d. „ 20d.
Superfine firsts	12d. „ 13d.	Winter hair	6d. „ 8d.
Average firsts	10d. „ 11d.		

HIDES AND SKINS.

The market is still weak and prices have declined considerably during the last few months. The following prices are quoted :—

HIDES.

	per lb.		per lb.
Sun-dried, sound	8d.	Dry-salted	8d.
Sun-dried, damaged	5d.	Fourths	5d.

SHEEPSKINS.

Sound	5⅞d.	Damaged	3¼d.

PELTS.

Sound	3d.	Damaged	1d.

GOATSKINS.

Sound	10d.	Damaged	2½d.

ANGORA SKINS.

Sound	5d.	Damaged	1¼d.

UNION OF SOUTH AFRICA

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PRINCIPAL CONTENTS.

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CONTENTS.

MARCH, 1921.

DEPARTMENTAL NOTICE.

There is a quantity of the following wheat, barley, and early rye seed available for disposal at the School of Agriculture and Experiment Station, Potchefstroom. Applications, with remittance, should be forwarded to the Principal:—

Wheat.—American No. 8 (a medium late variety of good milling quality and resistant to attack by birds), to be sold in quantities not less than or exceeding 1 bag at £2. 10s.; Comeback, Spring Early, Fourie, Bombay (very similar to Klein Koren), and Lalkasarwali (an early, bearded variety, short-strawed, and a very good yielder under irrigation), in quantities not less than or exceeding 60 lb., at 18s.

Early Rye.—In quantities not exceeding or less than 60 lb., at 12s. 6d.

Barley.—Variety, Smyrna (an early, high yielding, six-row barley), in quantities not exceeding or less than 50 lb., at 10s.

AGRICULTURAL SHOW SEASON, 1921.

List of Agricultural Shows, compiled from details furnished by the Agricultural Unions, still to be held.

CAPE PROVINCE.

Rosebank—1st to 4th March (inclusive).
Graaff-Reinet—2nd and 3rd March.
Aliwal North—2nd to 4th March (inclusive).
Cradock—7th March.
Port Elizabeth—8th to 11th March (inclusive).
Queenstown—9th and 10th March.
Dordrecht—15th and 16th March.
Komgha—1st and 2nd April.
Kingwilliamstown—27th to 29th April (inclusive).
East London—4th and 5th May.

ORANGE FREE STATE.

Ladybrand—1st and 2nd March.
Winburg—1st and 2nd March.
Bethlehem—2nd and 3rd March.
Thaba 'Nchu—8th and 9th March.
Senekal—9th and 10th March.
Vrede—9th and 10th March.
Central Show (Bloemfontein)—16th to 19th March (inclusive).
Harrismith—Early April.

TRANSVAAL.

Amersfoort—2nd and 3rd March.
Carolina—8th March.
Ermelo—16th and 17th March.
Johannesburg—23rd to 28th March (inclusive).
Standerton—13th and 14th April.
Heidelberg—27th and 28th April.
Klerksdorp—10th and 11th May.
Pietersburg—24th to 26th May (inclusive).
Pretoria—31st May and 1st June.

HOLT CATERPILLAR TRACTOR TRIAL, NEAR JOHANNESBURG. JANUARY, 1921.

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NOTES.

The Problem of Scab.

The eradication of scab is a subject which has engaged the attention of farmers and officials for many years past, yet our best efforts have not succeeded in ridding the country of a pest which is costing us vast sums of money annually. In Australia the disease was tackled and disposed of in a comparatively short time, while here we still labour under the burden which the baneful presence of scab imposes on us. But public opinion has been intensifying in recent years against the continuance of this great disability and demands are insistently being made that other means should now be found for effectually and finally extirpating the disease, seeing that our present policy has not proved entirely effective. A definite stage in the increasing desire for new methods in dealing with scab was reached at the last meeting of the Agricultural Advisory Board (representative of organized farmers), when a resolution was passed recommending the adoption of the principle of direct taxation. Very few farmers realize what the present system for the control of scab is costing them every year, because they are paying for it in indirect taxation, but if each sheep farmer had to pay a direct tax until his district was free of scab, the incentive to remove the cause of the tax would be so great that scab, it is held, would speedily be eradicated. The matter is dealt with at length elsewhere in this issue; it is one of supreme importance to farmers for the policy outlined foreshadows the adoption of new methods in South Africa, confidently anticipated to have far-reaching, beneficial results.

The Department wishes to have the benefit of the views of the farming community, and an invitation is now extended to all farmers' associations and other agricultural bodies in the Union to give an expression of opinion on the suggested policy for dealing with scab. All communications should be addressed to the Secretary for Agriculture, Pretoria.

Pica Survey.

The term "pica" in the ordinary dictionary sense means a depraved appetite of any sort and of any origin. There are various forms of pica which is found in the human as well as in the animal. As to the latter it is well known that over large areas of South Africa cattle show an abnormal craving, particularly for bones, being indeed of such common occurrence in some districts that it is becoming accepted by farmers as a natural feature in their animals. In some districts the craving is mild, while in others it becomes so acute that cattle are found to gather around the homestead or the hut, devour washing, bags, clothes, riems, skins, and miscellaneous rubbish, and persistently return when driven away. At present abnormal craving is regarded as a nervous disorder and its vagaries are many, for the best-conditioned animals are usually those which show the worst craving, and as their condition falls off their craving abates. While the Department possesses a degree of information on pica and its relation to the lack of phosphorus in the pasture, there is need for a much extended knowledge of an occurrence which may have a direct bearing on many of our animal diseases. The investigations into the disease of lamziekte and the discovery of Sir Arnold Theiler that it is connected with a craving for bones on the part of animals in certain areas of the Union, have convincingly proved the extreme importance of pica in the causation of one at least of our dreaded diseases, and it is considered that the time has arrived when a comprehensive survey of the Union should be undertaken with a view to ascertaining the districts in which pica exists and the connection between this craving and the various types of veld found in the Union. It is known, for instance, that certain differences in regard to pica in its relation to lamziekte exist on the various types of South African veld, such as sour grass veld, sweet grass veld, etc., but what these differences are and what they have to be ascribed to is at present unknown. The matter is of great importance to this country, and in order to clear up the problems surrounding pica it will be necessary to consider all factors bearing on the chemical composition of the pasture, the veld flora, soil composition, and the behaviour of animals towards bones.

The question has been before the Government, and the Minister of Agriculture has approved of what is to be known as the "Pica Survey" being undertaken in all parts of South Africa and under all possible conditions. The survey will include (1) the actual pica test, i.e. the bone-eating test on the cattle present on the farm; (2) a chemical analysis of representative samples of the pasture, collected at different periods of the year; (3) a botanical survey of the area, in order to establish definitely the differences between the various types of veld; and (4) a soil survey of the farms on which the tests are carried out.

The data which will be collected as a result of the Pica Survey will undoubtedly be of the utmost value in the further study of animal diseases in South Africa, more especially that group of diseases which the farmer, since early times, has vaguely associated with the veld. And not only in this direction will benefit follow, for it can reasonably be expected that the work will be of value to other branches of science as well. The Department is in the fortunate position of being

able to undertake the survey which entails the co-ordination and co-operation of those of its Divisions concerned, and an endeavour is being made to commence operations immediately.

Retirement of the Principal Veterinary Officer.

Mr. C. E. Gray, M.R.C.V.S., the Principal Veterinary Officer for the Union, is now on leave of absence and will retire from the Public Service on the 9th May, 1921. Son of the Controller of Telegraphs of the General Post Office, Edinburgh, Mr. Gray was born and educated in Scotland, and in 1879 entered the Scottish Postal Telegraph Service, in which he spent seven years. He subsequently entered the Royal (Dick) Veterinary College, Edinburgh, and after qualifying and spending some time in practice in the Midlands went to the United States, where he practised for several years as a veterinary surgeon.

Mr. Gray came to South Africa in 1895, and finding no suitable opening in a veterinary capacity joined the Rhodesian Telegraph Service, remaining in it until the rinderpest invasion of 1896 when, on the recommendation of Dr. Hutcheon, then Chief Veterinary Surgeon for the Cape Colony, he was employed by the Chartered Company to investigate the disease, the subsequent operations undertaken for its eradication being carried out on his recommendations. But the Matabele rebellion put a stop, unfortunately, to these operations, and Mr. Gray served in the ensuing campaign, and at the close of the war again took up work with the Rhodesian Telegraph Service. Shortly afterwards, however, he was commissioned by the Chartered Company to acquaint himself with the new method of dealing with rinderpest discovered by Professor Koch, and upon completion thereof was employed in Rhodesia in a veterinary capacity. Further service in connection with rinderpest was rendered by Mr. Gray in 1897, when he was lent to the Native Affairs Department of the Cape Colony for that purpose. From then onwards he was placed in charge of, and was mainly responsible in building up, the Rhodesian Veterinary Division.

Mr. Gray's association with our veterinary service dates from April, 1905, when he accepted the appointment of Principal Veterinary Officer for the Transvaal. He served in this capacity until Union, when he was appointed to the post which he is now relinquishing.

Mr. Gray was called upon to perform many arduous and exacting duties connected with his important office, and his name will be closely associated with the control of the live stock pests of South Africa during an important stage of the country's development. Of his special services, we may mention his last, when he directed the operations of the Rinderpest Expedition sent to German East Africa in 1917 by the joint administrations of the South African Governments. The object of the expedition was to check the southward spread of rinderpest, a task of considerable difficulty owing to the East African campaign then in progress. The efforts of the expedition were crowned with success and the southward trend of the disease checked, but it meant the inoculation of close on one hundred thousand head of cattle, in a zone of country practically unexplored, extending from Lake Nyasa to Lake Tanganyika.

Agricultural Organization.

It is very evident that farmers of South Africa are realizing more and more the great importance of organization and the benefits co-operation brings. The agricultural industry, like practically every phase of industrial activity, depends for full success on efficient organization. This has been very patent during the past few years and the spirit of co-operation is spreading far and wide. The Department has constantly urged the necessity of farmers' organizations and endeavoured to promote the well-being of our agriculturists through this agency. At this stage of our development when co-operation is recognized as an essential to success, the article on "Agricultural Organization," by Mr. Melle, of the Division of Botany, published in this issue, will be read with benefit by all interested in the matter. In discussing the subject, the author takes three heads, viz., (1) organization of the farm; (2) organization of farmers in regard to the purchase of their requirements and the disposal of their produce; and (3) organization in its relationship between the State and the farmer. The article is written in a plain, practical manner, and is designed to add to the cumulative evidence of the necessity for proper organization in our agricultural industry.

Co-ordination of the Department's Work.

An important conference of Chiefs of Divisions and Principals of the Schools of Agriculture and Experiment Stations took place at Pretoria in January, 1921, as a result of which certain broad principles were agreed upon for the future working of the Department. The agricultural industry of South Africa is so intimately concerned with the work of the Department that the subject is of direct importance to every farmer, and we publish elsewhere a brief account of the conference and the matters discussed. The Department desires to keep in close touch with the farmer, and to this end wishes to make known its aspirations and work through the medium of the *Journal* and other channels at its command; it is felt, therefore, that the importance of the conference will be realized by all, and that the principles agreed upon will prove wise and enduring.

The World's Crops.

According to the December, 1920, report of the International Institute of Agriculture the estimated cereal crops for 1920 show no material change in quantity; the quality of Canadian grain is reported as excellent. The 1920-21 wheat crops of Argentina, Australia, and South Africa were grown on an aggregate area 13 per cent. greater than that of 1919, but 10 per cent. below the five years' average.

The autumn-sown crops of Europe and the United States have, generally speaking, made favourable progress. In Egypt an increased area will be available for cereals, as it is expected that cotton growing will be reduced owing to the decline in the price.

Between 12th November and 10th December all the important rates of ocean freight for grain declined by 25 per cent. to 30 per cent., while the prices for North American wheat were also rather lower.

Buchu.

As is well known, buchu leaves contain valuable medicinal properties widely used as a diuretic and stomachic. It has long been known at the Cape as a remedy for stomachic troubles, being taken as an infusion in brandy, and is now being extensively used in South African medical practice. Of our exports the bulk goes to the United States, where it is used as a compound in certain proprietary medicines; among English and continental chemists, however, it is not generally known. The first exportation of buchu from South Africa was in 1821, and since then there has been a steady trade in this commodity. Up to the time of the war the quantity exported did not show very great variations, but in recent years there has been a falling off in export trade. The average annual export for the five years 1910 to 1914 was 204,271 lb., valued at £30,394, while the average for the five years 1915 to 1919 was 130,161 lb., valued at £23,937. In 1900 the average price of export buchu was 4d. per lb., gradually rising to 8d. in 1909. The next year there was a large increase, the price being 1s. 9d. per lb., followed by 2s. 9d. per lb. in the succeeding year. Since then the price has never been below 3s., while in 1919 it was nearly 5s. per lb. These prices are the average, of course, for all grades exported, but for the best variety (*Barosma betulina*) much higher prices were obtained; for instance, in 1917 good round leaf (*B. betulina*) obtained 6s. 3d. per lb., while the Capetown market price in 1920 ranged from 9s. to 11s. per lb. In the 1919-20 Annual Report of the Capetown Chamber of Commerce it is stated that "our market here opened with quotations of 6s. per lb., but little business was done until prices advanced to 7s. and 7s. 6d. Even these figures were not long maintained, and soon 8s. was not considered a high price." In London the average price during 1914-19 was 2s. 5d. to 5s. 6d. per lb., according to quality.

In a valuable article on the subject which appeared in the *South African Journal of Industries* (Vol. I, No. 1), Dr. Phillips (now of the Division of Botany) remarks that the questions which should occupy the close attention of those interested in the buchu trade are:—"(1) Whether it will pay to cultivate the various species of *Barosma*, for which there is an outlet, especially *B. betulina;* (2) the gathering of the leaves at the right time and the proper curing, so as to obtain a good, dark, green leaf with the maximum quantity of essential oil; (3) the proper grading of consignments, which should be quite free from adulterants."

An interesting article on buchu by Mr. G. R. von Wielligh was published in the *Agricultural Journal* of July, 1913, in which the author referred to the manner in which this valuable plant has been injudiciously exterminated, and to the detrimental effect of continual veld fires in destroying seedlings and young plants, the result being that farms once possessing lucrative fields of buchu have been devastated to such an extent that to-day plants are found on them in isolated places only, and do not pay the cost of gathering the leaves.

The world demand for both the buchu herb and oil is rapidly increasing, and the future prospects of buchu as a field crop are good, so that increased interest is being taken in the cultivation of the plant, and experiments in this direction have recently been carried out at the National Botanic Gardens at Kirstenbosch, with very satisfactory results, and we publish in this issue an article which

affords valuable and up-to-date information on the subject. The greater part of the article, including the whole of the information on the practical methods of cultivation of the buchu plant, has been written by the Curator of the National Botanic Gardens, while certain other details have been added by the Director, who will be pleased to assist growers with further information arising out of the experiments at Kirstenbosch.

The Sweet Potato: Its Extended Use.

At present the sweet potato is used in South Africa solely as a human and stock food, and the area under the crop suffices to meet the demand. But given a wider use for the tuber, there are areas of land suitable for its production which could meet a demand far in excess of the present one. In view, therefore, of the shortage and high cost of petrol, Dr. Juritz, the Agricultural Research Chemist, draws attention to the possibilities of utilizing the sweet potato in the production of alcohol on a large scale in order to serve as a basis for liquid fuel. A cheap, industrial alcohol is needed, and Dr. Juritz, who has considered the possibilities of the prickly pear fruit and the sugar beet, is of opinion that in South Africa the sweet potato probably offers the best facilities for producing a raw material for the purpose. Particularly there is an extended belt of country between Riversdale and Humansdorp, an outside limit of nearly 200 miles, available for sweet potato culture and in view of the possibilities facing it, Dr. Juritz has prepared a valuable article, the first part of which we publish elsewhere in this issue, on the sweet potato and its cultivation, which will prove of great benefit to growers. In supplying the raw material for the manufacture of a cheap, industrial alcohol, the cost of production is a most important item; in the eastern sweet potato section of the United States the cost of production is given at £16. 10s. 2d. per acre (not including the cost of hauling to market), while in many sections of the southern States the corresponding cost would not exceed £8 per acre. Against this the produce of an acre has often realized as much as from £20 to £30. From information obtained from the largest grower of sweet potatoes in the Union, it is found that it costs him approximately £6. 12s. per acre, excluding costs of bags and cartage, cuttings, and manure. This farmer has obtained a yield as high as 16,000 lb. per acre, but the average Union yield, according to the 1918 Census is 3390 lb. For various reasons the latter figure is considered unduly low. Taking individual districts, we find that the average in Oudtshoorn was 7632 lb. per acre, while others produced an average ranging from 4600 to 5700 lb. The average in the United States is approximately 5340 lb. per acre.

The sweet potato is already used in other countries for the production of alcohol, and Germany offers a striking example of what can be done in this respect with the common or Irish potato and the ways in which agriculture benefited as a result. Dr. Juritz refers to this in his article. Altogether the author opens up a wide field of enterprise and his observations and advice, largely based on the information gleaned from a practical grower in the George district, will enable the farmer to acquaint himself with the economic and cultural aspects of the subject, preparing him to cope with such increasing demands for his product as may follow activity in the local manufacture of industrial alcohol.

Export of Maize: The 1919-20 Crop.

On the 19th August, 1920, the Controller of Imports and Exports called for applications for the export of 500,000 bags of maize or maize meal. On the 13th October he asked for applications for the export of a further 500,000 bags.

Allotments were made of 498,433 bags on the 9th and 10th September, 1920, and of 591,250 bags on 27th and 28th October, a total of 1,089,683 bags.

Of the first allotment only 25,000 bags went to the co-operative societies, and of the second allotment 250,000 bags. Of the total allotment of 1,089,683 bags, 275,000 went to co-operative societies.

According to the Railway Administration the following quantities were railed:—

> September, 74,551 bags; October, 211,383 bags; November, 160,566 bags; December, 105,116 bags; a total of 551,616 bags.

The Administration says that it was in a position to rail much more than these quantities, but they were not asked by exporters to rail more.

The following were the oversea and Johannesburg prices respectively, between May, 1920, and 6th January, 1921:—

	Oversea.	Johannesburg.
May, 1920	32s. 3d.—33s. 4d.	28s.—33s. 3d.
June, 1920	29s. 2d.—30s. 3d.	20s. 6d.—23s. 9d.
July, 1920	—	21s. 6d.—23s. 7d.
August, 1920 ...	32s. 3d.—33s. 4d.	19s. 3d.—21s. 6d.
September, 1920	33s. 4d.	21s.—22s. 6d.
October, 1920 ...	27s. 6d.	18s.—20s. 2d.
November, 1920 .	23s. 11d.	13s. 9d.—16s. 9d.
December, 1920 .	23s. 9d.	13s.—15s. 9d.
6th Jan., 1921 ..	—	12s. 9d.—13s. 10d.

It will be seen that prices dropped considerably and consistently since September, and that railings for export dropped similarly since October.

The Argentine is the biggest exporting country, and the price of maize in Europe depends almost entirely on Argentine production. The production of the Argentine and the Union in 1919 and 1920 was as follows:—

	1919.	1920.
Argentine	62,840,000 bags.	72,497,000 bags.
South Africa	11,598,000 bags.	12,327,000 bags.

There seems to be no doubt that this large increase in the Argentine production in 1920 over 1919, combined with increased shipping facilities, chiefly caused the decline in prices.

Of 814,683 bags allotted to private exporting firms, applications for railing 551,616 bags were made to the end of December, while the Railway Administration states that it was able and willing to rail at any time more than it was asked to do.

The system of permits for the export of maize was withdrawn on the 23rd November, 1920. Between 1st December, 1920, and the 31st January, 1921, the quantity railed to the coast for export was:—

Maize	292,207 bags.
Maize products	100,390 bags.
Total	392,597 bags.

Veld Burning and Overstocking.

It is not surprising that a matter of such moment to a pastoral country as the preservation of its pasturage should form the subject of much discussion and speculation by those whose prosperity depends principally on the vegetation of the veld. Indeed, it is strange that more serious thought has not been given to the proper study and investigation of the many problems connected with the veld which mean so much to stock raising in South Africa. As it is, veld burning for the purpose of assisting nature in replenishing the pasturage, a practice which has been in vogue since the early days of South Africa's history, has been discussed by generations of our farmers, and while some are convinced that the practice is beneficial, there are others again who strongly denounce it and join to their own experience the evidence seen in parts of the country, formerly covered, according to the writings of early travellers, with luxuriant vegetation, and now of sadly diminished stock-feeding capacity, due, so it is ascribed, to veld burning and overstocking, each producing subsidiary effects leading eventually to a changed vegetation.

The keen observation of the farmer has led to many shrewd theories on some of the problems which still confront us and on those which, happily, have now been solved, but on the subject of veld burning there is no general consensus, and the question is likely to be a vexed one until it has been thoroughly investigated in a scientific manner. It is pleasing to know, therefore, that a problem which has exercised the minds of our farmers for many years, and of which the solving will be fraught with incalculable benefits to the country, is now receiving the special attention of the Department, and the necessary research is being carried out by the Botanical Survey under the directorship of Dr. Pole Evans, Chief of the Division of Botany. The investigation is in progress, and two stages have already been reached in a series of experiments on veld burning which are being conducted by Dr. Phillips, of the Botanical Division. The results so far obtained are published (*a*) in the *South African Journal of Science*, Vol. XVI, January-March, 1920, under the title, "A Preliminary Report on the Veld-burning Experiments at Groenkloof, Pretoria," and (*b*) in Science Bulletin No. 17 (1920), "Veld-burning Experiments at Groenkloof" (Second Report).* Both articles are written by Dr. Phillips.

* Obtainable from this office, price 3d., prepaid.

In discussing the matter with Dr. Phillips, particularly the many opinions which exist as to the soundness or otherwise of the practice of veld burning, this officer states that when it is considered that the divergent views expressed are those of our most practical farmers, one is almost forced to the conclusion that there is more than an element of truth in the theories advanced by both sides. He points out that the work recently undertaken by Dr. Bews, in Natal, shows that the grass veld in some cases is only a stage in the succession to tree veld, which means that burning must be practised to keep back the succession in order to graze stock, while in other parts of the country the veld in its final stage is a grass veld, where the practice of burning may prove harmful. It is clear, therefore, that no general principle can be applied, and in the research now being carried out each area will need to be studied and investigated independently, and not until the response of the natural flora to external factors is thoroughly understood will it be possible to make any suggestion as to the proper treatment of each particular area.

There can be no doubt that when once the changes occurring in the veld through the various causes which operate in practical farming to-day are understood, it will be possible to control them, with the result that stock-farming in all its branches will advance considerably. The value of investigations on the natural flora of agricultural and pastoral countries is now being recognized, especially in America. In that country during the past decade the grazing value of farms has received attention and the areas have been divided into various grazing types, the maximum carrying capacity estimated, the results of overgrazing investigated, and suggestions put forward for the improvement of the grazing ranges. Dr. L. Cockayne, a well-known New Zealand Botanist, remarks: "If the reaction of a plant to the outer world be sufficiently known, it should be possible to so change the conditions of its environment that its frequency in an association could be so increased or decreased as its agricultural value may suggest." Dr. Cockayne has remarked also that "once the different classes of agricultural land are segregated for the next scientific process—intensive ecological investigations and experiment—then it can be truly said that the day of intensified national prosperity has dawned."

Equally important and allied to veld burning, is the question of stocking a farm to its optimum capacity, which we do not thoroughly understand, as no systematic and detailed work has yet been done to determine the effects of grazing by stock on the natural vegetation. The four kinds of stock usually handled, viz., cattle, horses, sheep, and goats, have not only a more or less definite preference for certain types of grazing, but the effects of their grazing differ markedly. It is patent, therefore, that in view of the various and diversified stock areas of South Africa the investigation of the problem opens up wide possibilities and calls for the most careful attention, and to this end the experiments now being conducted by the Division of Botany at Pretoria have been started. Arrangements are being made, also, for a similar series of experiments in respect of the different types of veld throughout the Union. When once the effects of burning and grazing are fully understood, suggestions will naturally follow as to the best methods of preserving and controlling the veld in such a way that it will yield its maximum grazing, and land

which has become poor or worthless grazing veld as the result of harsh treatment may then be restored to good pasture. Dr. Sim, in a recent paper on "Soil Erosion and Conservation," rightly points out that vegetation as a preservative covering is protective against (1) isolation, (2) drought, (3) radiation, (4) wind, (5) flood, and (6) donga formation. It is not an extravagant statement that in almost every problem which confronts the South African farmer to-day, the primary cause may be traced back to the native vegetation: it is the starting point at which all investigations must commence.

Now that we are on the road leading to a definite pronouncement on a matter striking to the roots of our pastoral system, we feel sure that the progress of the experiments will be followed by our farmers with the greatest interest. These experiments involve a great deal of research and studying of the many factors affecting the subject, and the data collected as the work proceeds will be published from time to time and reference made thereto in the *Journal*; farmers wishing to study the development of the experiments stage by stage should obtain the publications referred to above and those which will be issued by the Department in the future. It will be understood, however, that a matter requiring so much research and piecing together of evidence will be a lengthy process, and, while the Department will immediately make known any facts of practical use which its investigations may reveal as the experimental data accumulate, it is likely that considerable time will elapse before the final experiment is carried to a conclusion, when we shall be able definitely to decide upon the treatment of a problem which has remained unsolved for so many years.

Construction of Earthen Dams.

The story of irrigation enterprise in South Africa shows how the early methods of flood irrigation in vogue in the Cape Colony have given way to the need of securing a more secure supply of water during critical seasons of the year, and to-day conservation is the keynote of the Government's policy. In like manner the individual farmer requires his own conservation scheme, a matter of supreme importance and one calling for the consideration of many factors, each of which is essential to the success of the scheme. As a guide to farmers contemplating the construction of earthen dams, we publish in this issue an article on the subject by Mr. I. J. P. Kleyn, C.E., of the Irrigation Department, who, with the help of diagrams, points out the various factors to be observed and describes the progressive processes in the construction of a dam. One of the steps to be taken is, of course, the careful investigation of the proposed site for the reservoir, and it is here, Mr. Kleyn states, that expert advice may become necessary. The Government offers this assistance, and application forms may be obtained from the Irrigation Department, Pretoria, for use by any bona fide farmer who requires such assistance. The object of the article is to assist the farmer to a right appreciation of what should be done and much of what should be avoided, and will form a valuable addition to the existing information on a subject of such general interest in South Africa.

Currants: The Union's Deficient Production.

Are the climatic and economic conditions of Australia so much more favourable than ours that that country is able to grow currants and transport the product thousands of miles by land and sea to the heart of the Union in successful competition with the locally grown article? We think not, yet the Customs returns reveal the fact that the great bulk of the Union's supply of currants, a commodity of general and constant use, is obtained from Australia. The total quantity of currants recently imported into the Union was as follows:—

1918	179,819 lb.	Value £5891.
1919	1,214,914 lb.	Value £39,463.

Against these importations must be shown the quantity of the imported article sent out of the Union, mostly to adjacent territories such as South-West Protectorate, Portuguese East Africa, British East Africa, etc., amounting to 8143 lb. in 1918, and 13,674 lb. in 1919. Deducting these re-exported quantities, we find that the net importations into the Union representing our consumption of the imported currant was in 1918, 171,676 lb., valued at £5496; and in 1919, 1,201,240 lb., valued at £38,756.

We live in a country bountifully endowed by nature to raise the produce of the vine, yet our farmers are apparently content to lose a market at their doors worth nearly £40,000 in 1919, while at the same time our trade in currants with adjacent markets, which are surely the natural outlet for our own product, is largely met by re-exporting the imported article.

Our local production, and that not of the best variety of currant, is small. The 1919 census shows that for the year ended April, 1919, the output was 68,600 lb. At the valuation placed on our exports of locally grown currants, which is negligible in quantity, our 1918-19 production of currants was worth about £5000.

These figures will enable us to gauge the present dimensions of our market. The matter is worth the consideration of those sufficiently enterprising to take the opportunity of reaping the benefit of a local market for currants which is now supplied by a country thousands of miles distant. But a change in our methods is necessary before this can be attained. Our local production is almost entirely from what is known as the South African currant, whilst the article of commerce is obtained from the Zante or Grecian vine. This is the vine grown in Australia. It is a far heavier bearer than our small South African currant.

We make the suggestion, therefore, that a profitable enterprise in currant growing for the markets of the Union and adjacent territories, at least, awaits the grower in those parts suitable for the cultivation of the Zante currant vine. The vine is being propagated at this Department's Viticultural Experiment Station at Paarl, and cuttings are available for those wishing to take up currant culture. The Zante vine cultivation does not call for any special treatment, although it may be mentioned that in order to produce heavy crops it requires cincturing.

DEPARTMENTAL ACTIVITIES

January, 1921.

(NOTE.—The work of the several Divisions and Schools of Agriculture covers a wide range of agricultural industry in the Union, and we give hereunder notes and observations from certain of them treating with matters of special interest coming under their purview during the month. The object of these notes, which are not concerned with general routine work, is to inform the farmer of such matters as are calculated to be of interest and helpful to him at the present time.—EDITOR.)

THE DIVISIONS.

ENTOMOLOGY.

Locusts.—At the time of writing, 1st February, the brown locust, in all hopper stages, is present in great numbers over an extensive area of the Karroo, embracing more or less of the Graaff-Reinet, Aberdeen, Pearston, Jansenville, and Steytlerville districts. The outbreak is decidedly worst in the Graaff-Reinet district. These locusts are descendants of scattered locusts that occurred in the area a few months ago. For a time it seemed quite probable that the new generation would be only in trifling numbers, owing to the good work done with poison, supplemented by the depredations of birds. But, owing to the insects being so scattered, it was impracticable to forecast with any certainty what was in store; and almost the worst fears, not the highest hopes, have materialized. The present hoppers seemed disposed to gather into genuine swarms at first, but now to be spread out to so great an extent that the effective use of poison is difficult. However, along with the scattered individuals and small clusters, there are a great many real swarms, large and small, and these are being combatted energetically. Hundreds of drums of poison were rushed to the area by passenger train, and the farmers are proving themselves thoroughly progressive and public-spirited in their use of it. Many of the farms are of enormous size and much infested. One holding of 80,000 acres is reported to be overrun with the pest to about one-quarter its extent. In coloration the insects are variable, having some protective resemblance to their environment as we now recognize to be normal in individuals of this species of locust when not bred in true swarms. Senior Locust Officer F. Thomsen is in the Karroo to exercise general oversight over the locust work there on behalf of the Division. The several magistrates concerned are ably doing their part to make the work successful; and they have been very fortunate in having men of tact, energy, and ability as locust officers. J. H. Smith is the district officer for Graaff-Reinet and P. Theron and J. A. Watermeyer local officers. A. E. Lee is the district officer for Jansenville and W. Musto a local officer. G. T. Graham is district officer for Pearston, and J. P. Terblanche the district officer for Steytlerville. White storks are said to be giving important assistance.

Stinksprinkhaans: From reports reaching the Division in January there seems to be a general recrudescence of the elegant grasshopper in the Transvaal and elsewhere, and this insect may be even more troublesome next summer in areas that have been relatively free during the past few seasons. From Basutoland we learn of an unusual abundance of a large green locust of the foetid group (*Phymatius leprosus*). Regarding it the agricultural officer, Mr. L. F. Wacher, writes: "This insect has been clearing gardens in the south of Basutoland and doing a good deal of damage. . . . It has been reported to me that in certain parts this insect is moving down from the hills and eating the leaves of pumpkins and peach trees." Concerning the same insect, Mr. C. E. Maitin-Casalis, of Ladybrand, Orange Free State, writes, in effect: "This locust is very destructive, this year at all events. This farm is on the border, and apparently the locusts have come over from Basutoland. Here they have done little or no damage. They are for the present confined to a small kloof, and are to be found on small dense bushes which grow there. As soon as they are attacked, they resort to the simple and very safe expedient of bolting to the base of the bush. At various trading stations in Basutoland and in certain gardens in Maseru they have not only destroyed all vegetables (lettuce, cabbage, peas, beans, etc.), but have also attacked fruit trees. I have seen them feeding and afterwards there was nothing but peach stones remaining on the trees."

Wooly Aphis Parasite.—Very satisfactory progress continues to be made by the Division in its efforts to establish the Woolly Aphis parasite, *Aphelinus mali*. The Senior Entomologist, Capetown, reports that the colony he started in a Stellenbosch apple orchard is doing splendidly, and colonies placed in and around Pretoria are also flourishing. During January liberations were made in and near Johannesburg and at Middelburg, Standerton, Heidelberg, and Ventersdorp, Transvaal Province, and at Clocolan, Orange Free State. Out of doors, the period from giving newly emerged adults opportunity to breed to the time their first progeny begin to appear on the wing has proved to be only about 21 days in December and January. It is, therefore, evident that when and where conditions are favourable, the insect can multiply with extraordinary rapidity. Some colonies have been reared in bell jars at the laboratory and these have been kept warmer at night than were the out-of-door colonies. The development of the insect is evidently greatly accelerated by such circumstances, for in two generations in succession the life-cycle in the jars has required only 10 to 13 days.

Cotton Insects.—During the last week in January Entomologist Geo. C. Haines accompanied the Chief of the Tobacco and Cotton Division on a tour of inspection of cotton fields in the bushveld of the Rustenburg District. On the whole the general condition as to insect pests was good. As usual, bollworms were the most serious, but the average percentage of infestation was very low, about 5 per cent. Ratooned fields uniformly showed a higher infestation than first-year fields, some having fully 25 per cent. of the bolls infested. On the whole, the Sudan bollworm predominated, but the American bollworm was decidedly the more prevalent in some fields. The spiny bollworm was found in most fields, but nowhere as abundant as the

other species. A few other pests were noted, but no instance of material damage by any of them. It was noticed that there seems to be an inclination toward more thorough cultivation methods. Good cultivation and thorough preparation of the land before planting are to be encouraged, as they do much toward keeping the bollworm in check. The Division of Entomology is continuing the investigation of cotton pests; and this work includes observations on the effect of cultivation methods on bollworms and experiments on the control of bollworms by dusting with arsenate of lead.

January Insect Troubles.—During the month of January letters have been received and dealt with by the Pretoria office of the Division of Entomology upon the following pests and matters appertaining to insect control. *White ants*: Destroying thatch, young gum trees, willow wood, and citrus trees. *Cotton insects*: Giant crickets, millipedes, and slugs destroying seedling plants; caterpillars mining in foliage; caterpillars feeding on foliage; Sudan bollworm. *Maize insects*: Black beetles (*Heteronychus arator*); ants destroying seeds planted in black turf. *Orchard insects*: Codling-moth; pernicious scale; chafer beetles (*Cetonids*); elegant grasshoppers; fumigation for scale insects. *Field crop insects*: Tomato erinose due to mite attack; small cabbage moth; plant bugs on beans; caterpillars of death's head moth on potatoes; fly maggots (*Dacus*) in pumpkins; caterpillars on peas; melon aphis; veld grasshoppers; elegant locusts; stinkvlieg. *Flower-garden insects*: Beetles destroying sunflowers; tortoise beetles on convolvulus; elegant locusts destroying carnations; scale insect on orchid; Australian bug on broom; mealy bug on fern; tip-wilter bugs; cockchafer grubs on roots. *Miscellaneous*: Bee pirates; hunting spiders; beetle larvae in imported oil cakes; pepper trees as harbours for insect pests; bowling green troubles; weevils in grain; uses of carbon bisulphide; sodium fluoride and fowl lice; cockroaches; tampans in dwelling houses; chafer beetles (*Adoretus*) and processionary caterpillars on wattles; robber flies; borers in poles; giant scale (*Aspidioproctus*) on cassia roots; scale (*Chionaspis globosus*) on euphorbia.

CO-OPERATION.

January was a quiet month with the co-operative agricultural societies. At this time of the year the disposal of the maize and wool crops is the main business engaging the attention of the directors. The recent marked decline in prices has made this a difficult matter, more especially as, following on the glowing results attained by societies last season, many new members have joined, and a record quantity of maize was delivered at the stores.

This Division is extending to societies what help is possible in the matter. General inspections have been carried out by officers of the Division at several places.

In response to a long-felt need, a Union Bill to provide for the formation and management of both consumers' and producers' co-operative societies and companies throughout the Union is now being prepared. Arrangements are being made for a general conference of all co-operative organizations in the Union to discuss the Draft Bill.

VETERINARY EDUCATION AND RESEARCH.

The inoculation of the first batch of private horses against *horse-sickness*, referred to in our last issue, has passed off very successfully; 108 horses, belonging to 48 owners, were accepted for inoculation, and *two* only died as a result of the inoculation. This is considered extremely satisfactory, and it is hoped that future tests will pass off equally well.

In this connection a few interesting facts may be recorded. The conditions under which horses are accepted for inoculation state very definitely that horses showing any sign of an infectious disease will be returned to the owners. In spite of this, no less than 77 of the 108 horses were affected with mange and about 90 per cent. of the total number carried ticks, some of them being literally covered with these parasites. In its dealings with farmers, this Division has always been particularly anxious to give no cause for complaint. In some instances, however, where a farmer thought he had a grievance against any officer of the Division, very full use was made of the opportunity of censuring the Department. But here we have an instance where the Division has every reason to be dissatisfied with the treatment it has received at the hands of the farmers. In some cases the owner may have been unaware of the fact that his animals were infected with mange, but many cases point to gross negligence.

It is not in a spirit of retaliation that these facts are recorded here, but rather with the idea of warning owners who intend sending horses for future inoculations. Naturally these horses cannot be stabled separately; they all stand together in one or two large stables. It is therefore impossible to prevent clean horses from getting in direct or indirect contact with infected ones. If such horses are returned to the owners infected with mange, the blame will probably again be laid on the Government!

The very serious outbreak of horse-sickness in the Herbert district, mention of which has repeatedly been made in the papers recently, was investigated by this Division. The point at issue was whether it was actually horse-sickness or possibly some other disease. A private veterinary surgeon who examined a few cases expressed the idea that it was pernicious (infectious) anaemia. An officer of this Division was sent to investigate the matter, and further tests were then carried out at this laboratory. As a result of these experiments, it can now be stated definitely that there is absolutely no doubt that the disease is horse-sickness. The investigations (that are still in progress) seem further to prove definitely that it is horse-sickness *only*.

The *anthrax spore vaccine* has now been issued in very large quantities. In a small percentage of cases complaints came in about the swellings already referred to. Some owners also complained of the fact that dairy cows yielded less milk for some days after inoculations. Steps have been taken to reduce these occurrences to a minimum. Many farmers who used the spore vaccine wrote to the laboratory testifying to the very good results. In some instances, animals that actually showed signs of anthrax at the time of inoculation are reported to have recovered. In other cases, where very serious outbreaks had occurred on farms, deaths stopped two or three days after inoculation.

VETERINARY.

Anthrax.—With a view to strengthening the hands of the Government in its campaign against the spread of anthrax, the subjoined regulation, providing for the reporting of all deaths of cattle and the proper disposal of the carcasses, has been approved and is now in force:—

(*a*) It shall be the duty of any owner or person in charge of stock travelling along any public road to immediately report any case of illness or death of any cattle from any cause whatever to the magistrate, Government veterinary officer, or justice of the peace of the district, area, or ward, or at the nearest police station or police post, and to the resident, owner, or occupier of the land on which the animal or animals may have died or been left behind on account of any sickness. Such report made to a magistrate, Government veterinary officer, justice of the peace, or at a police station or police post shall be made in manner provided by paragraph 1 of Minister's Orders, published under Government Notice No. 637 of 1915 and Section 15 of the regulations issued under Government Notice No. 638 of 1915, and all and several the provisions of such regulations shall *mutatis mutandis* and in so far as applicable apply in respect of such report and of the steps to be taken thereupon.

(*b*) The owner or person in charge of such stock shall be responsible and liable for the proper burial or destruction of such dead animals or such animals as may be sick and subsequently die upon the farm.

Any contravention of or failure to comply with these regulations will render the owner or person in charge of the stock liable to the penalties provided under section *twenty-one* of the Stock Diseases Act and for any loss or expense which the resident owner or occupier may incur through such non-compliance.

East Coast Fever.—In the Pietersburg District the disease is considered to be so well in hand that arrangements have been made to permit cattle to be moved to the open markets from the western portions of the district, and it is hoped shortly to be able to open a large tract of the Zoutpansberg. In the Piet Retief and Barberton Districts satisfactory progress is being made, but the Pretoria District still remains a menace to the surrounding districts, the majority of stock owners still being unconvinced that the tick is the root of the evil and consequently the erection of dipping tanks progresses slowly. The Transkei has had a disconcerting outbreak in the Elliotdale district, which has been clean for over two years, but as the district is well tanked, it is hoped that the outbreaks will be promptly overcome.

Horse-sickness.—Most serious losses from horse-sickness have been taking place for the past few months in the Kimberley, Modder River, and Douglas areas. Many owners who suffered losses from the disease have expressed the opinion that it was not horse-sickness, but both the Government Veterinary Officer and the officer from the Research Laboratory who investigated the outbreaks declare the disease to be horse-sickness.

DAIRYING.

The position of the dairy industry did not undergo any marked change during January, and the output of butter and cheese by creameries and cheese factories has hardly increased to the extent anticipated at the end of last year. Natal factories are doing fairly well, but drought is still severe in the dairying districts of the Orange Free State and Cape Province. There is, however, still time for a considerable improvement should good rains fall during February, as in several previous years March and April have been two of the best months for the creameries in those areas. But in any case there is not likely to be any considerable quantity of either butter or cheese available for export this season.

Export.—The Imperial Government have, as a result of representations made to the Ministry of Food, agreed to advance the price of this season's South African butter to 257s. per cwt. (112 lb.) f.o.b. for first grade, and 252s. per cwt. (112 lb.) f.o.b. for second grade. These prices, however, only apply to butter delivered into cold storage at Durban or Capetown on or before the 31st March, 1921. It is understood that the Government control of butter in Great Britain will cease as from the 1st April, 1921, and after that date any butter shipped there will be sold on the open market at competitive prices.

A cable has been received from London intimating that the Imperial Government are now buying first quality Argentine butter at 200s. per cwt. f.o.b., and Danish at 266s. per cwt. f.o.b. Very heavy supplies are being received from Australia and New Zealand, and in view of these facts, it is reasonable to suppose that butter shipped to the open market subsequent to the end of March will realize considerably lower prices than those at present offered by the Imperial Government.

The market for cheese has been released from control for some time, and the latest information received indicates that prices are somewhat lower, being in the neighbourhood of 150s. to 156s. per cwt. for large size and 144s. to 154s. for the smaller sizes.

Cheese factories having in view the export of their surplus stock, should bear in mind that the size of cheese required by the oversea market is from 70 to 90 lb. each, and higher prices are obtainable for such sizes, than for 25 to 40 lb. cheeses, which are most popular in our South African markets. It should also be remembered that either a deep colour, or white cheese, is required, and not a light-coloured one, as desired here.

Gouda Cheese.—Very large quantities of South African Gouda (or sweet milk) cheese are at present being manufactured, principally in the Transvaal and Orange Free State, from milk which may be described as "surplus" produced by farmers supplying fresh milk to the towns, but who at this time of the year have more than is needed for their contracts. This has resulted in a fall in the price of this commodity, and there would appear to be some danger of the market being flooded. This type of cheese, as made under South African conditions, is hardly suitable for export, while the cost of placing it in cold storage for sale during the winter is likely to eat up all profits, unless the factory has its own cold storage. It is suggested, therefore, that factories making Gouda should consider turning at least a portion of their milk into cheddar, which stands storing longer, and is more suitable for export.

Milk Records.—The official milk record scheme supervised by this Division has been strengthened by the Ayrshire, Shorthorn, and South Devon Breeders' Societies taking part on the basis, and under the same conditions as the Friesland Breeders' Association. The value of the scheme has been very much emphasized by the visit to South Africa of Mr. Trevor Williams, ex-president of the British Friesian Association, who is touring the country in connection with the contemplated export of Frieslands to Great Britain. In the event of export being arranged, it is understood that only animals, or the progeny of animals, which have produced a fixed standard of milk, containing a minimum percentage of butter-fat officially certified, would be accepted. It is obvious therefore that breeders who are not in possession of official records of their cows would be debarred from exporting.

BOTANY.

During December Dr. Pole Evans visited the Tygerberg district in connection with the death of horses which was suspected of being due to some plant poison. He also visited Bredasdorp on account of a suspected outbreak of lamziekte in sheep.

The Pathological Section reports the occurrence of a large number of fungous and bacterial diseases in the vegetable and fruit crops. "Blossom end rot" in tomatoes has been unusually severe in certain localities, in particular Pretoria, and is attributed to unfavourable weather conditions. So far as is known the trouble is not due to any disease organism, but to physiological causes and can be controlled to a large extent by regular irrigation and the selection of varieties of tomatoes resistant to the disease.

Other diseases of economic and special interest recorded include "mildew" and *Exobasidium vitis* on vines (the latter a rare disease in this country), peach freckle on apricots, walnut blight and bacterial diseases of peas, beans and tobacco. Several interesting mycological specimens were received, in particular three new ergots occurring on native grasses near Capetown. It is hoped that these may prove of some economic importance as a substitute for the rye ergot (*Claviceps purpurea*) if they are found to occur in sufficient quantities. The widespread occurrence of the myxomycete, *Physarum cinereum*, during the month of January is also of considerable interest. It has been reported from several parts of the Union and Rhodesia on grass and on lucerne, and has been suspected of being injurious to young stock. So far as can be ascertained, however, it is harmless in this respect, although it may cause some damage to the grass and lucerne on which it grows, by injury through causing suffocation. The organism is not a parasite and does not cause direct injury to the plants on which it grows.

Several phalloids—rather rare fungi—were found during January, including *Lysurus borealis* in a potato patch in Johannesburg. This is only the second occurrence of this fungus recorded in the mycological herbarium.

A tobacco disease occurring in the Piet Retief District and known to farmers as "verterende roest," was brought to our notice by the Chief of the Tobacco and Cotton Division. An officer of this Division was detailed to investigate the matter; the disease starts in the lower leaves which at first appear to be maturing prematurely, and spreads

to the upper leaves. The disease was prevalent on the experiment station as well as on neighbouring farms, and it was stated that only 10 per cent. of the 1920 crop reached its normal development, the remaining plants being stunted. Considerable losses had also been suffered on other farms which were visited. The "verterende roest" is due to a bacterium which is being carefully studied in the laboratory, with a view to devising preventive measures which may be tested on a practical scale next season. Specimens of tobacco affected by a similar trouble have also been received from Rhodesia; these are also under investigation.

In the *National Herbarium* the study of the thorn pears (*Scolopia* spp.) has been completed and an account of this genus is ready for publication. A collection has been made of the *Trifoliums* growing at Groenkloof, and these have been sent to Kew for accurate identification.

The *Agrostologist* supplies the following interesting note on the nomenclature of kikuyu grass: "We received last mail an answer to a letter addressed to Mr. Stapf on the subject of kikuyu grass, which appeared to have been wrongly named at Kew. I wrote suggesting that the grass was *Pennisetum inclusum*, Pilger, and at the same time sent a specimen of a *Pennisetum* which had been collected on a vacant erf at Brooklyn. Mr. Stapf replied that after re-examination of the material of kikuyu and of related species he had established the fact that kikuyu grass was not *Pennisetum longistylum* as he had previously supposed, but was *P. inclusum*, Pilger; however, as the grass had been previously described under the name of *P. clandestinum*, kikuyu must henceforth be known scientifically under that very appropriate name. The grass collected at Brooklyn is an entirely new introduction, *P. villosum*, nearly related to kikuyu grass. It is a North African grass, which is much cultivated in Europe as an ornamental plant in gardens, and has probably been introduced mixed with other grass seed. It is reported as a good fodder grass and may be of economic value in this country."

There has been a great deal of correspondence during the month on the subject of impurities in lucerne seed. Samples submitted were found to contain a variety of impurities, amongst which was the seed of the goosefoot (*Chenopodium*), a weed which has caused considerable trouble in the lucerne crop.

THE SCHOOLS OF AGRICULTURE AND EXPERIMENT STATIONS.

GLEN, ORANGE FREE STATE.

Owing to the prolonged and continuing drought, the variety trial test with the maize has failed entirely, and a great many experiments planned have not been laid down.

The school opened on the 24th January. The number of students enrolled being as follows: Juniors, 16; seniors, 29; one-year practical, 3; total, 48.

In addition, fifteen students, all well qualified, have been accepted for the special course in dairying, commencing on the 15th February.* Several applicants for this course had to be refused on account of lack of accommodation.

*See note under "Grootfontein" in this section.

ELSENBURG, MULDERS VLEI.

Purchase of Fertilizers.—The present condition of the market for fertilizers is still far from normal, and there exists considerable discrepancy between the agricultural value and the commercial value of many fertilizers. In the statement of the guarantee which accompanies any fertilizer frequently no mention is made of the quality of the ingredients of the same kind in different fertilizers, so that the farmer has often to pay top price for material that is very insoluble and slow in its action. Further, the purchaser should take into account the state of fineness of the ingredients in those fertilizers where the constituents are of a nature insoluble in water. In such fertilizers as basic slag, bone meal, and bone dust the availability of the phosphoric oxide increases with the fineness.

At present the bulk of the fertilizers on the market are mixed or compound, hence the importance of the statement of the quality of the valuable constituents. For many reasons farmers have had to fall back on these fertilizers, which supply in greater or less degree most or all of the ingredients that the crop requires. The fault with regard to most of these mixed fertilizers is that no attempt has been made to compound a mixture suitable to the soil or crop.

It is usually advisable that the farmer should purchase the necessary ingredients and mix them himself or get a reliable fertilizer merchant to compound the mixture according to his specification. The farmer ought to know the manurial needs of his land better than the fertilizer merchant, and if he is not certain on the point, he can get reliable information from the agricultural school in his area. It is usually more economical for the farmer to mix his own fertilizers, as there are often slack periods when the farm labour could be turned to this work, thus saving the farmer the charges, sometimes very heavy, that the merchant makes for mixing.

In making up these mixed fertilizers, it is very necessary that all the materials should be in a fine condition and possess as nearly as possible the same degree of fineness. If heavy, finely ground material is mixed with light, coarsely ground material by the merchant, they may become almost entirely separated in transit to the farm. This would give a fertilizer very uneven in composition and consequently in its action on the crop, since all the coarse material tends to work to the top of the bag and the fine stuff to the bottom.

If the farmer makes up his mixed fertilizers on the farm the different materials should be thoroughly mixed in small quantities. Any lumpy materials should be sifted before mixing and the mixed material should be sifted and lumps broken up before bagging.

In some commercial mixtures and in most mixtures that the farmer would make up, superphosphate would be one of the ingredients. This fertilizer can be mixed with bone dust, bone meal, or guano and produce no serious loss unless the mixture is allowed to lie for a long time, or the store is damp. This mixture on many of our sour soils is preferable to superphosphate alone and a further advantage is that it is easier to sow than superphosphate owing to its drier condition.

Superphosphate should not be mixed with ground rock phosphate or basic slag, because this mixture renders the water-soluble phosphate of the super less soluble and slower in its action. Farmers do sometimes use a mixture of superphosphate and slag to counteract the acidity of the superphosphate, especially when used on light sour soils, but bone dust is certainly preferable to slag for mixing with superphosphate.

Superphosphate should not be mixed with nitrate of soda, as apart from the loss of nitrogen, the mixture soon gets pasty and difficult to sow. It can be mixed with sulphate of ammonia, but at present the price of sulphate of ammonia and nitrate of soda is prohibitive and their use is limited to special purposes.

In purchasing fertilizers, the farmer must make up his mind what ingredients the crop requires on his particular soil, and then find where he can get these at the cheapest rate.

From a knowledge of the percentage amounts of the valuable constituents in a fertilizer and its market value, it is easy to calculate the cost of the actual valuable ingredient "per unit," i.e. the value per ton of each per cent. For example, if phosphates in the water-soluble form are required and the following quotations are obtained—

Superphosphate.	Water Soluble P_2O_5.	Price per Ton.
No. 1	15.2 per cent.	£10 5 0
No. 2	18 per cent.	11 10 0
No. 3	17 per cent.	15 10 0

the value per ton of each per cent. of the required constituent, i.e. the value per unit can be calculated by dividing the price per ton by the percentage of material in the fertilizer, i.e.:—

No. 1, $\frac{£10.\ 5s.}{15 \cdot 2}$ = 13s. 5d. per unit: No. 2, $\frac{£11.\ 10s.}{18}$ =12s. 9d. per unit; No. 3, $\frac{£15.\ 10s.}{17}$ = 18s. 3d. per unit.

By comparing the above unit values, No. 2 is seen to be much the cheapest; if the three are f.o.r. the same station it has the further advantage of being high grade, and thus less expensive in transit to the farm.

At present the unit values of citric-soluble phosphoric oxide in basic slag vary from 13s. 4d. to 16s. 4d., a very wide range in the market value.

In the purchase of bone meal and bone dust, etc., the fineness must be taken into account when comparing the values, as well as the amounts of the different constituents present. Here we are dealing with fertilizers containing nitrogen, phosphoric oxide soluble in 2 per cent. citric acid and phosphoric oxide which is insoluble. The phosphoric oxide is sometimes expressed as lime phosphate, which to the uninitiated gives the fertilizer an inflated analysis, but the farmer should take no notice of this figure, as it simply represents the chemical combination of the phosphoric oxide with a portion of the lime, and is arrived at by multiplying the real percentage of phosphoric oxide by 2.

The nitrogen in bones costs about 20s. per unit at the present time. Citric-soluble phosphoric oxide costs about 8s. 6d. per unit.

Insoluble phosphoric oxide costs about 4s. 3d. per unit. With these unit values the following two bone meals may be compared:—

No. 1 BONE MEAL:—

Analysis—

Nitrogen.	Phosphoric Oxide Soluble in 2 per cent. Citric Acid.	Phosphoric Oxide Total.
5·3 per cent.	16·5 per cent.	18 per cent. quoted at £12. 10s. per ton.

Calculation—

Nitrogen 5·3 × 20s.	£5	6	0
Phosphoric Oxide soluble in 2 per cent. Citric Acid 16·5 × 8s. 6d.	7	0	3
Phosphoric Oxide insoluble (18:16:5) 1·5 × 4s. 3d.	0	6	5
	£12	12	8

This sample is therefore quoted actually at 2s. 8d. under its market value.

No 2 BONE MEAL:—

Nitrogen.	Phosphoric Oxide Soluble in 2 per cent. Citric Acid.	Phosphoric Oxide Total.
4 per cent.	20 per cent.	22 per cent. quoted at £14. 10s. per ton.

Calculation—

4 per cent. Nitrogen at 20s.	£4	0	0
20 per cent. Phosphoric Oxide soluble in 2 per cent. Citric Acid, at 8s. 6d.	8	10	0
22–20 = 2 per cent. Phosphoric Oxide insoluble. at 4s. 3d....	0	8	6
	£12	18	6

This fertilizer is therefore quoted at £1. 11s. 6d. above its actual value, so that No. 1 is much the cheaper.

In conclusion we would remind farmers of the necessity of having their fertilizers analysed especially in the case of basic slag which is at present very scarce, of variable composition, and very liable to be adulterated.

GROOTFONTEIN, MIDDELBURG (CAPE).

The Special Dairy Course.—The course commenced on 1st March and finished on 14th December; the two previous courses being each of six months only. Many applications were received for this course, but owing to lack of facilities and accommodation, only twelve could be accepted. The course was especially arranged for men who desired to become factory managers, and included lectures and practical work in dairying, dairy chemistry, dairy bacteriology, engineering, book-keeping, and animal husbandry. Upon completion of the course at the school, the candidates are required to perform at least six months' work in factory dairying and management at an approved butter or cheese factory. At the conclusion, if their work has been of a satisfactory nature, they undergo an examination in these subjects, this examination being conducted by the Dairy Division.

Unfortunately, owing to the prolonged drought, little practical work was possible and consequently the 1920 course was, in the main, a theoretical one, the major portion of the time being devoted to lectures.

By courtesy of the management of the Tweespruit Dairies and the Bloemfontein Creamery, the students were allowed to see the working of a butter and cheese factory under commercial conditions; and were further given an opportunity of making cheddar and Gouda cheese, and also practice in cheese and cream grading. Such visits are of great educational value to the men, and this opportunity is taken of thanking Messrs. Fischer and Dalldorf for making the trip the success it undoubtedly was.

The final examinations began on 1st December, and the results are as follows:—

Diploma, with Honours.—G. Pote.

First-class Diploma.—R. T. St. George, A. Jones, W. Dalldorf.

Second-class Diploma.—G. Lake, C. G. Taylor, P. van der Merwe, A. Morton, C. S. van der Walt.

Eight of the men have already begun their practical work in the various factory dairies.

There can be no doubt that these courses are of immense value not only to the men who attend the course, but to the dairy industry, since the trained man can assist the farmer by giving him technical advice which brings benefit to both producer and consumer.

The dairy course will be held this year at the School of Agriculture, Glen, Orange Free State, commencing on the 15th February.

CEDARA, NATAL.

Experiments with New Varieties of Sugar Cane.—The first six varieties dealt with in this investigation are those introduced about two years ago from the Argentine Republic by the Natal Sugar Association. These were planted out on the Winkle Spruit Experiment Farm on 7th November, 1918, and harvested on 8th December, 1920.

All the Argentine varieties made very vigorous growth and compared well with the stands of Uba and other varieties growing in the immediate vicinity of the plots. All these varieties of cane, however, were more or less inclined to lodge, although they were raised in a well-sheltered spot on the farm. The plots were comparatively small, so no undue importance should be attached to the figures in the following tables giving the yields per acre for each variety, but the figures are sufficiently accurate to warrant the statement that each variety is a good cropper. Since these Argentine canes have been harvested it has been observed that they are all ratooning fairly well.

The cane known as Agual is about the only one left of the nine varieties imported from India in 1911. It seemingly belongs to the same group as the Uba, and like the latter thrives very well indeed under local climatic conditions; it ratoons well, does not lodge, and is not subject to attack by the "borer" insect.

The Cheribon cane is one of the three varieties received in March, 1909, from Egypt, and is the only one that thrived sufficiently well

to make it worth while to keep it on permanently. This cane lodges rather badly, but ratoons better than the ordinary soft varieties of cane that have been tried from time to time at Winkle Spruit.

1. *Yields of Sugar Cane per Acre from the various Plots.*—All the crops given in this table are from plant canes which had been in for approximately two years before being harvested:—

(1) Argentine: J.213 ... ... 52 tons.
(2) Argentine: No. 2 ... ... 45 tons.
(3) Argentine: R.G.719 (first lot) ... ... 60 tons.
(4) Argentine: R.G.719 (second lot) . ... 41 tons.
(5) Argentine: J.36 ... ... 39 tons.
(6) Argentine: J.139 ... ... 37 tons.
(7) Egyptian: Cheribon ... ... 41 tons.
(8) Indian: Agual ... ... 51 tons.
(9) Uba ... ... Over 30 tons.

(2) *Yields of Sugar from the different Varieties of Sugar Cane.*—In this investigation six typical canes were selected from each plot and weighed. Each lot separately was then passed three times in succession through a hand-power three-roller laboratory cane mill, and all the juice carefully collected, weighed, and then analysed. The results obtained are given in the following table:—

No.	Variety.	Percentage of Juice by Mill.	Composition of the Juice in lb. per gallon.			Glucose Ratio.	Quotient of Purity.
			Sucrose.	Glucose.	Solids not Sugar		
		per cent.	lb.	lb.	lb.		per cent.
1	J. 213	57·0	1·76	0·01	0·17	0·65	90·6
2	No. 2	59·9	1·82	0·01	0·23	0·65	88·4
3	R.G. 719 (1st Lot) ...	65·4	1·65	0·01	0·46	0·74	77·6
4	R.G. 719 (2nd Lot) ...	58·1	1·75	0·01	0·22	0·63	88·6
5	J. 36	65·1	1·74	0·01	0·38	0·68	81·7
6	J. 139	65·9	1·76	0·01	0·34	0·64	83·4
7	Cheribon...	70·6	1·86	0·01	0·12	0·60	93·6
8	Agual	56·9	2·01	0·01	0·16	0·72	92·1
9	Uba ... ... Harvested in 1913	61·0	1·90	0·04	0·19	1·98	89·2

In the above table the following terms may require some explanation:—

Sucrose.—This is the crystallizable cane sugar.

Glucose.—The uncrystallizable sugar, which is all left in the molasses.

Solids not Sugar or Non-Sugars.—These are the soluble solids, other than sucrose and glucose, contained in the juice. The sum of the sucrose, glucose, and non-sugars in the juice is known as the total solids.

Glucose Ratio.—The proportion of glucose in the juice to every hundred parts of sucrose.

Quotient of Purity.—The proportion of sucrose to every hundred parts of total solids in the juice.

With regard to the composition of the juice obtained from each of these varieties, no safe comparison can be made with the results obtained from the unmanured plots of Uba (fourth ratoons) harvested in 1913, seeing that the conditions as regards climate, soil, period of growth, etc., would be different. We are, however, fairly safe in assuming that the quality and purity of the juice from each of the varieties does not differ very greatly from that obtained from the Uba, and since the yields of cane are probably in most cases higher than from the Uba, it is safe to state that the amount of sugar obtainable per acre compares favourably with the amount from the latter and standard type of cane.

POTCHEFSTROOM, TRANSVAAL.

School.—The term commenced with lectures on 19th January. The number of students enrolled up to date is 84 and all available accommodation is now taken up. There are 31 second-year diploma students and 41 first-year diploma students in Hostel No. 1; 12 one-year soldiers' course in Hostel No. 2; total, 84.

Sudan Grass vs. *Teff in Dry Seasons.*—The month has proved an extremely dry one, resulting in the loss, as grain crops, of those fields of maize sown in November. It has been found practically impossible to establish fields of teff in this and the preceding month. One field was sown partly to teff and partly to Sudan grass in December. A good stand was obtained from the Sudan grass, but the teff was a complete failure. Although this portion of the field was resown to this crop later, at the time of a light shower, the results were again negative. The whole field was sown, in consequence, with Sudan grass at the end of January. On the experiment division, Sudan grass planted on the same piece of land and at the same time as teff in December produced a good stand; while the stand of teff was very poor. These experiences confirm our knowledge of the relative value of Sudan grass, in comparison with teff, as a hay crop in dry years and for dry localities.

Sorghum vs. *Maize and Cowpeas* vs. *Soya Beans in Dry Seasons.*—On the experiment division cowpeas have shown a far greater degree of drought resistance than soya beans. Incidentally the variety trials of sorghums (kaffir corns, etc.) and maize have illustrated the drought-resistant qualities of the former. The sorghums have made a very vigorous growth and have apparently not suffered from the drought. Turkestan and Jap Panicle (Proso & Broom) millets have shown a remarkable drought resistance compared with other varieties. Birds have shown a marked preference for the Panicle millets as compared with the Foxtail, Barnyard, and Pearl millet types.

Winter Cereals.—Threshing of winter cereals has been completed and the results in general are very satisfactory. "Rate of sowing" trials, run in duplicate with the Indian variety Lalkasarwali, showed that the quantity of 45 lb. of seed per acre was the best amount sown in this season. The quantities sown were the following: 30, 45, 52½, 60, and 75 lb. per acre. The crop was irrigated three times.

CO-ORDINATION OF THE DEPARTMENT'S WORK.

An Important Conference.

A CONFERENCE of great importance to the Department, and the result of which is likely to serve as a plan of its future development, took place at Pretoria on the 26th, 27th, and 28th January, 1921, when the heads of divisions and principals of the schools of agriculture and experiment stations met at the instance and under the chairmanship of the Secretary for Agriculture, for the purpose of discussing the relationship between the work of the divisions and that of the schools.

The organization of the Department to-day is well known to farmers. Under the direction and control of a permanent secretary, it is composed of a number of technical divisions and schools of agriculture, the latter also serving the purpose of experiment stations, while attached to certain of the divisions is also a number of experiment stations. The history of the evolution leading to the present composition of the Department need not be traced here. It is sufficient to say that the most pressing needs and problems of the country were the compelling factors in the establishment of the various divisions and schools as they exist to-day. Those responsible for the building up of the Department had before them the example of other countries with the different systems adopted by them, and while in this respect the famous system of the United States enters largely into the plan fashioned for the Union's Department of Agriculture, there are problems peculiar to South Africa to which the experience of other countries is not applicable; consequently, like other countries, our Department must develop along lines best suited to our extremely varying conditions, and so work out its own salvation. South Africa's unified system of Government, under which authority is exercised from a single centre, is favourable for effective organization. To aid us in surmounting our present problems, which are many, and also new ones arising with the expansion of the country, we possess both our past experience and the example furnished by other countries, which will enable us to organize according to a definite design and so to cope with our expanding needs. The conference was, therefore, important, for arising from it certain broad lines of organization were agreed upon, and it is confidently hoped that upon this foundation will be built an enduring structure.

The Department as constituted to-day has involved the establishment of the several divisions and schools; and to obtain the greatest economy and co-ordinate all effort and activity, it is essential that their duties should be so arranged as to avoid unnecessary overlapping and ensure development on right lines. The diverse and numerous activities of the Department present an intricate webwork of organization, and the proper control and guidance thereof calls for the greatest care and foresight. It is gratifying to state, therefore, that a free discussion marked the conference, and agreement was

arrived at on the main issues. Some of the chief points discussed are set out hereunder; they indicate the guiding principles which will be followed in directing the future development of the Department.

Co-ordination of Research.—The great vitalizing factor in the Department is the nature and scope of its research work. From it emanate the life and growth of its activities. At present research is carried out both by the divisions and the schools. It is recognized that the value of the teacher is intimately bound up with research, enabling him to have at his command a knowledge of the latest developments in the science he has to teach. The lecturers at the schools deal, of course, with many different sciences. In most cases also there are divisions, each of which deals with a specific science, and at the head of which are the country's leading experts in their respective subjects. As with the schools, so with the divisions; each is directly engaged in research work. It is evident, therefore, that the need for the control and guidance of research work in every branch, with definite objects in view, is essential. The schools, with their own peculiar local problems, are carrying out certain classes of research work, while in some cases the same or an allied class of research is being conducted directly by the division concerned. A very useful discussion arose on this subject, in the course of which the various classes of research now in operation, and their objects, were described by the heads of divisions and the principals of the schools. As an outcome the definite understanding was arrived at that the control and guidance of research work would be vested in the chiefs of the divisions, each of whom is recognized as the chief authority on the science concerned, and that the services of the technical officers at the schools would be utilized in their respective spheres, to the greatest extent possible, to assist the heads of divisions. Thus, with the greatest benefit to the teacher stationed at the schools, research work in his science will be conducted by himself, but the work of himself and other teachers in the same service will be inspired and co-ordinated by the chief of the division. At the same time, the school staff will have wide freedom in carrying out, and every opportunity for initiating research, so that their individuality may have full scope. For disciplinary purposes the school staff will be under the direct control of the principal.

Experiment Stations and Laboratories.—By "research" is meant seeking after principles and facts. Allied to research work are the various experiments carried out at the experiment stations. These experiments are designed to improve general farm practice. The following are the present stations:—

Agricultural Education.—School of Agriculture and Experiment Station at (1) Elsenburg, Mulders Vlei, Cape; (2) Grootfontein, Middelburg, Cape; (3) Potchefstroom, Transvaal; (4) Glen, Orange Free State; and (5) Cedara, Natal, with sub-station at Winkle Spruit, Natal.

Tobacco and Cotton Division.—Experiment Station at (1) Rustenburg, Transvaal; (2) Elsenburg, Mulders Vlei, Cape; and (3) Piet Retief, Transvaal.

Botany Division.—Groenkloof Experiment Station, near Pretoria.

Agronomy Division.—Experiment Station, Pietersburg, Transvaal.

Viticultural Division.—Headquarters, Oenological Institute, Elsenburg, Mulders Vlei, Cape, under which the Government Wine Farm, Groot Constantia, falls, also the Experiment Station, Paarl, Cape.

General.—In addition, the property "Prinshof," near the Union Buildings, Pretoria, recently acquired, will be used by certain of the divisions for experiment purposes, but chiefly by the Division of Botany.

As indicated, such experiments are being carried out both by some of the divisions and at all the schools, and here also arises the necessity for co-ordination of present work and a policy for future development. As mentioned above, the present organization of the Department is a result of urgency arising out of certain problems and, to some extent, expediency to meet them. Thus we have a Tobacco and Cotton Division dealing independently of the schools with all phases of the crops indicated, carrying out its own research and experiments and having experiment stations for the specific purpose. It was admitted at the conference that the necessity for the present arrangement was justified, and that it would continue so for some time to come, but it was agreed that the policy in experiment work would aim at building up the strength of the schools (and sub-stations), so that in the course of time all such experiments would as far as practicable be centred at the schools, under the guidance of the principal, while the divisions would in time be concerned only with administration and research. In view of the diverse conditions to be dealt with by the various schools, some of these experiments would be peculiar to certain schools only, but all experiments of a more general nature would be co-ordinated and unnecessary overlapping avoided, it being recognized at the same time that duplication or even multiplication of certain experiments was essential.

The policy affecting the conduct of experimental work having been agreed upon, the important question of the work to be done was discussed. Again the special problems of atmosphere and soil have to be taken into consideration. For this purpose the school centres only are manifestly inadequate and our markedly varying conditions call for experimentation in different parts of the country. To meet this need, the conference was unanimously of opinion that the establishment of a number of sub-stations was essential to good work. Both before and since Union, sub-stations (some resembling the nature of those proposed) have come and gone. Their vicissitudes need not be entered into here; some were not efficiently staffed, others were not well situated, while a number were abandoned owing to change of policy. But with the expansion of the country and the advance of agricultural science, the need of efficiently staffed and controlled sub-stations is insistently brought home to those charged with South African agricultural enterprise, and the work they are eager to carry out is at present being delayed by the lack of such facilities.

Closely related to the experiment station is the system known as "co-operative experiments." These comprise certain experiments carried out by the farmer on his own farm under a plan formulated by the Department to test results obtained at the station. This

system has been in operation for many years, but rather as taking the place of fully equipped and manned stations than as supplementing the work of such stations. The principle of co-operative experiments is sound, but as a means of furnishing experimental data of a reliable nature, these co-operative experiments are unfortunately a failure. While there are happy exceptions, it is generally experienced that the private experimenter, however willing, is unable to give the experiment the attention it needs. It is not always understood that an experiment calls for most careful attention and the scrupulous noting of apparently insignificant details throughout the course of the experiment and of which only the scientifically trained experimentalist knows the value. Thus it is that while the experience to the farmer himself has not been lost and may justify the continuance to some extent of the co-operative experiment, the Department has not added materially to its agricultural data as a result thereof, while such data as have been collected cannot be accepted as being of scientific exactitude. It is evident, therefore, that the only way in which the needs of the country can be properly met in this direction is by the work of the trained experimentalist in localities typical of the main features of the country. The Department's aim will be first of all to build up the strength of the schools where most of the experimental work will emanate and from which later will radiate the sub-stations of the future.

Extension Work.—The efforts of the Department would be restrained unless the farmer, who has to put its advice into practice, is easily reached. From far and wide comes the request for practical advice on the farm. At present both the divisions and the schools perform a measure of extension work, i.e. give advice on the farm by personal visits, arrange lectures and demonstrations in various parts of the country, publish articles in the Department's *Journal* and other agricultural papers, and give information by correspondence. It is admitted that the Department is greatly understaffed for this purpose and at present can only touch the fringe of this field of work. But with the building up of the schools and experiment stations, more facilities will become available for extension work. In the meantime officers who carry out extension work under the direction of the division will continue their activities, while the various schools will also endeavour to extend their present system of extension work, and an arrangement will be devised whereby the work of the various officers concerned will be co-ordinated, so that overlapping will be prevented and what may now savour of haphazard methods be guarded against. But with the development of the Department, the tendency will be to place under the control of the schools more and more extension work. It is inevitable, however, and even desirable, that officers attached to divisions do some extension work, though not as a regular systematic course.

Relation of Agricultural Education at the Schools to the Agricultural Education at the Universities.—The establishment of two faculties of agriculture, one at Stellenbosch and one at Pretoria, and the apparent prevalence of a desire for the establishment of at least another, have a direct bearing on the aims and objects of the schools of agriculture. The need for instruction in the higher branches of science is obvious; the country needs exponents of agricultural science

trained locally, and with all the advantages which only local association can give. But the country's population is small and its resources limited, and there is danger that its needs in this direction may be over-supplied, while lack of funds may detrimentally affect the high standard and thoroughness of instruction which will be expected from a University conferring a degree of Bachelor of Science (Agriculture). The Department is experiencing great difficulty in supplying its scientific staff, and the difficulty is increased by the advent of the faculties, which also require men of a similar standard. In how far these faculties will overlap the work of the schools is not yet apparent; the matter is under consideration at present. But various projects have been put forward by the faculties involving the services of officers of the Department, and the Rhodes University College has also submitted a scheme. Further comment need not be made at present, pending the result of further inquiry, but one thing emerges from the discussion which took place at the conference, namely, the fact that the standard of the technical staff of this Department is such that the Universities recognize the ability of the staff to give instruction to University students qualifying for a Bachelor of Science degree. This is a compliment which is appreciated and should be a happy augury to the public, in that the teaching of the coming farmers of South Africa is in the hands of such capable instructors.

Outstanding Features.—The conference was composed of officers of long standing and experience, and their views and aspirations bear a great deal of weight in the future development of the Department. Arising out of the discussion on the several matters before the conference, the following features were outstanding:—

(1) The present inadequacy of staff and equipment, and the pressing need for expansion in this direction in view of the forward movement of agriculture and the importance of solving many problems so as to make farming in South Africa increasingly popular and remunerative.

(2) The Department's future development will tend to confine the activities of the divisions to the broad issues of policy and to the administration of laws, combined with specialized scientific research bearing on matters of general or national importance. Concurrently the schools will broaden out and will be the centres for teaching, research, and experiment; from them will radiate the necessary substations and under their control most of the extension work will be carried out. It is laid down as a principle that the teacher at the school, in order to be of most value to the country, must combine research with his teaching.

(3) The divisions and the schools are inseparable and interdependent.

Index of "Journal."

With this number the index to Volume I of the *Journal* is being issued. This index embraces the nine months, April to December, 1920, but in future it is proposed to issue an index for the six months ended June and December in each year.

THE CULTIVATION OF BUCHU.

By R. H. COMPTON, M.A., Director, and J. W. MATHEWS, F.R.H.S., Curator, National Botanic Gardens, Kirstenbosch.

(Reprints of this article will be issued as "National Botanic Gardens: Economic Bulletin No. 1," and correspondence on the subject should be addressed to the Director. The greater part of the article, including the whole of the information on practical methods of cultivation, has been written by the Curator of the National Botanic Gardens, certain other details having been added by the Director.—EDITOR.)

OWING to the increased interest taken in the cultivation of buchu,* it is found desirable to publish the conditions under which such satisfactory results have been obtained at Kirstenbosch, with impressions gained from observations thereon.

The site is that of an old vineyard and is on a sunny slope, with almost a true north aspect. The gradient is about 1 in 15, which gives a rapid run-off for heavy rains.

The soil is a deep red sandy loam, rather adhesive when wet, and caking somewhat on drying. It is evidently rich in iron but somewhat deficient in lime for general crops. The sub-soil is a reddish clay, with here and there seams of ironstone and quartz gravel. It is "dry," that is, there is no "water-table," and consequently there is no stagnation of moisture around. Good peach, apricot, vine, or hillside lands would suit buchu well. There is an abundant rainfall, and the atmosphere is decidedly moist at all times, with an absence of those scorching days under which some districts labour.

Partial shade is beneficial, so that sites with an eastern or western aspect would be advantageous. Dense shade is detrimental.

"Dry" cultivation is practised, and is generally the most suitable for the western and south-western districts. Deep trenching, 2 to 3 spades deep, is essential to resistance to drought and the longevity of the plantation. On "foul" lands the surface soil should go under and virgin soil come to the top to obtain a "clean" surface. Any hollows and humps should be remedied during the trenching, which is best done in March. During April, after decent rains, harrowing and light rolling should be carried on until a fine tilth is obtained.

No manure has been used, but where good rotten farmyard manure is obtainable its use should be beneficial, either incorporated with the soil or as a mulch.

Sowing should follow as soon as the land is fit. Mark off the ground in lines 3 feet apart. Where a Planet Junior sower is not available drills must be drawn out 1 inch deep, and the seed spaced therein not more than 2 or 3 inches apart by hand. Return the fine soil as a cover with the back of a rake. The Planet Junior set as for spinach will do all these operations at one trip at the speed of a moderate walk.

* The market price in Capetown of dried *Barosma betulina* leaves in 1920 ranged from 9s. to 11s. per lb.

Germination takes place in about a month, and is invariably poor, the average being from 40 to 50 per cent.

Should the plants not be sufficiently even throughout, the blanks can be resown the following season. About 7 lb. of seed are required per acre for the above distances.

Experiments performed by Miss Davison, B.A., show that no improvement in the germination is effected by treatment of the seed

FIG. 1.—Part of the Plantation of *Barosma betulina* at Kirstenbosch, January, 1921. (The small trees in the rows are Carob Beans.) The Buchu plants show part of one season's growth.

before sowing with hot water, ether, sulphuric acid followed by soda, or by filing or cracking the seed-coats. A certain percentage of good-looking seed always seems to contain shrunken non-viable embryos.

Some growers sow the seed in tins and transplant to open ground, but a large proportion of the seedlings are always lost or stunted in

transplantation, and the final result seems inferior to that obtained by sowing *in situ*.

Propagation by cuttings is being tried this season.

After germination the cultivator and scuffler must be kept going to keep down weeds as well as to secure a surface mulch to conserve soil moisture.

At a year old the young plants can be cut back to three inches from the ground to induce a bushy habit.

At two years cut back again from one to two inches above last year's cut, and so on annually, the resultant bush slowly increasing in surface area, and yielding a maximum of leafy twigs.

FIG. 2.—Twigs of the three commercial Buchus. Left to right, *Barosma serratifolia*, *B. crenulata*, *B. betulina*.

The best all-round time for harvesting is March or April, as soon as a rain has washed the foliage clean. Grasp a fair handful of shoots just above the point where they are to be cut, and a good pair of secateurs will quickly do the remainder. The shoots can be laid on a sack flat on the ground, or in a truck.

Harvesting should not be performed by the method of tearing or breaking off the branches, as is usually the case in the collection of wild buchu: this causes injury or death of the plant.

Drying should be done as quickly as possible, and to keep a good colour it is essential it should be done in shade. A corrugated iron

roof, with open sides, or latticed with spars or leafless branches, would approach the ideal. The layers should not be more than 15 or 18 inches thick, and should be shaken loose as they are placed in position. The layers should be turned over and shaken loose daily until it is found that the leaves are separating, when a gentle thrashing with a pliable rod or fir-spar will separate them readily in two or three daily applications. The drying takes from ten days to a fortnight, according to weather conditions. Great care must be taken to avoid sweating when bulked, as a considerable loss of oil is occasioned thereby. It

FIG. 3.—Leaves of the commercial Buchus and of some other aromatic South African Rutaceae. 1, *Barosma serratifolia* Willd., upper surface; 2, do. under surface; 3, *B. crenulata* Hook., upper surface; 4, do., under surface; 5, *B. betulina* B. & W., upper surface; 6, do., under surface; 7, *B. succoparia* E. & Z.; 8, *B. Peglerae* Dümmer; 9, *Adenandra fragrans* R. & Sch.; 10. *Agathosma apiculata* Meyer; 11, *Coleonema pulchrum* Hook. 7 to 11, under surface. All drawings magnified two diameters. (Del. Miss M. M. Page.)

is well to turn over the sacks or bales daily for a further week or so before dispatching.

The dried buchu should be as green as possible. A whitish colour indicates that the leaves have been dried in the sun and have, in consequence, lost a large amount of their oil-contents,

For export purposes the buchu should not contain more than 10 per cent. of the small green twigs and none of the larger ones.

The produce is usually marketed in wool packs, and is mainly exported to England, Australia, and America.

To secure a crop of seed from cut-backs it is necessary to allow the bushes to develop unchecked and uncut for two years, or three years if a good crop is desired. When the seed is ripe the capsule bursts and the seed is thrown some distance. In gathering this stage must be anticipated a little, and the capsules dried in the sun on trays or sheets, with light hessian laid over to prevent loss by the explosions.

The climate of the "winter rain belt" is naturally suited to the requirements of buchu, and generally throughout the western and south-western districts it will thrive with a minimum of attention. On the Karroo or other arid regions it is doubtful if the plant would thrive, though here irrigation may ensure success. It is a moot point as to whether or how much frost it will withstand. In districts with good summer rains there is a possibility of its doing well if not allowed to dry out during the winter. But just what amount of success can be attained can only be learned from actual trials. It is hoped to obtain reports of the results from seeds distributed to districts throughout all the Provinces of the Union.

The future prospects of buchu as a field crop are bright in that the demand for the herb and oil is increasing rapidly throughout the world. The supply of seed is very limited, so that the acreage cannot rapidly increase, as propagation is limited to this means up to the present.

The dried leaves of *Barosma betulina* are official in the British Pharmacopœia under the name of Buchu Folia. Admixture with other species depreciates the market value of the herb. In the United States there is also a good sale for *Barosma crenulata*. *Barosma serratifolia* is the only other species of commercial value at present, the value of the three species being in the order named.

Under distillation buchu yields a resin and also a volatile oil. C. J. S. Thompson gives the following yields for the three commercial varieties, calculated as percentages of the weight of dried leaves:—

	Resin.	Oil.
B. betulina	4.25	1.45
B. crenulata	3.75	1.6
B. serratifolia	3.45	1.0

Fluckiger gives the percentage of volatile oil derived from dried *B. betulina* as 1.56 per cent.—the higher yield being doubtless due to more careful drying.

The oil can be obtained from green leaves as well as from the dried herb, and Mr. R. M. Williams states that the yield of oil from green *B. betulina* leaves is about 1 per cent. Moreover, the green twigs give a yield of about 0.5 per cent. As the herb loses about half its weight in drying it is clear that a considerable waste of oil takes place in this process; and this is evident from the strong scent of a heap of drying branches as compared with the almost imperceptible scent of the growing plant. The most economical way of extracting the oil, therefore, would be by distillation of the green shoots shortly after cutting, and this could best be done as one of the operations in an essential oil industry in South Africa.

The oil derived from *B. betulina* leaves is a clear yellowish mobile liquid, which deposits a mass of colourless needle crystals of diosphenol or "Barosma camphor" in the cold. The oil from the twigs of *B. betulina* is inferior, no diosphenol crystallizing out on freezing; and the oil from *B. crenulata* leaves is also deficient in diosphenol.

The volatile oil of buchu, taken internally, is eliminated by the kidneys. It is said to produce no increase in the volume of the urine, and is, therefore, of no value in dropsies. It has, however, a marked effect upon the mucous membrane, and is, therefore, employed in the treatment of various diseases of the genito-urinary tract. It is also said to be an ingredient in certain patent medicines. Steeped in brandy, the leaves are widely used in South Africa as a remedy for many complaints; and the dried and powdered leaves were formerly used by the Hottentots for rubbing on the skin.

Buchu, when first introduced into England, about 1823, was considered to be a mixture of *Barosma crenata, Barosma crenulata,* and *Barosma serratifolia.* The two first are now considered synonymous. Thunberg mentions *B. betulina* and *B. pulchella* as being used by the Hottentots. The natural order, Rutaceae, is rich in plants with essential oils of varying odours and pungency, and no doubt some at least under test would prove to be of practical value. Many other species belonging to this order (genera Barosma, Agathosma, Diosma, Adenandra, Coleonema, etc.) than those mentioned are in use locally where they are found wild, but at the present time are not of any commercial value. As some aromatic and medicinal species are not yet represented in the collection at Kirstenbosch, seeds would be greatly appreciated.

The National Botanic Gardens will be pleased to identify specimens of the varieties of buchu occurring wild: correspondents in the Union can send specimens or seeds free by post or rail if addressed O.H.M.S. to the Director.

The National Botanic Gardens distributes such buchu seed as may be available, preference being given to Members and Associates of the Botanical Society of South Africa. Applications for seed should be made to the Director, and for membership either to him or to the Honorary Secretary of the Botanical Society, P.O. Box 70, Capetown.

Plant Nurseries in Quarantine.

The following nurseries were placed in quarantine during January last and must be added to the list published in the January, 1921, *Journal* (page 88):—

Name of Nurseryman.	Address.	Cause of Quarantine.	Extent of Quarantine.
C. Starke & Co. ...	Mowbray ...	Red scale, *Eriococcus*	Veronicas, Euonymus & Balsam: Araucarias.
Chas. Ayres & Co. ...	Capetown ...	*C. dictyospermi* and Red scale	Block "B," Courville St. Nursery.

THE SWEET POTATO AND ITS CULTIVATION ALONG THE SOUTHERN COAST BELT.

By CHAS. F. JURITZ, M.A., D.Sc., F.I.C., Agricultural Research Chemist, Capetown.

IN conection with the production of alcohol on a large scale, in order to serve as a basis for liquid fuel, in view particularly of the scarcity of petrol, attention has lately been turned to the possibilities of utilizing the sweet potato, which is fairly extensively cultivated along the southern coast belt of the Cape Province.* At present the extent of this cultivation adequately suffices to meet the demand, which is restricted to the employment of the tuber as human and stock food, but it is practically certain that the area indicated has potentialities for sweet potato production far in excess of the demands now made upon it.

CLIMATIC CONDITIONS AND SWEET POTATO SOILS.

Sweet potatoes are best grown under climatic conditions which afford sunny days and warm nights, a rainfall which is neither scanty nor excessive, and which is available during a growing period of from four to six months annually. Although the crop adapts itself readily to other soil conditions, it attains perfection preferably in light sandy loam with a more clayey, but nevertheless well-drained, sub-soil. The soil must be well drained, because standing water around the developing tubers is most harmful; at the same time the sub-soil should be sufficiently clayey to prevent the leaching away of fertilizers and the consequent formation of long stringy tubers. Fortunately for some of our southern coastal soils, which consist of almost pure sand, even unpromising areas give good yields of tubers, provided a reasonable supply of suitable manure be forthcoming. In fact, such poor sandy soils are in some respects better suited to sweet potato culture than fertile soils in which the tubers become sacrificed to a profuse growth of vines or runners. If, however, sweet potatoes are to be grown on poor sands, the locality should be so chosen that sufficient organic matter is present in the soil, and that there is a possibility of the crop obtaining such mineral plant food as suits its natural tendencies.

MR. ROBERTSON'S FARM.

I have drawn attention elsewhere to the fact that within the Union of South Africa the Division of George and the areas adjacent thereto exceed all other districts in the abundance of the sweet potato crop. That statement I may now supplement by saying that no planter in the Union harvests more sweet potatoes every season than Mr. W. E. Robertson, whose farm is situated about three miles from Little Brak River railway siding and eight miles from Mossel Bay.

* See article on "A New Motor Spirit" by the writer, in the *South African Journal of Industries*, October, 1920, pages 889–894.

Mr. Robertson and his four brothers own farms which are not, it is true, actually in the George Division, but lie in the adjoining Division of Mossel Bay; they are, however, so near to the George boundary—only some six miles west thereof—that they may well be considered as belonging to the area which excels all others in sweet potato production. As regards rainfall, however, Little Brak River is less favourably situated than George, and east of George the rainfall is even higher.

In order personally to inspect the harvesting of the sweet potato crops and to collect samples both of the different varieties of the plant under cultivation as well as of the soil on which it is grown, a visit was paid towards the end of September last to Mr. W. E. Robertson's farm with its 80 acres of sweet potatoes. Apart from sweet potato culture, there are many points of interest about this farm which suffice in themselves to repay inspection. In passing, it may be mentioned that the now sub-divided farm, whereof it formed a part, at one time belonged to Mr. Robertson's father, the late Mr. Donald Robertson, whose brother, the late Mr. Alfred G. Robertson, used to represent the Division of George in the old Cape House of Assembly. The part now held by Mr. W. E. Robertson is situated between the two tributaries of the Little Brak River,* and is unique in respect of its successful growing of a number of sub-tropical plants. The household has been accustomed to the use of coffee from actual coffee trees which are still thriving excellently on the farm. For a number of years pawpaws flourished there, and the dried stems remain to bear some evidence to the size they attained. Several avocado pear trees may still be seen profusely laden with young fruit, and a little plantation of sugar-cane adds to the Natalian features of the surrounding scenery; nor must I omit reference to the fact that a crop of 3000 custard apples was harvested this season, while mangoes are also being grown on the farm.

The homestead stands some way up the southern slope, and near the eastern end of a long low hill. The hill does not much exceed 100 feet in height and stretches east and west for nearly a mile. The Moordkuil stream, which is the eastern affluent of the Little Brak, after turning the flank of this hill, winds some distance further in a southerly direction, and then flows west towards the confluence of the two tributaries. Within the space enclosed between hill and river a semi-circular level plateau extends below the homestead to a distance of about 700 yards. Outside the semi-circle the level suddenly drops some 9 feet to an alluvial deposit, and thus continues to the river. On this lower level, between the plateau and the river, the best sweet potato harvests are gathered from a field lying in a direct line between Mr. Robertson's homestead and Rooiheuvel farm. The soil of this field used to be cultivated at least 35 or 40 years ago, and has ever since lain fallow until four years ago, when a somewhat more intensive cultivation was begun. First of all the field was put under wheat; then mealies were grown on it; next it bore a crop of sweet potatoes, followed by peas, and then again sweet potatoes. At the time of my visit, beans had recently been sown on the land, and were about 3 inches high. The soil, which is represented by No. 2 (see fig. 1), is dark in colour and has never been manured.

* See Fig. 1.

SOIL COLLECTION ON THE FARM.

Further from the Moordkuil River than No. 2, and more to the west, a sample of reddish soil (No. 3) was collected from the same stretch of alluvium; it represented a portion of the alluvial stretch about $1\frac{3}{4}$ morgen in area, on which oats were growing. This field has been under cultivation, according to Mr. Harold Robertson, for

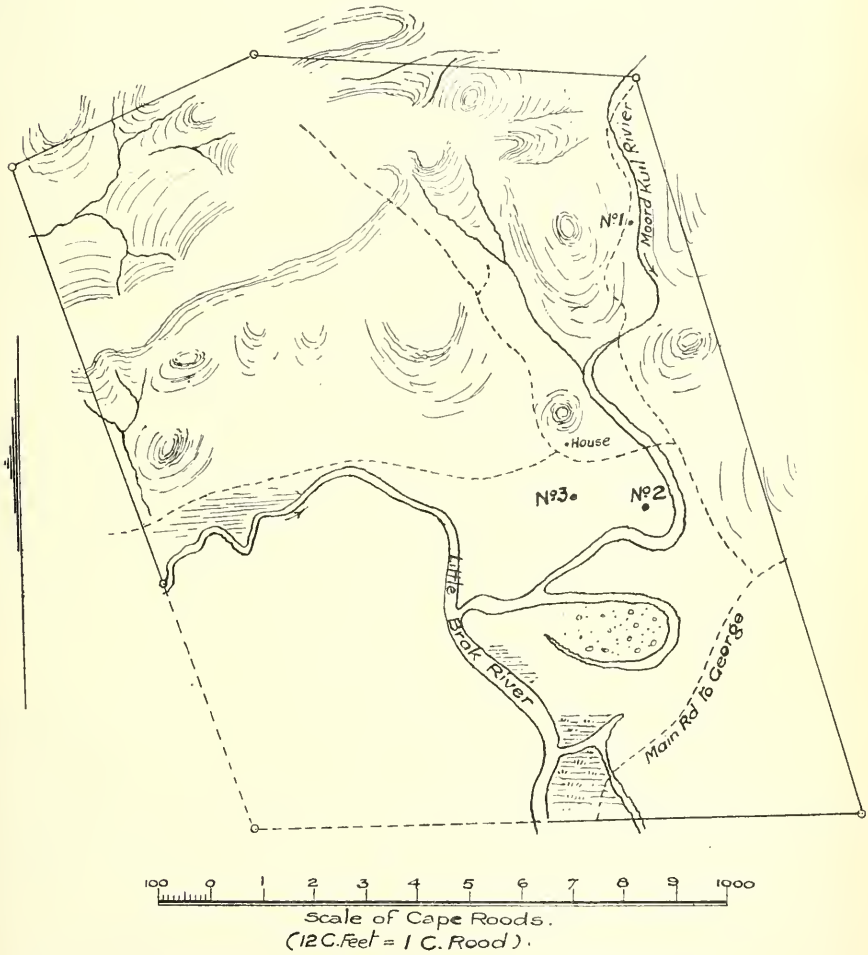


FIG. 1.

about 15 years, and had been manured once every other season with manure from the cattle kraal. During those 15 years it has grown principally sweet potatoes under irrigation, swedes, barley, beans, and peas being used, however, as rotation crops. Up to about four years ago the sweet potato crops were quite good, but since that time the *tubers* have deteriorated, although the production of *runners* has continued quite satisfactory. Latterly it has been found, moreover, that the peas do not germinate well,

By way of contrast to the soil types referred to above, it was thought desirable to examine a sample from alluvial lands, where sweet potato culture is less successful. A small field of this type, represented by sample No. 1, was found behind (i.e., to the north of) the hill on which the homestead stands, in a bend or elbow of the eastern tributary, or Moordkuil River, at Kleindoorn (The Causeway). The crops yielded by this soil are said to be poor, not only as regards sweet potatoes, but also with cereals and vegetables. For some years past these lands have been manured every six months with cattle manure at the rate of about one wagon-load per ¾ morgen.

The physical character of the soil on Mr. Robertson's farm may be gathered from the results of the mechanical analyses, which are given below. The soils sampled were entirely free from stones and coarse gravel, their percentage composition being as follows:—

	No. 1.	No. 2.	No. 3.
Fine gravel	.64	Nil.	Nil.
Coarse sand	2.50	Trace.	.52
Medium sand	13.98	1.56	44.22
Fine sand	23.92	12.54	7.11
Very fine sand	39.20	41.35	21.49
Silt	11.30	26.87	14.83
Very fine silt	7.08	15.67	9.68
Clay	1.38	2.00	2.14

The above figures show the considerable differences that exist between these types of soil. No. 1 is a sort of transition between a fine sand and a fine sandy loam, inclining, however, more to a sandy than to a loamy character. No. 2 is a silt loam and physically far the best soil of the three. The above mechanical analyses would also imply its chemical superiority over the other two. No. 3, a soil of somewhat peculiar type, may be called a sandy loam.

SWEET POTATO SOILS.

In the North American Union the principal sweet potato growing States are Alabama and Georgia, which have respectively 153,000 and 130,000 acres under the crop. The sandy loams of the Norfolk series, which are specially adapted to sweet potato culture, cover 543,000 acres in those two States. The average percentage composition of these soils is given below, and for the sake of comparison I repeat, in summarized form, the results of the Little Brak analyses:—

	Norfolk, Sandy Loam.	Little Brak, Sandy Loam. No. 3.	Norfolk, Fine Sandy Loam.	Little Brak, Fine Sandy Loam. No. 1.	Little Brak Silt Loam. No. 2.
Fine gravel	4	0	1	1	0
Coarse sand	5	1	3	3	0
Medium sand ...	14	44	5	14	2
Fine sand	31	7	38	24	13
Very fine sand .	18	21	24	39	41
Silt	11	24	22	18	42
Clay	7	2	8	1	2

The agricultural chemical analyses of Mr. Robertson's soils are tabulated below:—

	No. 1. Per cent.	No. 2. Per cent.	No. 3. Per cent.
Moisture	1.15	3.44	1.07
Organic and volatile matter	3.37	5.34	2.64
Nitrogen	.126	.147	.070
Potash	.099	.205	.076
Lime	.144	.216	.114
Magnesia	.185	.323	.069
Phosphoric oxide—			
Soluble in cold hydrochloric acid	.041	.049	.034
Soluble in strong boiling acids	.081	.069	.072

These results confirm the deduction already drawn from the mechanical analyses, namely, the decided superiority of No. 2 over the other two soils. It is well furnished with nitrogeneous material and has a satisfactory proportion of potash, its humus-content is higher than either Nos. 1 or 3, and its moisture-retaining power is also better. In respect of lime it is likewise the best of the three soils. No. 3, on the other hand, is chemically the poorest soil of the three. It is only moderately supplied with nitrogen, potash, and lime, and its proportion of humus and capacity for retaining water are comparatively low. Its available supply of phosphate is also scantier than in the other two soils, although it must be said that in respect of phosphate there is not much to choose between the three; all alike have no more than a "fair" reserve of phosphoric oxide.

VARIETIES OF SWEET POTATO.

Four varieties of sweet potato were being grown on the farm at Little Brak River on the occasion of my visit:—

1. Common six-months.
2. Red-skinned three-months.
3. Yellow-skinned three-months.
4. British East African white-skinned.

The six-months variety is the kind for which the demand is greatest all over the Union, on account of its keeping qualities. This variety, moreover, is said to stand transport and rough treatment better, and, under adverse circumstances, to give a larger yield per acre, than any of the other kinds. The tuber, however, is stated to be more fibrous than in any other variety. The midribs and veins on the underside of the leaves of this class of sweet potato are purple.

The red-skinned type is the most delicate potato of the four, and the demand for it is only one-ninetieth of that for the six-months variety. Its tubers require the greatest care in handling, and the cultivation of the plant itself gives more difficulty than the other varieties do. This variety has the leaf-ribs wholly green on both sides.

The yellow three-months tuber also needs special cultural care, but not to the same degree as the red-skinned. Both these quick-growing three-months varieties, however, are said to be more watery

than the six-months type. The sweetest potato of the four grown on Mr. Robertson's farm is supposed to be the yellow (Cape) three-months variety, the next in order being the red tuber.

The East African potato is said by Mr. Robertson to be the least sweet of his four kinds, but intermediate in general characters

FIG. 2.—Planting Sweet Potato Slips.

between the six-months and the more watery three-months varieties. Internally the tuber is very white in colour, and even the skin is of a lighter shade than any of the other varieties. It is also more luxuriant in growth and hardier, and is reputed to stand drought and frost better. On account of its trident-shaped leaves this variety is known locally as *hoenderpoot*.

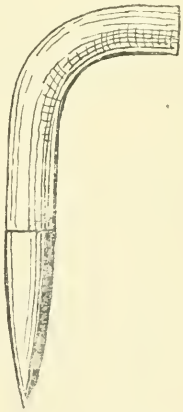


FIG. 3.—Sweet Potato Dibble.

METHOD OF PROPAGATING.

There are two methods of propagating sweet potatoes; they are grown either from plants or slips produced by allowing the seed tubers to sprout in warm sand, and planting the slips with the eyes from which they are developed; or by making cuttings from the runners or vines of the sweet potatoes and planting those cuttings.

The latter is the method which is principally adopted wherever sweet potato culture is carried on in the Union of South Africa. In the northern United States the sprouted slips are employed for the main crop while the runners are used only to provide the seed tubers for the following season; south of Virginia, however, the main crop is grown from runner cuttings; sufficient tubers are planted in the first instance to provide slips for about one-eighth of the area to be eventually planted. When these slips develop runners, enough cuttings are made to plant the rest of the field. Good sweet potato land in the United States will readily support 10,000 plants per acre, and when everything is in good condition from 7000 to 10,000 slips per day, or one acre, may be planted by three workers (fig. 2), i.e. a boy going ahead to drop plant slips on the ridges, a second operator following with a dibble (fig. 3) to make holes to receive the slips, while a third inserts the plants and closes up the holes again. When a large acreage has been planted, the work is greatly facilitated by the use of transplanting machines (fig. 4), which under reasonably favourable conditions may plant from 3 to 4 acres of sweet potato slips per day.

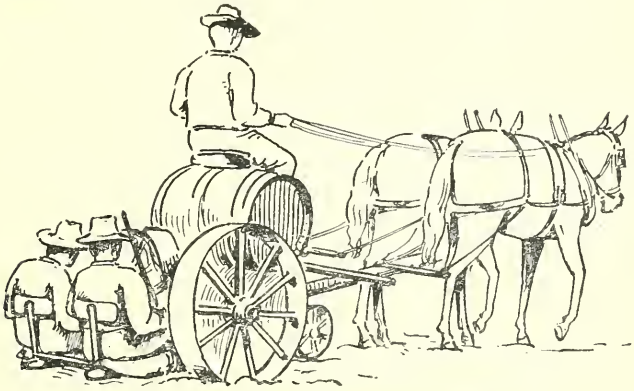


FIG. 4.—Sweet Potato Transplanting Machine.

Notwithstanding their proximity to the sea, large portions of the George and adjacent Divisions, where sweet potatoes are cultivated, are subject to frosts. Further inland, this condition is accentuated. Hence such districts are unable to propagate fresh crops of sweet potatoes from those of the preceding year, because the frost nips all the young shoots before there is any possibility of their developing into vines or runners. On Mr. Robertson's farm, although frost does prevail on a considerable extent thereof, about twenty acres seem to be quite immune, and on this frost-free stretch luxuriant runners are formed without restraint. The result is that from all parts of the Union, far and near, requests for supplies of runners come streaming in season after season—demands more numerous, at times, than the potentialities of the season's crop can cope with. As an instance, it may be mentioned that within an hour of my arrival on the farm, on the 27th September, 50 bags of sweet potato runners were dispatched to the railway siding, three empty trucks were telephoned for to Mossel Bay, and at least two fresh orders had to be declined.

HARVESTING.

Mr. Robertson practises two methods in the harvesting of his sweet potato runners for sale and planting:—

1. The tubers and runners are taken up simultaneously. This method provides the best tubers for human consumption.

2. The runners are cut off separately (to a certain extent late in August, but principally in September) and sold as a first crop, the tubers being left in the ground to provide a second crop of runners; these are taken off a month later—generally some time in October—when the tubers, which have deteriorated in the meanwhile and

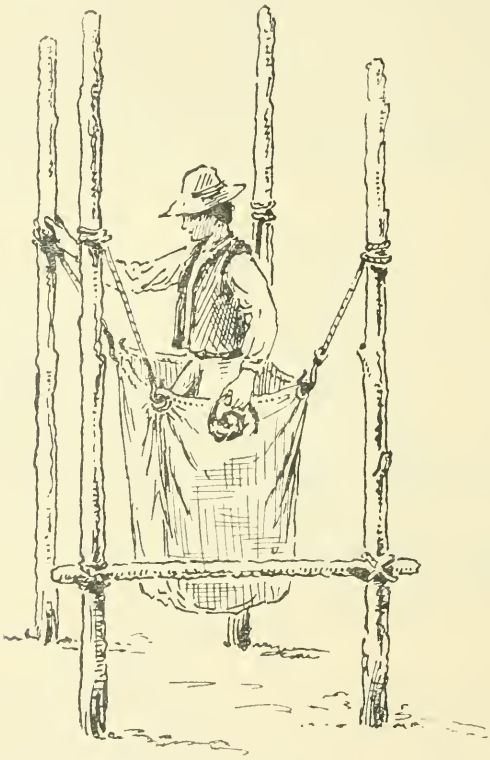


FIG. 5.—Bagging Sweet Potato Runners at Little Brak.

become fit only for cattle food, are dug up. This second crop of runners is not sold off the farm, but is used by Mr. Robertson for his own planting.

At the time of my visit, the farm hands were all busy harvesting tubers and roots by the first of the two methods above described.

BAGGING RUNNERS FOR SALE, AND PRESERVATION.

It was interesting to watch the operation of bagging the runners or vines for export to other districts by rail. Four posts (fig. 5), each from 9 to 11 feet high, are erected at the corners of a square of 4-feet side; from these posts an open bag is suspended by means of

four iron hooks; each length of runners is rolled up as tightly as possible in order to economize bag space and thrown into the bag, in which a native labourer keeps treading them down until the receptacle is packed as full as it can hold.

Sweet potato runners are reckoned very poor feeders for working animals, but good for ostriches and sheep. Mr. Harold Robertson considers the runners an excellent remedy for wire-worm in the latter. Of the tubers only the large ones are collected for human consumption, the small ones being used for feeding stock, including horses, cows, and fowls. Cattle are reputed to prefer sweet potatoes, after having once been accustomed thereto, to any other class of feed.

The practice in planting runners on Mr. Robertson's farm is first of all to cut them into lengths of about 11 inches, and then to plant them 15 inches apart in rows, with only one-fourth of each cutting showing above ground. The parallel rows themselves are 28 inches apart.

In order to preserve the runners of the sweet potato over a frosty winter it has been recommended to set them in early in Autumn, and shield them from frost, while allowing them free air supply, by erecting a horizontal thatch-screen on a frame about 2 feet above the runners.

PROPAGATION METHODS IN OTHER COUNTRIES.

No doubt many who grow sweet potatoes in South Africa will read with interest the following account of a method of planting adopted in Ohio, U.S.A. The writer begins by remarking that ground intended for sweet potato culfivation should be put under some hoed crop the previous season, and kept free from weeds, a procedure which will enable the sweet potatoes to be much more easily raised. After removal of the hoed crop the ground should receive a coat of well-rotted manure, and it will be an ideal place for sweet potatoes the next season. He continues as follows:—

> "Sweet potatoes require a long season for their growth; therefore as soon as danger of frost is past they should be set out. Do not plough the ground over 4 inches deep; if ploughed deeper there is too much loose soil, and the potatoes will grow long and slim. On the other hand, they will grow downward until they strike the solid bottom, and will then grow thicker and shorter, making a potato that will sell better than a long potato will. In making the ridges, make but slight elevations; these can very easily be made by placing the shovels on the double cultivator to throw the earth to the middle. This will almost complete a ridge; if it be not complete in all places, it will take but a short time to give it a few finishing touches with the hoe. Make the ridges 3 feet apart from centre to centre. If one wishes to raise only enough for home consumption, he can best buy his plants; but if raising them for market, by all means make a hotbed and raise the plants. In setting the plants, it is best to choose a cloudy day. The ridges should be made a few days beforehand, so as to become somewhat compact. Scatter the plants along the ridge about 18 inches apart (not too far ahead, as they will soon wilt); use a pointed stick to make the hole and place the plant in it the same depth as it was in the

hotbed. If the ground be dry, pour in a little water and press the soil down firmly around it. If the ground be moist, there is no need of using the water. Plants set in this manner will scarcely show that they have been moved. They should be cultivated after each rain until the vines cover the ground; they will then take care of themselves. Use the cultivator between the ridges. In cultivating the ridges until the plants get started, I find nothing better than a common garden rake. After the vines cover the ground I do not disturb them."

In Queensland, Australia, some sweet potato growers have been in the habit of planting so thickly that the ground becomes one mass of roots and tubers, which require to be ploughed up. This was condemned by the *Australian Agriculturist*, that journal characterizing the practice as a method not of cultivating sweet potatoes, but of filling the soil with a mass of inferior tubers. The Queensland farmers were advised to plant 10 feet apart, for the reason that sweet potatoes in open soil will spread their roots upwards of 10 feet each way, bearing as they run, and therefore 10 feet apart for plants cannot be excessive. Farmers at one time used to represent to the Queensland Department of Agriculture that, although no disease was apparent in the sweet potato crop, the vines failed to yield tubers.* The Department attributed this failure to the common custom of continuously planting the same piece of ground, and raising potatoes from vines, instead of obtaining a change of roots and growing the crops upon fresh ground from young shoots. The system in operation was pronounced to be altogether wrong, having a tendency to weaken the constitution of the plant. The real nature of the malady was ascribed in the Annual Report of the Queensland Department to what was there called "the pernicious system of constant propagation by suckers, instead of from seed." The method recommended to the Queensland farmers was that about the end of July or the beginning of August a few fairly large tubers of good varieties should be planted and covered with not more than 2 inches of soil. These would then throw up many young shoots, and when the shoots are about 6 inches above ground the tubers should be lifted, and the eyes from which the young shoots spring should be carefully cut out with a sharp knife. The eye with the young shoot should then be planted in the ground slightly ridged, and, if the season be at all a favourable one, potatoes of good quality would be ready for lifting at least one month earlier than by the method of planting a piece of the runner, and the plants would be all the stronger. It may be added, however, that danger of transmitting disease to the new crop is less if tubers from cuttings are used for seed.

In the United States of America, where sweet potatoes are very largely grown, irrigation is often resorted to with success in regions of scanty rainfall, but it is recognized that the greatest caution should be exercised not to apply too much water during the latter part of the growing season, lest runners should be formed at the expense of tubers; moreover, proper ripening of the tubers is best achieved if water be entirely withheld for some time prior to harvesting. It follows from the above that, if it be at all possible to grow two crops annually, the time of planting should be so arranged that the

* Similar occurrences have been noticed in the Cape Province.

manuring of one crop may wholly anticipate the rainy season, and that of the other fall well after its close.

Irrigation of the planted cuttings is not advised by Mr. Robertson, unless absolutely necessary. For open crumbly soils it is best to plant the cuttings in a damp soil, and for stiff soil irrigation should not follow but precede planting; sandy soils, however, may be irrigated after the cuttings are in.

When the young plants have started growing, the important point is the continuous use of the cultivator for getting rid of weeds, and hand-scuffling must also be practised. This is specially necessary in the early stage of growing, for later on the crop itself, with its interlacing runners and leaves, chokes all further growth of weeds.

(To be continued in next month's issue.)

Average Yields of Certain Crops.

The following comparative statement of the average yields per acre of cereals and potatoes has been drawn up from available information. The South African figures have been taken from the Census of Agricultural Production, 1918. The average for oats (given in brackets) has been calculated by assuming that the weight of "oats green in bundles" given in the Census would yield 40 per cent. grain, while the average for barley (given in brackets) is obtained by assuming that the green barley consisted of 25 per cent. dry matter, and that if grown to maturity it would have yielded 50 per cent. grain. These figures are only rough approximations.

The figures for foreign countries are either the average of the last five years (where obtainable) or for 1917 or 1918.

The weights per bushel taken are those adopted by the United States, as it is considered they are best suited for comparative purposes for most of the countries enumerated hereunder.

Weight per Bushel.	Average Yield per Acre in Bushels.						
	South Africa.	Australia.	United States.	Canada.	Argentine.	United Kingdom.	Germany.
Wheat, 60 lb.	9·9	11·7	15·0	15·7	9·2	32·3	31·5
Rye, 56 lb.	6·4	—	14·4	—	—	—	—
Maize, 56 lb.	7·8	26·8	25·6	32·1	20·3	—	—
Kaffir Corn, 56 lb.	7·1	—	—	—	—	—	—
Oats, 32 lb. ... ... (S.A. 497 lb. Oats plus 649 lb. "Green")	(23)	16·8	35·3	29·3	12·2	43·7	35·1
Barley, 48 lb. ... ... (S.A. 737 lb. Barley plus 371 lb. "Green")	(16·5)	19·5	26·0	22·3	5·4	33·7	36·0
Potatoes, 60 lb.	33	103	95	143	171	227	160
Sweet Potatoes, 60 lb.	50	—	95	—	—	—	—

THE PROBLEM OF SCAB.

A New Policy Outlined.

SINCE the early days of our history scab has been a thorn in our flesh, retarding our progress and sapping our energy and wealth in the ceaseless and, unhappily, unavailing efforts to clean our country of the scourge. The problem is one which exercised the minds of our fathers and their fathers before them, and to-day we face it still. To what extent the presence of the scab insect in South Africa has impeded its development and well being, none can tell. It is a subject which, as far as our memory goes, has been discussed in Parliament and throughout the wide stretches of our land, yet all our plans and labours have not attained a definite end: the thorn remains in our flesh, nor does its smart lessen with the passing of the years. When we consider the successful handling of the problem in another continent—how a disease which continues menacingly with us has been removed and forgotten in Australia—it is surely a matter to give pause to every farmer of South Africa, and imbue each of us with a strong desire to do what others have done, and, in removing the stigma which its continuing presence attaches to us as a people, place in its stead, yet another monument of success in our campaign against the obstacles with which agricultural South Africa has contended.

South Africa has taken her place in the world's forward movement which science and experience make possible, yet our progress is being hampered by the cloud resting over us in the form of the scab insect seriously affecting the chief of the country's pastoral industries. Scab decreases the value of our wool, brings down the condition of our stock, engages the energy of hundreds of our men, and burdens the country with an ever-increasing expenditure amounting at present to £200,000 annually. Notwithstanding all our efforts the scab insect continues to exact its toll from us and requires our constant vigilance lest it should finally conquer us and so ravage our flocks as to break down an industry on which our prosperity in a large measure depends.

That is the position to-day, but happily we have not become discouraged with the non-success of our efforts, nor are we submitting to a condition of things which reflects discredit on us. We feel that the obstacle can be overcome by a change of methods. There is evidence that the progressive farmers of South Africa are becoming impatient of the incubus which is for ever bearing them down, and within recent years public opinion has increasingly clamoured for a more drastic means to remove the evil of scab from our midst. And this awakening of the farmer to the great need of *personally* grappling with the problem is the vitalizing spirit which we feel will bring about the consummation we all devoutly wish. The rising tide of opinion has at last taken shape in no uncertain manner. What may perhaps be the beginning of a new era in our scab eradication campaign emanates from the principle involved in a recommendation

to Parliament by the Select Committee on Public Accounts last year, that:—

> "Your Committee, having taken evidence, has come to the conclusion that the time has come for this cost (the expenditure incurred in the control and eradication of scab) to be borne by flock owners and not by the general taxpayer."

The recommendation has speedily borne fruit, for the principle has been affirmed by the Agricultural Advisory Board (representing the organized farmers of the country), which advocates a change in our present policy in the following resolution of the Board passed at its last meeting:—

> "The Board recommends that, in order to effectively clear the country of scab a system of direct taxation of so much per 100 sheep shall be imposed throughout the Union.
>
> "That stringent minimum penalties be imposed in respect of contraventions of the Stock Diseases Act and regulations thereunder in so far as scab is concerned."

Herein, it seems to us, lies the germ of success. The person most affected must realize, through *direct taxation,* that he is bearing part of the cost of eradicating the disease, so that it may be his aim to free himself from the burden of the tax by cleansing his stock from scab.

The trend of events leading to the realization of the principle of direct taxation has long been foreseen by those whose life-work has placed them in close contact with the problem of scab eradication. The value of the present policy of protecting areas which are clean or nearly clean, and the placing of restrictions on areas in which there is much infection, is probably recognized almost generally. But, however excellent this policy, experience shows that restrictions only (which form the basis of the present legislation and regulations) will never be the means by which scab can be eradicated. Restrictive measures can, indeed, be the means of controlling an undesirable thing within certain limits, but they will never entirely free a country of that thing. Restrictions impose difficulties which affect the methods of some, and so run counter to their personal interests. Thus a restrictive measure not furthering the direct interests of an individual is viewed askance and, in the nature of things, sometimes evaded, so that a temporary gain by the individual propagates an evil to the community which it is desired to overcome. To counterbalance this tendency it is evident that, while maintaining the restrictions or punishment as now obtains, there should be a system which induces the individual to keep a law which provides a direct reward to those who do so.

The control and eradication of scab is the duty primarily of the farmer, not of the sheep inspector. The latter is appointed for the purpose of aiding the farmer in the proper performance of this duty and of protecting the careful farmer against the indifferent or the unscrupulous one. In the same way the good citizen is expected to observe the laws of the land he lives in and the policeman is appointed to protect him from the danger of the lawbreaker and thus aid him in duly carrying out his obligations to the State. A very prevalent idea is that sheep inspectors are the people who are chiefly concerned with the eradication of scab and that if their efforts are unavailing the farmer cannot be blamed. This is an entirely

mistaken idea, and so long as the efforts of officials are not supplemented by the best efforts of the sheep owner, scab will never be eradicated. Therefore, the Advisory Board considers that the time has come for inducing the closest co-operation of the sheep farmer by holding out direct reward for success, and a personal loss, through direct taxation, for failure, in the country's campaign against scab.

The manner in which a direct tax will need to be imposed, taking into consideration the fact that at present the cost of scab control is paid for by the whole community through *indirect* taxation, appears to be the levying of a direct tax from each sheep owner in a district in which scab exists and according to the number of sheep owned at a rate, either fixed or sliding, to be agreed upon. For instance, if the cost of eradication is £200,000, a rate fixed at £5 per 1000 sheep would cover the whole cost. But as the community as a whole benefits from the measures adopted to extirpate the disease, it is considered that not more than half the cost should be borne directly by the farmers in scab-infested districts, and, therefore, that a tax of about £2. 10s. per 1000 sheep should be levied upon them. The remaining half of the cost could be met out of general revenue. The main point is that while the farmer, under the present system, also contributes, of course, towards the expenditure, he does so indirectly in the same way as other members of the community, and is, speaking generally, not aware that he does pay, and does not realize what the presence of scab in the country is costing him as an individual.

The proposal is that the direct tax would be levied on every district which has not been clean for twelve months and on every sheep owner within such district. As soon as any district thereafter becomes clean and remains so for twelve months, the tax on that district would be removed and the amount previously paid by that district in direct taxation be made good out of revenue, if necessary. If the district becomes reinfected the direct tax would be reimposed until the district is again clean for twelve months. But at the same time, once a district is declared to be clean, it would be the duty of the Government to give it all the protection in its power to prevent reinfection.

That, in brief, is the system which has been recommended. At the first glance it might give the appearance of penalizing the innocent for the wrongdoing of the guilty and would be resisted for this reason alone. This can be understood, for a fault of indirect taxation is that the persons so taxed are either ignorant of the fact or do not fully realize to what extent they are being taxed. As already indicated, every sheep owner to-day is taxed for the eradication of scab, but few seem to appreciate the fact. If it were reckoned out how much is paid out in indirect taxation for each large service rendered by the Government a different impression would prevail. It is maintained that, reckoned as a business proposition, the direct tax should be welcomed by all. Under such a system, instead of all the responsibility practically being upon sheep inspectors, it would be thrown primarily on the owners themselves. Thus a man who is a breeder of scab or negligent would, on conviction, be considered a danger and expense to his district and be dealt with by the district accordingly. At present it is not unusual for a man convicted and fined to receive the sympathy of his fellow-farmers instead of the opprobrium his action deserves, because his misdemeanour does not affect directly in taxation the other farmers of the district. Under a

direct tax every sheep owner in a taxable district would not only keep his sheep clean, but would do his best to make his neighbour do likewise, so as to escape the direct tax. The tax on individuals might be small, yet the mere fact that it is paid would, it is urged, be the greatest possible inducement to get rid of it.

At present the inspector is liable to be punished for neglect of duty or bad service, while his chances of reward are small. We must face the fact that in an organization which gives no special reward for individual effort and in which the greatest benefit is that acquired by length of service and the pension it carries, the human tendency is to keep an appointment as long as possible. Here, also, is a matter which calls for a change of policy, namely, the introduction of the principle of awarding bonuses. But the bonuses will need to be such as to be a real inducement to an inspector to do his utmost, and to attract the right class of man. A scheme considered by the Board was that an inspector would receive a substantial bonus, in the form of an increase in salary, as soon as his area had been declared clean for a period of, say, twelve months and if he kept it clean for, say, three years an additional bonus would be paid. When as a result of the greater efforts which would ensue, a sufficiently large portion of the country were clean to permit a reduction in the number of inspectors, those whose services might accordingly be dispensed with would have the option of receiving a large bonus or of being transferred at their own salaries to another area which was not clean, with the same ultimate prospect of another substantial bonus when finally their services were no longer required by the Government. If it be objected that the expenditure involved would be too great, the system holds out the prospect of speedily eradicating scab and eventually saving the hundreds of thousands of pounds which are now expended year after year on a scourge which cannot be removed. And with the passing of scab, there will be available the vast sums now, in a large measure, fruitlessly expended which could be used in developing our agricultural industry.

We go on from year to year with the high hope that each will see the diminution of scab, but each year seems to bring a train of circumstances which frustrates our best efforts. Indeed we have become familiar with the presence of the disease, and many have become lethargic in their fight against a pest which is causing great loss to the community. We have an army of sheep inspectors charged with assisting the farmer in his dipping operations, educating him, and generally controlling the spread of scab, but many farmers do not give sufficient attention to their dipping, and in other ways are responsible for the continuance of the insect in our flocks, nor are the penalties inflicted by our laws sufficiently stringent apparently to act as a deterrent or corrective. We need new methods.

The Advisory Board gives a lead, therefore, to the sheep farmers of the Union. Our past efforts having met with little success, can the scab problem be tackled from the new vantage afforded by the lessons of the past?

The Department wishes to have the benefit of the views of the farming community on the subject, and an invitation is now extended to all farmers' associations and other agricultural bodies in the Union to give an expression of opinion on the suggested policy for dealing with scab. All communications should be addressed to the Secretary for Agriculture, Pretoria.

CONSTRUCTION OF EARTHEN DAMS.

By I. J. P. KLEYN, C.E., Department of Irrigation.

GENERAL.

SUCCESSFUL farming in South Africa is very much dependent on the water supply available on any selected farm, no matter what class of farming is practised. The natural water supply of this country, however, is erratic. Rivers having a perennial flow are few and far between and are only found in those regions where the rainfall is sufficient for agricultural requirements appropriate to the local rainy season. With a few exceptions the flow in these rivers decreases to such an extent in the dry season that there is barely enough flow in them for agricultural operations, and frequently what little water there is flows for long distances literally underground below the sandy bed of the channel. The best conditions are found in a narrow strip along the coast of the Cape Province, Natal, and the portion of the Transvaal east of the Drakensberg. The summer rainfall over the greater part of the Transvaal and the northern and eastern portion of the Free State is usually sufficient for summer crops, such as mealies, millet, etc. For spring crops, fruit and permanent crops, irrigation is necessary. Unfortunately, when spring or summer crops require water badly, the rainfall throughout the country cannot be relied upon; this period is from August to the end of October, and irrigation must be resorted to. As most of our rivers are intermittent streams, i.e. rivers that only flow during the rainy season or after a heavy rain, it is essential that provision be made to conserve the flow, or some of it, during the wet season, in order to carry out operations when it is dry.

It will thus be seen that the most important factor in irrigation in South Africa is conservation, and that successful agricultural operations are almost entirely dependent on adequate storage works.

Before deciding on the extent of the works necessary for any class of farming, one should know what is the amount of water required to bring any particular crop or fruit to maturity. In a country where the climate and rainfall vary so considerably, it is impossible to lay down a hard and fast rule. In the Karroo and the north-west of the Cape Province the annual rainfall is often not more than 8 inches per annum, and the country is subjected to very dry and hot winds, while in the Transvaal the annual rainfall is 28 inches on the high veld, and hot and dry winds are unknown; it is therefore clear that the amount of water required to bring a crop to maturity in the latter area will be totally inadequate for the same purpose in the former area. As a general rule it can be taken that the amount of water required to mature a crop by means of irrigation and rainfall combined varies from 18 inches to 36 inches.

No matter in which part of South Africa agricultural operations are carried out, provision must be made to give the crop at least one

watering between the months of August and October. An assured watering in December is needed in most cases in the high veld of the Transvaal to ensure a successful crop of mealies.

Having arrived at the approximate amount of water required for any given cultivated area, it will be necessary to carefully study the question of the adequacy of the water supply. This is dependent on the area draining into our storage works, the annual rainfall over that area, and the intensity of individual rains. Unfortunately, the data collected by the different Government Departments are mostly of such recent date that it is not advisable to apply them without caution. Generally speaking, it would not be wise to estimate the run-off from a small catchment area at more than 5 per cent. and for large areas 2½ to 3 per cent. will be found safe.

The water stored will be subject to heavy losses from the reservoir from evaporation, which amounts in many cases to from 15 to 20 per cent. Again, when distributing the water from the reservoir to the lands a large amount is lost in the conduits by evaporation and percolation. This amount may reach from 35 to 45 per cent., and is dependent on the distance the lands to be irrigated are situated from the storage works. If the lands are immediately below or in the near neighbourhood of the works, this loss will be very much less.

Having estimated the probable loss under the above headings and determined the depth to which the acreage to be irrigated will require flooding, the least volume of water to be stored can be readily calculated. The next step to be taken is the careful investigation of the proposed site for the reservoir, and it is here that expert assistance may become necessary. The Union Government offers this assistance wherever wanted, and printed application forms can be obtained from the Irrigation Department, Union Buildings, Pretoria, when any bona fide farmer requires such assistance.

It is not proposed to describe here the methods of preparing for or constructing large and far-reaching storage works. The methods of constructing now described, it is hoped, will be sufficient to assist the ordinary farmer to a right appreciation of what should be done and much of what should be avoided.

EARTHEN DAMS.

(1) *Selecting Site.*

In selecting the site for storage, the following points must be observed:—

(*a*) *Catchment area or source of supply.*

(*b*) *The basin to store the water.*

(*c*) *Proximity and suitability of materials with which to construct.*

(*d*) *The suitability of the foundations.*

(*e*) *The waste weir.*

(*f*) *The proximity of the lands to be irrigated.*

(*a*) *Catchment Area or Source of Supply.*—It is obvious that the amount of ground that can be irrigated is entirely dependent on the volume of the water supply, and that this again is governed by the

mean annual rainfall over the area draining into the selected site for storage, the extent of this area, and its topography. The rainfall can be arrived at from observations taken by the Meteorological Branch at stations inside the catchment area, or, failing these, by approximation from surrounding stations, and as near as possible to the selected site. Local inspection and information obtained from farmers living around will suffice to determine the extent of the catchment area, and it is also clear that the water draining from hilly, rocky country will be more than that draining from gentle slopes well covered with grass, or some other dense vegetation. The percentage to allow for the run-off should not exceed 5 per cent. for small catchments, and 2½ to 3 per cent. for larger ones. As an example, if we have a medium catchment area, with a rainfall of 20 inches, from which 4 per cent. may be expected to run off, and if the losses by evaporation in the reservoir be 20 per cent., and 30 per cent. of the remainder is lost in the canals, it will require the storage of the water from 27 morgen to irrigate 1 morgen of ground with four 3-inch waterings.

In many cases it will be found impossible to select a suitable site for a storage dam in an adequate catchment area; but outside the main drainage course a suitable site may be available. It may then be possible to construct diversion works in the main drainage course and lead the water by means of a canal to the selected site. This, of course, is a more expensive procedure than having the selected site on the main drainage course.

(*b*) *The Basin.*—The catchment area being large enough to give the required amount of water, it is necessary that the works will retain this amount. As the cost of an embankment increases considerably with its height, it is essential to endeavour to obtain our purpose with a low wall. In selecting the basin it will be necessary that the site of the wall be as narrow as possible, i.e. a narrow contraction in a depression. Behind the wall where the water has to stand the depression should preferably widen out and the slope of its bed should be even and not steep, so that the edge of the water will be a good distance away from the wall.

It is, however, unwise to carry out these principles to the extreme as a too shallow wide basin is subjected to excessive losses in evaporation.

In order to find out the volume of water a basin will store, a contour survey of the basin is required. But as farmers are unable to carry out such work themselves a rough idea of the volume of water can be obtained by taking the area of the water at full supply level of the dam (i.e. the level of the sill of the waste weir) and multiply this by one-third of the depth of water above the outlet-pipe.

All the water stored in the basin is not available for irrigation, as during the period of storage a large amount is lost by evaporation and percolation. This loss varies from 15-30 per cent.

(*c*) *Proximity and Suitability of Material.*—The soil to be used in the embankment must be such as will consolidate and form, as far as possible, an impervious homogeneous mass. A sandy loam containing clay is very suitable for this purpose. Black turf or any other earth containing vegetable matter should not be used. The nearer the place where such suitable soil can be found to the seat of the wall, the lesser the expense in constructing the embankment will be. Avoid excavating below the dam.

(*d*) *Suitability of Foundations.*—The foundations at the selected site should be carefully inspected. Very often when the surface of the selected site seems suitable, by digging a few trial holes in the site it is found that the soil overlays a very deep stratum of gravel and sand, making the work impossible. Trial pits should always be sunk in order to find the impervious foundation, such as rock or potclay. If such foundations are not obtainable at a reasonable depth, the site must be abandoned.

(*e*) *Waste Weir (Overspill).*—The site available for the waste weir often determines the feasibility of the storage work. The requirements for the waste are: Sufficient length, a flat longitudinal and gently sloping cross-section, hard foundation, proper elevation, and good outfall. The length is necessary to get the discharging capacity, the flat section and hard foundations to do away with costly works in the channel, the elevation of the crest is determined by the full-supply level of the reservoir, and a good outfall is required to prevent damage by floods. The ideal site for a waste weir is generally a low "nek" near to the embankment, but separated from it by a "kopje."

It is necessary that the waste weir should discharge the maximum flood expected. If it cannot do this, the safety of the works is endangered. In determining the maximum discharged, it is unwise to assume or guess the amount, and farmers wanting to construct a storage work are urged to obtain the required information from the Hydrographic Surveyor, Irrigation Department, who makes it his duty to gather this information all over the Union of South Africa by taking actual measurements. It is far better to construct a waste weir that is several feet too long than one 1 foot too short.

If it is impossible to have a waste weir over a "nek" away from the embankment it will be necessary to construct a wingwall up-stream and a lining wall on the down-stream side to prevent the flood water coming over the waste weir scouring away the toe of the embankment.

(*f*) *Proximity of Lands to be Irrigated.*—The loss of water in the canals conveying the water from the storage works to the lands is considerable, and very often this loss reaches 50 per cent. The further the lands are away from the reservoir, the greater will be the loss, and in determining the site for the works, this matter is of much importance, as far as expensive works may be required, in order to compensate for the losses in the canals, and these losses may show the supply to be inadequate.

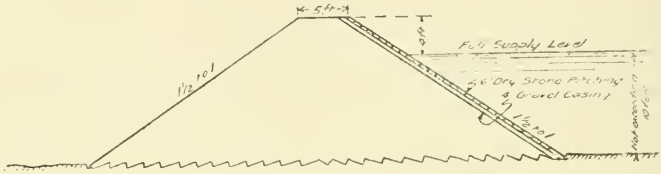
(2) *Dam Embankment.*

The construction of the earthen embankment here described, refers only to such as will retain water to a maximum depth of 15 feet against the wall. If it is desired to construct works for storage of a greater depth, expert technical advice should be obtained.

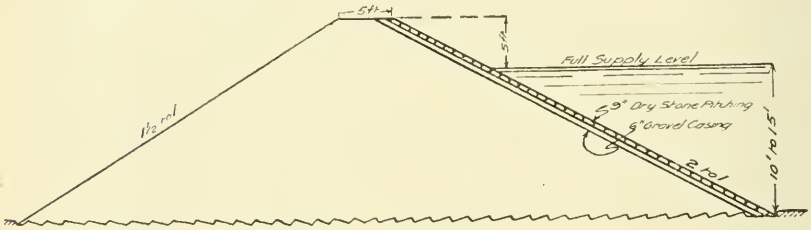
In constructing an earthen embankment the following points must be observed:—

(*a*) Section of dam, (*b*) setting out of dam wall, (*c*) cleaning seat of dam wall, (*d*) puddle core, (*e*) outlet, (*f*) earthen embankment, (*g*) pitching, (*h*) waste weir or overspill.

(*a*) *The Section of the Dam.*—The following section for dam walls may be adopted with safety for ordinary good and properly consolidated soils resting on good foundations. For depths of water not exceeding 10 feet the top width of the dam must be 5 feet, the up-stream slope 1½ to 1 foot, the down-stream slope 1½ to 1 foot, and the top of the dam above the full-supply level 4 feet. For depths of water from 10 to 15 feet, the top width of the wall must be 5 feet, the up-stream slope 2-1 foot, and the down-stream slope 1½ to 1 foot, and the top of the dam above the full-supply level must be 5 feet.



SECTION FOR DAMS UP TO 10 FT. HEAD OF WATER



SECTION FOR DAMS WITH FROM 10 TO 15 FT. HEAD OF WATER

(*b*) *Setting out Dam Wall.*—On each side and above the top level of the dam the top width must be staked off, so that when the dam is completed the up-stream and down-stream edges of the top will be in line with these stakes. Stakes defining this line should also be put in at the flanks of the dam marking the ends. The up-stream and down-stream toes must be staked on the ground, and these stakes well protected by beacons built up with loose stones, in order to prevent them being interfered with during construction.

(*c*) *Cleaning Seat of Dam.*—The seat of the dam must be cleaned from all vegetation and loose rock, and if the embankment has to cross over a gully or donga, care must be taken to remove all silt deposited there and to slope down and step the banks of the gully or donga in order to ensure a proper bond with the new work. The seat must now be deeply ploughed over.

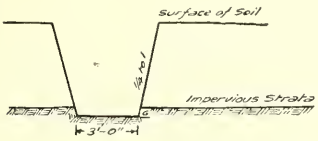
(*d*) *Puddle Trench.*—The trial holes described in section (*d*) above will show whether or not an impervious core is required. In the majority of cases it has been found that a layer of gravel and sand underlies the surface soil, necessitating the construction of a core. In many cases good retentive clay can be procured in the neighbourhood where the core may be constructed of clay. A trench is now excavated in the centre line of the dam and across the area

of pervious stratum, and through this stratum well into impervious layers of either potclay or rock below it. The section of this trench is as shown in the sketch below.

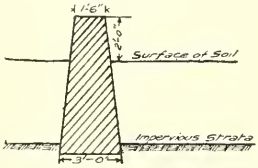
This trench is now filled with clay. The filling must be constructed as a compact mass filling the whole section of the trench, care being taken to avoid badly consolidated joints or porous layers. This can be prevented by constructing the different layers as rapidly as possible and by keeping wet the surface attained whenever the work is stopped. The clay must be damp and plastic, but not wet. This puddle filling is generally carried up to 2 feet above the surface of the ground.

If good retentive clay cannot be procured, a core wall of concrete is generally substituted, having a section as shown above.

The concrete used for the core is made in the following proportions: 1 part cement, 2 parts sand, and 4 parts broken stone.



PUDDLE TRENCH

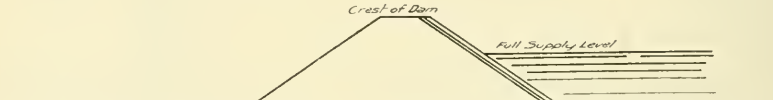


CONCRETE CORE WALL

(*e*) *Outlet.*—For our requirements, a 6-inch pipe with a valve on the down-stream side will suffice. In very rare cases a delivery exceeding that of a 6-inch pipe will be needed. The position of the outlet pipe should be so chosen that settlement in the dam wall will have no injurious effects on it, and the best place will be where it can be laid in rock or in hard sound insoluble material. If these are not available, the outlet pipe should be laid in a trench well carried down into the ground, and the pipe embedded in a casing of concrete with a wide base. Whether laid in rock or otherwise the pipe should be encased in at least 6-inch of concrete. When deciding where the outlet pipe is to be put, it should be borne in mind that space should be provided below the outlet for the accumulation of silt in the reservoir; the capacity of the reservoir below the outlet is smaller relatively than the capacity above the outlet; it is, therefore, not worth much extra expense to utilize the former, the lower the sill the greater the cost of the outlet and the danger of damage through settlement of the dam; generally the canal will gain command of the ground quicker and will be shorter for a higher sill than for a lower one. At the inlet the pipe should have a head wall and if the pipe is level with the ground a channel should be excavated from the pipe into the reservoir basin to ensure the tapping of the reservoir down to the level of the intake. A staunching ring round the outlet pipe, situated in the centre of the dam will prevent any percolation of water along the sides of the pipe. A head wall at the outlet of the pipe is also required. A basin 5 feet wide and 12 feet long excavated in front of the outlet and paved with a 9-inch grouted pitching will check the rush of the water from the outlet pipe into the canal, and

so prevent scouring of the canal. The bed of this basin must be 12 inches below the bed of the canal.

(*f*) *Earth Bank.*—On the up-stream side of the dam the ground must be ploughed over, and all soil containing any vegetation or vegetable matter removed. Only soil free from these must be used in the earth bank. The soil in the down-stream side of the dam should not be disturbed. It will be well to commence operations after some rain has fallen, or if this cannot be waited for to give the seat of the earthen wall a wetting in order to ensure a proper bond between the foundation of the earth bank and the soil being deposited on it. It is wrong to bring absolutely dry soil on or into the earth bank, as this will only be pulverized by the draught animals, and no proper consolidated mass can be obtained. It is, therefore, well not to plough over more ground than can be used in one shift of say 4 hours in order not to lose all humidity in the loosened ground. The ground is conveyed to the wall by means of dam-scrapers pulled by oxen or donkeys.



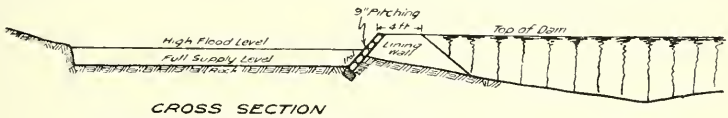
SECTION ALONG OUTLET PIPE

A better consolidated wall will be made by using oxen instead of donkeys as draught animals, for they are much heavier in weight and have split hoofs. For bringing the earth into the wall endeavour must be made to let the animals follow a course as much as possible parallel to the centre line of the wall. The wall should be carried out in layers of 6-inch thickness spread over the whole width of the wall, having a slight dip towards the centre of the wall. These dams are generally commenced after the rainy season and finished before the wet season starts again. It may happen that the dam cannot be completed before the rainy season starts, and in this case it will be necessary to take precautions to allow floods to pass without doing damage to the works already carried out. Any water gathered in the storage basin can be tapped by means of the outlet pipe, and the works can be resumed. No matter how thoroughly the work has been carried out, settlement in the embankment must be anticipated and provision made therefor. The embankment should, therefore, be carried out 12 inches higher than originally designed to allow for this.

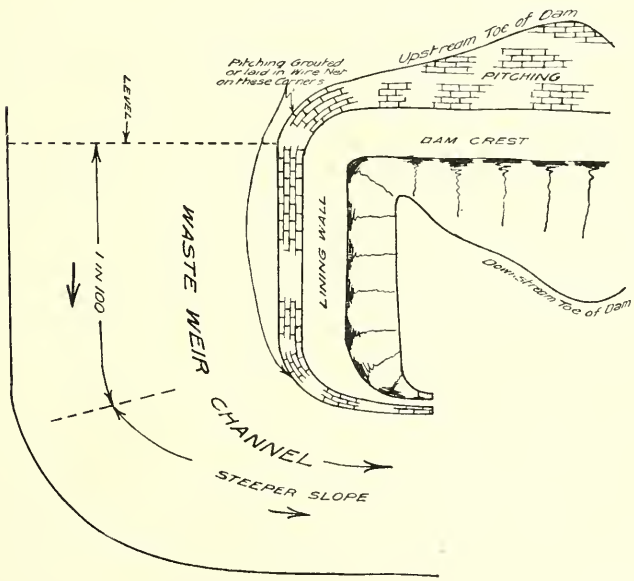
(*g*) *Pitching.*—The up-stream slope of the embankment is provided with a 6 or a 9 inch dry-stone pitching resting on 4 or 6 inches of gravel. The stone must be hand-packed and must rest well into the gravel. All openings in between the stone must be filled up with smaller stone, and then rammed in with a 4-lb. hammer. The idea of the pitching is to prevent the wave action drawing away the

soil from the embankment and so weakening the structure. Only a well-packed and properly built pitching will therefore suit the purpose.

(*h*) *Waste Weir or Overspill.*—If the conditions laid down in section (*e*) of part (1) above are present and the ideal site for the waste weir, a "nek," is available, the only work necessary will be to excavate this nek to the full-supply level of the reservoir and to such a width as to enable the expected maximum flood to pass through. The bed of the waste weir must be of rock or hard sound inscluble material, otherwise masonry check walls, along the length



CROSS SECTION
ON CENTRE LINE OF WASTEWEIR



PLAN
SKETCH OF WASTE WEIR LINING WALL

of the waste weir and carried down to good hard foundation, will be needed to prevent the flood water scouring the bed and thus lowering the full-supply level of the reservoir. If the foundations for these check masonry walls are not present or are too deep to justify the expense of carrying them out, a dry-stone wall hand-packed in a wire net made of No. 8 galvanized wire, and having a 6-inch mesh, may be substituted. Behind these dry-stone walls a dry-stone pitching made in a similar wire net, and about 15 feet wide, is made to

prevent erosion and possible undermining behind them. Ideal waste weirs are very seldom met with, and mostly a waste weir immediately adjoining the earth bank must be made. The earth bank is then carried to a point where the ground surface is about 12 inches above the full-supply level of the reservoir, and it then swings round and runs along the waste weir forming a lining wall. From this point the ground is excavated to a width corresponding with the length of the waste weir. The depth of the waste channel is level in the line of the centre of the dam and above this line towards the reservoir. The down-stream side of the waste channel is excavated to a slope of 1 in 100, and the bed of the down-stream channel is a little deeper on the side farthest from the dam wall, in order to throw the current away from the dam. The tendency of the flood water to flow down the steep slope and probably damage the toe of the embankment is checked by the above-mentioned lining wall extending for such a length that the flood water cannot possibly harm the dam any more (see sketch-plan). The height of the lining wall must be such that the flood water cannot possibly top it.

The pitching of the dam wall is carried round to the lining wall and all along the inner side of this wall. As a rush of water may be expected round this point of the dam, the pitching is carried well down into the ground resting on very large stones or on a mason wall and is grouted or laid in a wire net with a 6-inch mesh. A better, but more expensive, construction is to let the earth bank abut against a wing wall carried down to good foundation. The lining wall is then an extension of this wing wall on the down-stream side. The remarks made above with regard to the bed of the waste weir are applicable here.

It is not uncommon to see the flank waste weir excavated in rock, and, though this is very expensive, it gives a very good waste weir, and generally the rock so excavated can be used for the pitching.

Export of Grain, etc.

The following quantities of grain, etc., were exported during January, 1921 (in bags):—Maize, 59,499; maize meal, 33,020; hominy chop, 4400; oats, 10,869; bran, 500; kaffir corn, 302; and millet, 11; total, 108,601.

The total number of bags exported for the seven months from the 1st July, 1920, to 31st January, 1921, was:—Maize, 356,001; maize meal, 254,054; maize flour, 1199; maize grit (rice), 3111; hominy chop, 52,716; kaffir corn, 966; oats, 12,006; beans, 1213; lucerne seed, 366; millet, 11; bran, 500; total, 682,143 bags.

The stocks in hand at all ports at 31st January, 1921, were (in bags):—Maize, 97,322; maize meal, 22,650; oats, 451; rye, 498; hominy chop, 275; kaffir corn, 200; total 121,396.

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LOCAL MARKET PRICES.

The Rise and Fall of the Market.

We publish hereunder, as a matter of general interest, a comparative statement showing the market rates for a number of local products ruling at certain centres of the Union at mid-January in 1919, 1920, and 1921. In the absence in our marketing system of any definite standard of quality for the commodities concerned, the minimum and maximum prices are given, and as the quality of each commodity would be, in a large measure, of similar standard at the same period of the season in each year, the prices afford some indication of their value on the municipal markets at the dates stated. The bulk of the produce so disposed of passes through the Johannesburg market, and the prices obtained there may be taken as representative of the larger portion of our locally sold production; the other centres are also important marketing ones, and the prices ruling there also indicate the state of the produce trade. In the statement hereunder the following main features are observed:—

Wheat.—At Johannesburg there was a sharp rise and almost as sharp a decline, the 1920 prices being about double those of 1919, falling in 1921 to very near the 1919 level. Prices at Capetown and Bloemfontein followed the same trend.

Maize.—This was fetching at Johannesburg 100 per cent. more in 1920 than 1919, but in 1921 prices had receded to about the 1919 level with a lower tendency, the maximum 1921 price being 1s. 9d. less than that of 1919. This can be applied to the other markets as well, excepting that the rise in price was somewhat greater than at Johannesburg, while 1921 maximum rates were still about 3s. 6d. higher than those of 1919.

Oats.—Prices in 1920 were about double those of 1919 on the Johannesburg market, and, while 1921 saw a considerable decline, the price was still about 5s. greater than that of 1919. In Capetown there was the same great increase between 1919 and 1920, but this year the prices ruling are at the same level of 1919; this applies also to Bloemfontein, excepting that the 1921 price has not quite fallen to the 1919 level.

Lucerne.—On the Johannesburg market the 1920 price was double that of 1919, while in 1921 it had fallen practically to the 1919 level. The same fluctuation is observed at Bloemfontein, similarly at Capetown and Durban, though at the two last-named markets the 1921 price was still somewhat higher than that of 1919.

Potatoes.—The 1920 Johannesburg (maximum) price was double that of 1919, and while there was an appreciable decline in 1921, the latter price was still 8s. 6d. in excess of 1919. This is applicable to Capetown also. At Bloemfontein the increase of 1920 over 1919 was much greater, the maximum being almost treble that of 1919, and although 1921 shows a big drop, the price remains almost double that of 1919. At Durban the maximum 1920 price was 24s. in excess of the 1919 maximum, falling only slightly in 1921, when the excess over 1919 was 21s.

Eggs.—At Johannesburg the 1919 prices were highest, being from 3d. to 9d. higher than the 1920 ones, which again were about the same in 1921. In Capetown the maximum price shows a progressive rise of 3d. each year, at Bloemfontein the same tendency as at Capetown is observed, except that the increase between 1919 and 1921 is greater, being from 9d. to 1s., and at Durban the maximum prices of 1920 and 1921 are 8d. and 5d. greater respectively than 1919.

Butter.—There was a large difference in the Johannesburg prices of 1919 and 1920, the latter being more than double the former, but there is a decided decline again in 1921, when the price was greater than that of 1919 by from 4d. to 9d. only. At Capetown the 1920 prices were exactly 100 per cent. greater than those of 1919, and although there has since been a decline the maximum 1921 price is still 1s. greater than that of 1919. The Bloemfontein prices reflect those of Johanesburg, excepting that the difference between the 1919 and 1921 prices is somewhat larger at the former centre. Durban is more or less similar to Capetown, but the decline between 1920 and 1921 is negligible, being 2d. per lb. for best butter.

Beef.—Compared with 1919, the maximum 1920 Johannesburg price was 50 per cent. greater and the 1921 price 30 per cent. greater. At Capetown the maximum 1920 and 1921 prices are identical, each being 1d. in excess of 1919. This is the position in Bloemfontein, the excess on 1919, however, being 3d. Similarly in Durban, the 1920 and 1921 prices are the same, but the increase on the 1919 price is greater than at the other centres.

Mutton.—At Johannesburg minimum and maximum prices moved in sympathy: the 1920 maximum was 7d. higher than the 1919 one, but had fallen in 1921 to 1d. lower than in 1919. At Bloemfontein the 1919 and 1921 maximum price is identical, that of 1920 being 3d. higher. At Durban there was a progressive increase of about 4d. each year, the 1921 price being 7¾d. higher than the 1919 one. At Capetown the minimum price of 8d. in 1919 was 9d. in 1921 and 10d. in 1920, but unlike most other commodities the maximum 1920 price was 2d. and 4d. less respectively than those of 1921 and 1919.

Summary.—The prices at mid-January shown in the statement were obtained from market reports and are *actual* prices ruling at a definite date and are not averaged in any way. It is possible, therefore, that there may have been certain local factors affecting prices at any or all of the centres on the dates in question of which this Department is not aware. But the outstanding feature the returns reflect is the great effect on our production of the 1918-19 drought at its height, when prices generally were double those of a year previous; wheat, maize, oats, lucerne, and butter show this, and though in some cases the present-day prices have reached the pre-drought level, there is still a tendency for prices to remain somewhat higher than those of 1919. Potatoes showed a great increase in 1920, and while prices have fallen they are still far in excess of 1919. Beef increased in 1920, but no decline is seen in 1921, but in mutton Johannesburg and Bloemfontein prices show a decline to-day over those of 1919; the position is reversed in Durban, while at Capetown at the height of the drought the price was lower than both that of 1919 and 1921. In regard to eggs the general tendency has been towards an increase in price, due in a measure to the export trade in this article.

LOCAL MARKET RATES RULING IN MID-JANUARY OF 1919, 1920, AND 1921.

	Wheat. 200 lb.		Maize. 200 lb.		Oats. 150 lb.		Lucerne. 100 lb.		Potatoes. 150 lb.		Eggs. Doz.		Butter. Lb.		Beef. Lb.		Mutton. Lb.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
January, 1919—	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Johannesburg ...	18 0	28 0	10 8	15 9	10 0	12 4	3 3	6 9	2 0	14 0	1 9	3 6	1 0	1 6	*42 6	50 0	0 7½	0 9
Capetown	32 0	33 0	14 6	15 0	11 2	11 3	6 3	6 6	10 0	17 6	1 5	2 0	1 6	1 8	0 11	1 2	0 8	1 4
Bloemfontein ...	26 6	31 6	11 0	14 6	11 0	16 6	4 9	7 0	5 0	13 6	1 0	2 0	1 0	1 9	0 10	1 0	0 10	1 0
Durban	—	—	12 0	13 0	12 0	14 0	4 9	5 6	4 0	14 0	1 9	2 10	1 0	1 6	*20 0	44 0	0 6¾	0 8¼
January, 1920—																		
Johannesburg ...	37 6	53 6	28 0	31 6	22 6	23 9	11 6	13 0	10 0	28 3	1 6	2 9	2 7	3 6	*50 0	75 0	1 1	1 4
Capetown	40 0	50 0	31 0	33 0	22 0	23 0	12 0	13 0	20 0	35 0	2 0	2 3	3 0	3 6	0 10	1 3	0 10	1 0
Bloemfontein ...	48 0	55 0	30 0	35 0	23 6	26 0	10 6	13 6	20 0	37 6	1 6	3 0	2 6	3 9	0 10	1 3	1 0	1 3
Durban	—	—	25 0	32 0	—	—	7 6	10 0	16 0	38 0	1 9	3 6	1 6	3 5	0 4	0 9	1 0	1 0
January, 1921—																		
Johannesburg ...	28 0	31 6	12 0	14 0	14 10	16 6	3 9	7 0	4 0	22 6	1 9	2 9	1 4	2 3	*37 6	65 0	0 6	0 8
Capetown	34 0	35 0	17 0	18 0	10 6	11 0	8 0	8 6	14 0	25 0	2 0	2 6	1 3	2 8	0 10	1 3	0 9	1 2
Bloemfontein ...	30 0	35 6	13 6	17 0	12 6	17 6	4 6	6 6	15 0	25 0	1 9	3 0	1 6	2 9	0 10	1 3	0 9	1 0
Durban	—	—	13 0	17 6	—	—	4 6	7 0	10 0	35 0	1 9	3 3	1 6	3 3	0 4	0 [illegible]	0 6	1 4

* Per 100 lb.

AGRICULTURAL ORGANIZATION.

By H. A. MELLE, B.A., Division of Botany.

UP to twenty years ago South Africa was regarded as the most backward dominion in the British Empire. A writer in 1901, comparing it with the others, showed that South Africa was the second oldest dominion and yet lagged far behind the other British colonies in every industry with the exception of those of gold and diamonds. He attributed this backwardness to the adverse conditions prevailing in South Africa, and went on to say that if the early settlers of South Africa had gone to any other British colony they would have fared infinitely better. Thanks, however, to the unremitting efforts of the farmer and the Department of Agriculture, numerous plagues, pests, and droughts have been mastered and many economic problems solved, establishing our agriculture on a firm basis and removing the element of gambling formerly associated with farming in South Africa. Agriculture is now recognized as the premier industry of the Union, and farming in South Africa has made more comparative progress in recent years than any other country in the world. This was evident at the last Royal Agricultural Show at Darlington. South Africa has been notorious for its poor exhibits abroad, but this year, thanks in a large measure to the enterprise of the Trade Commissioner, Mr. Canham, the South African exhibit was one of the chief features of the show.

Our agricultural progress is reflected in increased production, decreasing imports and increasing exports of farm produce, improved methods of farming, the rising value of farm land, etc., and one of the most marked features of our forward movement is the recognition of the importance of organization

For convenience we can divide agricultural organization under three heads:—

(1) Organization of the farm; (2) organization of farmers in regard to the purchase of their requirements and disposal of their produce, i.e. co-operation; (3) organization in the relationship between the State and the farmer.

(1) ORGANIZATION OF THE FARM.

It is not the purpose of this article to go into the details of organizing a farm, but merely to emphasize the importance of running a farm on business principles.

Strict book-keeping is one of the essentials of sound farm management. The average farmer is primarily an open-air man. He works hard all day and does not concern himself much with account keeping. He likes to be out and about and hates to sit down to figures. He

looks on outdoor work as productive and account keeping as unproductive. Book-keeping is a subject which has not been included in the farmer's education to the extent that it ought to have been, and even in our agricultural schools and colleges this all-important subject does not receive the attention it should. Mr. Rayman, Chairman of the Legislative Committee of the Wisconsin Society of Equity, very suggestively remarks: "I believe that it will repay an agricultural college many fold to understand that farmers will be quicker to apply scientific methods to their industry *after they have learnt the value of science in the conduct of their own business activities, such as in co-operative societies, creameries, and cheese factories, and in associations organized for the purchase of their agricultural requirements.*"

The ascertaining of agricultural costings involves only the keeping of such financial records as are kept by many farmers, plus "departmental" accounts for the various branches of his farm. These extra "departmental" accounts require the keeping of labour records, of statements of food consumed on the farm, of records of how artificial manure and dung are used, and the analysis of all other expenses chargeable over the various fields or branches of the farm.

Without strict book-keeping and costings one cannot hope for efficiency in one's farming operations. The farmer's books show him whether his past management has been on the best lines, and by judging from results he can vary his present and future policy. A farmer, therefore, who is desirous of obtaining the best possible results *must* keep books if his farm management is to attain the highest standard.

In England a number of progressive men have commenced farming on industrial lines. While in England I visited Mr. S. F. Edge, of Gallops Homestead, Sussex, who has become world famous for his pedigree pigs and shorthorn cattle and is held up as a model farmer. He, too, is one of the pioneers of farming on industrial lines. Mr. Edge, it may be explained, was well known in the motor world, but owing to indifferent health exchanged his motor business for that of farming. Having acquired efficiency in the former he applied this knowledge to the business of farming. What is the result? He has been farming for only nine years and is already recognized as the most successful pig breeder in the world, and it is expected that his shorthorns will soon come into great prominence. When Mr. Edge commenced farming he was blissfully ignorant of the principles of agriculture, but, guided by his former business knowledge, has had an uninterrupted success in farming.

How many of our farmers keep a record of their costings or even keep books at all? If not, how can they possibly tell which branch of their farming is paying or not? Costings is admittedly more complicated than ordinary book-keeping, but if no accurate account is kept of the expenditure in each branch of farming it is at the best a gamble.

South Africa is so often stricken with drought, and yet how many farmers consider it worth while to improve their veld by tillage, fertilizers, etc., and so produce more and better fodder and store it up for the lean years? Let us for a moment compare the English and the South African farmer. The English farmer sows every year a certain portion of his land down to grass in order to provide fodder

in winter in the shape of hay. His expenditure approximately is per acre:—

Rent	£2	0	0
Seeds	4	10	0
Fertilizers	2	10	0
Ploughing	1	8	0
Harrow, seeding, and rolling... ...	1	10	0
	£11	18	0

Return: 1½ tons first cutting and 1 ton for second cutting; total 2½ tons of hay.*

How many South African farmers are there who will spend £12 per acre in growing grass and be content with a return of 2 to 2½ tons of hey? In teff we have an infinitely better hay grass than rye grass, and in kikuyu grass we can grow a better permanent pasture than the old English pastures. The English farmer has an outlay of £13 to £15 per acre in establishing his permanent pasture, whereas the South African farmer grudges a single ploughing in putting down land to kikuyu and complains that it does not come up to expectations. The English farmer grows root crops at the cost of £28 an acre and gets a return of 20 tons roots per acre. The South African farmer can grow spineless cactus and elephant grass, both permanent crops, at the cost of, say, £5 an acre and have a return of up to 60 tons of fodder per acre. Does the South African farmer make full use of his advantages? Is there any excuse why his stock should succumb to drought or die when sick solely for the want of some succulent and palatable food?

Another important item in the management of the farm is labour. The war has placed the much debated question of labour upon an essentially different footing to that which it occupied before. Nowhere has the effect been more marked than in the British Isles. Labour is mainly responsible for the establishment of the Agricultural Wages Board in England. Before the war the agricultural labourer received from 18s. to 21s. a week: now he receives a minimum wage of 50s. for a 48-hour week, with extra pay for any overtime work. Has this adversely affected the British farmer? Leading farmers like Mr. Edge and Major Amos say "no," and further, that it is one of the stimulating causes of the recent development of agricultural co-operation in England. The Scotch farmer has not been affected by this increase of wages; his labourers are educated and are worth more than £3 a week to him. A Scotch shorthorn breeder admitted to me that he was paying his labourers £10 a week, and he could afford to increase their wages.

The war has shown how serious was the mistake of undervaluing the agricultural labourer, and has happily knocked a good many old prejudices and misconceptions out of people's heads. The mistake was the more serious, since it is by no means difficult to evolve an industrial labourer out of an agricultural one, but extremely difficult to reverse the process and turn an industrial labourer into an agricultural one. The war has taught the British farmer that in stinting

* If the reader is interested in these figures I would refer him to the evidence given by the witnesses before the Royal Agricultural Commission in 1919.

labour he has starved agriculture itself. The world in the past set down the agricultural labourer as a "yokel," an "unskilled hand," whose labour could not be highly appraised, but recent history has shown that his labour is as skilled as that of his industrial brothers. The difference between the two is one not of degree but of kind.

Profit-sharing in agriculture has been tried by progressive farmers in England, e.g. Major Amos, and has met with success. Mr. Edge has a different system. He gives his labourers every opportunity and encouragement to learn their particular job thoroughly. Any labourer in his employ has the right to go to the office and obtain information as to how a particular branch of the farm is run. Then if he has any suggestion to make he submits it in writing and hands it in at the office, and for any of practical value to the business, a bonus is paid.

It is well known that cheap labour does not necessarily mean economic output. Mr. Hockaday, a great American practical expert in the sale of agricultural produce, urges farmers rather to employ an expert packer at 5 dollars a day than an ordinary man at 1 dollar. "Highly graded produce," so he adds, "in proper packing sells itself, the trouble lies with culls, low-graded, and mixed shipments." It is still an open question whether the farm tractor can economically replace the span of oxen in South Africa, but there is a general consensus of opinion that it soon will, and what preparations are we making for that time? What proportion of our agricultural labourers is able to work with machinery, let alone a complicated machine like a tractor?

(2) Co-operation.

Smith-Gordon says "Co-operation represents the reaction of the spirit in ordinary men of humble position and small resources against the tyranny of a social order which has thrown all the advantages of combination into the hands of the rich and the powerful. It is in fact the weapon of those who strive towards a democratic control."

True co-operation requires a certain type of human material both for leaders and for followers, and this type must be built up (usually out of adversity) by patient training. A co-operative society must deal only in pure goods at clean prices—there is no room for fraud, trickery, adulteration, or extortion. The greatest of all underlying principles, however, is undoubtedly that when a man becomes a member of a co-operative society he binds himself to support it—not only by his trade but by his lively interest in its affairs. The careful limitation of voting power to one vote for every member, be his interest large or small, does more than confer a privilege upon the member; it lays upon him the responsibility and duty of exercising his share of the control. Co-operation is based upon sound business principles; the bond of association is primarily a material one, and the form of constitution is built up exactly to correspond to practical needs and to safeguard concrete rights. On the other hand, it offers a method of bringing idealism into business and of training men to help one another and the State through rational citizenship. Such a movement demands that its pioneers must have, on the one hand, business knowledge, clear judgment, foresight, intelligence; on the other, honesty, faith, and, above all, loyalty. As the American Senator, Mr. Gronna, remarked, "there is no industry except farming

in which a man has to accept the price offered by the buyer," and yet there is no business like agriculture which responds to success better when organized. At the same time, however, co-operation is not a panacea for all ills. If one examines the history of co-operation in any country one will find that it is a touch of necessity that has brought farmers together to work and, if necessary, to fight in unison.

Agriculture may have been poor as in the case of Denmark. Up till the year 1864 Denmark was a country of large-scale cultivation, depending mainly on the export of grain for its foreign trade. In that year, however, as the result of an unsuccessful war with Prussia, the Danes lost the large mainland Province of Schleswig-Holstein, and found themselves confronted by a tariff barrier which effectually cut them off from their German markets in which they had been accustomed to sell the greater part of their produce. Farmers everywhere were in distress, and the position was rendered worse by a banking crisis. The Danish farmers were not slow in changing their mode of farming and successfully supplying the English market with poultry, eggs, bacon, and butter. This result has been achieved almost entirely by means of the co-operative system. The Danes early grasped the fact that the chief factor in establishing produce on the market is uniformity both of quality and, as far as possible, of quantity. They realized also that such uniformity could not be brought about by individual farmers working without organization.

It was the "gombeen man" or midleman who was the cause of agricultural co-operation in Ireland. The middleman with other business interests very naturally tries to make a profit at either end of his bargain. The middleman serves a most useful purpose where the two factors of supply and demand cannot otherwise be brought into touch with one another, otherwise his presence is burdensome and inimical to the community.

Organization is not merely an effective weapon for defence against profiteering and waste; it is an extremely useful aid to business in circumventing waste of time, and failure to produce at cheapest rates in best quality, and in quantities which command a market. To quote Mr. Hockaday again, "For the marketing of perishable products an organization is *absolutely necessary*, for the many questions arising in community shipping (i.e. transport) of such products can only be handled satisfactorily through an organization."

Dr. J. A. Ryan, a recognized authority in the United States on questions of social economy, to which he has devoted much study, writes: "Co-operation is a golden mean between individualism and socialism. It includes all the good features of both. On the one hand it demands and develops individual initiative and self-reliance, makes the rewards of the individual depend upon his own efforts and efficiency, and gives him full ownership of specific pieces of property. On the other hand, it compels him to submerge much of the selfishness and indifference to the welfare of his fellows, which characterizes our individual economy. It embraces all the good that is claimed for socialism, because it induces men to consider and to work earnestly for the common good, eliminates much of the waste of competitive industry, reduces and redistributes the burdens of profits and interests, and puts the workers in control of capital and industry. At the same time it avoids the evils of an industrial despotism, or bureaucratic

inefficiency, of individual indifference and of an all-pervading ownership."

Conditions Favourable to Successful Co-operation.

There is no magic about co-operation; it is not worth while to co-operate just for the sake of co-operating. There must be some real service to perform—either because of a lack of marketing facilities, or dishonesty of local buyers, or some other vital reason, before a farmer's economic organization should be called into existence, and then only after steps have been taken to ensure efficient management —at least as efficient as that of the individuals or firms with which the new organization has to compete.

Other essential features are that a co-operative organization must have sufficient business to make it worth while; sufficient capital to carry on its business efficiently; sufficient loyalty on the part of its members to stick to the organization in the face of the fierce competition to which it will be subjected; and sufficient patience to build up the organization gradually and not expect it to be a whirlwind success from the start. Most farmers have exaggerated ideas about the possible savings through co-operation, and are disappointed with the results of the first few months of it. Unless marketing facilities are actually non-existent, a farmers' organization must compete with experienced specialists already in the field, and unless it can perform the service with greater efficiency, or by eliminating some wasteful method, there is no reason for its existence. These things cannot be accomplished without efficient management and improved business methods, which are among the principal essentials to success. "There are many failures of co-operative enterprises, largely due to inefficient management. Education of farmers in the fundaments of marketing, education of managers in the technique of marketing methods, and the perfection of simple and efficient accounting systems, are all necessary before we may expect a more wide-spread development of co-operative marketing."*

Benefits Derived from Co-operation.

In the first place there are certain commodities where proper grading and packing cannot be accomplished except through co-operative endeavour. The best example is perhaps in the fruit business, where growers cannot hope to attain the highest efficiency through individual effort. The accomplishments of the California Fruit Growers' Exchange furnish valuable object lessons. By providing efficient means of marketing, co-operative organizations also serve as an inducement to farmers to raise larger and better crops. In addition to improvements in quality and grading and packing, co-operation also saves money to the farmer (if the management is efficient) both by retaining the profits otherwise taken by local buyers and by concentrating a larger business through a shipping agency, thereby reducing (unit) handling costs.

In addition to the direct economic gains derived from organization, important social and business benefits result. The individualistic tendencies of farmers are partly broken down through association; they have more in common, and their coming in contact with

* "The Marketing of Farm Products," by Weld.

each other at business meetings makes it easier for them to approach each other in social intercourse. Experience in a marketing association gives farmers a more rational outlook on marketing methods, and also both business experience and a higher sense of business responsibility. But none of these fortunate results occurs unless the farmers meet with, at least, a fair degree of business success, which in turn is possible only if their organization has undertaken to perform a real economic function and if it is managed efficiently.

"True co-operation," says Mr. Henry, "consists in organization based on mutual understanding to further community interests. Being a good neighbour is the first essential for being a good American"—and a good South African too, so one may add, or a good Christian. And Mr. C. W. Thompson, of the American Department of Agriculture, writes: "In the farming processes, from the first stage to the last, from the selection of the seed to the marketing of the product, as well as for the promotion of general social well-being in farm life, organization has proved its value, and, as this field is being reclaimed more and more fully, organized methods are being employed in increasing measure."

One of the brightest jewels in the crown of co-operation is the remarkable stimulating effect it has upon the pursuit of Education. Without exception wherever true co-operation has been practised it has been found to exercise the same power. And that power is compelling, constituting one of co-operation's best claims to our consideration in promoting national agriculture by means of education.

(3) ORGANIZATION IN THE RELATIONSHIP BETWEEN THE STATE AND THE FARMER.

"It may be asked, if co-operation is so advantageous to agriculture and to rural folk generally, in both an economic and a social sense, how is it to be organized? The question has, of course, attracted the attention of Governments claiming to be 'paternally' interested in the welfare of those whom they govern. Governments, appreciating its value, have tried to promote agricultural co-operation, and have in some cases set up imposing structures of organization having the title 'co-operation' conspicuously blazoned on their façade; but they have never yet succeeded in producing quite the right article. It is indeed difficult to see how they could produce it. *For co-operation, to be worth anything, requires to be the production of those who participate in it, being based upon pure self-help and self-reliance, qualities which the Government, be it ever so powerful, cannot produce in others.* Apart from that, the mere fact that co-operation which consists in persons doing for themselves what otherwise necessarily others would have to do for them, of necessity involves competition with other established interests, and so from the very outset in justice places a bar in the way of Government assistance."*

At the outset it is well to point out that the origin of Government aid, where such has been given, has not been the desire to assist co-operators as such, but rather to develop agriculture as a basic industry. Proof of this is to be found in the fact that there is

* The Future of Our Agriculture," by H. W. Wolff.]

practically no instance of such aid having been given to distributive or industrial societies.

Sir Horace Plunkett was the first to state clearly the limitations of Government action in the organizing of farmers and to formulate a policy for co-ordination between a State department and a voluntary agency. For this reason the Irish movement, which has always maintained its original theory, has been the subject of much study on the part of inquirers from other countries. Briefly stated, this policy consisted in the creation of two bodies, a State Department of Agriculture for the giving of technical instruction in the production of crops, and a voluntary organization whose business it would be—working hand in hand with the State department—to instruct farmers in the principles of combination for business purposes. In the words of Sir Horace Plunkett, "State action was desired to evoke and supplement, but not to provide a substitute for organized self-help."

While Germany is by no means the most thorough-going example of a State-aided movement in Europe, organization, with Government assistance, initiative, and control, has there been carried to a high pitch of efficiency. A masterly memorandum,* written by Sir Thomas Middleton, on the condition of agriculture in Germany as compared with that of England, where until recently organization was lacking, brings out some significant facts, viz.:—

1. The ascendency of the German has been gained in the past forty years.

2. The soil and climate of Germany are less favourable to agriculture than those of Britain.

3. The German farmer now produces about the same weight of cereals and potatoes per acre as the British farmer, but much greater weight per 100 acres of cultivated land. The German produces about the same weight of meat, and nearly twice as much milk per 100 acres as the British farmer. The German feeds from 70-75 persons per 100 acres of cultivated land, the British farmer feeds from 45-50.

4. The actual methods of tillage adopted in the growing of corn, potatoes, etc., in Britain are not inferior to the methods adopted in Germany. The difference in production is chiefly due to the circumstance that in Britain more than two-thirds of the cultivated land is now in grass, while in Germany it is less than one-third. There has been a slight decrease in the area ploughed in Germany; in England and Wales the area annually ploughed decreased by about 26 per cent. during the forty years prior to the war.

5. German land is mostly tilled by peasant owners; British land by tenants. The German depends to a great extent on woman labour, provided by the families of the occupiers. Wages are relatively low in Germany, and rural industries help to provide winter employment and tend to cheapen summer labour.

6. Much attention has been given to organizing production from German soil. The credit system is well adapted to promote good farming. Co-operation is largely resorted to. Education has been well developed. Statistics have been created to provide leadership.

7. German economic policy in recent years has favoured agriculturists, who have benefited partly from the higher prices resulting from tariffs and partly from the steadying effect which the known policy of the State has had upon the industry.

* Recent Development of German Agriculture, pub. 1917.

8. The general effect of the agencies and influences mentioned in the two preceding paragraphs has been to produce a very rapid improvement in the technical methods of the German farmer; the use of manures and feeding stuffs has greatly increased. Superior strains of both plants and animals have been raised. Business methods have been introduced and important rural industries have been developed.

Apart from direct aids, the Prussian Government has created special machinery by which governmental and local agencies work harmoniously together, namely, the system of Chambers of Agriculture (Landschaftskammern). This system is semi-official, and its income is derived from a tax levied on every agriculturist whose land is valued at a certain figure; grants are also made to them for special purposes by the State. The part played by these agencies is, in theory at least, a perfect example of the working out of the dual policy of State and voluntary action; the Chambers of Agriculture, being constituted on a semi-official basis, are able most advantageously to act as a connecting link between the official and the non-official. The local chamber ascertains the views of co-operators and small farmers with accuracy, while the central body can exert a very considerable influence on the policy of the officials in charge of agricultural legislation, by whom it is always consulted. The central body or German Agricultural Council (Deutsches Landwertschafstrat). function is to represent and foster the interests of agriculture in the whole of the German Empire.

The great respect which the German Agricultural Council enjoys to-day in the widest—and not merely agricultural—circles and among the administrative bodies rests on the strict attention to fact and the extreme thoroughness which are characteristic of its meetings, its resolutions, and its publications.*

It would appear from this account that the policy of State aid to co-operation in Germany had proved an unqualified blessing. But there is another side to the picture, and during the few years previous to the outbreak of war the other side was becoming more and more noticeable. The State Bank (Pressenkarse) absorbed most of the other co-operative credit banks. Within three years of its establishment grievances developed owing to the State Bank raising its rate of interest and adopting more stringent regulations without consulting the co-operative leaders.

Mr. Cahill, in his report on German co-operative credit, writes: "It is also felt that, as a result of the foundation of the State Bank, the sovereignty over Prussian co-operative credit has been taken out of the hands of co-operators, that office has been *assumed by the State*. It is sometimes urged that the State Bank is too bureaucratic in its methods; that it is not sufficiently elastic in its administration; and that it requires extremely minute and detailed information as a basis for its granting of credits. Finally there is the fact that the banking profits of a successful great central co-operative bank would return to co-operation, whereas under present conditions any resultant profits accrue to the State." To summarize Mr. Cahill's argument, State aid, carried to the point of direct financial intervention, necessarily brings with it State control, and what is controlled by the State cannot be controlled by its own members and therefore cannot be co-operative.

* Recent Development of German Agriculture.

In England during the past eighteen months co-operation has made phenomenal progress, mainly due, as in all other countries, to necessity, the chief reasons being unstable market in farmers' requirements, a feeling of uncertainty about prices when control was removed, the minimum wage and standardized working hours, and the prospect of foreign competition. There is now the Agricultural Organization Society, whose principal aim is to establish in every county one or two large and well capitalized societies for the purchase of the farmer's requirements and the sale of his produce, and, in the case of counties where societies already exist, to get them strengthened by increase of capital and unified by amalgamation. All societies are formed under the Industrial and Provident Societies Acts. Then there are other co-operative bodies such as the Farmers' Union, pig breeding societies, milk testing societies, etc. At Oxford, the Institute for Research in Agricultural Economics has been established, where the farmer may obtain information on the cost of manuring and the value of manure correctly applied, the cost of his milk per gallon, and the allocation of that cost between food, labour, transport, and management. There he can ascertain beyond doubt where a certain method of farming pays and where need of a change is indicated. It often happens that a farm makes a bad return because profitable and unprofitable operations are carried out side by side. Above all, costings will show what wages the individual can afford and the extent to which labour may hope to participate under some enlightened system of profit-sharing.

Kinds of Cotton Gins to Use.

The United States Department of Agriculture furnishes the following information regarding the use of roller gins for ginning long-staple cotton: "It is the custom in this country to gin only Sea Island and Arizona Egyptian cottons on roller gins. The minimum length of these varieties is about $1\frac{7}{16}$ inches.

"According to the American custom, only cottons with slick black seed, that is those varieties which originate from the botanic variety 'Barbadense,' are suited for ginning on roller gins. Long staples with fuzzy seed ('Hirsutum' variety) are commonly ginned on saw gins, even though the staple is sometimes as long as $1\frac{3}{8}$ or $1\frac{7}{16}$ inches. It is found that saw gins will give a much larger out-turn than roller gins. It is said that a good day's work on a saw gin on long-staple cotton is about 8 bales of 500 pounds each, while a day's work on a single roller gin is about $1\frac{1}{2}$ bales.

"It is known that some damage is done to the staple of cotton through the use of saw gins, but the greater production is supposed to more than counterbalance this loss. It is the custom among American ginners in ginning long staples on saw gins to slow down the saws, to speed up the brush, and to run a light roll in the gin box. The cotton should be reasonably dry, but not excessively so. By following these simple rules, the damage done through ginning long staples on saw gins is reduced to a minimum, and the best economic results are accomplished, all things considered, through the use of saw gins."

WHITE ANT NOTES.

By C. P. VAN DER MERWE, Government Entomologist, Durban.

A CASE of damage to the floors of a building by a termite ordinarily found inhabiting standing trees was recently brought to the notice of the writer by Mr. W. E. Butcher, of Ridge Road, Durban. The termite concerned is known as *Schedorhinotermes putorius*, Sjostedt, and is fairly common in Durban. This species only exists along the East Coast and has not before been recorded as injuring the woodwork of buildings. Though nests are usually found in hollows of living trees, the insects feed only on the dead wood thereof, and do not attack the live portions. The most common feeding grounds are in the dead wood of trunks and of large limbs from which branches have broken off. The white ants make superficial galleries over the trunk and limbs from one place to another, and also down the trunk to the ground. These galleries are quite characteristic of the insect and made of a carton-like material mixed with particles of soil and other matter. The nearer the ground, the more the soil in the composition of the material.

Though these termites are usually found on standing trees, these are not the only places where they occur. The strongest colonies observed by the writer were in dead logs and dead trees. On one occasion a tree in which there was a nest was cut down, and when the wood dried the termites seemed to increase abundantly, probably on account of the ample food supply which had become available. It is possible that the reason why this termite is mainly a tree inhabiting species, is because dead trees and logs do not last long enough on the Natal coast for colonies of this particular white ant to become established in them. Such soon decay or are destroyed by other termites and by fungi. As the species lives in wood, it can have more or less permanent colonies only where its home is not too soon destroyed by other factors.

Except for the unusual aspect, it is not surprising that *Schedorhinotermes* should destroy the floor of a house; but as it differs so much in its habits from other termites to find a building attacked was unexpected. The attack must have started in a way different from the common cases of termite damage.

First the floor of one large room was found to be infested, and the damaged portions were replaced; but after some time the floor in an adjoining room was found being attacked. Then it was noticed that the insect concerned was not one of the termites which commonly damage buildings, and specimens were submitted to the writer, Further examination showed that the pest was in the floor and in the moulding of a door in a passage near the rooms first attacked, and had spread to the other side of the wall of the passage, and there started to attack the skirting boards. Subsequent examinations by the writer showed that several feeding places were connected, under the floor, by those characteristic galleries this white ant constructs on the surface of trees.

The damage done somewhat resembled that of the Natal termite (*Termes natalensis*). The timber was eaten out, leaving a thin shell on the under-side and one of greater thickness above. Where the wood was destroyed, the space was not filled with earth, as is the case with the Natal and other termites, but with a papery substance. The space is also not so closely filled up as in the case of *T. natalensis*, the material being divided into thin perforated layers, so that it presents a more or less spongy appearance.

When the surroundings of the house were searched for a possible outside source of infestation, the dead stumps of eight loquat trees were found in a bamboo hedge above the house. These trees had been cut down several years ago. In all of the stumps this *Schedorhinotermes* was found or indications of its workings. One of the stumps was eaten down into the ground; of the others greater or smaller portions were still remaining.

In the stump nearest the room in which the infestation was first discovered, and about 8 feet removed from the outside wall, a particularly strong colony was located. The probability that the infestation in the house was connected with this colony at once suggested itself, and the most likely way by which the insects could have got under the floor seemed to be by following the dead roots. An examination was therefore made of the roots, and it was found that, as far as the roots extended, 2 to 3 feet, the termites were present. The roots could not be traced further, their ends having decayed or having been eaten away. Possibly the roots formerly extended below the house and had led the insects there.

In view of the abundance of the insects in the immediate vicinity, it is also possible that a colony originated in the house from a pair of winged adults. Numbers of these flying males and females must have escaped from the surrounding nests each year, and pairs entering the house might readily find a suitable place in which to establish themselves and their brood.

The house in question is an old one, built before the principles on which a house should be put up to secure protection from white ant attack were understood. The floors are not much raised above the ground level, and sufficient air is not admitted below the flooring. Though it was not possible to prove how the infestation originated, it was evident that had those precautions been taken, which we now know to be necessary to prevent other termite damage, the attack by *Schedorhinotermes* would not have occurred, or else it could have been easily dealt with, access to below the floor being possible.

Fruit Export.

The following fruit was shipped overseas during the month of January, 1921:—*Ex* Capetown (boxes): Peaches, 24,703; plums, 18,755; pears, 22,151; nectarines, 8982; apricots, 177; grapes, 951; melons, 4; total, 75,723. *Ex* Durban (boxes): Pineappples, 563. Total shipments from all ports during present 1920-1921 deciduous-fruit season: November, 1920, 42 boxes; December, 1920, 27,422 boxes; January, 1921, 76,286 boxes; total, 103,750 boxes. The total shipments during the 1919-20 deciduous season amounted to 265,300 boxes.

PRUNING OF DECIDUOUS FRUIT TREES.

By H. B. TERRY, Cert. R.H.S. (London and South Africa), Lecturer in Horticulture, School of Agriculture, Potchefstroom.

(*First instalment, February*, 1921, Journal.)

THE APRICOT.

This tree is treated according to the general instructions given for trees up to the third winter pruning. A short stem and well-

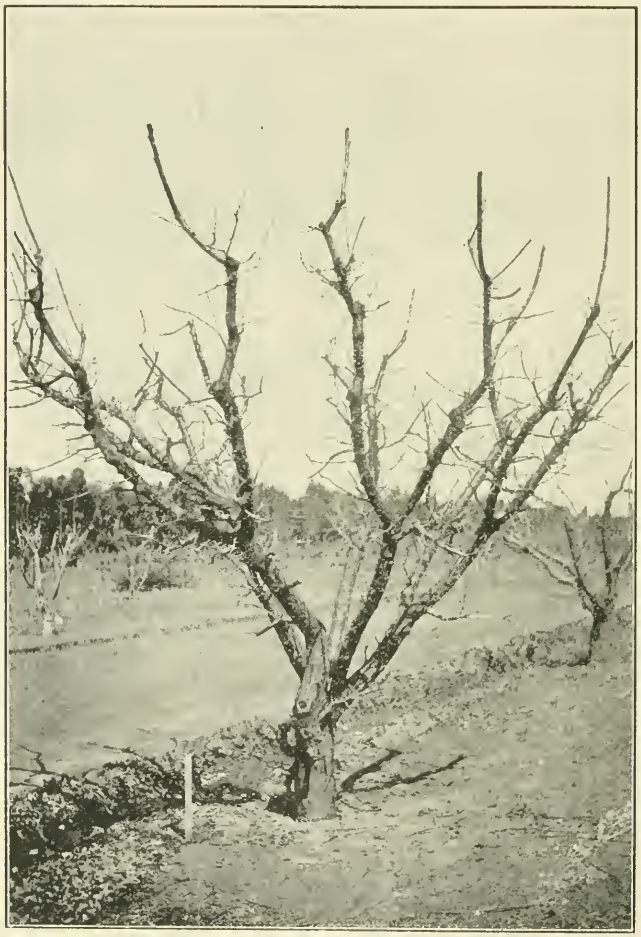

FIG. 7.—Apricot "Royal" after pruning.

designed tree is essential, as the wood is stiff and brittle, and when left long breaks under the stress of storms or a heavy crop. The tree

has a natural tendency to form forks—this should be checked as much as possible, because these forks are always weak points. Each branch should have a separate and distinct hold on the main or secondary arms to secure stability. Most varieties come into bearing during the third or fourth year, the fruit being produced on one-year-old wood, or on spurs two or more years old; this class of wood should be found spread over the framework of the tree from the crutch to the tips of the leaders.

The accompanying photograph will convey a clear idea of the distribution of fruiting wood on the apricot. Once the trees have borne a fair crop the tendency to rush into strong rambling growth is arrested, and the amount of cutting is reduced. The fruit-bearing

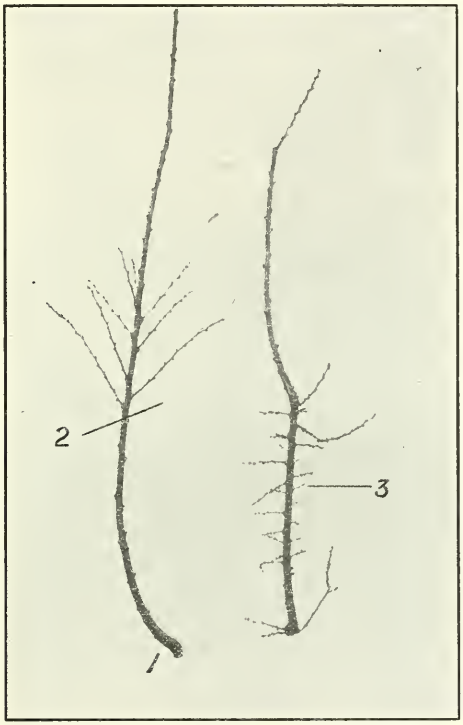

FIG. 8.—Illustrating Apricot leaders and manner of treating.

1. Point of origin on previous season's leader.
2. Where to prune the leader in winter.
3. Showing development of lateral fruiting wood between 1 and 2, as seen in the following season.

laterals that are too long (say over 1 foot) should be shortened back to 9 inches. Take care to cut just above a growth bud, otherwise the lateral may die after fruiting. Any wood under 6 inches in length should be left uncut. If laterals are too numerous suppress a few altogether, so that the remainder have room for development.

The apricot leaders present a difficulty to the uninitiated. It will be noticed by glancing at the photograph (fig. 8) that a series of laterals arise about half-way up; pay no attention to their fruiting

abilities, but cut the growth back below them. By so doing further strong leaders are obtained to keep the tree vigorous. The lower buds will break into lateral growth, thus furnishing the tree with more fruiting wood.

THE APPLE.

Until a few years ago the apple was considered an easy tree to prune, the main objects being to preserve shape, promote growth, and establish fruit spurs throughout the tree; old methods are being

FIG. 9.

superseded gradually, and each variety is being treated according to its needs. As this class of tree takes longer to come into bearing than stone fruits, the severe pruning may be continued until a good shape has been obtained and a sure foundation built to carry regular crops. About five to six years elapse before anything approaching a crop is borne, then light pruning should be practised. Some varieties, as Five Crown, Pippin, Ohenimuri, produce spurs freely and are not difficult to prune, whilst others, like Jonathan, Rome

Beauty, Cleopatra, and Irish Peach, do not develop spurs as readily, and fail to do so when severely winter pruned. The latter type of tree produces a number of thin laterals usually furnished with a terminal blossom bud. To prune it away means the sacrifice of immediate fruit and induces strong growth. When summer pruning is not practised in conjunction with winter pruning, these laterals are left uncut; if too numerous towards the centre of the tree they are thinned out. When this practice of leaving the laterals uncut

FIG. 10.

is adopted a greater spur development takes place along the laterals and tends to slow down the vigour of the shoot. When they need strengthening to carry the fruit they have to bear they can be shortened back to six or eight inches. It is a great mistake to presume a tree to be unpruned unless each individual growth has been cut. The protographs illustrate a spur-producer [Fig. 9 (apple) Ohenimuri] and a typical lateral bearer [Fig. 10 (apple) Irish Peach].

The leaders should be shortened to about half of the previous season's growth. This stimulates the tree roots and assists in distributing the sap evenly throughout the tree. It is an accepted rule

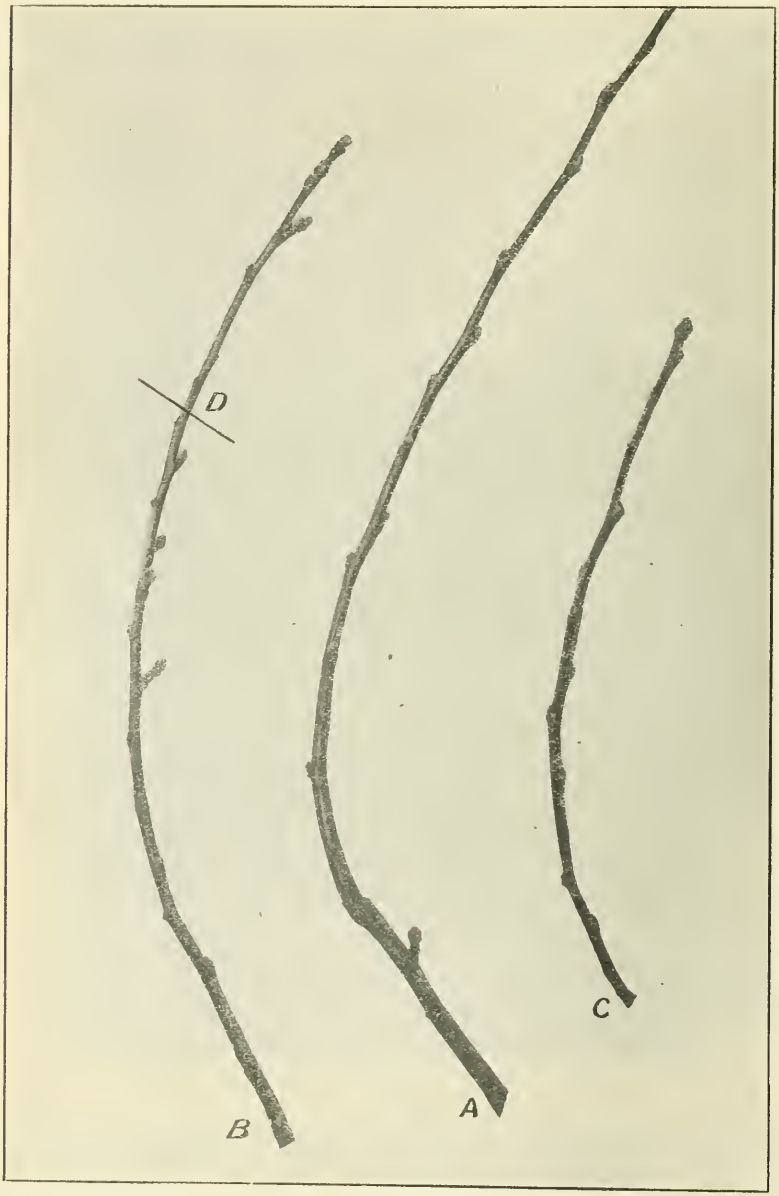

FIG. 11.—Laterals found on Apple "Jonathan," showing treatment.

that when growth is sluggish hard cutting back of leaders calls the roots into activity. When growth is vigorous long pruning tends to

assist this, and enables the grower to control his trees. The treatment of laterals may be stated thus: —

When it is desired to check their growth and induce fruiting

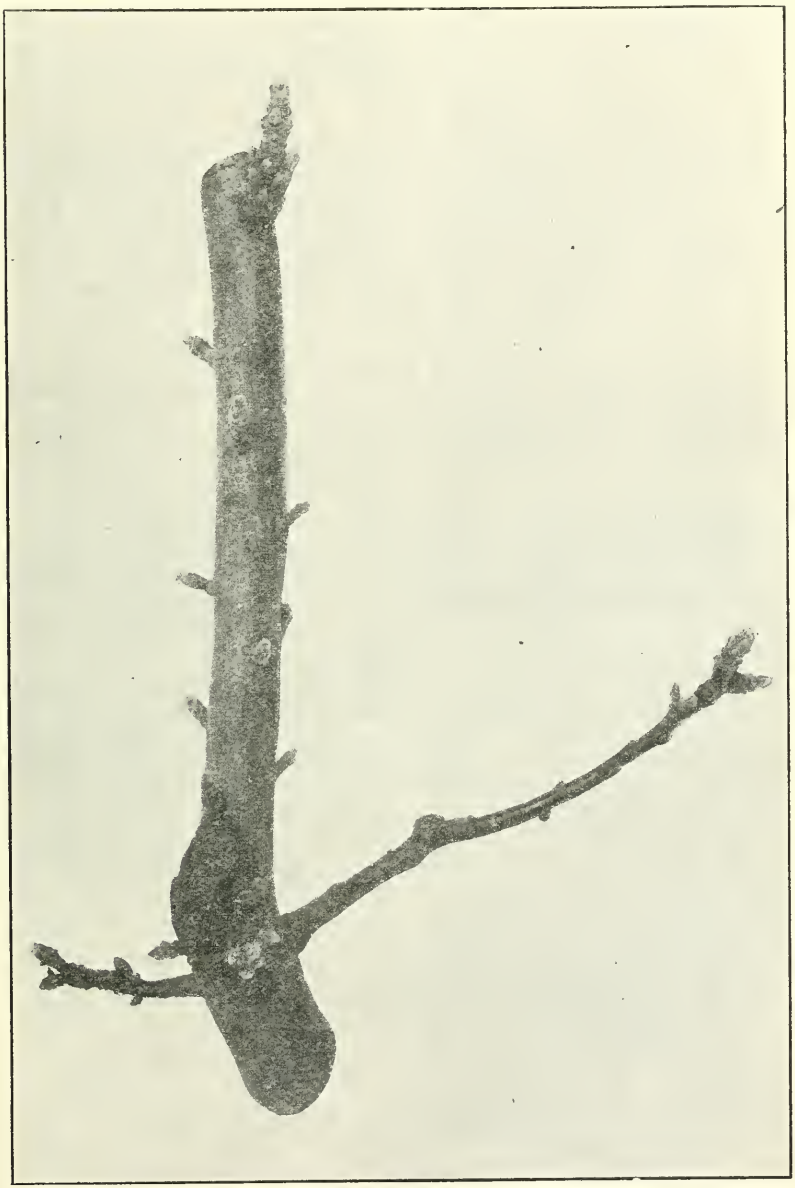

FIG. 12.—Showing Spur Development on Apple "Ohenimuri."

they are left uncut or pruned long; where growth is required prune short; after a number of spurs have developed between the top and

base of the laterals, shorten back according to their strength and ability to produce good fruit from the remaining spurs. No branches should be allowed to cross, and dead wood must be removed and burnt.

Fig. 11 illustrates the laterals taken from a Jonathan apple tree. "A" shows two seasons' growth with absence of spurs, except a solitary spur on the two-year-old wood; it was pruned too short. "B" illustrates the advantages of allowing the laterals to remain uncut—note the fruit spurs; this growth can now be pruned at "D." "C" shows the short type of lateral peculiar to this class of tree—the terminal bud is a blossom bud.

Fig. 12 gives a clear idea of the spur development which takes place along the main arms of varieties such as Ohenimuri, Stone Pippin, Five Crown Pippin, etc., thus producing a large bearing surface when the top is kept fairly open.

(A further instalment will appear in next month's issue.)

WORLD CROPS.

Special Cabled Advice from the International Institute of Agriculture, Rome, respecting the position of certain world crops.

9TH FEBRUARY, 1921.

Crop.	Season.	Estimated Production and Percentage it Represents of the World's Total Yield.		Percentage of Season's Estimated Production compared with	
		Production (1 metric ton = 2200 lb.).	Percentage.*	The Previous Season (which = 100).	The Five Years' Average prior to Previous Season (average = 100).
Northern Hemisphere—		metric tons.	per cent.	per cent.	per cent.
Wheat ...	Oct., 1920 Aug., 1921 (Autumn sown)	62,628,000	52	101	96
Oats ...	Do. do.	48,020,000	76	121	107
Tobacco	April–Sept., 1920 (Summer sown)	772,000	32	105	126
Maize ...	Do. do.	88,431,000	84	111	115
Southern Hemisphere—					
Wheat ...	April, 1920–Jan., 1921 (Winter sown)	9,490,000	8	127	122
Oats ...	Do. do.	833,000	1	87	92

* The estimated production is based on reports sent to the Institute by certain producing countries. At the date of the cablegram the estimated production of the group of countries from which advice was received (as shown above), represented approximately the stated percentage of the world's yield.

A NEW WOOL SCHEME.

Abortive Negotiations in Germany—Imperial Government's Offer.

The stagnation in the wool trade with its effect upon the wool producers and other business interests in the Union, has engaged the serious attention of the Government for some time past. In view of the abnormal accumulations in the United Kingdom, and the fact that prior to the war Germany was a very large buyer of South African wool, the first step to be taken appeared to be the re-establishment of the continental market. The instability of the German monetary system obviously set great difficulties in the way of such a step, and various schemes for obviating difficulties in regard to exchange were considered. These schemes included (*a*) barter of wool for articles manufactured in Germany, such as iron and steel, and (*b*) financing of the wool manufacturers in Germany by an outside agency which would recoup itself out of the proceeds of sale of the manufactured article and would show profits to the manufacturer. These schemes were found to necessitate the most highly skilled commercial management and were, therefore, not readily adaptable to operation by Government.

In these circumstances the Government requested Mr. Chappell, of the firm of Mosenthal & Company, and Mr. Reynolds, General Manager of the National Bank, who were in England, to associate themselves with the Union Trade Commissioner and investigate the possibility of re-establishing our continental markets. These gentlemen proceeded to Germany, where they interviewed textile manufacturers, bankers, and Government officials. Their negotiations, which at the outset seemed to offer prospects of success, were fruitless owing to a number of considerations which need not here be detailed. Consequently, conversations were opened with the Imperial Government, and as a result the Union Government is able to announce that the Imperial Government is willing to purchase up to 100,000 bales of last season's crop, the schedule of prices for various types of wool to be the schedule of 1913-14 prices used for the 1917 wool scheme, but the 55 per cent. addition to 1913-14 prices given in 1917 is now withdrawn; 50 per cent. of any profit realized on the re-sale will be credited to the Union Government for account of sellers.

Arrangements for valuing and paying for wool, and generally for carrying out the scheme, will be the same as those adopted in 1917. No cash payments will be made by the Imperial Government, but the cash disbursements by the Union Government will be deducted from that Government's indebtedness to the Imperial Government.

Investigations are proceeding with a view to the disposal of the new crop which it is fully recognized is a matter of far more moment than the disposal of the 100,000 bales, more or less, of the old crop still in the country, but before this question could be tackled seriously

it was necessary to find a means of getting the old crop out of the way and the offer of the Imperial Government, providing the means of doing this, affords the prospects of substantial and immediate relief, since it will release capital of banks, brokers, and others presently locked up, and permit its re-employment in financing products of the country.

The above offer, it will be observed, is in respect of last season's clip, and the Government is now in communication with the Imperial authorities, as an outcome of which it is anticipated that satisfactory arrangements will soon be concluded.

In view of any expectations, however, which may be held, that there is a possibility of similar satisfactory arrangements being made with the Imperial Government in regard to the present season's crop, farmers are warned that difficulties face the success of such negotiations, and consequently no reasonable means of selling their wool should be neglected or refused.

Citrus Scale Insects.

A considerable number of potentially important scale insects have been found on citrus trees in the Union, most of them introductions from oversea, and the following list of them is thought by Mr. Lounsbury, Chief, Division of Entomology, to be almost though not entirely complete:—

1. *Aspidiotus hederae.*
2. *Aspidiotus maskelli.*
3. *Aspidiotus silvaticus.*
4. *Chrysomphalus aurantii.*
5. *Chrysomphalus dictyospermi.*
6. *Chrysomphalus ficus.*
7. *Chrysomphalus rossi.*
8. *Lepidosaphes pinniformis.*
9. *Lepidosaphes gloveri.*
10. *Ischnaspis longirostris.*
11. *Parlatoria ziziphi.*
12. *Parlatoria pergandii.*
13. *Ceroplastes destructor.*
14. *Lecanium africanum.*
15. *Lecanium hesperidum.*
16. *Saissetia oleae.*
17. *Pulvinaria floccifera.*
18. *Filippia chilianthi.*
19. *Pseudococcus citri.*
20. *Pseudococcus filamentosus.*
21. *Pseudococcus fragilis.*
22. *Pseudococcus virgatus.*
23. *Tachardia actinella.*

No. 4 ranks as the most important; it does far more damage than all the others together.

It is strongly suspected that most of the imported species came from oriental countries, chiefly from India through Durban. No. 4 seems likely to have entered at Capetown in the days of the Dutch East India Company. No. 12 is suspected to have come in with a few trees introduced from Japan in 1897. Were it not for our carefully conducted nursery inspection, there would be grave fear that quite a number of the insects listed would soon get spread about the Union with movements of nursery stock and in the course of time become considered very serious citrus pests.

Do not lose your copy of the *Journal*. A full index will be sent subscribers every six months. The *Journal* will prove a useful book of reference to every farmer. In time it will be a valuable compendium of advice and information on farming in South Africa.

THE VEGETABLE GARDEN.

March.

By H. B. Terry, Cert. R.H.S. (Lond. and S.A.), Lecturer in Horticulture, School of Agriculture, Potchefstroom.

There are two more moderately good months for growth, after that the dry season and cold nights may be expected inland. At the coast, however, where conditions are different, gardening goes on with more regularity. But the growing season is rapidly declining and the garden must be filled up with transplants and seeds. The ground should be well prepared by ploughing or digging and liberally enriched with stable or kraal manure which is thoroughly decayed. When the preparation of the soil is complete, dust a little superphosphate over the surface and rake it in; it is a great help at all times. Where crops are growing, every effort should be made to keep the soil clean by frequent hoeings; the use of the hoe stimulates growth by allowing air to enter the soil, keeps down insect pests by exposing them to the light and birds, checks fungoid growths, and in every way makes for heavy yields. The use of the garden hoe is not sufficiently appreciated.

Brussels Sprouts.—These succeed best under Cape Province conditions owing to the winter rainfall.

Cabbage.—Should be transplanted immediately. Set out large growing sorts, such as Castle, Mammoth, Drumhead, Savoy, and Brunswick, 3 feet apart between the rows by 2 feet 6 inches in the rows. Seed may be sown where it is to mature, taking care to thin out sufficiently to enable the heads to develop. Try Surehead, All Head, Webb's Emperor, Spitzkool.

Cauliflower.—Should be transplanted now for winter and spring; Gilt Edge, World Beater, Veitche's Autumn Giant, or Snowball as early sorts except on high veld, and broccoli for late maturing. Broccoli is much hardier than ordinary cauliflower and should be grown when failures have occurred with the latter.

Celery.—May be sown in the Cape Province only.

Carrot.—May still be sown, using Dutch Horn, Chanteney, Danvers, and Maincrop. The soil for this crop should be in good condition, not recently manured (unless very old stuff), as the roots are liable to fork. Sow in rows 15 inches apart, and thin out the seedlings later on.

Turnips.—Turnips are a reliable winter vegetable and should be sown at intervals of three weeks for succession. Use Snowball, Jersey Lily, Red Top, White Globe, Red Strapleaf.

Lettuce.—Good sowings should be made. Sow All-the-Year-Round, Boston, Iceberg; also Cos varieties. The great secret of obtaining large crisp heads is rich soil, plenty of water, and frequent cultivation. The rows should be 15 inches apart.

Beetroot.—Make a big sowing of Eclipse or Egyptian Turnip-rooted. Sow in rows 15 inches apart, thin out to 6 inches apart, and hoe frequently.

Kohl Rabi.—Kohl Rabi or Knol Kohl should be sown everywhere as a substitute for turnips; it is a good vegetable in itself.

Leeks.—A good sowing should be made if not already done.

Onions.—This is the best month to sow for the early spring crop; keep the beds free from weeds until the seedlings are large enough to transplant in May. Sow Early Cape Straw, Silver King, Red Flat, Bermuda, White Barletta, Italian Tripoli.

Peas.—May be sown for succession. Dwarf varieties, such as Daisy, Stratagem, Sutton's Matchless, Pride of the Market, should be sown in drills 2 feet 6 inches apart; two drills about 3 inches apart is the general practice; then use the space for cultivation.

RADISH.—Should be grown quickly to be palatable. Use Red and White Turnip-rooted for a thirty-day crop, French Breakfast to follow, and then China Rose. Seeds of the first two should be sown at intervals of fourteen days, a little seed at a time to save waste.

SPINACH.—Sow winter varieties on rich soil in drills 18 inches apart; sow the seed ½ inch deep; grow it quickly, otherwise it will be leathery. Swiss Chard is an excellent substitute for sowing now; it is perennial and keeps growing all through winter and spring.

SALADS.—Sow Mustard and Cress under shade for salads.

BROAD BEANS.—As cooler weather approaches this crop has better chances of succeeding; a light sowing should be made.

PARSNIP.—Continue to sow except on high veld.

THE POULTRY YARD MONTH BY MONTH.

March.

By J. J. JORDAAN, Lecturer and Instructor in Poultry, Glen, Orange Free State.

Moulting.—The moulting breeding birds should by this time have progressed sufficiently in regard to new feathering to be almost completely feathered. During this month every effort must be made to excite the egg organs so as to get the hens laying by the end of the month, or at the latest next month before the first frost falls. Feed as follows:—

Morning Mash: 4 parts bran, 1 part crushed oats, 1 part mealie meal, 1 part pollard, 1 part meat meal or Crayferine, 8 parts lucerne-hay or meal. *Midday*: Green food. *Evenings*: Oats, sunflower, Japanese millet, and crushed mealies alternatively.

To the drinking water add Douglas Mixture daily for two or three weeks until the comb and face show signs of reddening up.

Egg Production.—Early hatched pullets should also be fed as above to assist them in getting to the paying stage this month. The smaller the number of birds in a flock the better the results will be as regards egg production. New laid eggs rule high, and therefore the flocks should be kept small. Have the roofs of all houses covered with soil or stable manure to break the effect of early frosts which would stop egg production almost instantaneously.

Breeding Pens.—Cockerels intended to be used in the breeding pens should also be penned up and fed well to get them into good condition. Always keep an extra one as a reserve bird in case of accidents. Discard from the breeding pen any birds that have developed vices such as feather or egg eating during the moulting period and also any that have been backward in the moult.

Showing.—The agricultural shows are now in full swing; the wideawake poultryman will exhibit even more strongly here than at poultry shows, because he is more certain of getting into touch with buyers than at the latter shows. By exhibiting at agricultural shows the breeder indirectly assists in furthering the industry by helping to make a good exhibition which creates interest in and respect for the industry.

General.—Only birds that are required for breeding purposes and egg production should be kept. All others should be disposed of; this is a splendid month for sales. The pullets that are to be tested for egg production, in view of possible use the following year in breeding pens, should now be selected and penned in individual runs or in pens in which trap-nests are provided.

Advertise young turkey cocks for sale. When selling pens, sell old hens; this will give better results and more satisfaction to customers.

NOTES FROM THE "GAZETTE."

Attention is drawn to the following matters of interest which appeared in the *Union Government Gazette*:—

(Abbreviations: "Proc."—Proclamation; "G.N."—Government Notice.)

Gazette. No.	Date.	*Items.*
1115	14/1/21	Under the Stock Diseases Act the Minister has approved of the withdrawal of paragraph (2) of G.N. No. 1049, 1920, restricting the movements of cattle in so far as a certain portion of the Pretoria Municipal Area is concerned. (G.N. No. 67.)
1116	21/1/21	The appointment of members of the District Woodcutter Boards for the Divisions of George, Knysna, and Humansdorp is notified in G.N. No. 105.
1116	21/1/21	All brands for horses, cattle, ostriches, sheep and goats registered under the Brands Registration Acts (C.G.H.) during the quarter ended 31st December, 1920, are published in G.N. No. 124, and for brands registered during the same quarter under the Orange River Colony Brands Registration Ordinance of 1903 in G.N. No. 125.
1116	21/1/21	The Minister of Lands has authorized an amendment to G.N. No. 865, 1919, regarding the Tariff for Government Surveys in the Provinces of the Cape of Good Hope, Transvaal, Orange Free State, and Natal. (G.N. Nos. 86 and 87.)
1116	21/1/21	Regulations under section 3 of the Land Settlement Acts Further Amendment Act, 1920, to govern advances to groups of lessees of holdings leased in terms of the Land Settlement Act, 1912, are published in G.N. No. 92.
1116	21/1/21	A Commission to inquire into and report upon matters concerning the surveys of land has been appointed. (G.N. No. 106.)
1116	21/1/21	Tenders are invited by the Secretary for Lands, Pretoria, for a grazing lease on a holding on Majuba, Barberton District. (G. N. No. 117.)
1117	28/1/21	Under the provisions of the Fencing Act, No. 17, 1912, contributions towards the cost of dividing fences in the Ward Elands River, District Rustenburg, are declared to be obligatory. (Proc. No. 17.)
1117	28/1/21	Under the provisions of the Agricultural Pests Act, No. 11 of 1911, cotton seeds with lint attached and cotton lint containing cotton seeds have been added to the list of plants which may not be introduced into the Union from overseas except under certain prescribed precautions. (Proc. No. 18.)
1117	28/1/21	Regulations under the Statistics Act, 1914, are published in connection with the rendering of particulars relating to agricultural, horticultural, viticultural, dairying, and pastoral productions. (G.N. No. 148.)
1117	28/1/21	A portion of G.N. No. 1934, ordering the removal of all cattle from certain farms in the Lydenburg District, has been withdrawn in respect of certain of the farms mentioned. (G.N. No. 159.)
1117	28/1/21	The Secretary for Lands has published a list of approved leases granted under the Crown Lands Disposal Ordinance, 1903 (Transvaal). (G.N. No. 169.)
1119	4/2/21	The Minister has ordered amendments to Government Notices having reference to protected and semi-protected areas (scab) in the Districts of Malmesbury, Fraserburg, Riversdale, and Estcourt. (G.N. No. 187 and 223.)

Gazette. No.	Date.	*Items.*
1119	4/2/21	Lists of brands registered under the Orange River Colony Brands Registration Ordinance, 1903, and of applications for brands under the Brands Registration Acts of 1890 and 1897 (C.G.H.), are published. (G.N. Nos. 200 and 201.) Also a list of brands allotted and registered in terms of Great Stock Brands Ordinance (Transvaal) for the quarter ended 31st December, 1920. (G.N. No. 221.)
1119	4/2/21	The Secretary for Lands notifies that the homestead on farm Boven Campbell, Hay Division, will be offered for lease at Campbell on the 17th March, 1921. (G.N. No. 204.)
1120	11/2/21	In terms of the Forest Act, No. 16, 1913, a certain piece of land, portion of the Salt River Forest Reserve, in the Division of Knysna, has been withdrawn from the demarcated forest area declared by G.N. No. 116. (G.N. No. 225.)
1120	11/2/21	Regulations under the Diseases of Stock Act, section 23, in regard to the reporting of deaths of cattle, are published. (G.N. No. 226.)
1115 1117	14/1/21 28/1/21	Crown lands are offered for sale as follows: At Kingwilliamstown on 9th April; at Windsorton on 8th March; at Williston on 23rd March; at Still Bay on 30th March; at Oudtshoorn on 26th March; at Upington on 16th March; at Knysna on 29th March; at Capetown, Civil Commissioner's Office, on 13th April; at Fraserburg Road on 27th April. (G.N. Nos. 70, 175, and 194.)
1120	11/2/21	Applications will be received by the Secretary for Lands, Pietermaritzburg, up to the 25th March, for certain farms situated in the Umvoti and Ixopo Divisions, and by the Lands Branch, Windhoek, up to the 7th March, for certain farms situated in the South-West Protectorate, to be disposed of on terms of conditional purchase lease. (G.N. Nos. 251 and 252.)
1115 1116 1117 1119 1120	14/1/21 21/1/21 28/1/21 4/2/21 11/2/21	The compulsory dipping of cattle has been ordered (*a*) every three days in the three-day dip for portions of Zoutpansberg District; (*b*) every five days in the five-day dip for portions of Pretoria Municipal Area and portions of Elliotdale, Umzimkulu, Babanango, Richmond, Pretoria, Tsolo, Willowmore, and Ipolela Districts. (G.N. Nos. 67, 101, 158, 222, and 237.)
1116 1117 1119	21/1/21 28/1/21 4/2/21	Compulsory dipping of sheep and goats under the Scab Regulations and Diseases of Stock Act has been ordered for the Districts of Vredefort and Kroonstad within the period 25th January to 30th April; for the Districts of Jacobsdal, Philippolis, and Fauresmith within the period 1st February to 30th April; for the District of Caledon within the period 14th February to 14th March, 1921. (G.N. Nos. 102, 160, 188.)

STAFF: APPOINTMENTS, TRANSFERS, ETC.

(1) AGRICULTURE.

1/10/20 *Lieut.-Colonel G. N. Williams, D.S.O.*, appointed Under-Secretary for Agriculture, *vice* P. J. du Toit.

1/10/20 *F. W. Green*, appointed Chief Clerk, *vice* Lieut.-Colonel G. N. Williams, D.S.O.

15/12/20 *G. v. d. W. de Koch*, appointed Senior Research Officer, Onderstepoort.

23/1/21 *J. F. Macintyre*, District Veterinary Officer, transferred from Potchefstroom to Umtata.

(2) AGRICULTURAL EDUCATION.

15/1/21 *Andre Marais, M.Sc.* (Stell.), appointed Assistant Chemist, Grootfontein.

15/2/21 *W. G. Mason*, Director of Training Farms, returned to duty in Pretoria from his visit to St. Helena for the purpose of advising the Imperial Authorities on the agricultural potentialities of the island.

THE WEATHER.

Extracts from the Monthly Report of the Chief Meteorologist for the Union.

THE weather of the month of January, 1921, was characterized by a practically general serious shortage of rainfall—absolute drought prevailing at many stations in the Karoos and Northern Border; persistent cool, cloudy weather over the south-west of the Cape; good light rains over the greater part of the Transvaal, Orange Free State, Natal, and south-east Cape in the early part of the month, followed by a hot droughty spell broken only by highly localized thunderstorms, hot drying and occasionally destructive winds, and some severe hailstorms causing damage to crops and fruit.

Precipitation in excess of the normal was confined to a few areas of very limited extent, notably the south-west of the Cape including the Peninsula, the neighbourhood of Knysna, Port St. Johns, and Umtata and Durban, along the coast; inland excesses were confined to the neighbourhood of Rustenburg and Nylstroom, where the monthly totals were 2.02 and 3.02 inches respectively above the normal, and Heidelberg, where the surplus was only 0.03 inch. Elsewhere large shortages were experienced, ranging from 0.01 inch to more than three inches over the Cape; from a few tenths to about three inches in the Orange Free State; from three-quarters of an inch to more than six inches in Natal; and from about a third of an inch to seven inches over the Transvaal, where the shortage was greatest in the east, south-east, and south-west. Absolute drought prevailed throughout the month over large sections of the Karoos and Northern Border. The early portion of the month was very favourable to agriculture, light rains falling from the 1st to 12th over the south-east Cape, Natal, Orange Free State, and Transvaal. These rains were particularly favourable, falling mostly during the latter part of the evening and throughout the night, thus not interfering with the day's work. Unfortunately this was succeeded by a spell of hot, droughty weather, relieved only by very local thunderstorms, occasionally of considerable intensity. In consequence, agricultural reports this month are of the gloomiest description, veld dried up, crops, particularly mealies, burned up or partially destroyed, and even dams and vleis dried up, with rivers down to the normal winter flow.

The cumulative rainfall since 1st July, 1920, still shows an excess over the south-west and west of the Cape, the west of the Northern Karoo, and the East Central Karoo. Surplus amounts of 2-5 inches are also met with between Durban and Howick. A precipitation in excess of the normal for the period is confined in the Transvaal to a few stations in the south-east centre and north-west. In Swaziland there is an excess of more than 6½ inches at Mbabaan. In all other parts of the Union there is a considerable deficit, ranging from 1-7 inches over the Cape, but mostly between 3 and 5 inches; generally 2-3 inches in the Orange Free State; about 3 inches in Natal, but reaching 9.19 inches at Vryheid; usually 2-4 inches over the Transvaal, but amounting to 9.36 inches at Woodbush.

Outbreaks of Animal Diseases: January, 1921.

Disease.	Transvaal.	Natal.	Cape.	Orange Free State.	Transkei.	Total.	
						January, 1921.	December, 1920.
East Coast Fever	10	4	—	—	4	18	5
Mange	2	1	7	—	—	10	31
Anthrax	89	6	17	26	44	182	182
Dourine	—	—	1	—	—	1	2
Glanders	—	—	3	—	—	3	—
Epizootic Lymphangitis ...	—	—	1	—	—	1	—
Tuberculosis	—	—	—	—	—	—	2

THE OVERSEA MARKET.

MARKET PRICES OF SOUTH AFRICAN PRODUCE CABLED BY THE TRADE COMMISSIONER, LONDON, ON THE 11TH FEBRUARY, 1921.

Wool.—January sales just closed, 6393 bales South African free wool being offered, which experienced demand better than at the December auctions. Prices of all descriptions at opening of auction ruled from par to 5 per cent. below previous rates, but with increased Continental and American competition, brokers were able to make fair clearance at the close. Best qualities were above December rates, with snow-whites in better demand; other descriptions recovered initial decline. Current prices: Snow-white, extra superior, 2s. 10d. to 3s. 1d.; superior, 2s. 2d. to 2s. 9d.; medium, 1s. 9d. to 2s. 1d.; inferior, 1s. 4d. to 1s. 8d.; greasy combings, long, 10d. to 1s. 7d.; medium, 8d. to 1s. 1d.; clothing, light, 8d. to 1s.; heavy, 5d. to 7½d.

Mohair.—No business is being done. Nominal price in store, London: Summer, first, 1s. 2d. to 1s. 3d.; Basuto, 11½d. to 1s.; winter hair, 9d.

Hides.—Auction held yesterday, but no sales. Nominal price: Cape hides, wet-salted, Johannesburg, best heavy, 7d.; dry, best heavy, 9½d.; Cape hides, dry-salted, best heavy, 8½d.; other selection in proportion.

Cape Merino Sheep Skins.—There was some inquiry for Capetown combing wool, best, 9d.; long, 7¼d.; no demand for others.

Grade Cape Goat Skins were extremely quiet. Capetown selections, light, 1s. 1d.; extra light, 1s. 1½d.; heavy, 1s. 3d. per lb.

Natal Wattle Bark.—Small business was done; £10 c.i.f. for chopped, but practically no demand; only slight demand for ground at £11. 10s. c.i.f.; extract, £29 c.i.f.

Maize.—45s. and 46s. was paid for quantities South African maize, flat yellow, No. 4, and round yellow, No 6, January-February shipments. Parcels of South African flat white, No. 1, and flat white, No. 2, January-February shipments, quoted 46s. 6d. and 46s. respectively.

Ostrich Feathers.—The market is unchanged. Auction to be held on 7th March.

Fruit.—The "Norman" consignment, which left Capetown on the 14th January, arrived in good condition. Average prices: Peaches and nectarines, 6s. to 12s.; plums, 6s. to 10s., extra choice variety, 14s., 17s.; pears, 7s., 8s., 10s. The market is likely to go down lower on account of large shipments near to hand.

South Devon Bull, Glen School of Agriculture.

LOCAL MARKET PRICES.

RATES OF AGRICULTURAL PRODUCE AND STOCK RULING AT THE 15TH FEBRUARY, 1921.

CENTRE.	Wheat. Per 200 lb.		Wheat Flour. Per 100 lb.		Boer Meal. Per 200 lb.		Mealies. Per 200 lb.		Mealie Meal. Per 180 lb.		Barley. Per 150 lb.		Oats. Per 150 lb.		Oat-hay. Per 100 lb.		Lucerne Hay. Per 100 lb.		Potatoes. Per 150 lb.	
	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.
Cape Province—																				
Aliwal North....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6 0	6 0	15 0	15 0
Beaufort West...	35 0	45 0	32 6	35 0	45 0	50 0	17 6	20 0	20 0	22 6	22 6	24 6	16 6	17 6	7 6	8 0	5 6	6 0	17 6	22 6
Capetown.....	33 0	33 6	—	—	—	—	16 0	17 0	—	—	15 0	17 0	9 0	9 6	4 6	4 9	6 6	7 0	10 0	20 0
East London....	—	—	34 0	34 0	—	—	17 0	20 0	—	—	—	—	—	—	—	—	—	—	12 0	33 0
Grahamstown....	—	—	—	—	—	—	15 0	20 0	—	—	—	—	—	—	6 6	8 6	3 6	4 6	9 0	24 9
Kimberley.....	32 6	37 6	33 6	37 6	51 0	54 0	14 0	15 0	15 0	18 0	19 6	22 6	13 6	16 6	6 9	8 0	5 9	7 6	4 0	23 0
Kingwilliamstown	—	—	—	—	—	—	6 0	9 2	—	—	14 0	20 0	—	—	5 0	9 0	6 6	6 6	5 0	21 0
Port Elizabeth...	—	—	—	—	—	—	16 0	22 0	—	—	11 3	14 3	—	—	6 3	6 9	3 0	5 6	4 6	10 6
Queenstown.....	30 0	32 0	36 0	37 6	54 0	55 0	14 3	16 6	20 0	21 6	18 6	21 0	15 0	17 6	5 3	6 0	4 6	5 0	12 6	17 6
Natal—																				
Durban.....	—	—	—	—	—	—	10 0	13 6	11 0	14 0	—	—	—	—	5 0	7 0	3 6	6 0	6 0	21 0
Pietermaritzburg.	—	—	—	—	—	—	11 0	11 6	—	—	—	—	—	—	5 6	6 0	5 6	6 0	13 9	14 3
Orange Free State—																				
Bloemfontein....	33 0	36 6	36 6	40 0	55 0	67 6	10 6	14 6	17 6	22 6	19 6	30 0	14 6	20 0	5 0	7 0	4 6	6 6	10 0	25 0
Harrismith.....	33 0	35 0	32 0	32 0	60 0	60 0	9 0	9 6	12 6	12 6	16 0	16 0	15 0	15 0	5 0	7 6	—	—	10 0	14 0
Transvaal—																				
Pretoria.....	38 0	40 0	—	—	—	—	11 10	14 0	—	—	19 0	19 0	—	—	6 6	7 0	5 6	6 0	6 0	17 0
Johannesburg....	28 0	34 6	—	—	—	—	10 6	12 9	10 0	11 6	17 3	17 3	12 3	14 0	5 6	6 0	3 6	5 6	5 9	16 3

CENTRE.	Onions. Per 120 lb.		Tobacco (Boer Roll). Per lb.		Beans. Per 200 lb.		Beef. Per lb.		Mutton. Per lb.		Fresh Butter. Per lb.		Eggs. Per dozen.		Cattle (Slaughter). Each.		Sheep. Each.		Pigs. Each.	
	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. £ s. d.	Max. £ s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.
Cape Province—																				
Aliwal North....	—	—	—	—	—	—	—	—	0 6	1 0	1 3	1 9	2 0	2 6	—	—	—	—	—	—
Beaufort West...	—	—	1 6	1 9	—	—	0 10	1 4	0 8	0 10	2 6	3 0	2 6	2 6	10 0 0	17 0 0	25 0	35 0	40 0	200 0
Capetown.....	6 0	9 0	0 9	1 0	40 0	100 0	0 10	1 3	0 9	1 2	1 6	2 2	1 10	2 6	14 0 0	17 0 0	27 6	32 6	23 6	42 0
East London....	15 9	25 0	—	—	30 0	55 0	—	—	—	—	1 4	2 11	1 6	3 8	—	—	—	—	—	—
Grahamstown....	12 0	13 2	1 4	1 8	36 0	40 0	0 4	1 0	0 9	1 0	1 6	2 2	2 2	3 0	—	—	—	—	—	—
Kimberley.....	9 0	18 6	0 9	1 6	28 0	68 0	0 6	1 0	0 9	1 0	1 3	2 0	1 0	3 1	12 0 0	15 0 0	11 0	15 0	*0 8½	*0 9
Kingwilliamstown	10 0	12 0	—	—	20 0	52 0	0 8	1 0	0 10	1 2	1 1	1 6	1 6	2 8	—	—	—	—	—	—
Port Elizabeth...	12 6	22 3	—	—	50 0	50 0	0 9	1 0	0 9	1 0	1 5	2 3	1 6	3 3	—	—	—	—	30 0	80 0
Queenstown.....	—	—	1 0	1 3	—	—	0 7	0 9	0 6	0 9	1 4	2 1	1 9	3 5	12 10 0	17 10 0	15 0	22 6	*0 4	*0 6
Natal—																				
Durban.....	11 0	22 6	0 2	0 9	20 0	48 0	0 4	0 8	0 6	1 2	1 5	3 0	2 0	3 6	—	—	—	—	—	—
Pietermaritzburg.	—	—	—	—	—	—	0 6	0 9	0 9	0 11	1 10	2 8	2 3	3 0	—	—	—	—	—	—
Orange Free State—																				
Bloemfontein....	9 6	16 0	0 9	1 6	28 6	40 0	0 10	1 3	0 9	1 0	1 6	2 9	1 6	3 0	14 0 0	25 0 0	20 0	28 0	*0 8	*0 9½
Harrismith.....	12 6	15 0	—	—	—	—	0 8	0 10	0 9	1 0	1 7	2 0	2 0	2 7	10 0 0	20 0 0	15 0	35 0	20 0	50 0
Transvaal—																				
Pretoria.....	17 6	18 0	—	—	22 0	52 0	3·9d.	5·7d.	0 5	0 6¼	1 5	1 9	2 6	3 6	3 17 6	18 10 0	13 3	24 9	*0 6½	*0 9½
Johannesburg....	9 6	13 6	—	—	13 0	53 0	†23 0	† 7 6	0 5	0 6	1 2	2 0	1 6	2 9	7 0 0	20 0 0	9 0	27 6	*0 5	*0 11½

* Live weight per lb. † Dressed weight, including hides, offal, etc., per 100 lb.

NOTE.—The rates quoted for produce sold in bags include, as a general rule, an additional 3 lb. for weight of bag.

THE LOCAL MARKET.

Position at Mid-February, 1921.

(NOTE.—The local market prices of certain other agricultural produce and stock are published elsewhere in this issue.)

WOOL.

SINCE the issue of the last report there has been a more general competition for good and average combing and medium wools, and also for good coarse and coloured wool, at prices slightly above those quoted last month. The demand for the better classes of combing wools has principally been from American buyers who are anxious to fill their orders and ship the wool so as arrive in the United States before the anticipated new Customs tariff comes into operation. Some thousands bales of wool of the better types have been bought during the last weeks at very satisfactory prices. A demand has also arisen on Japanese account for really superior clips of Kaffrarian and similar wools and exceptional prices have been paid for special lots. The highest record prices so far are from 17½d. to 17¾d. per lb. Bradford buyers are operating more freely but there is no tendency on their part to force prices. For heavy and seedy wools there is no demand whatsoever.

There are still large stocks of old season wool at the ports and the disposal of these is a most difficult problem as buyers are reluctant to touch old wools.

The Port Elizabeth catalogue sales were resumed on the 4th February; 841 bales were put up for sale, but only 181 bales changed hands. The sale was well attended by both buyers and sellers.

The following are the latest quotations of prices :—

	per lb.
1. Extra superior combing, 12 months', skirted, choice...	15d. to 17d.
2. Superior combing, 12 months', skirted... ...	13d. „ 14d.
3. Superior combing, 12 to 14 months' growth, skirted, deep stapled	13d. „ 14d.
4. Good average combing, 12 months' growth... ...	10d. „ 11d.
5. Superior combing, 10 to 12 months', skirted ...	10d. „ 11d.
6. Average combing, 10 to 12 months', skirted ...	8½d. „ 9½d.
7. Extra super medium, 8 to 10 months', well skirted ...	9½d. to 10½d.
8. Superior medium, 8 to 10 months', skirted	8½d. „ 9½d.
9. Average medium, 8 to 10 months'	7d. „ 8d.
10. Superfine shorts, 8 months' and less, skirted	8½d. „ 9½d.
11. Good average shorts, 8 months' and less, skirted	5d. „ 6d.
12. Average shorts, 8 months' and less	4d. „ 5d.

The freight rates for wool to England and the continent have been reduced by ⅜d. to ½d. per lb., but the benefit derived from this reduction will be somewhat counteracted by the increased rates of exchange.

MOHAIR.

There is no change to report, the market remaining in a very depressed condition. There are a few enquiries for super mixed hair at 9d. Winter hair is wanted at 6d. and Basuto hair at 9d., but sellers are reluctant to dispose of their stock on this basis. Bradford reports state that in spite of the low prices there has been practically no business doing. The following nominal quotations are given :—

	per lb.
Summer kids	20d. to 24d.
Summer firsts	10d. „ 13d.
Winter kids	14d. „ 20d.
Winter hair	6d. „ 7d.
Basuto	8½d. „ 9d.
Mixed hair	5d. to 10d.
Long O.F.S. Blue (12 months')	8d. „ 11d.
Grey and seconds	5d. „ 6d.
Locks	4d. „ 4½d.

HIDES AND SKINS.

There is a better tone in the market and a slight increase in prices has taken place during the month. Buyers show a more ready inclination to purchase on a firm basis at ruling current rates. Damaged skins are entirely neglected other than at very low rates. The following prices are quoted :—

HIDES.

	per lb.		per lb.
Sun-dried, sound	8d. to 8¼d.	Salted, sound	6¾d. to 7¾d.
Sun-dried, damaged	5½d. „ 6d.	Salted, damaged	4½d. „ 5d.
Sun-dried, fourths	1d. „ 1¼d.	Salted, fourths	1d. „ 1½d.

SHEEPSKINS.

Sheepskins, sound, per lb....	5½d.	to	5¾d.	Capes, damaged, each ...	6d.	to	9d.
Sheepskins, damaged, per lb.	2d.	„	3d.	Capes, staked	—	„	1d.
Pelts, sound, per lb. ...	4d.	„	4½d.	Capes, slinks	—	„	¼d.
Pelts, damaged, per lb. ...	1½d.	„	1d.	Coarse and coloured, sound, per lb....	4¼d.	„	4¾d.
Coarse wools, sound, per lb.	4¼d.	„	6½d.	Coarse and coloured, damaged, per lb. ...	½d.	„	1d.
Coarse wools, damaged, per lb.	1d.	„	1⅛d.				
Capes, sound, each ...	3s. 7d.	„	4s. 0d.				
Capes, sundried, each ...	1s. 6d.	„	2s. 2d.				

GOATSKINS

Angora, light, per lb....	4⅝d.	Goatskins, light	9d.
Angora, heavy and sundried, per lb.	3¾d.	Goatskins, sundried	8¼d.
Angora, shorn	2½d.	Goatskins, heavy	8d.
Angora, damaged	½d.	Goatskins, damaged	3⅝d.
Bastard, sound	7⅛d.	Goatskins, badly damaged and staked	½d.
Bastard, damaged	2⅛d.	Goatskins, slinks and bastards, each	1¼d.

OSTRICH FEATHERS.

The following information has been furnished by Messrs. Dunell, Ebden & Co., Port Elizabeth :—

Sales were held on 10th, 17th, 24th, and 31st January, 1921. The total quantity sold was 15,057 lb. which realized £17,070. There was little change in the prices and the quantity of feathers offered by farmers was comparatively small. A large percentage of the feathers sold consisted of old stock, which accounts for irregularity of the market.

The London sale should have been held on 7th February, but, owing to trade depression and unfavourable rate of exchange, has been postponed until 7th March. Not much improvement in regard to the markets is anticipated until affairs in Europe become more settled and the exchange improves.

Meat Statistics: January, 1921.

EXPORTS—

Beef, 437 quarters ; Pork, 153 carcasses ; Bacon and Ham, 34,134 lb.

CATTLE IMPORTED FROM ADJOINING TERRITORIES—

For slaughter, 3563 ; for breeding, 77. Total, 3640.

SUMMARY.

Calendar Year.	Beef Exported.	Cattle Imported from Adjoining Territories for Slaughter and Breeding.
	Quarters.	No.
1916	115,992	26,580*
1917	309,214	53,410
1918	123,354	50,053
1919	285,367	57,267
1920	69,885	89,135

* 1st July to 31st December only.

RECENT AGRICULTURAL LITERATURE.

SELECTED LIST OF BOOKS ADDED TO THE DEPARTMENT'S LIBRARY.

[NOTE.—The first number is that of the class to which the book belongs; the last number is that of the book itself.]

GENERAL.

017,94.4 Hawkesbury Agricultural College. Catalogue of Books available for use of the Staff and Students. Sydney, 1906. No. 7352.

050.68.2 Governor-General's Fund. Report on Work and Position of the Fund, 1914 to 1920. 1920. No. 7353.

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Cattle Dipping, Glen School of Agriculture.

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CONTENTS.

APRIL, 1921.

DEPARTMENTAL NOTICES.

SALE OF PURE-BRED STOCK.

An unreserved sale of pure-bred stock will be held at the School of Agriculture and Experiment Station, Cedara, on Saturday, 25th June, 1921.

FRIESLANDS	about 7 Bulls and	4 Cows and Heifers.
SHORTHORNS	„ 9 „ „	10 „ „ „
ABERDEEN-ANGUS	„ 6 Bulls.	
AYRSHIRES	„ 4 Cows and Heifers.	

Also a number of pedigree Large Black and Berkshire Pigs, and pens of pure-bred Poultry, as well as a few individual birds, will be offered.

All animals sold will be forwarded carriage paid to buyer's nearest railway station.

For catalogue and further particulars apply to the Principal at the above address.

SEED FOR DISPOSAL.

There is a quantity of the following wheat, barley, and early rye seed available for disposal at the School of Agriculture and Experiment Station, Potchefstroom. Applications, with remittance, should be forwarded to the Principal:—

Wheat.—American No. 8 (a medium late variety of good milling quality and resistant to attack by birds), to be sold in quantities not less than or exceeding 1 bag at £2. 10s.; Comeback, Spring Early, Fourie, Bombay (very similar to Klein Koren), and Lalkasarwali (an early, bearded variety, short-strawed, and a very good yielder under irrigation), in quantities not less than or exceeding 60 lb., at 18s.

Early Rye.—In quantities not exceeding or less than 60 lb., at 12s. 6d.

Barley.—Variety, Smyrna (an early, high yielding, six-row barley), in quantities not exceeding or less than 50 lb., at 10s.

AGRICULTURAL SHOW SEASON, 1921.

List of Agricultural Shows, compiled from details furnished by the Agricultural Unions, still to be held.

CAPE PROVINCE.

Kingwilliamstown—27th to 29th April (inclusive).

East London—4th and 5th May.

Komgha—6th and 7th May.

ORANGE FREE STATE.

Harrismith—Early April.

TRANSVAAL.

Standerton—13th and 14th April.

Heidelberg—27th and 28th April.

Pietersburg—24th, 26th, and 27th May.

Pretoria—31st May, 1st and 2nd June.

Barberton—10th June.

Rustenburg—15th June.

NATAL.

Dundee Agricultural Society (Dundee)—14th and 15th June.

Vryheid Agricultural Society (Vryheid)—7th June.

Klip River Agricultural Society (Ladysmith)—9th and 10th June.

Umvoti Agricultural Society (Greytown)—14th and 15th June.

Weenen Agricultural Society (Estcourt)—16th and 17th June.

Royal Agricultural Society (Maritzburg)—21st, 22nd, 23rd, and 24th June.

Newcastle Agricultural Society (Newcastle)—29th and 30th June.

Richmond Agricultural Society (Richmond)—13th and 14th July.

Victoria County Farmers' Association (Stanger)—12th July.

Dronk Vlei Agricultural Society—19th July.

Camperdown Agricultural Society (Camperdown)—20th July.

Ixopo Agricultural Society (Stuartstown)—21st July.

Alexandra County Agricultural Society (Umzinto)—15th July.

ARRIVAL OF SOUTH AFRICAN FRUIT; SCENE AT COVENT GARDEN, LONDON.

JOURNAL OF THE DEPARTMENT OF AGRICULTURE.

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NOTES.

THE MINISTER OF AGRICULTURE.

It is announced (10th March, 1921) that the Honourable Sir Thomas Smartt, K.C.M.G., has taken over from the Rt. Hon. F. S. Malan the Portfolio of Agriculture in the newly-formed Cabinet.

The Misuse of Sheep-dip Powder on Grain Bags.

Merchants, traders, farmers, and others concerned are warned of the danger attending the use of poisonous compounds in the treatment of grain bags as a preventive against weevil development or the depredations of rats and mice in the stacks and stores. An instance has recently come to the notice of the Department. Large consignments of maize arriving at one of the Union's ports for shipment oversea were found to contain a great number of bags bearing a yellow stain, suggesting the use of a dipping powder apparently for the purpose of guarding against weevil infection. On examination it was found that the poison had penetrated the bags, and a sample of the grain revealed, on analysis, that it contained an appreciable amount of arsenic, which precluded its use as a human or animal food.

Apart from the danger to life which this practice entails, it is pointed out that, should it become known that powders of a poisonous nature are being used on bags, the Union's maize export trade, which has attained such a high standard and is so well thought of overseas, may be affected. No opportunity should be lost by all whose interests are concerned to discourage this practice.

Wheat and Its Cultivation in the Union.

Many articles on the subject of wheat growing in South Africa dealing with various problems in connection therewith, have been published from time to time, but no complete collection of information has appeared under one cover in the nature, more or less, of a text-book for the student and the producer. A bulletin (No. 22) has been published, however, by the Department of Agriculture, Victoria, entitled "Wheat and Its Cultivation," which covers very fully the whole ground of wheat cultivation in Australia, and as the climate of Victoria is somewhat similar to that of the main wheat-producing area of the Union, the south-western districts of the Cape Province, much of the information given in the bulletin is directly applicable to wheat growing in these districts and of outstanding interest to farmers there. It is written by Mr. A. E. V. Richardson, M.A., B.Sc., who is well known for valuable contributions on various agricultural matters, both from an economic and cultural point of view, and the bulletin in question contains a remarkable collection of information, treating with detail and interest such subjects as seeding operations, methods of cultivation, manurial problems, wheat improvement, wheat varieties, seed wheat and its treatment, and concluding with a general summary of the essential factors in successful wheat cultivation. Indeed the bulletin (which contains 160 pages, and is obtainable on application to the Department of Agriculture, Victoria, Australia) is of so much value to the South African wheat grower that a prominent grower in the Caledon district, Mr. J. J. de Villiers, of Dunghye Park, has written to this office urging the publication in the *Journal* of extracts from the bulletin, and in the course of his letter states: "In my farming experience of over twenty years I have not handled a publication of greater practical value, to my mind, to the Western Province grain farmer than this excellent work." While it is difficult adequately to summarize a publication, practically all of which is useful to the farmer of this country, Mr. Parish, of this Department, has taken certain extracts from it of general applicability to local conditions, and has supplemented them by adding certain remarks and information based on South African experience. This is published elsewhere in this issue, and should be of direct benefit at this season to wheat growers in the south-western Cape.

The South African Honey Bee.

Apiarists will be interested in an article in this issue of the *Journal* by Mr. Skaife, at one time Entomologist at Cedara and now Inspector of Technical Education, Cape Province, on the subject of the honey bees of South Africa, especially in connection with the question of securing colonies of Italian bees or pure-bred Italian queens. The question is important in view of the fact that the presence of European foul brood is now recognized in South Africa. The article discusses the races of honey bees occurring in South Africa and shows that the pure *adansoni* race is an excellent one for our conditions, which should be noted by bee-keepers as present circumstances preclude the possibility of obtaining pure-bred Italian queens.

Wheat: Cost and Economics of Production.

The Department is anxious to obtain some information relative to the cost of production of wheat, and a scheme similar to that now in operation with maize has been drawn up, a few farmers in the chief wheat-growing areas being asked to keep records, on prepared schedules supplied by the Department, of all costs concerned in the production this season of a crop of wheat on their farms.

It is anticipated that the information furnished by the records as to the cost of growing and marketing wheat in representative areas will benefit not only the wheat industry in general by indicating the minimum cost per bag at which the crop can be grown under specified conditions, but also to a very great extent the individual farmer, by providing detailed information of the costs involved in producing wheat, and indicating means of avoiding some portion of this expenditure or of cheapening his methods or otherwise lowering the cost of production in succeeding seasons.

Schedules have now been addressed to some forty farmers in the Bredasdorp, Malmesbury, Caledon, Paarl, Cape, Humansdorp, Queenstown, Middelburg, Wodehouse, Uniondale, Alexandra, and Albert districts of the Cape Province, and to a few farmers in the Orange Free State and Transvaal.

It is proposed that an officer from the School of Agriculture serving the area concerned, will visit each farmer participating in the scheme at the beginning of the coming season, in order to explain the method of entering up the labour record sheets and any difficulties that may arise; and at the end of the season, probably November or December, it is hoped that the officer in charge of the investigation, Mr. E. Parish, Technical Assistant, will be able to make a final visit to each farmer in order to collect the information recorded, and work out the cost of production.

Farmers interested in the scheme are invited to apply for further particulars, and to submit figures they may possess relative to the cost of producing wheat.

A Market for Egg-plant Fruit and Avocado Pears.

The egg-plant fruit (*Solanum exculentum*) grows readily and to perfection in many parts of the Union, and as there is a considerable demand for it, the Department is anxious to test the overseas market which, once established, should prove a very lucrative outlet for growers of the fruit. It is intended, therefore, to send some trial shipments oversea during the coming season, and the Chief, Division of Horticulture, Pretoria, is anxious to get in touch with growers of the fruit for the purpose of obtaining and making arrangements for the packing and shipping thereof of some first-class samples. With the same purpose in view, it is intended also to send a few shipments of avocado pears. Growers of either or both of these fruits are requested, therefore, kindly to communicate with the above officer, so that the required supply may be obtained, and bearing in mind the benefits to growers which will follow the establishment of a regular overseas market, it is trusted that this request will meet with a ready response.

For the benefit of growers, it may be added that the varieties of egg-plant fruit recommended by this Department are (purple) New York Purple, Black Pekin, New York Spineless, and (white) Long White.

The Potchefstroom Pearl Mealie.

The variety of maize now well known as the "Potchefstroom Pearl," is growing in popularity and each year sees an increasing demand for the seed. It has been found suitable to a wide range of soils and is now grown in most districts of the Transvaal, in the moist, low country as well as in the drier parts. In the course of its supervision of the trials with this variety carried out by farmers, the Potchefstroom School of Agriculture has received reports showing that on a large number of farms the average yield has ranged between 10 and 12 bags per acre, while in some instances yields of from 15 to 25 bags per acre have been obtained.

In view, therefore, of the favour it is finding with maize growers, it is interesting to learn from Mr. Sellschop, Assistant Experimentalist at the school, that the Potchefstroom Pearl has been developed from a single ear—which may be regarded as a sport—selected in 1909 at the Potchefstroom School of Agriculture from a plot of the Champion White Pearl, a rough medium-early variety introduced from the United States. The progeny of this single ear was carefully observed each year, and selections continued to be made, until in 1913 a field crop was grown. After this date it appeared on the market as the *Potchefstroom Pearl.* The aim kept in view when the annual selections were made was the production of a variety of white maize possessing the following features:—

(*a*) Quality equal to that of the Hickory King for export purposes.

(*b*) A smaller proportion of waste for milling purposes than Hickory King.

(*c*) A good cropper during normal and droughty seasons with better resistance to drought than Hickory King.

During the experimental stages this variety was considered a medium early, but it is now classed as a medium to late, and ripens in from 145 to 150 days, according to the season, and usually is earlier than Hickory King. It is robust and vigorous, and reaches a height normally of about 7 feet 6 inches.

The ears have twelve rows which are very regular. The length is 9 inches, the circumference at butt 7 to 7¼ inches and the tip 6 to 6¼ inches. The butts and tips are well covered with grain. The ear is cylindrical and compact with narrow sulci; show ears generally weigh from 14 to 15 ounces.

The grain is broad, flat, and thicker than Hickory King. It is a little longer than broad, and should show good width. It is slightly wedge-shaped and is crease-dented. The grain may show wrinkles in the crease, but should not be rough. The colour is pearl white; the bushel weight averages 64 lb.

As shown by recent milling tests, it makes meal of the first quality. A prominent miller who kindly carried out the tests reported as follows:—

> "This maize grinds well, producing an excellent granulated meal with good flavour and suitable for table use. The meal yielded 54 per cent. flour of good colour and fine even grain.
>
> "The contents of the seed do not appear to be of so horny a nature as in some white flat varieties and therefore more friable."

The effort to produce a maize with the characteristics kept in view appears to have been attended with gratifying success.

Weeds of South Africa.

Like other countries, South Africa has awakened to the menace which the occurrence of noxious weeds presents, and the problem of their control and eradication is receiving close attention. During the past ten years the appearance and spread of harmful weeds have alarmingly increased, and correspondingly there is the growing danger to our pasturage and wool and other agricultural pursuits which the unchecked presence of these weeds engenders. Recognizing that every farmer of South Africa should be acquainted with the nature of the weeds likely to be found on his farm so as to be able to distinguish them and cope with the danger, this Department has published from time to time articles on certain of these plants. But the problem is becoming increasingly serious and the time has arrived for publishing all available information on the subject of our noxious weeds, and to gather it into one publication which will be of use to the farmer, the student, and the general public. This work has now been undertaken by Miss K. A. Lansdell, of the Division of Botany, and the opening contribution to the series, the first publication of its kind in South Africa, appears in this issue of the *Journal*. The work will appear in instalments in the *Journal* and eventually be issued under one cover in bulletin form.

The author has compiled an illustrated glossary of the terms used in describing the weeds and has drawn all examples from the weeds found in this country. For some time past Miss Lansdell has been studying the life-history of local weeds from the germination of the seed to the adult plant, a phase of the subject which has hitherto received little or no attention in South Africa. The publication of this information, therefore, will be of great interest and value to farmers, and in placing it before them we would ask for the co-operation of all in assisting to complete our knowledge of South Africa's noxious weeds by sending, O.H.M.S., to the Chief, Division of Botany, Pretoria, specimens of suspected weeds with full particulars regarding them, as in this manner much valuable knowledge will be obtained and serve to add to our information on this very important subject.

New Zealand Hemp or Flax: Possibilities in the Union.

Mr. W. G. Mason, Director of Training Farms, who has recently returned from St. Helena, visited by him for the purpose of advising the Imperial Government on the agricultural potentialities of the island, is impressed with the success obtained there by cultivators of hemp, which has proved a highly remunerative enterprise. He is convinced that the same success awaits the cultivator in the Union in those parts where climatic and economic conditions are suitable, particularly throughout the whole coastal area. The prospect appears bright for New Zealand hemp, with its high yield of fibre as compared with other varieties (a most important and, indeed, deciding factor in the proposition), which can be cultivated in a part of the country where land at present of little agricultural value is available. The introduction of the crop, moreover, in parts such as Knysna, where the poor-white problem is serious, would create a demand for labour

at the mills, while the establishment of a number of subsidiary industries would in all probability follow. The cultivation of hemp does not call for highly specialized agricultural skill, and the capital involved both in culture and manufacture is comparatively small.

Mr. Mason considers, therefore, that New Zealand flax (*Phormium tenax*) is a fibre plant worthy of consideration as a possible addition to the agricultural activities of the Union, and offers the following comments for the information of all who may be interested in, and desirous of considering, what seems a good proposition.

In the *Journal of Industries* for February, 1919, a report appears by Mr. E. Holmes-Smith, B.Sc., on investigations into fibre plants, and *Phormium* is one of the crops which the author recommends should be encouraged and extended as far as possible. He also states that, generally speaking, the whole coastal area passed through from the Transkei to Mossel Bay offers great possibilities for the development of fibre-growing and fibre industries.

The fibre of New Zealand flax finds a regular market, and is being commercially produced in that country, also in California, St. Helena, and the Azores. It is mainly used in the manufacture of binder twine, rope, string, and coarse mats, whilst some of the finest samples are woven into cloth. In the United States it is mixed with plaster to form a fibrous material used for the walls of sheds and other similar buildings. The tow, which is the refuse from the scutching and hackling processes, is used for upholstering work and can also be used in the manufacture of oakum. The plant is found growing almost wild at many places in the coastal regions stretching from Ixopo in Natal to Capetown. The climatic conditions required for its growth are an equable climate, plenty of sunshine, a reasonable rainfall, and at a distance not too far removed from the sea.

It will grow in almost any soil, but succeeds best in light soils by the sides of rivers and brooks protected from the wind: it should not be planted in swamps unless they have been previously drained. It does not thrive under shade, and should only be planted in localities free or almost free from frost. The climate and soil conditions around Plettenberg Bay, Knysna, and George seem all that could be desired for its growth.

In these districts the plant is growing wild and without a doubt could be cultivated on an extensive scale with every prospect of success. Propagation can be effected by means of seed or by the division of the roots of established plants. The latter is the method most commonly employed, as the growth from seed is said not to be uniform. The usual plan is to plant out the suckers at 5 feet apart between the rows and 2 feet in the rows. On good soil the latter distance might with advantage be extended to 3 feet.

No cultivation is given beyond keeping down the more prolific weeds: protection against fire must be provided. Should the land become exhausted, manuring must be resorted to, and this may be done by returning to the land the refuse from the mill.

The crop is cut once every third year, and a fair average return may be taken at about 20 tons to the acre, though under exceptionally favourable conditions more than twice this return can be obtained.

The cost of production varies according to locality and conditions.

The initial expenses are the price of the land, the establishing of the crop, and a small charge for attention during the first three years.

In St. Helena the price paid to the farmer by the mills for flax is calculated at 5 per cent. on the London market price of fibre. If fibre is selling at £30 per ton, the grower would receive 30s. per ton for his flax, delivered at the mill, and the arrangement appears to be a satisfactory one. The pre-war price of fibre varies between £20 and £40, but was usually between £24 and £32 per ton. The latest average market prices have been in 1917, £81. 9s. per ton; in 1918, £91. 17s.; in 1919, £48. 15s.; in 1920, £47.

It would be useless for any one to attempt to grow *Phormium* unless milling facilities were obtainable. The mill requires to be as near the plantation as possible in order to reduce the cost of transport to a minimum; it must have a good water supply for the washing process. A suitable piece of ground is required adjacent to the mill on which the fibre can be bleached and a cheap supply of fuel is desirable. The chief machinery required is a 30-40 horse-power engine, a stripper, a scutching and hackling machine, and a hydraulic press. The cost of the building and plant may be gauged from the provision made by the Imperial Government in St. Helena of £3500 for the establishment of their mill.

The leaves of the flax are first weighed and sorted into sizes, and are then fed to a machine called the stripper at the rate of 100 to 120 per minute. The drums of the stripper are driven at from 1000 to 2000 revolutions per minute. After passing through this machine, the partially cleaned fibre is hand-washed in hanks of about 20 leaves, and the bundles are suspended in water for about 2 hours. The fibre is then carted to the fields, where it is spread out for bleaching for a time, which varies according to the weather. In wet periods it is hung on lines to prevent it from becoming discoloured. After bleaching it is brought back to the mill, where it is scutched and hackled and then put up into bales for export.

The quality of the fibre depends upon the green leaf being in a proper condition and upon the care with which the various operations are performed.

The milling costs include the ordinary running expenses of the engine and mill, and if two strippers are employed from 25 to 30 hands are required.

With two strippers 8 to 10 tons of flax can be handled per day, and will produce about 1 ton of fibre and $\frac{1}{3}$ ton of tow.

To keep such a plant fully employed, about 600 acres would need to be under the crop, a third of which would be cut each year.

Most fibre ventures in the Union have failed on account of the heavy transport charges which have been involved, and in this respect New Zealand flax has a distinct advantage over either sisal or Mauritius hemp.

The amount of green leaf required to produce a ton of fibre is stated by different authorities at from $5\frac{1}{2}$ to 8 tons, whereas with Mauritius hemp from 40 to 50 tons have to be transported and milled in order to give the same weight. Sisal yields 3 per cent. of fibre, Mauritius hemp $2\frac{1}{2}$ per cent., whilst New Zealand flax gives at least 14 per cent.

Farmers' Meeting at Rustenburg.

Organized by the Division of Tobacco and Cotton, gratifying success met the demonstration held at the Government Tobacco and Cotton Experiment Station at Rustenburg, Transvaal, on the 24th February last, when over one hundred and fifty farmers, some coming from parts 75 miles away in the bushveld, and a number of other visitors, including a few from Johannesburg, availed themselves of the invitation of the Department to attend a series of short lectures and of demonstrations on the classes of farming carried on in the district. Rustenburg is the largest tobacco and cotton growing district in the Union, producing last year about four million pounds weight of tobacco and three hundred thousand of cotton lint, and these two crops received special attention. It is likewise foremost in the production of citrus fruit, and this subject was also dealt with in particular.

Mr. Du Toit, Secretary for Agriculture (having as chairman Mr. G. Otterman, one of the directors of the Magaliesberg Tabak Planters' Vereeniging, Rustenburg) addressed the visitors on certain broad principles of agricultural policy and enterprise. He was accompanied by the Under-Secretary, Mr. G. N. Williams, while Mr. Lounsbury, Chief of the Division of Entomology, attended for the purpose of giving general information on the work of his division, which forms such an important part of the Department. Mr. Scherffius, Chief of the Division of Tobacco and Cotton, assisted by Mr. Oosthuisen, the manager of the experiment station, and Mr. Tribolet, Chief of the Division of Horticulture, were the principal speakers on the particular cultures with which they are concerned and which are practised so extensively in the district.

The visitors were entertained at the experiment station, and were shown round by Mr. Oosthuisen, who explained the nature of the work being carried out and the varieties of crops growing there. This ocular evidence, with the presence of several of the Department's officials and the advice they were able to give, added to the lessons of the day. Much good is expected to result, and there is no doubt that the Department's action was fully appreciated by all who were present.

World Prices and Crops.

Hastened in a great measure by the upheaval of normal trade movements and the disturbance of economic laws caused by the war, there is a healthy spirit of inquiry in the farming community regarding the marketing of produce. The farmer recognizes the necessity of being well acquainted with the prices ruling for his products, not only on the local market, but oversea as well. In the latter respect the information hitherto available has been most meagre, a disadvantage accentuated in a country of distant reaches remote from sources of information, so that such intelligence as has in the past been available, is frequently belated when it reaches the farmer, and the world prices, which largely affect the local prices of his produce, may have materially altered. To be of the greatest value, market

intelligence must, of course, be up to date, and it is not possible in a monthly publication of the nature of the *Journal* to place before the farming community the latest market rates. The publication in the *Journal* of the best available market information serves, however, a useful purpose, besides being valuable as a record of the trend of the market, and will therefore be continued, but, in addition, the Department has arranged, with the co-operation of the Press, to publish weekly throughout the Union cabled information from the Trade Commissioner, London, regarding the prevailing prices of the Union's principal agricultural products on the oversea market, together with those obtaining for the products of other countries of interest to the South African producer. While the London market remains the chief index of the trend of world prices, information will also be given from time to time of the rates ruling on certain continental markets. This intelligence will enable the local producer to gauge the state of the oversea market and its relation to the prices to be obtained on his home market, and we trust that every farmer will avail himself of the opportunity thus afforded of being acquainted with the position.

In order further to assist the farmer in taking an intelligent interest in the production of crops outside the Union, the Department has arranged with the International Institute for Agriculture, Rome, which is supported by and obtains advice from most of the civilized countries of the world, to furnish a monthly cablegram showing the latest information on the world's estimated production of certain crops which are grown in this country. The figures of the estimated production are based on reports received from producing countries at the time the cablegram is dispatched, and in order to accurately gauge their significance, the advice will include also the estimated percentage of such production to the total world's production. In addition, a comparison will be made between the present crop and the crop of the previous season, and also the average crop of the prior five seasons. The first cablegram received was published in last month's *Journal*, and while at the time of writing the next has not arrived, it is hoped that the Institute will be able to furnish the information at such dates as will enable it to be published regularly every month in the *Journal*.

The Vegetable Garden and the Poultry Yard.

We conclude with this issue a series of monthly notes, published regularly during the twelve months now ended, giving practical hints on the cultivation of the farm vegetable garden and the care of poultry throughout the year. The seasonable advice contained in these notes should prove useful to the farmer wishing to have a constant supply of fresh vegetables and to ensure the best results from his poultry, branches of the farming system frequently neglected, but which well repay the care they call for. The monthly publication of these notes will be continued, and further information which may be desired will be furnished on application to the nearest School of Agriculture

Export of Cape Wine.

Mr. Cuthbert Burgoyne, member of the well-known London firm of P. B. Burgoyne & Co., which has played such a prominent part in creating an export trade in Australian wine, recently visited South Africa in connection with our viticultural industry and the possibilities of finding a market overseas for our wine. He has been in touch with many of our leading wine farmers, and has placed before them his views on our wines and the widening of our very limited market. We are indebted to him for kindly supplying us with a copy of the notes of an address given by him, during his visit, to a representative body of South African viticulturists, and which we publish in this issue. Mr. Burgoyne's statements are valuable in being an expression of opinion of a large distributor of wine, and demand the careful attention of all concerned in an industry which can be of great worth to the country and which calls for the vitalizing stimulus of an expanded market.

In this connection it is interesting to read the Jurors' Report on the Colonial Wine Competition of the Brewers' Exhibition held in London towards the close of last year (when South African wines secured eleven first, five second, and two third prizes), which states, *inter alia*, that "there were quite a number of rich, sweet wines with distinctive styles, some very pleasing, but those that found the most favour were the samples with not too much colour." The report continues: "Although not generally known on this market, there is no reason why a demand could not be created. The Cabernet and Hermitage were of good quality, and the red fuller wines, more resembling Burgundies, were sound and useful, but in some cases might have been older. The best specimens were in the lighter white wines of the type used mostly at meals, the Drakenstein and Reisling showing very well." Thus, while Mr. Burgoyne was advocating in South Africa the need and good prospects of finding an extended market in the United Kingdom, South African wines were meeting with conspicuous success in an oversea competition, evoking from the judges a favourable comment regarding the possibilities of certain of our wines securing a footing on the oversea market.

Maize Stalk Borer.

Maize can be grown in the Union under a wide range of varying conditions, and being easy of preservation as a food both for man and beast, and having great industrial possibilities, is the most important of the cultivated crops of South Africa. Of all the pests with which growing maize has to contend in South Africa, the stalk borer is the most formidable. Almost entirely unknown in some seasons, it assumes serious proportions in others, destroying 50 per cent. or more of the plants—and in parts as much as 75 per cent.—while in addition the mature grain is reduced in weight. The subject has for many years received the attention of Mr. C.W. Mally, Senior Entomologist, Capetown, and we now have the great benefit of his investigations in a work entitled "The Maize Stalk Borer," to be published by this Department as Bulletin No. 3, 1920.* Mr. Mally has dealt with the subject from a scientific, practical, and an economic standpoint, the

* Obtainable on application to this office, price 1s. 6d. prepaid.

result being a valuable, comprehensive exposition which is likely to become a standard work in South Africa, and indeed in all maize-growing countries of the world. The subject has been treated so exhaustively that it is not possible adequately to summarize the contents of the publication. Moreover, it is of so much value that it should be in the hands of every maize grower of South Africa, for anything that is intimately concerned in an increase or decrease of yield per acre in the Union's chief crop is of national importance and calls for careful attention. The loss inflicted by the stalk borer is estimated by Mr. Mally to be well over half a million pounds sterling annually, and is, in effect, an indirect tax levied on the public. Eliminate the loss and the saving effected would in two years cover the cost of the elevators for handling the grain crops of the country. Complaints continue to be received from farmers that their lands have been devastated to such an extent by the stalk borer and other pests that they had to be ploughed and sown two, and even three, times. Happily we have means of overcoming the pest, and Mr. Mally gives a clear account of the control and remedial measures to be employed in doing so. Briefly, the control measures are divided into the following five groups, each one of which is complete in itself and, under some circumstances, adequate for the suppression of the insect:—

1. Uproot over-wintered stubbles and stumps and burn them together with any remnants of the stalks before moths emerge therefrom in spring. The farmer is then free to plant and to harvest as he pleases.

2. Plant trap maize early and sow main crop late. Destroy traps immediately the first pupae are formed, about 10th December. Unless destroyed, traps do more harm than good. Trap maize should be used as a supplementary measure rather than as a control measure.

3. The young larvae in the top of the plant can be poisoned or crushed. Repeated applications may be necessary.

4. Make the most complete use possible of the crop by preserving it as grain, fodder, and silage, and thereby avoid waste in the form of pest-harbouring remnants. The burning of remnants will then be necessary only as a "finishing touch" where a certain amount of waste is unavoidable.

5. On some farms it may be an advantage to plant the silage maize early so that it will serve as a huge trap to protect maize planted as late as possible for grain.

Each maize farmer must, however, decide for himself which line of action is best suited to his conditions and to what extent there should be a combination of the above measures. We trust, therefore, that farmers will obtain and study Mr. Mally's very valuable article and carry out the advice he tenders, when a marked diminution in the great losses caused by the maize stalk borer will speedily follow.

Export of Dried Fruit.

South Africa with its comparatively small population depends largely on the oversea market for the sale of its products and the consequent expansion of its agricultural industries. Therefore the requirements of that market must carefully be studied and every endeavour made to supply an article according to the tastes, and sometimes the idiosyncrasies, of the consumer catered for. It is well

known how conditions prevailing as a result of the war have helped this country to open up a market oversea for its dried fruit, as well as for other products for which formerly no market there existed. But with the opportunities which thus arose of finding a wider outlet for our produce and building up a much-needed oversea trade, there have arisen also obstacles in the way to success through the action of exporters sending forward inferior goods. We refer in particular to the criticism which has recently been levelled by oversea and local merchants at the poor quality of raisin produced in the Union and placed on the London market. Prior to decontrol, the Imperial Government paid the same price for all raisins, irrespective of quality or package. Since the removal of control, however, the South African raisin has commanded a smaller price than the product of other countries, and the demand for it has seriously fallen off, the principal cause lying in the failure to pack or grade the article with sufficient care. Many complaints have been made in this respect, and the oversea sale is seriously affected, the consequence of failure to study the requirements of the market. During the war, when supplies were short, the market was content to take anything provided it was sound, irrespective of how it was graded, but now that trade has reverted more or less to the ordinary competitive system, the need is urgent for the marketing of our produce in the most attractive manner and in conformity with the wishes of the market we wish to secure. Other exporters, indeed, who recognized this in the past are awake to the necessity of even greater care than previously in presenting their articles for sale; Valencia packers are now doing this, with the result that their goods are eagerly sought after by retailers, while the sale of Cape raisins languishes. And it is expected that there will be a heavy production of raisins this season, and producers, merchants, and others concerned in the raisin trade have strongly represented the urgent need for a change of methods to save the situation on the London market.

With a view, therefore, to fostering the trade in South African dried fruit, the Department convened a conference of fruit growers and others concerned, for the purpose of discussing the question of inspection, grading, etc., of dried fruits for export, and considering the regulations proposed to be issued in this connection.

The conference took place in Capetown on the 4th March, 1921, and was most representative. Mr. Du Toit, Secretary for Agriculture, was in the chair, and in his opening address outlined the present position of the trade and the need for its proper control. Mr. H. E. V. Pickstone moved and Mr. Heatlie, M.L.A., seconded: "That this meeting of delegates, interested in the export of dried fruit, is unanimously in favour of the same being placed under Government supervision, and under such regulations as may be decided upon later."

The conference then proceeded to deal with the various clauses of the draft regulations, drawn up by the Department, copies of which had previously been sent to producers interested in the industry. The matter was fully and freely discussed, and it is certain that the regulations finally adopted, details of which will duly appear in the *Journal*, will be the means of securing for South African dried fruit the same excellent name on the oversea market that our inspected produce now enjoys.

DEPARTMENTAL ACTIVITIES

February, 1921.

(NOTE.—The work of the several Divisions and Schools of Agriculture covers a wide range of agricultural industry in the Union, and we give hereunder notes and observations from certain of them treating with matters of special interest coming under their purview during the month. The object of these notes, which are not concerned with general routine work, is to inform the farmer of such matters as are calculated to be of interest and helpful to him at the present time.—EDITOR.)

THE DIVISIONS.

ENTOMOLOGY.

The Sheep Blow-fly.—One of the principal stock problems in Australia of recent years has been the control of the sheep blow-fly. The losses from this pest have been enormous. Unfortunately, it is not altogether unknown in South Africa, and several correspondents of the Division of Entomology have suggested that the trouble is upon the increase. The Division has been in communication with the Queensland authorities with a view to ascertaining the progress in the investigations in hand there, and, as a result, has been favoured with the following suggestions for the solving of the problem, made by the Queensland Special Blow-fly Committee of the Commonwealth Institute of Science and Industry.

The jetting of sheep mentioned is accomplished with a high-pressure spray pump delivering a solid jet of fluid. The poisonous dip referred to is believed to be one well known on the South African market, but here we would use five pounds of arsenite of soda in place of the arsenic and carbonate of soda recommended.

"These suggestions are the outcome of seven years' investigations . . . . The problem is a very complex one. It has been found, for instance, that out of somewhere about forty-nine specifics used as preventives most were useless, some fairly effective, and several effective for a longer or shorter period. It has been found, too, that sometimes a specific has been found effective in one season and useless in another.

"Sick or wormy sheep are more susceptible to blowfly attack thanhealthy animals. It is wise, therefore, to keep the flock healthy. In the case of wormy sheep, they may be drenched two or three times, with an interval of seven days, with arsenic and epsom salts.

"Segregation of flyblown sheep should be always carried out. It is found that 'once struck, always in danger' applies most certainly even in a moderately mild attack. We consider that stricken sheep should be drafted off from sound sheep at the beginning of the fly season.

"It has been estimated that even one dead sheep at watering places, camping grounds, etc., will breed as many as 10,000 maggots, and is consequently quite sufficient to stock a large paddock with flies within a month or six weeks. Therefore, where practicable, all carcasses should be destroyed at such places as sheep congregate.

"The Orion Downs method of jetting a poisonous solution into the breech of the sheep has been found very effective up to two and a half to three months. This was proved at Gindie, where the Orion Downs formula of four packets of poisonous dip to 100 gallons of water was used. But it was evident that the sulphur was in excess in that proportion of dip, and as it appeared to us that it was the arsenical content of the various dips which was the chief factor in poisoning the wool, it was decided to use only one-fourth quantity of the Orion Downs formula to 100 gallons of water, supplemented by the addition of 4 lb. of arsenic dissolved by 8 lb. of carbonate of soda, boiled for three-quarters of an hour in a sufficient amount of water, say 5 gallons. This formula was used at Dalmally in April, 1920, in the form of a jet at 100 lb. pressure. Not one sheep in about 3000 ewes was struck until July, the flies being very active everywhere, thus putting the ewes over lambing without

any trouble. Mr. Linton, of Mount Abundance, had a similar experience with 12,000 full-woolled hoggets. He despaired of getting his sheep shorn without serious losses. He wrote Dalmally, and Mr. Russell gave him the formula as above. He had only three sheep struck in six weeks. Other cases are known to this Committee quite as convincing, so we say positively—the use of the above method will save serious losses if applied in time, and it may be repeated at intervals of, say, two and a half months without injury to fleece or health of sheep. The cost, labour included, runs to about one farthing per head. One gallon will jet about eight sheep if carefully used. We believe that the cleansing effect of a strong jet is a big factor in the protection given.

"This method of jetting at the above strength only protects the breech of the sheep. The Committee knows from experience that dipping in a poisonous solution will give a certain amount of protection. It was found in the Gindie experiments that three dippings at intervals of three months minimized fly attack. The Committee is experimenting with dips, with the object of protecting the whole body of the animal as has been accomplished by jetting for the breech. To that end Mr. W. A. Russell, of Dalmally, has erected a shower dip and 50-ft. swim dip to try and discover some method which will protect the animal from the fly without injuring the health or the fleece.

"Many dressings for flyblown sheep have been tried out and found in the great majority of cases useless. None of the naphthalene or carbolic preparations has been found of any use. The Committee regrets that at present it is prohibited from publishing the results and names of the dressings tried. Very few have been found effective, and it is hoped that in the near future permission will be obtained for publishing the names of these dressings, as the Committee realizes that much money and time are being wasted by sheep-owners in using dressings already known to this Committee to be useless. This is the worst season for fly this Committee has known.

"A cheap and effective dressing for lambs' tails has come under our notice. We have not tried it out yet, but many practical men are using it successfully. It is as follows :—

15 lb. of fat, beef or mutton ;
1½ pints of paraffin oil. Mixed together.

To be warmed before using on the purse and tail of marked lambs."

Tipwilters.—These large, long-legged dark brown plant-bugs (*Holopterna valga*) have, as usual, been much in evidence this summer, and many garden-flowers have suffered from their attack. They are very familiar creatures, and the name "Tipwilter" well describes them. In the veld they have been noticed on small yellow flowering composites, and in the garden they have been numerous on dahlias and sunflowers, the latter seeming to be a preferred food-plant.

There is no other way of dealing with this evil-smelling creature than that of collecting and destroying as many as possible. It may be a bit discouraging at first, but a good deal of annoyance can be avoided if the insects are regularly destroyed. The simplest means to this end is a tin can with water and paraffin oil in it or some carbolic disinfectant. The bugs can be knocked into the can from the plant, and this is of easy accomplishment if done early in the morning whilst the creatures are sluggish.

Fruit-fly.—Upon the whole, the summer fruits in the Pretoria District have escaped destruction by fruit-fly, but early in February the inroads of the pest on yellow peaches became very marked in some gardens. In one, where all the stone fruits were destroyed last summer only the yellow peaches have been attacked this year, the damage running to very nearly 100 per cent. of the fruits. This instance seems to show how enormously this insect may breed up in a few months, even after it has had a decided set-back. It will be remembered that in Pretoria the damage was very great last summer; it started early and continued to be severe all through. This is attributed to the mildness of the preceding winter (1919), whilst the relative freedom of attack during the earlier part of this summer seems due to the frosts of the 1920 winter.

Tomato Erinose.—This is a disease of the tomato plant often mistaken for an attack of mildew. In bad cases of attack the stems and leaves, and even parts of the green fruits, become covered with white patches, and before long the plant is seen to be thoroughly diseased and collapses more or less rapidly. The mildewed-like appearance is due to abnormal growth of plant hairs, and this again is due to the presence of a multitude of minute mites, which shelter in the protection of the hairs and can only be detected with a microscope. Tomato erinose usually starts in a small way as whitish patches on the main stems, but, as the mites breed with great rapidity, it does not take long for them to spread over the greater part of the plant, carrying destruction with them. Badly diseased plants may not die outright, but linger on in a withered, useless condition for quite a while.

This seems to be a summer trouble and to be more in evidence from the middle of summer onwards. It is reasonably supposed to be the main cause leading to the failure of summer crops of tomatoes in some parts where winter crops are quite successfully grown.

It has not yet been found possible to conduct experiments for its control, but the application of nicotine extract or greatly diluted lime sulphur, in the early stages of the disease, may arrest its progress.

Potato-stem Borer.—A new pest in the shape of a potato-stem borer from Lyndhurst, near Johannesburg, has recently come under notice. This is the larva of a moth (*Euzophera villora*) which bores in the stems and tubers, riddling them with galleries. It belongs to a genus with several species of a harmful nature. One (*E. osseatella*) has been reported as a potato-stem borer in Egypt; a second (*E. aglaeella*) as a borer and girdler of walnuts in the United States; a third (*E. semifumeralis*) as a borer in plums in the United States and Canada.

Borer in Wheat.—When at Selborne, Sundays River Valley, in November last, Entomologist Gunn found a considerable amount of damage being done to wheat by a moth larva somewhat like the maize-stalk borer, but smaller. The borers were in different stages of development and located in the internodes. All the infested plants were found to ripen prematurely, but the grain, although yellow, remained quite soft. Similar borers were also found in barley and oats. The moths bred at Port Elizabeth from these borers have been identified as *Sesamia calamistris*, Hmpsn. This insect is believed by Senior Entomologist Mally to be the same as that observed by him throughout the coast-belt, especially at Alexandria, 1908. It has been reported as attacking maize in Zanzibar and Southern Nigeria.

Tobacco Slug at Middelburg, Transvaal.—The tobacco slug (*Lema bilineata*) has already been the subject of several notices in the *Journal*. Its presence at Middelburg, Transvaal, is now to be recorded. Writing to the Division under date of the 20th January, 1920, Mr. L. Watermeyer stated he had that day seen for the first time at his farm, Hammarkop, insects on his tobacco plants which he took to be the same as those described in the *Journal* for January. Later, Mr. Watermeyer was good enough to send the Division specimens confirming his observation.

Locusts.—The indications at present (2nd March) are that next spring there will be extensive outbreaks of voetgangers in many of the Karroo districts. Farmers are urged to be keenly on the watch for evidence of egg-laying and to report observations without delay to the magistrate of the district. The outbreaks of voetgangers in Graaff-Reinet and the neighbouring districts southwards have now nearly subsided. About 1500 swarms are reported to have been destroyed in Graaff-Reinet district alone. As narrated in previous notes, a close approach to eradication was quite impracticable, and swarms of flyers representing the voetgangers that survived the poisoning operations are now spread far and wide. The chief movement has been west to north. Swarms thought to have come from the middle Karroo area, chiefly Graaff-Reinet, have been reported since 8th February in the Prince Albert, Beaufort West, Murraysburg, Victoria West, Richmond, Britstown, Prieska, Carnarvon, Middelburg, and Steynsburg Districts. Some small swarms of voetgangers in the Prince Albert and Carnarvon Districts were also reported during February. It further seems probable that there have been some swarms in the far north-west. Sheep Inspector C. J. Mollett reported a swarm of flyers at Lariesfontein, in the Calvinia District, in the middle of February, and on the 26th of the month the Magistrate at Springbok (Namaqualand) telegraphed he had learned of two small swarms of flyers in Bushmanland.

The Railway Administration reports that during January and February gangers on the track between Graaff-Reinet and Kendrew destroyed seventeen swarms of voetgangers. One swarm is said to have been one-quarter to half a mile wide by one-half to a full mile long.

Woolly Aphis Parasite.—The outlook in the Transvaal for the permanent establishment of this beneficial insect became very gloomy early in February. The woolly aphis decreased almost to the vanishing point owing, it is thought, to the very hot dry weather where the largest liberations of the parasite had been made. But the aphis has come on again, and is now (2nd March) already as prevalent as it was in December, and the parasite is showing up strongly at places where we thought it might have died out. The latest reports from the Capetown branch of the Division are also very favourable. Liberations of colonies reared at Pretoria have been made at ten places in or near Pretoria, five in or near Johannesburg, and also at one or more places in Heidelberg, Standerton, Middelburg, and Ventersdorp, in the Transvaal, and at Clocolan, in the Orange Free State. One colony has also been sent to Kokstad, in Griqualand East. Colonies reared at the Cape branch have been put out at several places in the Cape and Stellenbosch Districts. Although little larger than fly specks, the insects appear to be great wanderers and readily able to find small colonies of aphis on trees a hundred yards or more from where they are put out, despite intervening trees of kinds other than apple.

The original material from America, which began to yield adult parasites on 5th December, continued to yield a few up to the 22nd February. Apparently nature wisely provides for the emergence of the parasites after winter to be over a period of many weeks as an insurance against all perishing through lack of aphis at any time.

Mystery Worm.—Following upon rumours of outbreaks of mystery worm reaching the Division from Southern Rhodesia, the appearance of the pest in the high veld in March was anticipated. A warning notice giving defensive measures was therefore issued to the Press. To the close of February outbreaks in three Transvaal districts have been reported. These are all in the low veld or bush-veld, but later outbreaks may be expected in the high veld. The first reports were received about the middle of February, and subsequently reports came from Barberton, from Naboomspruit, and the valleys of the Koedoes and Middle Letaba Rivers, north-east of Pietersburg.

Cheese Mites.—The advice of the Division having been sought for the prevention of damage by cheese mites in factories, especially during the summer months, the following remarks, based on American records, are offered for the information of those interested.

It is not possible to destroy mites which are actually within a cheese, and there is no remedy except that of cutting out the infested portion. Every cheese-room is liable to become infested, and all efforts must be directed towards prevention. Nothing but the utmost cleanliness and watchfulness will prevent the appearance of the mites. These creatures breed all through the summer months, and in warm houses they will breed in the winter. The rapidity of their multiplication under favouring circumstances is almost incredible. Throughout the summer months they are soft-bodied and possess comparatively feeble powers of locomotion. In the soft-bodied form they can endure a fast of eleven weeks, and although they may not travel far at one time, they may cover considerable distances in a search for food.

The remarkable feature of their biology is the provision that a number may fast for an indefinite period. Thus, when mites have devoured a whole cheese and there is no more accessible food, all the young ones and all the old ones die off. Those that are middle aged have the power of undergoing a complete change of form, acquiring a hard brown protective covering into which all the legs can be withdrawn in repose. These resting forms are those that can survive until food is available. They remain inert until some insect or animal, such as a mouse, passes near by and then seize on to this with their legs taking the chance of being transported to some new supply of food. The difficulties of disinfecting are due to the extreme tenacity of life of the mite in the resting stage.

Infested rooms should be cleaned out thoroughly, fumigated with sulphur, and washed with a strong soap solution. The fumigation with sulphur should be at the least at the rate of two pounds to every 1000 cubic feet of enclosed space.

The Vegetable Ivory Beetle (*Coccotryphes dactyliperda* F.).—Soft-goods merchants in Durban have considerable trouble with a small insect damaging the buttons (on ready-made garments) made from the so-called "vegetable ivory," which is the hard seed of a palm, *Hyphaena crinata.* The insect is a small beetle, rather more than one-sixteenth inch long. The beetles are not often seen wandering about, and the first thing noticed usually is that the buttons are attacked. Storekeepers are therefore inclined to think that the buttons are infested when received. However, no trouble is experienced with buttons in closed packages, and buttons on the clothes which are most exposed are the most damaged. It is therefore considered that the infestation is derived mainly from beetles on the

premises. The inside of the button is eaten out, till only a shell is left. Beetles, pupae, grubs, and eggs may be found together, and it therefore seems as if breeding inside the button is continued as long as there is any food left. As many as 30 beetles and 50 pupae and larvae have been counted in one button. Merchants have to replace the damaged buttons, and the expense in large establishments is very considerable. What is apparently the same trouble has been discovered by the Eastern Province Entomologist at Port Elizabeth; but it is said not to be serious there, and it is possible that the insect is one which will be troublesome only in the warmer parts of the country.

It is possible to kill the insects in the buttons by treating them with certain substances or by fumigation; but this is hardly practicable with big stocks of clothing, and there is no assurance that reinfestation will not take place. Preventive remedies will probably prove more effective, and it is intended to carry out certain experiments. Durban merchants are stipulating that no vegetable ivory buttons are to be supplied with their orders, and this seems to be the simplest safeguard against loss, unless the manufacturers of vegetable ivory buttons could make them proof against attack, which could probably be done by incorporating some poisonous substance with the material with which the buttons are coated.

February Insect Troubles.—During the month of February letters have been received and dealt with by the Pretoria office of the Division of Entomology upon the following pests and matters appertaining to insect control:—

Orchard insects: Fruit-fly; red scale; mealy bug of figs, vines, citrus; Australian bug; root knot of peach and fig. *Field-crop insects*: Root knot of vegetables; potato gallworm; mystery worm; tobacco slug; melon aphis; cabbage aphis; red spider; melon fly; potato-plant bug. *Garden insects*: Red spider; tip wilter bug. *Household insects*: Ants; fleas; bed bugs; cockroaches; tampans. *White ants*, destroying wood-work of houses, teff, forestral transplants, etc. *Cotton insects*: Bollworm; leaf-eating caterpillars; "jassid disease." *Maize insects*: Weevils. *Miscellaneous*: Mill insects; cheese mites; insect galls on grass; Australian bug in wattle plantations; phoracantha borer of eucalyptus; scab of springbok; hare ticks; bagworms; lawn caterpillars; Indian cochineal; fumigation.

VETERINARY EDUCATION AND RESEARCH.

Scab in Sheep Kraals.—A very interesting and most important series of experiments have just been concluded by Mr. H. H. Curson, the veterinary research officer in charge of the laboratory at Grahamstown. It will be remembered that Shilston in Pietermaritzburg first carried out experiments under strictly scientific conditions with a view to establishing the longest period that a sheep kraal will remain infected with scab. He found that if scabby sheep were taken out of a kraal, and the kraal left empty for sixteen days, and if clean sheep were then put back into the kraal, these sheep would remain free of scab. In other words, the kraal is not able to retain the infection for a period of sixteen days. The same results were obtained by

Bedford working at Onderstepoort (see Third and Fourth Reports of the Director of Veterinary Research).

These results have often been questioned by farmers who believe that an infected kraal is capable of retaining the infection for months or even for a year and longer. It was with the object of demonstrating the erroneousness of this belief that the investigations were again undertaken by Mr. Curson. The suggestion of having the results obtained by Shilston and Bedford retested was first made by the Somerset East Agricultural Society. The Division of Sheep then took the matter in hand, and it was decided that Mr. Curson would arrange and supervise the experiment in Somerset East, the sheep inspector of the area actually controlling the experimental animals. In addition to this, three similar experiments were concluded in Grahamstown. It may be added that further similar experiments on a much larger scale are being carried out at Onderstepoort. A full detailed report of all this work will be published later. These notes are merely intended to give farmers the outstanding results of Mr. Curson's tests.

In the first experiment an open sheep kraal measuring 80 × 43 feet was used. A flock of sheep, 12 of which were infected with scab, was kept in it for over a month. The kraal was then left empty for sixteen days, after which period six clean sheep were brought into it and left there for 27 days. All these sheep remained free of scab.

In the second experiment an open sheep kraal 21 × 21 feet was occupied by eight scabby sheep for 18 days. The kraal was then again quarantined for 16 days, and then two sheep and one goat were put into it for 38 days. All three animals remained clean.

A closed corrugated iron shed 9 × 10 × 12 feet was occupied by eight scabby sheep for 18 days, and then left empty for 16 days. Two clean sheep were then put into it for 38 days, and remained free of infection.

The last experiment was the one carried out in Somerset East in collaboration with the Division of Sheep. Two scabby sheep were left in a closed brick stable measuring 6 × 12 × 12 feet for 84 days. The Somerset East Agricultural Society was particularly keen that a closed stable should be used instead of an open kraal. It was suggested that the former would retain the infection much more easily than the latter. After removal of the two scabby sheep the stable was left empty for 16 days, and was then occupied by two clean sheep for 47 days. At the end of the experiment, these two sheep were found to be free of scab.

It may be added that all these kraals or sheds contained some 6 inches of manure, and in addition logs covered with bark and stones were used in the second and third experiments, to afford as much protection as possible to the scab parasites. Furthermore, infected wool and crusts were taken from the scabby sheep on the day they were removed from the kraal and deposited in the latter, so as to ensure a heavy infection. Nevertheless, as can be seen from the above results, no single animal picked up the infection on being put in the kraals after a period of 16 days.

We can therefore safely assume that the results originally arrived at by Shilston and Bedford were correct, and that if scabby sheep be taken out of a kraal, shed, or stable, and the latter left empty for 16 days, there will be no danger of reinfection if clean sheep are put back into this enclosure after this period.

VETERINARY.

Mr. James Chalmers, M.R.C.V.S., Government Veterinary Officer, who has just completed a visit to Argentine, Uruguay, Brazil, and England, in connection with the export of meat and its products, furnishes the following preliminary remarks, to be amplified later on by detailed reports, for the information of all interested in the subject:—

Argentine.—As is well known, this country supplies most of the world's markets to-day with meat and meat products. It has a population of 9½ millions. The following are the approximate figures for stock at the last census in 1914, viz.: Cattle, 26 millions; sheep, 43¼ millions; goats, 4½ millions; and pigs, 3 millions.

Like the Union of South Africa, the Argentine is divided up into districts or departments. The principal city in the Republic is Buenos Aires, which has a population of 2½ millions. It is here that all of the *frigorificos* (or abattoirs) are situated at the coast.

Although this country has to-day a great reputation for meat, etc., I am informed by those better able to express an opinion that there remains a still greater future before the Republic, and that the possibilities are enormous. The country or veld appears to be of greater density and of better quality than that of South Africa. The low-lying veld is marshy and coarse, but the undulating upper veld is on a par with the best to be seen in the United Kingdom. The country generally is flat. The rainfall is good and spread over a longer period than that of the Union. The farms or *estancias* are large, but are cut up into fenced paddocks or camps, and are all run in the latest up-to-date scientific manner. Where necessary, bore-holes have been put down to get water, and complete irrigation exists. The result is that all farms have large areas growing lucerne, into which the cattle are turned three months prior to their being sold for slaughter. Practically all farms have a cattle dipping tank to eradicate ticks—as it is a punishable offence which is strictly enforced to send cattle to the market showing tick infestation.

All stock (cattle, sheep, and pigs) are loaded into trucks at one end (of a row of trucks) and are driven through until they are one by one filled, when dividing doors are let down at the ends. The only difference is that sheep and pigs are conveyed in double-deck trucks. This arrangement does away with the necessity of a large loading "bank."

Argentine farmers have to-day to thank their Bureau of Animal Industries and its various divisions for the prosperity and development which have produced such contentment amongst them. The most important of these divisions is the Veterinary, which has the meat inspection control as a sub-department.

To give some idea of the importance of the meat inspection department, there are under its control 12 frigorificos and 84 sausage factories, which necessitate the employment of one chief of sub-division (who is a veterinary officer), 64 veterinary officers, and 104 laymen (under control of veterinary officers). As a comparison, there are only 57 veterinary officers in the whole Veterinary Division of the Union of South Africa.

As all the frigorificos are situated near to Buenos Aires, this permits administratively of the establishment of two markets to which all stock must be consigned. These are situated within the boundaries of the city, and come under Government sanitary control. One market deals with all equines, cattle, and pigs, and the other is solely for sheep. All buyers visit these, and on purchase consign stock per rail direct to frigorificos.

The breeds of cattle most favoured are in order of importance: Shorthorn, Hereford, Aberdeen-Angus; of sheep: Leicesters, Lincolns, Merino; of pigs: Poland, China, and Berkshire. The diseases of importance met with in stock are:—Cattle: foot and mouth, tuberculosis, actinomycosis, anthrax. Sheep: foot and mouth, scab, anthrax. Pigs: tuberculosis, foot and mouth, trichinosis.

In some areas Texas fever or ordinary redwater is prevalent amongst cattle, and a campaign of tick eradication is proceeding. East Coast fever does not exist.

During 1919 the following were slaughtered under Government supervision: 2,052,498 steers, 256,263 cows, 6171 calves, 2,551,404 sheep, 261,041 pigs.

The following were exported during January to October, 1920: 1,416,299 frozen carcasses of mutton, 3,833,178 frozen beef quarters, 544,705 chilled beef quarters.

Uruguay.—The country, generally speaking, is more undulating and hilly, and the veld is similar to that of the Argentine. It has a population of 1,378,808, and its area is 72,153 square miles.

The following are the approximate figures for stock at the census of 1916:—Cattle, 8 millions; sheep, 11½ millions; goats, 12,000; pigs, 304,000.

The country is divided into 19 departments. The three frigorificos in the country are situated at the coast near to Monte Video, the capital.

The remarks already made regarding Argentine are applicable to this country, with the following exceptions:—In the meat inspection department there are employed in Government service one chief of sub-division (who is a veterinary officer), 15 veterinary officers, and 26 laymen. The breeds of cattle most favoured are Herefords and Shorthorns.

During 1918 the following were slaughtered under Government supervision:—796,725 cattle, 119,768 sheep, 15,298 pigs.

The following were exported during January to July, 1920:—65,456 metric tons of frozen beef quarters, 17,077 metric tons of jerked meat. The latter is meat which has been salted and sun-dried.

Brazil.—On account of language difficulty, I was not able to gain much information. The Hereford breed predominates, and the export of beef is on a par with that of South Africa.

United Kingdom.—My investigations were confined to London and the Smithfield market, and it is intended to publish later on a full report thereon.

BOTANY.

At the beginning of the month Dr. Pole Evans and Dr. Phillips went to Capetown to a conference of botanists to discuss the proposed "pica" survey of the Union in connection with the investigation of lamziekte; the botanists composing the council of the Botanical Survey have been asked to assist in this matter.

In the *National Herbarium* numerous determinations have been made for the Division of Veterinary Research in connection with its work on stock diseases. The Forest Department has also been assisted with identifications of forest trees, and much information has been accumulated with reference to the yellowwoods (*Podocarpus* spp.). Arrangements have recently been made for the acquisition of the valuable collections of Rhodesian plants made by Mr. Fred Eyles; this will be of great value both from a scientific and economic aspect.

In the *pathological section* there has been considerable correspondence with farmers on the subject of bacterial diseases of plants, which have been especially prevalent. Bacterial wilt of potatoes and tomatoes has been sent for identification from various localities in the Transvaal, Natal, and Swaziland.

A particularly severe case of bacteriosis in cotton (*Bacterium malvacearum*) was reported from Wolhuters Kop. A large number of seedlings were attacked, remained stunted for some weeks, and finally died. Our correspondent stated that this was not a case of one plant dying here and there, but was a matter of acres. Angular leaf-spot caused by the same organism has also been recorded from Swaziland.

The bacterial disease of tobacco previously recorded from the Piet Retief District is now spreading rapidly at Marikana in the Rustenburg District, and is probably very widespread. So far as the investigation of this disease has gone, it bears a very strong resemblance to the wild fire in tobacco recorded in the United States.

A bacterial blight of Sudan grass sent from Kaalfontein and found at Groenkloof and in the experimental plots at the Laboratory is also under investigation.

In connection with the study of ergot on *paspalum* germinating sclerotia have been found for the first time in South Africa—an important discovery from a scientific point of view, as it completes the life-cycle of the fungus and establishes its identity as *Claviceps Paspali*.

On the recommendation of this Division, a further examination of the poplar plantations in the Bedford district was made by the Forestry Department, and numerous specimens of bark were collected. An examination of these confirmed the opinion that the death of many of these trees in recent years is due to a fungus parasitic on the living trees. The disease is thought to be identical with *Cytospora chrysosperma* reported from America as causing a serious disease of poplars, willows, etc.

What promises to be quite a serious disease of arums (*Richardia* spp.) has recently been noticed. The trouble is characterized by the presence of disfiguring spots on the leaves, which in severe cases cause the death of the latter. It is caused by the fungus *Cercospora richardiaecola*, and spraying experiments are being conducted with a view to finding a means of controlling the disease.

In connection with the spraying experiments being carried out at Stellenbosch against scab or *fusicladium* in pears, the Western Province mycologist reports that whilst it is rather premature to state what the results are likely to be, these promise to be less satisfactory than was at first anticipated, in that the sprayed trees show a fairly high percentage of infection. This is probably due to certain unavoidable causes such as heavy rains in the spring and the protracted periods of blossoming and fruiting.

The disease known as "vrotpootje" in wheat is one which has been known to farmers in the Western Province for a number of years, and about which prominent wheat growers are becoming rather concerned. The symptoms appear to correspond with those of the disease known as "take-all," which occurs in Europe, Australia, and America. A series of field experiments in the control of this disease have been planned in collaboration with the botanist at Elsenburg, Mr. Starke, of Messrs. C. Starke & Co., having kindly allowed the Department the use of several acres of land near Durbanville for this purpose. Any information with regard to this disease which can be furnished by wheat growers in the Western Province will be much appreciated.

THE SCHOOLS OF AGRICULTURE AND EXPERIMENT STATIONS.

CEDARA, NATAL.

Kikuyu Grass.—Analyses of Kikuyu grass hay have been made and compared with the composition of veld hay. They are as follows:—

	Kikuya Grass Hay cut February, 1919. Per cent.	Kikuya Grass Hay cut December, 1920. Per cent.	Veld Hay cut March, 1915. Per cent.
Moisture	17.7	11.2	8.4
Ash	8.8	11.2	5.1
Crude protein	14.5	10.3	3.8
Amides	—	3.8	.5
Crude fat	1.7	2.6	2.8
Soluble carbohydrates .	33.8	37.4	47.4
Crude fibre	23.6	23.5	32.1
Nutritive ratio	—	1:4.4	1:14.4

These analyses show the high feeding value of Kikuyu as compared with veld hay; its high nutritive ratio should be noted.

Farm.—During the month a commencement will be made with silage making; the requirements for the cattle for the winter months approximate to 400 tons. Most of this will be maize silage this year owing to the soya-bean crop failing through damage by hail and by cutworm attack. Dairy cows are requiring heavier feeding, owing to the poorer grazing. A convenient rough guide to the

amount of concentrated food to be fed to a dairy cow daily is to allow 1 lb. of concentrated food to every 4 lb. of milk yielded; a second method is to allow as many pounds of concentrated food daily, as the cow yields pounds of butter-fat weekly.

Poultry.—For the period 26th December, 1920, to 25th January, 1921, the total egg production from the 120 hens in the laying competition was 2444, or an average of 20 eggs per bird for the period, which must be considered very satisfactory. The 54 ducks under test laid during the same time 1065 eggs, an average of 20 also. White Leghorns lead in the fowl competition and Indian Runners in the duck competition. The best pen in the egg-laying competition has up to 2nd February, 1921, laid 893 grade A eggs and 7 grade B eggs in a period of 44 weeks. This pen is White Leghorns. This compares with Cedara-bred birds under similar conditions as follows: In 9 months 12 hens laid 1912 eggs, an average of 159 eggs per bird, with the highest individual record of 204 eggs for 9 months.

GROOTFONTEIN, MIDDELBURG (CAPE).

Notes on the Planting of Crops during April.—During April wheat, rye, oats, barley, emmer, and rape may be sown for grazing purposes. When these crops are raised mainly for grazing, a larger quantity of seed should be used than when sown for grain. Also when sowing Durums a greater weight of grain should be used than of the "common" varieties of wheat, as the grain of the Durums is much larger and the plants do not stool as well as the common wheats. The difference in the number of grains in a measured quantity of seed, between Durums and the common wheats is sometimes 50 per cent. more in the case of the latter. While an average of 40 lb. of seed per acre of the common wheats is sufficient for most areas when grain is the object, it would be necessary to sow 60 lb. of the Durum types to procure a similar stand.

The following rates of seeding per acre are dependent on locality and the time of year sown:—

Durum wheat may be sown at the average rate of 50 to 60 lb. per acre for grazing.

Common wheats at the rate of 30 to 50 lb. per acre for grazing.

Rye at the rate of 40 lb. per acre for grazing.

Oats at the rate of 50 to 70 lb. per acre for grazing.

Barley at the rate of 40 to 60 lb. per acre for grazing. Barley sown for grazing has not proved a success at Grootfontein, as it does not recover as well as some of the other crops after being fed off.

Emmer at the rate of 60 to 70 lb. per acre for grazing. The Emmer grain is enclosed in the chaff, and therefore this point must be considered when estimating the quantity required. This also explains the apparently large amount of seed recommended per acre.

Rape at the rate of 3 to 5 lb. per acre. This crop gives a large amount of feed with the first growth, but does not withstand frost when fed down. It is a very quick grower, and is generally quite fit for grazing about ten weeks after being sown.

All the above weights are for broadcasting; the quantities may be lessened by about 15 per cent. when drilled.

Lucerne.—March is the best month for establishing lucerne where there is no danger of the caterpillar pest, and the month of April ranks next. Where there is danger from caterpillar, it is often to be found that the early winter months are the best for planting. Where irrigation is practised, lucerne may be sown during any month of the year, provided the soil is not weed-infested, but March and April are recommended for the summer rainfall areas for the following reasons: A good germination may be expected, as the soil is warm and yet is not dried out as it would be by the excessive heat of mid-summer. The young plants make a good root growth before the winter, and lastly the weeds that come up in spring and summer are killed by cultivation prior to sowing, and any that remain are killed by the first frosts.

Maize.—Special selections made from an early yellow dent maize called "Minnesota 133" are proving to be early and prolific. These were sown on the 20th October, 1920, and several matured at the end of February, 1921. This would not be considered early in the maize-growing areas, but is early for dent varieties in the Karroo. Minnesota 133 has proved to be suited to semi-arid conditions in America, especially over the Great Plains area, where it has occupied first place in yield in many tests (*vide New South Wales Agricultural Gazette,* July, 1919, page 499).

Sudan grass continues to be a very successful crop for the Karroo. A plot sown on the 20th October, 1920, produced a good cutting at the flowering stage on the 14th January, 1921, giving a weight of 5 tons of green fodder, which lost about 60 per cent. on being made into hay. The height of this cutting averaged 5 feet 6 inches, and although the crop was grown in rows 2 feet 6 inches apart, all the stalks were very fine. The second growth, now at the flowering stage, is ready for harvesting and is about 4 feet 6 inches in height (25th February, 1921). If harvested for fodder or hay at the flowering stage, Sudan grass makes a further growth immediately after cutting. Natural crosses between Sudan grass and "Early Amber cane" and "Planters Friend" sorghums, are very vigorous, being over 10 feet in height and possessing characters mid-way between the parents, that is, the stalks are finer in growth than either the Amber cane or Planters Friend, and carry heavier leaves.

GLEN, ORANGE FREE STATE.

Owing to copious rains, the prospects for the winter are good.

Winter Feed.—The importance of providing green feed for winter cannot be emphasized too strongly, particularly as the majority of the summer crops have succumbed to the dry weather. As winter crops have to go through a very dry period, the importance of good cultivation is evident.

Educational.—The staff was fully engaged during the month holding various meetings and judging at shows. All available accommodation at the institution is booked. The number of students on the roll is 63.

POTCHEFSTROOM, TRANSVAAL.

In March, Kale (variety Chou Moullier), Dwarf Essex Rape, Early Rye, and Barley will be sown to provide green winter-feed for stock. Farmers are advised, especially in the drought-stricken section of the Province, to sow the last three crops and also Winter Dun and Algerian oats in March and April with the late rains (if any), in order to provide green feed in early winter for cattle, pigs, and more especially sheep. On irrigable land, Winter Dun and also Algerian oats will be sown in April at this station, in order to provide grazing for ewes dropping their lambs in early winter. Such crops are grazed at various intervals as late as the end of July and sometimes the middle of August. The yield of oat grain or hay is not materially reduced, provided a fair supply of irrigation water is available in late winter, and the land is in a good state of fertility.

A small plot of sunflower on the experimental section yielded green forage at the rate of 14⅛ tons to the acre. On the farm an area of 1½ acres of sunflower yielded 10 tons of green fodder, whereas an adjoining crop of maize proved a failure and would realize (estimated) about 2 tons green feed to the acre. Sunflower silage has been made in order to test its feeding value and palatability compared with maize silage. The crop has proved more drought resistant than maize.

An analysis of the results of trials with varieties of wheat under irrigation for several years up to and including 1920, in each case shows the following varieties as leading in the periods for which averages were taken:—

1. *Varieties in a Five-year Average* (yield in lb. per acre).—Gluyas Early, 1561; Australian Early, 1481; Marshall's White, 1461; Rymer, 1411.

2. *Varieties in a Four-year Average* (yield in lb. per acre).—Gluyas Early, 1511; Washington Blue Stem, 1442; Comeback, 1421; Red May, 1305.

3. *Varieties in a Three-year Average* (yield in lb. per acre).—Gluyas Early, 1748; Comeback, 1528; Bombay, 1513; Australian Early, 1436.

Note.—Washington Blue Stem and Comeback grown for four years only; Bombay for three years only.

For the Indian varieties Lalkasarwali and Pusa No. 12, with Union Sel. No. 3, only two years' results are available. The yields in lb. per acre of the leading varieties, on the average results for 1919 and 1920, are as follows: Lalkasarwali, 1812; Gluyas Early, 1665; Bombay, 1585; Union Sel. No. 3, 1524; Pusa No. 12, 1477. Although the comparative positions of these varieties must not be taken as final, the results indicate that Lalkasarwali is a variety which farmers, growing wheat under irrigation in this area, should give a trial. It is a bearded variety, earlier than Gluyas Early.

Fruit growers are advised at this time to pick up and destroy all fallen fruits, in order to assist in controlling codling-moth and fruit-fly. Wherever weeds have made any headway in orchards, or a green manure crop has been grown, these should be ploughed in now, in order to allow the vegetable matter to decay before the dry weather sets in.

WEEDS OF SOUTH AFRICA.

By K. A. LANSDELL, Botanical Assistant, Division of Botany, Pretoria.

I.

THE occurrence of noxious weeds has assumed an economic aspect in South Africa, a country of vast expanse, and the problem of their control is engaging serious attention.

South Africa has enormous agricultural wealth, and Government, stockowners, and farmers are striving after greater production. In the endeavour to produce greater crops there is a danger of pasturage

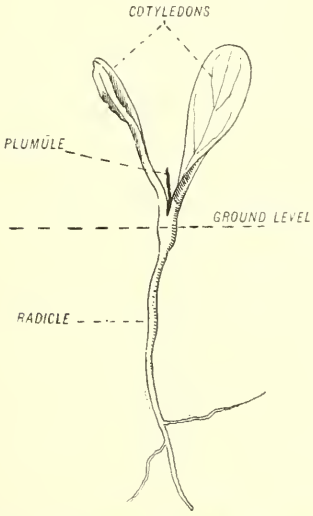


FIG. 1.—Seedling of "Malta Thistle" (*Centaurea melitensis*) with epigean germination.

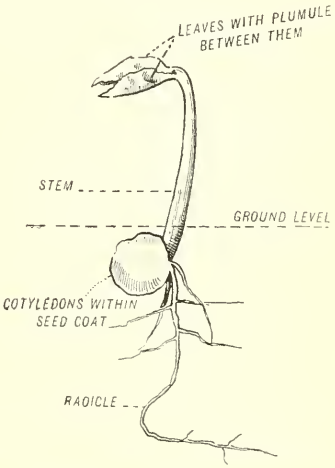


FIG. 2.—Seedling of Pea with hypogean germination.

and wool being destroyed by the growth of weeds, and during the last ten years the appearance, growth, and spread of noxious weeds has increased considerably. It is partially through the lack of knowledge and literature on South African weeds that the noxious weeds problem in the Union has become so serious. Every farmer should be able to distinguish the noxious weeds on his farm so that he may be in a position to cope with the danger. The present work has been prepared with this end in view, and is intended for the use of the farmer, the student, and the general public. The illustrations have been prepared solely from the noxious weeds found in South Africa.

This publication is the first of its kind in South Africa. Although the fullest use has been made of field observation and the material at the Division of Botany, Pretoria, the author feels that much remains to complete our knowledge of the South African noxious weeds; therefore specimens of suspected weeds, with full information about them, will be welcomed, and should be forwarded O.H.M.S. to

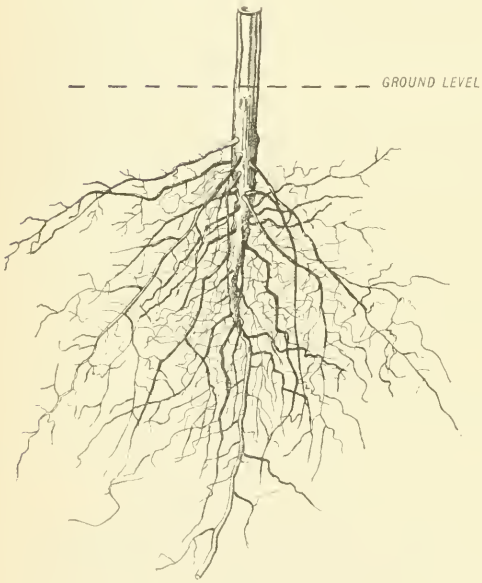


FIG. 3.—"Mexican Marigold" (*Tagetes minuta*), showing fibrous roots.

FIG. 4.—"Spear Thistle" (*Cnicus lanceolatus*), showing the tap root.

the Chief, Division of Botany, Pretoria. In this way much valuable knowledge will be obtained which can be used in future to supplement the information contained in this work.

In the text of the illustrated pamphlets entitled "South African Weeds" which are from time to time published by the Division of Botany, botanical terms are occasionally used. As these terms are often not generally known to laymen, and as it is difficult to write

popular articles without the use of many of these technical terms, an illustrated glossary on the morphology of weeds has been prepared.

CLASSIFICATION OF WEEDS.

Weeds may conveniently be classified according to the time they take to complete their life-history, and three main types can be recognized, namely *annual*, *biennial*, and *perennial* weeds.

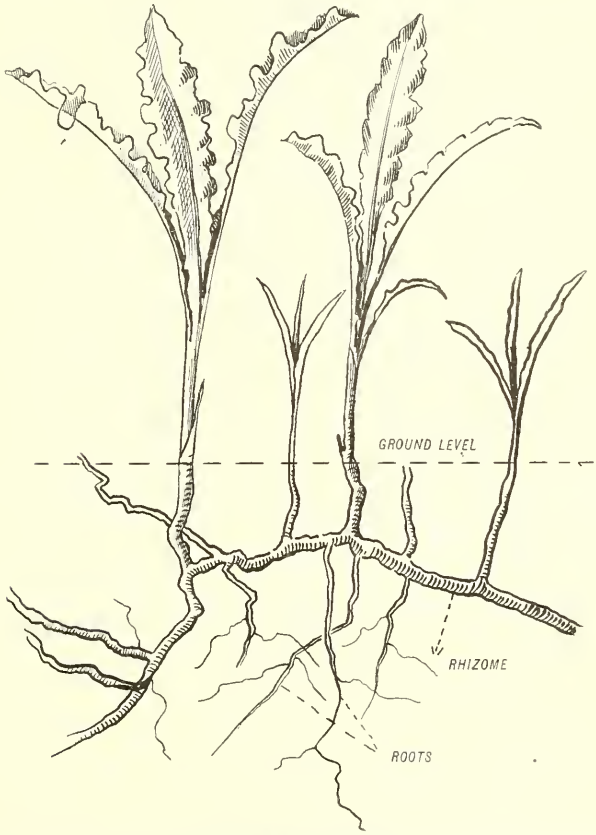


FIG. 5.—"Canada Thistle" (*Cnicus arvensis*), showing the underground *rhizome* or root-stock.

Annual Weeds are those in which the complete life-history is completed within one growing season. The seed germinates and the resulting plant produces roots, stem, leaves, flowers, fruits, and seeds all in the same season, and then dies. The Mexican Poppy (*Argemone Mexicana*), the Mexican Marigold (*Tagetes minuta*), the Khaki Weed (*Alternanthera achyrantha*), Cocklebur (*Xanthium occidentale*), Burweed (*Xanthium spinosum*), are examples of this type.

Biennial Weeds complete their life-history in two growing seasons. Germination takes place in the spring and during the first season only root, stem, and leaves are formed. The leaves often consist of a rosette pressed closed to the ground. In the second season

the stem elongates and produces flowers and seeds, and so completes the life-history, e.g. the Spear Thistle (*Cnicus lanceolatus*), St. Mary's Thistle (*Silybum marianum*).

Perennial Weeds produce roots, which send up flower-stalks year after year, and such weeds may exist for an indefinite period, e.g. the Canada Thistle (*Cnicus arvensis*) and the Prostrate Star-bur (*Acanthospermum xanthoides*).

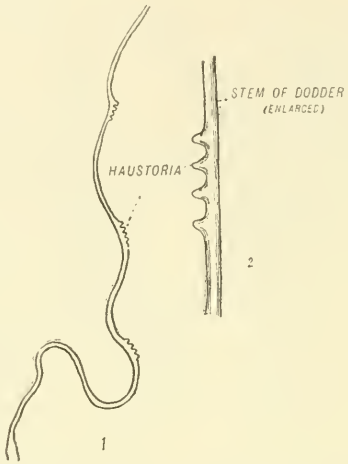


FIG. 6.—(1) Stem of "Dodder" (*Cuscuta* sp.), showing haustoria.
(2) Portion of stem with haustoria enlarged.

The following table gives the duration of twelve noxious weeds:

Common Name.	Scientific Name.	Type of Weed.
Blessed Thistle	*Carbenia benedictus*	Annual.
Burweed	*Xanthium spinosum*	Annual.
Canada Thistle	*Cnicus arvensis*	Perennial.
Cocklebur...	*Xanthium occidentale*... ...	Annual.
Corsican Thistle	*Carduus pycnocephalus* ...	Biennial.
Dodder	*Cuscuta spp.*	Annual, Perennial.
Dwarf Marigold	*Schkuhria bonariensis* ...	Annual.
Malta Thistle	*Centaurea melitensis*	Annual.
Mexican Marigold	*Tagetes minuta*...	Annual.
Prostrate Starbur	*Acanthospermum xanthoides*...	Perennial.
Spear Thistle	*Cnicus lanceolatus*	Biennial.
Upright Starbur	*Acanthospermum hispidum* ...	Annual.

THE MORPHOLOGY OF WEEDS.

Seeds may be of different sizes and shapes, and their surface may also vary considerably. Each species of plant has seeds which are constant in almost all respects for that species. The seed consists of the following parts: (1) one or two seed-coats, and (2) the embryo. The embryo is divided into (*a*) two cotyledons: leaves which contain nourishment for the young plant; (*b*) the radicle or future root; and (*c*) the plumule or shoot.

In germination the cotyledons may come above the ground, in which case the germination is said to be *epigean*, e.g. the Malta Thistle (*Centaurea melitensis*), etc.; when they remain below the ground the germination is *hypogean*, e.g. broad bean seeds or pea seeds, etc. (See figs. 1 and 2.)

The Root is one of the four important organs of a plant. It increases in length by the elongation of the growing point, which is situated a short distance behind the extreme tip. Not far from the root apex are the *root hairs*, which are the channels through which the water of the soil with mineral salts in solution enters the root.

There are different kinds of roots, e.g.:—

A fibrous root, one in which the rootlets are in the form of fibres, such as the Mexican Marigold (*Tagetes minuta*), etc. (See fig. 3.)

A tap root is an elongated much thickened main root, e.g. the Spear Thistle (*Cnicus lanceolatus*). (See fig. 4.)

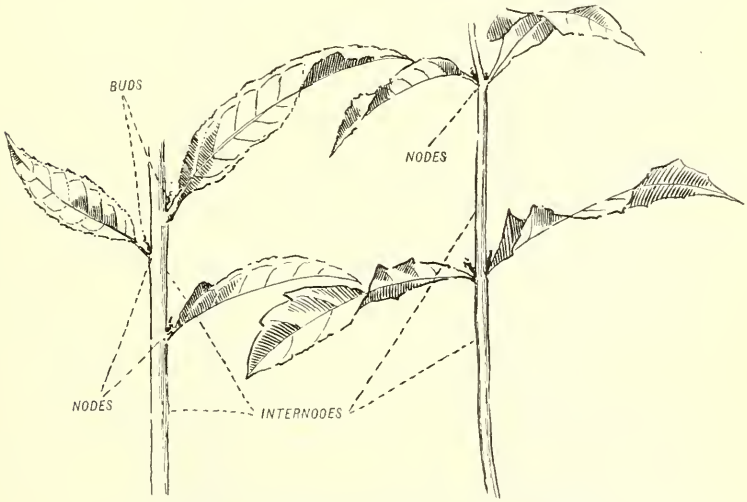


FIG. 7.—Stems showing opposite and alternate leaves.

In the Lucerne Dodder (*Cuscuta* spp.), which is a parasite, peg-like out-growths called *haustoria* are produced from the stem which penetrate the tissues of the host and absorb food. These *haustoria* are regarded as modified roots. (See fig. 6.)

The Stem is the axis of a plant usually above the ground. It is divided into nodes and internodes; the leaves arise at the nodes, and the portions of the stem between the nodes are the internodes. Buds are also produced on the stem in the axils of the leaves. (See fig. 7.)

A *rhizome* is a creeping underground stem which sends out roots from its lower surface, and stems and leaves from its upper surface, and so forms new plants, e.g. the Canada Thistle (*Cnicus arvensis*). (See fig. 5.)

FIG. 8.—The Devil's Claw (*Martynia fragrans*), showing a pubescent stem.

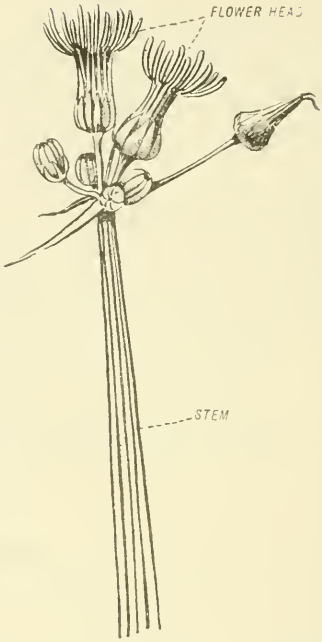


FIG. 9.—"Sow Thistle" (*Sonchus oleraceus*), showing a striate stem.

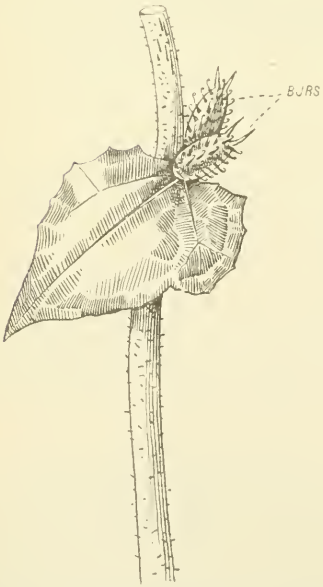


FIG. 10.—The Cocklebur (*Xanthium occidentale*), showing rough stem.

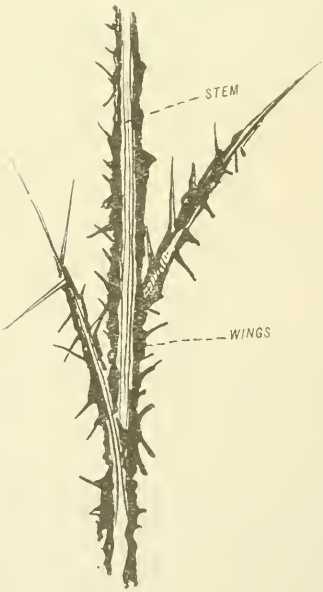


FIG. 11.—The Corsican Thistle (*Carduus pycnocephalus*), showing portion of the winged stem.

The surface of the stem may be quite smooth, as, e.g. the Burweed (*Xanthium spinosum*), or it may be covered with hairs or other outgrowths. Special terms are applied to the stem according to the nature of its surface. It may be:—

Pubescent, i.e. covered with very fine hairs as in the Upright Starbur (*Acanthospermum hispidum*) and the Devil's Claw (*Martynia fragrans*). (See fig. 8.)

Striate, when the stem is grooved with longitudinal furrows as in the Sow Thistle (*Sonchus oleraceus*). (See fig. 9.)

Rough, when the stem is covered with stiff coarse hairs, as the Cocklebur (*Xanthium occidentale*). (See fig. 10.)

Winged, when the base of the leaves is produced as a ridge or wing on the stem, as in the Malta Thistle (*Centaurea melitensis*). (See fig. 11.)

(To be continued.)

Fruit Export.

Shipments of fruit for overseas during the month of February, 1921, were as follows:—*Ex* Capetown (boxes): Peaches, 7290; pears, 99,394; plums, 13,517; nectarines, 899; grapes, 16,899; melons, 488. *Ex* Port Elizabeth (boxes): Pines, 447. *Ex* Durban (boxes): Pines, 277. *Ex* Capetown to America in ventilated hold (boxes): Melons, 2213. Total boxes exported during the month: 141,424.

Total shipments from all ports during 1920-1921 deciduous fruit season: November, 1920, 42 boxes; December, 1920, 27,422 boxes; January, 1921, 76,286 boxes; February, 1921, 141,424 boxes. Total, 245,174 boxes.

Exports for the 1919-1920 deciduous season amounted to 265,300 boxes.

The Union's Maize Industry: Conference at Potchefstroom.

The Principal of the Potchefstroom School of Agriculture has arranged a conference of maize farmers and others interested in the maize industry to meet at Potchefstroom on the 6th April, 1921. The morning will be spent in the experimental fields of maize, and after lunch, which will be provided at the institution, a series of lectures on maize growing and other matters concerning the industry will be given by officials of the Department. Towards the evening the experimental plots and other points of interest at the institution will be visited. It is proposed, also, to have an open discussion on the questions of maize export and the system of crop estimates.

WHEAT AND ITS CULTIVATION.

EXTRACTS FROM BULLETIN No. 22 OF THE DEPARTMENT OF AGRICULTURE, VICTORIA, AUSTRALIA, WITH NOTES CONCERNING THEIR APPLICABILITY TO WHEAT-GROWING IN SOUTH AFRICA, WITH SPECIAL REFERENCE TO THE SOUTH-WESTERN WHEAT AREAS OF THE CAPE, BY E. PARISH, B.Sc., DEPARTMENT OF AGRICULTURE.

BULLETIN No. 22 of the Department of Agriculture, Victoria, on "Wheat and its Cultivation," by A. E. V. Richardson, M.A., B.Sc., contains in 160 pages a remarkable collection of information concerning wheat cultivation in Australia. Chapters full of interesting and valuable detail are given on seeding operations, methods of cultivation, manurial problems, wheat improvement, wheat varieties, seed wheat and its treatment, and a summary of essential factors in successful wheat cultivation. Since the climate in Victoria is somewhat similar to that of the south-western area of the Cape, much of the information to be found in this bulletin is directly applicable to wheat growing in these parts. Moreover, no complete collection of information on this subject in South Africa has hitherto been published. It is thought, therefore, that the publication of the Victoria bulletin in the following abridged form by selecting certain extracts considered applicable to wheat growing in South Africa, with the addition of remarks and information based on South African experience, will be of direct benefit at this season to the wheat growers of the south-west Cape. For fuller detail and information the bulletin should be obtained from the Department of Agriculture, Victoria.

Information concerning Victoria.—The rainfall of the dry-land wheat areas of Victoria is in the neighbourhood of 20 inches or less, and is largely distributed over the months of April to October, being therefore almost identical with the rainfall of the south-west area of the Cape. The wheat production—average of the four years 1915-1918—amounts to roughly 15,000,000 muids, compared with South Africa's 3,000,000 muids. The average yield per acre during the same period was 4.4 muids, compared with 3.3 muids for the Cape and 2.6 muids per acre for Malmesbury, 3.9 for Caledon, and 2.7 for Piquetberg. Moreover, the rainfall in Victoria is even more irregular and unreliable than in the south-western Cape, and its yields of wheat have varied in two consecutive years from 0.4 muids to 4.7 muids per acre from this cause. There is, therefore, sufficiently close similarity between the two areas to make the methods of wheat growing in the one area directly applicable to the other.

Seeding Operations.—"Wheat growers in the drier districts have learned, from long experience, that in the great majority of seasons the ultimate success of the crop depends very largely on getting the seed sown on soil in good physical condition at the *right time*—within what may be called the *normal* seeding period, which under most favourable conditions extends over some six to eight weeks. When,

however, heavy showers fall intermittently during this period the seeding is considerably delayed, and much of the crop must be sown too late to secure optimum results."

Time to Sow.—"Speaking generally, it may be said that it is safe to sow seed during the normal seeding period, when the soil is either sufficiently dry to leave the seed ungerminated, or else when the soil is so thoroughly moist as to induce immediate germination. There is an intermediate stage, however, between these extremes when it is dangerous to sow wheat. This condition arises when the soil is neither dry nor wet, but contains sufficient moisture to induce germination, yet insufficient to keep the young plant fully supplied with moisture. Under these circumstances, unless rain opportunely falls, the soil begins to dry out and the grain malts. While wheat and other naked seeds are very susceptible to malting in slightly moist and rapidly drying soils, oats and barley, with their tough, fibrous, protective envelopes, are not so susceptible. Hence, while it may be unsafe to sow wheat under such conditions, barley and oats may be sown with much less likelihood of loss. Many farmers in their anxiety to get overlarge areas, frequently commence seeding operations earlier than is indicated above. If timely showers supervene and the young plants are brought on with exceptional vigour resulting in rank, heady growth, a check may be administered by judicious feeding down with sheep, or if a comparatively late maturing variety is selected for seeding in the early part of the season, such condition will not arise."

Varieties to Sow.—"The choice of varieties is governed by the physical character of the soil, the climate in which the wheat is to be grown, and the purpose for which the wheat is required. The farmer must select those particular wheats which prove the most favourable and profitable under his particular conditions. The difference between the yields of two varieties of wheats grown on the same farm, under absolutely identical conditions, is often sufficient to more than pay the rent or interest on the land on which the crop was grown.

"In the drier districts, in normal seasons, the earlier varieties are generally the most suitable, whilst in districts where the rainfall is heavy and the growing season more protracted, late maturing wheats may be expected to yield better results than early wheats. Some wheats of outstanding excellence may do well in any district, but it rarely falls to the lot of any variety to have such a wide range of usefulness. It is a good maxim for the wheat grower not to confine himself to a single variety of wheat."

Varieties recommended for South-West Area of Cape.—For detailed information as to the variety to sow in this area, the reader is referred to an article entitled "Results of Winter Cereal Experiments at Elsenburg," appearing in the April and May, 1920, and February, 1921, numbers of the *Journal.*

Varieties recommended for the South Coast (Humansdorp) Districts.—In experiments carried out at Humansdorp which is representative of a large stretch of south-coast districts, the Durums, owing to their slightly superior resistance to rust, gave as satisfactory or in many cases better yields than the "Vulgare" wheats. The following wheats are recommended as a result of these trials :—

Durums: "Persian Black."—Very slight rust and a good yielder. It has proved to be the best coastal wheat for several years.

"S.A. Medeah."—Rust on straw and a good yielder, though not quite as good as the "Persian Black." It is a great favourite in this area. The 1919 crops were very good.

"Blignaut," "Harmse," and "Kort Zwart Aar" also give good results.

Vulgare Wheats: "Rietti."—Rust on straw, inclined to shed and not an exceptional yielder. Has proved suitable for this area during three years' trial.

"Mains Patent."—Rust on straw. Proved the heaviest yielder of all the varieties. This is the first year it has been put on trial and is a promising wheat. "Bombay," "Primrose," "Florence," "Clarendon," and "Bunyip" also give fair results in this area.

Varieties recommended for the Transvaal.—Full information concerning varieties suitable for the Transvaal may be found in Local Series Bulletin No. 23 of the Department of Agriculture.

The Government Agronomist from the experience gained at the Pietersburg Dry-Land Station, and from co-operative experiments with farmers, recommends Emmer as a rust-resistant variety, and Black Don as a spring or summer wheat.

Rate of Seeding.—"The average amount of seed for grain is 45-60 lb., while for hay and forage 1 to 2 bushels may be used. For grain the amount sown may be as low as 30 lb. in dry mallee* districts to 65-70 lb. in moister districts. Generally speaking, sow early crops thin and late crops thick; sow light land thicker than rich, heavy land; and be sparing with good stooling varieties, and correspondingly liberal with varieties of poor tillering capacity. About 20-25 per cent. more seed is required with the broadcaster to give the same braird as the drill."

The ordinary rate of broadcasting in the south-western wheat districts of the Cape is 1 bag of seed to 2½-3 morgen of ground, according to variety and other circumstances.

Method of Sowing.—"Since the introduction and general use of superphosphates in the wheat-growing areas of the State, the old broadcaster has been superseded by drills, which sow seed and manure through the same hoes.

"The advantages of broadcasting are: (1) The small cost per acre; (2) the large areas that may be sown in a day. The advantages possessed by the drill more than outweigh those of the broadcaster. With the drill, seed and manure may be sown in the one operation. This not only economizes labour, but it also enables young plants to rapidly find the superphosphate and make vigorous growth in the earlier stages of their existence. Moreover, with the drill the germination is far more regular, because it is sown at a uniform depth. Finally, the depth of sowing may be regulated with the drill to suit the condition and nature of the seed-bed."

Experiments at Elsenburg during the last five years have shown fairly conclusively that a heavier yield may ordinarily be expected from drilling than from broadcasting. From these experiments, however, it cannot yet be definitely stated that the increase in yield is sufficient to compensate for the increased cost of drilling over broadcasting, though the indications are that drilling is profitable. The experiments will be continued until the question is settled.

Field trials by the Experimentalist in the south coast (Humansdorp) wheat areas, and at the Grootfontein School of Agriculture, over a number of years, have, with one exception, been all in favour of drilling, with yield and cost considered.

Grading of Seed.—"If there is one thing that has been conclusively demonstrated by carefully conducted experimental work it is the fact that plump grains are greatly superior to shrivelled grains from a productive point of view. Great emphasis must be laid on the necessity for the *selection* of hardy, vigorous prototypes, because, under favourable conditions, small but well-developed seeds from highly productive, vigorous plants, may give better results than large grains from unproductive plants."

* Mallee districts, so-called from the Mallee Scrub which covered this part of the country when in a virgin state.

After-treatment of Wheat.—"*Rolling* the crop after it has grown some 6-8 inches is frequently practised. With hay or ensilage crops this is often beneficial, as it helps to make a level surface for the binder, thus facilitating the harvesting of the crop. Moreover, on light, open land, the consolidation of the soil effected by rolling is very beneficial to the growing crop. On heavy lands which tend to set hard, and which are likely to run together with the winter rains, the roller should be displaced by the harrows."

"*Harrowing* is always beneficial to a young wheat crop, provided it be not already too thin. Certainly, a percentage of the young plants is dragged out in the operation, but it is well in this connection to remember the healthy proverb: 'The man who harrows should never look behind.' This disadvantage is more than compensated for by the increased vigour of the remaining plants, and by the great stimulus given to stooling; nor must it be forgotten that the harrows assist in subjugating the weeds, and in the drier portions of the State assist in conserving the limited supplies of soil moisture by retarding capillary activity and lessening evaporation. In harrowing the crop, the work should be done at right angles to the drills."

"*Feeding down the Crop.*—It has already been remarked that, in favourable seasons, the early sown crops are likely to come away very rapidly and make heady, vigorous, rank growth in May and June. Such heady growth is exposed to two dangers: (1) lodging in wet weather; (2) blighting wither from late spring frosts, or by a premature burst of hot weather in spring.

"Such growth may be arrested by feeding down with sheep. This is a decided advantage on light land, or on land which has, for various reasons, not been consolidated sufficiently, through adequate tillage operations; but on heavy land it may be a positive disadvantage to feed down a crop with sheep. One point must not be overlooked in this connection, and that is the time such operations may with safety be performed. Late feeding down is generally decidedly detrimental, and can only be performed with any prospect of success when the spring rains are frequent and copious."

Methods of Cultivation.—"The nature of the Australian climate is such as to render thorough tillage a prime factor in successful wheat cropping. . . . More, however, is required than this. No system of cultivation can be permanently effective and adequate, unless it makes provision for the maintenance of the fertility of the soil. . . . The fact that there are wheat lands in this young State which practical farmers and the Press frequently describe as 'worn out,' shows that this aspect is frequently ignored. Methods which lead to the conservation of moisture, but not to the conservation of soil fertility, may be temporarily effective and profitable, but ultimately they must be disastrous both to the farmer and to the community.

"Wheat may be grown under three different systems of cropping: (1) continuous cropping with wheat; (2) wheat after bare fallow; (3) wheat in rotation with other crops."

Continuous Cropping.—"Continuous cropping with wheat is very general in countries where methods of cultivation are *extensive* rather than *intensive*. In the early stages of a new country, lands are cheap, and even free; capital and human labour comparatively

scarce and dear. To suit these circumstances, large areas are sown under pioneer conditions of culture. Large areas under crop and small average returns per acre are the rule. While it may be said that continuous growing of wheat on the same land year after year is not good practice, the results obtained in the Broadbalk field at the Rothamsted Experiment Station show that it is possible. For example, wheat has been grown continuously in the Broadbalk field for over 60 years. The highest yield was obtained from Plot 8, viz., 37.1 bushels per acre; but in order to secure this result a liberal dressing of nitrogenous phosphatic and potassic manures was applied each year. Continuous cropping has been practised at Roseworthy College (South Australia) on seven different plots in the Permanent Experimental Field. The results are highly interesting, and indicate what is likely to take place in districts with a similar rainfall (17 inches).

"The plots which had been bare fallowed the previous year gave 11 bushels in the second year and 12 bushels in the third year more than plots on which the wheat was grown continuously. Moreover, since the yields in the continuously cropped plots decreased from 29 bushels to 4 bushels in two years, it is obvious that these plots were rapidly reaching the condition known as 'worn out,' and would need a long period of rest before again giving a profitable return."

With regard to the main wheat areas of South Africa, farmers know from long experience that continuous cropping with wheat is not advisable, and they have found it necessary to allow the land to recuperate by leaving it fallow for two or more years.

Wheat after Bare Fallow [Braak].—"Bare fallowing is the most popular method of preparation for wheat in all but the most humid portions of the State. The fact that the area under bare fallow in this State annually exceeds 1,000,000 acres is a silent testimony to the effectiveness of this mode of cultivation under the conditions prevailing in the wheat areas."

Bare Fallowing conserves the Soil Moisture.—"In the drier districts the rainfall during the growing period is not sufficient to ensure high yields, but, by a good system of bare fallowing, a considerable proportion of the rainfall from the previous year is conserved and carried over to augment the supply which falls during the period of growth of the crop."

The summary of Mr. Richardson's statement shows that to obtain the maximum results from bare fallowing, certain principles must be complied with—

(*a*) Every facility must be given to allow the moisture that falls to penetrate the soil. This is obtained by keeping a loose broken surface, especially during the fallowing. If the crop be grown on stubble lands, the breaking of the surface by using a one-way disc cultivator or plough to the depth of three or four inches will promote the absorption of rain.

(*b*) The soil must be so worked as to allow free capillary movement of the soil water. A finely divided and firmly consolidated stratum of soil resting on the well-moistened sub-soil is in the very best condition not only for the storage of moisture, but for the movement of that moisture upward by capillary action.

(*c*) The moisture must be prevented from evaporating at the surface. This is brought about by maintaining a mulch which should be loose but not overfine.

Bare Fallowing increases the Supply of Available Plant Food.—"One indirect result of the moisture conserved by the process of bare fallowing is that during the summer months many chemical and biological changes take place within the body of the soil and result in the liberation of plant food. There is no doubt that the process of

nitrification goes on rapidly in well-tilled bare fallows under Victorian conditions. The rate of nitrification under Victorian conditions has not yet been completely worked out, but, owing to the high soil-temperature during summer, it is fairly rapid in the well-tilled bare fallows. In addition to the increase in nitrates, there can be little doubt that other important plant foods, particularly potash and phosphoric acid, are converted from unavailable to available forms.

"Subsidiary advantages of bare fallowing are that it cleans the land of weeds, increases the amount of available plant food formed in the soil, and enables a consolidated seed-bed to be formed."

Limitations of Bare Fallow.—"Obviously the most serious drawback to bare fallowing is that only one crop can be grown in two years, and the crop must be debited with two years' rental value of the land. A continual alternation of wheat and bare fallow must ultimately lead to the depletion of the organic content of the soil. As a permanent practice it is, therefore, inadequate."

When to Fallow: Early versus *Late Fallowing.*—"The general advantage of early fallow is that it exposes the soil to the ameliorating influences of the atmosphere for a longer period than late fallow, and that heavy winter rains readily penetrate the sub-soil and are conserved. Moreover, it is easier to effect a satisfactory consolidation of the seed-bed with early than with late fallowed land. With late spring fallowing much of the winter rain may be lost by evaporation and surface drainage, and the main benefit accruing from fallowing thereby lost. The practice of early autumn discing as a preparation for winter ploughing is frequently adopted in the drier areas with very satisfactory results. The practical difficulty in carrying out this process is that in many parts of the State the soil sets so hard in the dry summer weather that discing is precluded. Otherwise there is no reason why the operation should not be commenced as soon after harvest as possible."

Above shows clearly how the value of fallowing in Victoria is recognized, and how the adoption of it has become almost general in dry areas. In the south-western wheat areas of the Cape the value of fallowing in principle is recognized inasmuch as farmers usually "braak" their lands, in preparation for wheat; i.e. in the preparation of land which has been grazed for one or more years, the custom is to plough the lands deeply in July and August, and plough only three or four inches deep at seeding time. An experiment commenced in 1915 at Elsenburg tends to support this practice of "braaking." In this experiment five plots are braaked against five plots in which a crop of vetches is ploughed in as green manure in one season, followed in the next season by the planting of a cereal in the whole ten plots. The results to date are:—

1916.—The plots which had been fallowed or braaked in the previous year gave 158 lb. of oats more per acre than the plots which had been green manured.

1918.—The plots which had been fallowed or braaked in the previous year gave 240 lb. of wheat more per acre than the plots which had been green manured.

Depth of Working.—"Obviously deep working would be quite undesirable wherever the soil was shallow, or where it rested on an inferior type of sub-soil. It is also very undesirable to bring a crude, raw clay sub-soil to the surface. On soils that are naturally deep, however, it is well to give, wherever possible, a good stiff furrow. Provided that the soil is of sufficient depth, and the sub-soil is satisfactory, deep working is better suited to the requirements of an arid climate than shallow working. Wherever deep working is practised, it is necessary, if wheat is to be sown, that the ploughing should be done many months before seeding. No plant suffers more from the

effects of a loose, open, non-consolidated seed-bed than wheat, and if it is intended to give deep tillage, care must be taken to see that the fallowing is started early in the season. As a general principle, land should be left in the rough during the winter in a wet district, whilst in the very dry areas the sooner the land is worked down the better."

Summer Cultivation.—"Under no circumstances should a hard crust be allowed to form on the surface. A loose crumbling layer of soil will act as a mulch and reduce the losses by evaporation to a minimum. Frequently summer cultivation is overdone."

Means of Adding Organic Matter to Soil necessary when Alternate Bare Fallowing is practised.—"There are three general ways of supplying the soil with the organic matter necessary to maintain its fertility: (1) by the application of farmyard manure; (2) by pasturing and by rest; (3) by green manuring."

Rotation Systems for Wheat.—"In the wheat areas proper, the growing of summer crops is more or less risky and uncertain, and for securing suitable crops for rotation with wheat we are driven back to the use of winter-growing forages or cereals. A very widely practised rotation in the wheat areas is that of wheat, pasture, bare fallow. This practice enables but one crop in three years to be taken off a given piece of land. One-third of the farm area is devoted to pasture for sheep and lambs, whilst the remainder, for a portion of the year, is under bare fallow. Since but one crop is taken off in three years, and the crop is followed by a year of pasture, the system is not exhausting, and with careful working one would expect a succession of heavy crops for many years. The important point about this rotation is that it requires a minimum of labour, and is well adapted for a district in which holdings are large and land is relatively cheap, and the rainfall scanty.

"A modification of this rotation is largely practised in the Wimmera and consists of wheat, oats (for pasture), pasture, bare fallow. The wheat is sown in well-prepared bare fallow, and, after the wheat is harvested, oats are disced in the autumn on the stubbles, and utilized for pasture. After oats, the paddock is depastured for sheep and lambs, and the rotation brought to a close by a season of bare fallow. Under this scheme of rotation there can be little doubt that the organic content of the soil may be maintained, as two years of pasture are given for every year of crop. As will be shown later, however, the nitrogen content of the soil is not likely to increase unless legumes, such as trefoil and clover, regularly appear in the pasture.

"From time to time various forage crops, such as peas, rape, rye, vetches, barley, etc., have been grown in more or less regular rotation with wheat and bare fallow in the drier areas, and the results have been such as to render it extremely probable that these crops will play an important part in the future of wheat growing, more especially as the lamb industry is now firmly established. It is only when the soil is rich in organic matter that the highest yields may be obtained from bare fallowing, and the feeding off of forage crops, grown in systematic rotation with wheat, provides the grower with a means of preventing the depletion of the organic content of his soil. The restoration of organic matter to the soil

can be brought about by *green manuring*, as well as by the feeding down of forage crops. Green manuring, i.e. the ploughing in of green crops such as peas, rye, vetches, etc., is a much more *effective* method of restoring organic matter to depleted soils than the feeding down of forage crops. As, however, the feeding value of a green crop is usually greater than its manurial value, the general practice is to convert the crop into milk, mutton, or beef, instead of ploughing it under. No system of crop rotation—however well conceived and carried out—can make up for any shortcomings in either cultivation or manuring. Crop rotation alone, without adequate manuring, will not increase, nor even maintain, the soil's fertility."

Rotations for the South-Western Wheat Areas of the Cape.—The rotation commonly followed in these areas is: wheat, usually fertilized; oats, usually for forage; grazing for one or more years followed by "braaking" during winter in preparation for wheat.

Thus the rotation is four or five years according to circumstances. Under this system the yields are low, and, moreover, little improvement can be expected so long as it continues. Various experiments were designed by the writer at Elsenburg in 1915 to discover a system of farming which would be productive of increased yields and at the same time maintain or improve the fertility of the soil. The results of the past five years indicate two means of improvement: (1) by the introduction of green manuring into the rotation; (2) by the introduction of a leguminous crop, fed off on the land. The experiments so far show that method (1) gives greater yields, but at greater expense. By method (2) some value is obtained from the crop by the stock which feed it off, and this method is therefore recommended.

Manurial Problems: Sources of Plant Food.—"In the case of the wheat crop (straw or grain), of the total amount of food taken in by the crop (1) no less than 93½ per cent. is obtained from the air and from the rain; (2) 3½ per cent. consists of mineral substances with which the soil is abundantly supplied; (3) about 3 per cent. consists of nitrogen, phosphoric acid, and potash, which the soil contains in strictly limited quantities.

"So far as chemical considerations are concerned, it would appear that a fertile soil is one which contains a sufficiency of plant foods—and particularly nitrogen, phosphoric acid, and potash—in an *available* or soluble form. Emphasis must be laid on the presence of available plant food, because the greater portion of the plant food is locked up in inert forms, i.e. in forms incapable of being used by the plant.

Biological Condition of Soil.—"Perhaps the most important group of organisms are the nitrifying bacteria. It is interesting to note in this connection that these nitrifying organisms require for their full development: (*a*) Air; (*b*) warmth—they thrive best at 99 degrees F., and are ten times more active at that temperature than at 57 degrees F.; (*c*) moisture; (*d*) presence of lime; (*e*) organic matter. In well-tilled soils, in good "heart" and condition, containing adequate supplies of carbonate of lime, the useful types of bacteria predominate. In badly tilled soils, sour through want of drainage, or from an absence of lime, moulds, fungi, and harmful types of bacteria flourish to the exclusion of the useful forms.

"*Manuring.*—If the soil is deficient in any one of the necessary ingredients, no amount of tillage can put it into good "heart"; and as the yield of the crop is governed by the amount present of the deficient soil ingredient, it is imperative that the deficiency be made good by the direct application of fertilizers, if satisfactory crops are to be obtained.

"*Nitrogenous Manures.*—The most striking and fundamental difference between the manurial practice of Europe and that of Australia is that, in the Old World, nitrogenous manures are all important, whilst in Australia they are generally unnecessary and unprofitable. In European agriculture, the controlling factor for successful cropping is the amount of available nitrogen present in the soil. In Australia, assuming the rainfall be sufficient, the limiting factor in crop production is the amount of available phosphoric acid. The conditions of soil and climate, and mode of cropping in our wheat areas, are conducive to rapid nitrification of the organic matter, resulting in the formation of a sufficiency of available nitrates for all demands of the cereal crop. Most of the wheat sown in this State is on fallowed land, and during the progress of fallowing nitrification proceeds at a very rapid rate.

"From this table [one dealing with nitrates in fallowed or 'braak' and non-fallowed land at Longerenong, Victoria] it will be seen that the amount of nitrate in the fallowed land gradually rose from 59½ lb. in December to 118.3 lb. in the first week in February (and 105 lb. at the end of March), to 91.87 lb. in May, and 89.6 lb. in August, as contrasted with 21 lb. in the non-fallowed portion. As a 15-bushel wheat crop removes in its grain and straw about 21 lb. of nitrogen per acre, it will be observed that there was four and a half times more available nitrogen in the fallowed [or braak] portion at seed-time than was required for a 15-bushel crop. On the other hand, in the non-fallowed portion there was barely enough nitrogen to supply the requirements of one such crop even assuming that every particle of nitrate-nitrogen in the first 5 feet could have been used by the crop."

It is evident, in the opinion of the writer, that nitrification proceeds at a rapid rate in the Western Province soils during the summer and early autumn months on "braak" lands, and it is recommended to farmers, either by "braaking" or by summer ploughing of their stubble lands, to prepare their grain lands ready for seeding with the first rains, in order to lessen the risk of loss of nitrates by leaching if heavy rains occur in April and May. It is admitted that the stubble lands are sometimes too hard to plough in summer unless power traction is available, but if a one-way disc plough be run over the stubble lands to a depth of three or four inches during the summer, subsequent ploughing will be possible. It is recognized also that early seeding may result in rank growth, but this may be obviated or remedied by methods discussed earlier in this article. The rapid nitrification during the summer, with possibility of loss by leaching, furnishes a warning against excessive summer cultivation of "braaked" lands.

Phosphatic Manures.—"It is sufficient to note that practical experience and experimental work throughout the wheat belt of Australia has conclusively demonstrated the value and necessity of phosphates in cereal culture. In many of the wheat areas the use of soluble phosphates is absolutely essential to secure a crop."

Superphosphate.—"This is deservedly the most popular and profitable artificial manure used in the wheat areas of Australia at the present time. There are very few soils in the wheat areas proper which will not favourably and profitably respond to applications of super, and in dry seasons many soils fail altogether to produce a crop without soluble phosphates. The reason for the efficacy of the super may probably be accounted for by the fact that when it is applied to the soil, the soluble phosphate is dissolved by the soil water or by the rains, and it immediately becomes thoroughly and intimately diffused through the soil.

Rate of Application.—"Many farmers apply as little as 30 to 40 lb. per acre, and consider the dressing quite sufficient; whilst there are many who use relatively heavy dressings, namely, 1 to 2 cwt. per acre. Now, it is a well-established fact that relatively heavy dressings of superphosphate produce in Australian wheat soils a remarkable effect on the pastures. A marked stimulation of the leguminous growth on the stubble and pasture succeeding the wheat crop invariably results from heavy dressings of soluble phosphates, and the stock-carrying capacity of the pasture is greatly increased."

In the south-west wheat areas of the Cape, owing to the lack of indigenous leguminous growth on the stubble, superphosphate does not produce such an obvious effect. Basic slag however, does produce noticeably better grazing, according to the experience of many farmers.

"In soils deficient in lime the continual application of heavy dressings of superphosphate may cause the soil to become acid or sour in character, thus impairing vegetation. In such cases, however, this acidity may be corrected by suitable applications of lime.

Time and Mode of Application.—"In the majority of seasons the best results are obtained with superphosphate when the seed and manure are drilled in together in the normal seeding season."

Basic Slag.—"In the wheat areas it is used at present only in relatively small quantities, and experience proves that, though a valuable manure, it is less effective than an equivalent amount of phosphoric acid in the form of superphosphate. On sour peaty lands, however, it will be found a most useful and valuable manure. By reason of the lime it contains, it tends to correct the acid conditions. The rate of application to wheat lands is similar to that of superphosphate."

These remarks apply directly to wheat growing in the south-west wheat areas of the Cape. As mentioned above, basic slag noticeably improves the stubble grazing.

Bone-dust.—"The value of bone-dust will depend on its composition and its fineness of sub-division. It gives best results on soils rich in organic matter, for with these there is a possibility of the insoluble phosphate being slowly made available."

Potash Manures.—"Potash is not likely to be of value in the wheat areas, except in the case of certain sandy soils deficient in this ingredient."

Stable Manure.—"The average wheat holding at the present time is so large, and the amount of stable manure produced in a year so small, that the effect of the stable manure on the fertility of the farm will, for all practical purposes, be inappreciable. This state of affairs will not, however, continue indefinitely. With the rapidly increasing population, and the inevitable increase in land values ahead of us, individual holdings must gradually become much smaller in size, and the system of farming more diversified. Live stock will become more and more prominent, and ultimately the amount of farmyard manure produced on the farm will be sufficient to have a distinct effect on the fertility of the farm. On the dairy farm, however, as contrasted with the wheat farm, farmyard manure is of great importance. Generally speaking, a good sample will contain about 13 lb. of nitrogen, 7 lb. of phosphorus, and 13 lb. of potash per 2000 lb. Losses may be reduced to a minimum by (*a*) controlling the fermentation of the manure, and (*b*) by prevention of leaching. The fermentation may be controlled by keeping the manure heap well compacted, and keeping it moist. Losses by leaching may be avoided by building the manure heap on a raised cemented floor, with

sloping sides. The liquid manure drains towards the side of the floor and collects in a pit, and is periodically pumped over the manure heap.

"*Green Manuring.*—The object of green manuring is to increase the organic content of the soil, which we have already seen is a dominating factor in soil fertility. There can be no doubt that many of the soils in the wheat-growing areas, which have been under cultivation for a comparatively long period, have lost a considerable amount of the organic matter they formerly contained. The turning-in of green crops is one of the most rapid methods of increasing the organic reserves in the soil.

"The important point to bear in mind is that crops which produce a maximum weight of green stuff that can be turned under in early spring, before the soil becomes too hard and dry to plough, should be grown rather than crops which give a relatively small yield of green stuff of high quality."

In tests of various crops for green manure at Elsenburg, the best results have been obtained from field peas and English mustard. The yields of oats in 1916, and of wheat in 1918, where field peas and mustard had been ploughed in the previous season, were double the returns normally obtained from that class of soil.

Feeding Down of Forage Crops.—"As the feeding value of a green crop is usually greater than its manurial value, the practice of raising green crops and converting them into mutton, beef, or milk, instead of ploughing them under, will be preferred to the practice of green manuring. For this purpose rape, mustard, peas, rye, vetches, etc., will be found extremely useful."

In this connection it may be stated that according to New Zealand figures 60 per cent. of the total organic matter in the crop is left in the ground as root and other débris, and the droppings of feeding-off stock. Experiments at Elsenburg have lent support to this practice of feeding-off crops as a means of increasing the soil fertility, and it is anticipated that the growing of fodder crops fed off on the land will before long become an integral part of farming practice in the grain areas of the Western Province. Some farmers are already adopting this system with beneficial results, and once the remainder are convinced of the value of the practice, it may be expected that the objection now raised, viz., that these crops interfere with the cultivation of the cereal crops, will disappear.

According to Mr. Richardson, the following is the summary of essential factors on successful wheat cultivation :—

(1) Early fallowing ;
(2) thorough cultivation ;
(3) systematic rotation with some means of maintaining the amount of organic matter in the soil—and this can be done most practicably on wheat farms by the pasturing and feeding down of forage crops with stock. "Not only is it possible to extract higher returns per acre by the growing of forage crops instead of relying on the pasture following the wheat stubbles, but the organic content of the soil is increased, and, what is more important, the yield of wheat grown in such rotation will be raised" ;
(4) rational manuring ;
(5) systematic seed selection.

Marketable Peaches.

The Trade Commissioner in London draws attention to the fact that some growers this year packed a considerable number of boxes with small peaches, which are not easily disposed of, and points out that the larger fruits are always in better demand and are more readily sold.

EXPORT OF CAPE WINE.

Interesting Observations by a Prominent London Wine Merchant.

[NOTE.—During the course of a visit to South Africa towards the end of last year, Mr. Cuthbert Burgoyne (of the well-known London firm of P. B. Burgoyne & Co.), took the opportunity of placing before wine farmers his views on the possibilities of an extended sale of South African wines in the United Kingdom, and we publish herennder extracts from an address on the subject delivered by him to a representative body of the Union's viticulturists. —EDITOR.]

THE LESSONS OF HISTORY.

THE history of an industry enfolds lessons of value if read intelligently, so I draw attention to a few outstanding historical facts in the South African wine industry. The great Dutch pioneer, Johan van Riebeek, introduced the vine in 1653, and the first wines exported were to Batavia in 1670. Development was considerable in those early days, especially in the years following 1688, when the Huguenots brought to the Cape their knowledge of viticulture. In 1800, 12,000 leaguers were produced in the Stellenbosch and Drakenstein districts. In the eighteenth century small quantities of wine were shipped to India, but they were evidently not of an acceptable quality. In 1800, under British rule, attempts were made to improve the quality of the wines by the introduction of new methods and greater skill, but little came of it. In 1811 further and more serious attempts were made, and with success, to bring about improvements, and a proclamation was issued calling attention to the alteration of the duties on wine entering Britain, as a beneficent intention of the British Government to promote this branch of commerce.

History is repeating itself. During the last year of the Great War, after import restrictions for social reasons and shipping restrictions for war reasons, had been in operation for some time, wine importers in the United Kingdom were suddenly permitted to withdraw from bond an additional 25 per cent. of the previous allowance, which was 50 per cent. of their 1916 imports, making 75 per cent. of their 1916 imports in all. This was granted by the Government in a desire to increase the consumption of light wines as opposed to other spirituous liquors, and was a beneficent intention similar to that of 1811. But the present Government in Britain have gone further and have introduced, under the policy of preferential tariffs within the Empire, advantageous import duties for the wines of Australia and the Cape over the productions of foreign countries. Empire wines of lower strength, i.e. under 30 degrees, now pay 1s. 6d. per gallon import duty and foreign wines 2s. 6d. per gallon.

Whatever sentiment in the United Kingdom may be with regard to spirits, it is certainly favourable towards light wines and beers,

and there need be little apprehension that a prohibition of these beverages is likely to terminate an export trade in wines between the Union and Great Britain.

The proclamation of 1811, referred to, required the farmers to abandon existing practices that prevailed in the preparation of wine, terming them erroneous and negligent, and having no regard to quality or age, their object being a little profit for the moment with no regard for the future. Although wine-making has advanced enormously, the remarks of a hundred years ago in regard to age apply to-day, for in export it is of imperative importance to have quality.

The proclamation further continued: "It is an undoubted fact that it (the wine industry) should make the pride as well as wealth of the inhabitants, that the Colony can produce as excellent wine of various sorts as any country in the world." That is as true to-day as then. It is not every country that is endowed by nature to grow vines to perfection, and European countries have learnt to value this generous gift, and have established viticulture as one of the primary industries. They are rightly proud of their vineyards. Viticulture should be and might well become the "pride industry" of the Union, but there must be unity of purpose in aspiring to so great an aim, and the business instinct to progress must be tempered with co-operation and common sense.

The markets of the British Empire are at your disposal waiting to be exploited. You require to foster every market available to you, and when once gained never to relinquish it. There is room in a healthy industry for every branch of the trade. The home markets, for instance, are, in my opinion, the fundamental basis of a great industry. Those who have your industry at heart would urge you to foster every established market, taking care that sufficient supplies are available to meet increasing demands. Your present surplus position is due to your home markets being insufficient for your needs; in other words, if you had created an export trade years ago, you would not only have avoided the present extremely unhealthy position, but would have "made the pride as well as the wealth of the inhabitants," as one of the great wine-growing countries of the world, bringing, by your export, wealth from without to the Union.

It was through their export trade that France, Portugal, and Germany established their great reputations as wine producers. The French war-vintage of 1918 was 929,810,000 gallons, which at, let us say, 2s. a gallon is worth 93 million pounds. Their export trade is part of the national good-will.

The Government of the Cape offered a bonus to growers in 1811 on exported wines, with the result that 67,985 leaguers were exported in 1825. What was possible then is surely possible to-day. From that date (1825) the trade dwindled, and in 1913 you shipped wine to the value of £1080 only, to the United Kingdom market of 45 millions of people. It was not entirely the fault of the growers, but largely due to causes over which they had no control. But to-day you have the markets of the Empire willing and anxious to take your wines; you have a preferential tariff over European wines in a market of 45 millions of people; you have the ability and knowledge and skilled assistance to produce wines of a quality that might establish for ever a trade in competition with the oldest wine-growing countries

which have been permitted for generations to retain a virtual monopoly of supply.

The average production of France and Italy is upwards of a thousand million gallons, and Algeria produced 137,126,000 gallons in 1917, which was a lean year. Your production is under twenty million gallons. You do your country and yourselves an injustice if you believe it is not within your power to create an industry, both in quality and production, that will place South Africa amongst the greatest wine-growing areas of the world. Your wines would have their own characteristics, and their own standard of excellence. You would have educated the millions to an appreciation of the particular qualities upon which you build your reputation. You would have imitated no other wine-growing country, but have relied upon your climate and soil for individuality, and you would have set up your own standard for coming wine-growing lands to follow, as to-day you follow France.

TRADE CONDITIONS IN THE UNITED KINGDOM.

If it is your intention to export to the oversea market, you will do well to keep in sympathetic touch with your customers and consumers, acquainting yourselves with the statistics connected with their requirements. In 1913, the last complete pre-war year, the imports of all wines into the United Kingdom were 12,364,856 gallons. In 1918 they were 13,155,760 gallons, and the figures have an upward tendency, because spirits are being controlled out of popularity through heavy import duties.

Consider the consumption of wine in various countries, based upon the average per gallon per head of the population during the years 1907 to 1911, figures which have probably not altered materially during recent years. France stands a long way first with 34.32 gallons per head; in the German Empire it was 1.12 gallons per head; in South Africa 0.70 (under one gallon); and in the United Kingdom only 0.27 gallons per head of the population. In Germany and the United Kingdom the principal beverage is beer.

But this comparatively small wine consumption is now increasing; moreover the United Kingdom is only the nucleus of wider markets. France is a great wine consumer of dry productions of low strength. South Africa must not expect to become a great wine-drinking country until her wine industry has educated the people to ask for light beverage wines, instead of sweetish wines with added spirit. Australia is under the same bane.

In creating an export industry for Australian wines, followed by such market success, my father put Australian productions upon the English market in 1871 for the first time. In the first years of his enterprise he realized that he could not hope to make a business with his limited capital, notwithstanding unlimited energy, in direct competition with the wines of Europe. Australian wines were distinct in type, and would not sell except on their own merits. Under any circumstances my father realized that, were he to put the wines before the country as imitations of the productions of older wine-growing countries, he could never excel. So he decided to create his own Australian-wine consumer, and not try to wean French-wine drinkers from the beverage they had learnt to appreciate. He put up the

wine in a special form of bottle with a screw-stopper, which is quite practical for the naturally higher strength Australian wines, but unsuitable to light French wines, and he advertised to the millions, caring not a button about the French-wine drinkers. The result is that he created a taste for wine amongst the great middle and lower middle classes, who had not been wine consumers previously.

But every class is conservative in its likes and dislikes and has strange prejudices, so it was uphill work throughout the years, educating the flagon-wine consumer to the excellent article that was grown in Australia, yet in 1915 one bottle in every fifteen bottles of wine drunk in the United Kingdom was Australian. That is success, but it is not enough. Australia and South Africa should aspire to supply more than half the requirements of the Empire markets throughout the world. Since the war we have been overwhelmed with demands for Australian wines and South African wines also, for it has become known, through the media of a few advertisements, that we had small stocks of your productions in London.

But do not lose sight of the fact that a production has no value in a market until a demand has been created in that market. The producer supplies the article, the merchant the market, and one is absolutely useless without the other.

Distribution in England is through wine and spirit merchants, who probably also retail beer, mineral waters, and tobacco, and through grocers who can obtain wine and spirit licences. There are also the market distributing houses, which supply any requirements to the licence-holder at wholesale terms, and receive a commission from the brand owner. The value of our market houses is very great indeed, and through their agency we have centres of operation throughout the United Kingdom. Practically every one of the many thousands of licence-holders in Britain stocks Australian wines, and advertising is done in many forms.

South African wines would clash in no way with the Australian business, which stands alone with its own media of consumption, whereas South African wines will find their markets in direct competition with the lighter productions of Europe.

The few hundred hogsheads we have had in London during the last three years have been very carefully tended until fit for bottling, and then bottled with scrupulous care and offered for sale as a South African production upon its great merits. They have been sold—if you will—in direct competition with foreign productions; they are another class of wine of equal merit. It is for the British public to decide which they prefer, and they are biased in favour of your wines on patriotic grounds.

REQUIREMENTS OF THE ENGLISH MARKET.

On this point I do not lay down any hard and fast rule or express any definite opinion, but I think my personal taste has been educated by trying to keep in intimate touch with the wants of the British consumer.

I have seen many delightful white wines in South Africa. I am inclined to the opinion that Hermitage and Cabernet Sauvignon would, together, produce a wine very acceptable to the people of the United Kingdom, and I am personally enthusiastic about a good Pontac. Your sweet wines will never make your reputation in the

United Kingdom. Portugal has the monopoly of the use of the word "Port." The Sherry trade is insufficiently important to make it worth the while of any merchant to oppose the popular belief that every Sherry that is not Spanish is a mere imitation. Because you produce a sweet wine of which you are proud, do not delude yourself that it is commercially valuable in England. If you produced a sweet wine quite peculiar to your vineyards, we might be able to create a useful little market for it in the end through association with the standard types of dry wines, but it would be a luxury side-line. To me a sweet wine is a wine that has required some fortification, so you must not imagine I include "rich" wines that contain natural spirit only.

A natural Pontac might have an attractive richness (as opposed to sweetness) that would make it a valuable article on the English market. I hope the time may come when demand and price enable you to replant this remarkable grape.

The words "Sherry" and "Port" indicate origin, whereas the words "Claret" and "Burgundy," through custom and the use of the words preceded by that of the country of origin, such as "Australian Burgundy," have become terms indicative of type and not of origin. This has come about through fifty years of advertisement and education.

A question of great importance regarding the type of wine is: "What is the natural production of your soil and climate?" I think you have discovered that, and it would be absurd for any firm such as ourselves to say that you must do this and that, alter it in this way, grow this grape, have it just so-so strength, and so forth. You are producing wines of high merit, and it is eminently wise to test the markets with the type wines you have evolved before we harass you by asking for something else. When we are satisfied that that is necessary, after having tested the markets, it will be time enough. On the other hand, if you wish to foster an export industry, you must have confidence in the merchants who are trying to open up markets. The reason you have never built up a good export trade in recent years is because you have failed to understand that recognized custom in Europe and even Australia throws the burden of adequate maturation upon the grower. It is the grower's duty to train young wine until it is fit to go out into the world. Australian wine is put free on board at about eighteen months to two years old. French wines are usually shipped to England bottling bright.

A requirement of success—the paramount necessity—is quality. We should never be satisfied with our production, but ever be aspiring to something better. Thus alone can a producing country avoid mediocrity and keep pace with and ahead of competition. The Empire markets will only accept your fine quality wines, for in all these markets are keen European competitors. France and Germany have always aimed at perfection, which the wise man knows is never attainable and the fool fondly imagines he has reached. Your wine industry is no longer merely in training for the race, but is fully qualified to take part. Your viticulture is complete in all but markets, and these are the life-blood of industry.

The wine farmers of the Union have now co-operated, they have decided to act as one for the good of all, and this is surely the embryo of greatness.

MANGOES, PAWPAWS, AND AVOCADO PEARS.

Notes on their cultivation by I. TRIBOLET, Chief, Division of Horticulture.

MANGOES.

THE mango, like most other fruit trees, thrives best on a deep, fertile, loamy soil. Notwithstanding this, it is one of the trees that can be grown successfully over a big range of ground, one of the essentials being that it be well drained. It stands exposure to winds better than most fruit trees, and on suitable soil and under good conditions becomes a huge tree, reaching 20 to 30 feet in height in ten or twelve years, assuming that the area is frostless.

Some types, such as Cambodian and others, produce fruit very similar to the parents. When definite varieties are required, they should be worked on to seedling stocks. In growing seedlings, either for stock or fruiting purposes, the seed should be removed from the ripe fruit, and not held over too long before planting, and when planted should have the outer shell carefully removed. This is to ensure prompt germination and even-growing plants. Those seeds producing only the one shoot are preferable as stocks to those producing a number of shoots. In the latter case, the weaker shoots should be removed. When about pencil thickness they may be budded or grafted in the ordinary way. The scion should be less advanced in growth than the stock. Waterproof paper is usually tied round the place operated on and lapped right over the scion to prevent atmospheric moisture entering. When the scion starts to grow, remove the paper. In-arching is sometimes used where scions are scarce or valuable. Old trees may be top-worked.

In the orchard they should be planted 25 to 40 feet apart, according to fertility of soil—25 is usually sufficient in this country.

PAWPAWS.

Set out seed in beds; transplant when 4 to 10 inches high; plant 15 to 18 feet, or even less, apart. They must be in a sheltered spot. Do not give too much water when planted out, as they are subject to damping off. They bear in about a year's time.

AVOCADO PEARS.

These are easily grown from seed, but the plants are exceedingly variable in growth, variety, and productive qualities. Worked trees are recommended for commercial planting. Seeds are usually planted with pointed end up in 4 to 5 inch pots or other receptacles containing sandy soil, and about one-fourth of the seed uncovered. They germinate in about a month, if bottom heat is used; about three to four months in the open. When the seedlings are 6 to 8 inches high, they are planted into nursery rows.

Avocados are ordinarily budded in the usual way. Use large shield buds, but young wood of current season's growth is mostly used for scions in grafting. Budded or grafted trees are left one year in the nursery, and then planted out about 25 feet apart.

Worked trees begin to bear in the fourth or fifth year. The tree grows well on anything from a sandy loam to a heavy soil, with plenty of manure. The first season or two they should have abundance of water to keep the tree in active growth. Later on, water should be reduced in autumn to check the growth and allow the tree to make its wood for winter. It requires about the same amount of water as a lemon tree. Old trees may be top-worked and produce fruit two years after. A good average yield is about 500 fruit from a ten to fifteen year old tree.

Wheat: Change of Seed.

There is a notion very prevalent among wheat growers that the "continued cultivation of the same variety of wheat under the same soil conditions for a number of years results in a deterioration of that particular strain of seed to such an extent as to render a change absolutely imperative." Richardson, of Victoria, considers, however, that "unless the change be for the purpose of obtaining a better variety, or more vigorous seed, or for seed that has been subjected to careful and continued systematic selection, there can be no advantage resulting from change of seed. . . . The balance of evidence goes to prove that farmers should rely on locally developed seed, and should give more attention to their own seed, and the prevalent idea that *mere change of seed* gives good results would appear to be founded more on opinion than upon well ascertained fact."

Prices of Agricultural Implements, etc.

In its monthly trade report, No. 47, the National Bank states that the prices of agricultural implements and machinery show no tendency to ease. Indeed, most lines are now invoiced higher than previously, and American manufacturers state that, since they are working on raw material bought at high prices, it is unlikely that there will be any appreciable fall for some time. Locally, the demand for new implements continues small. The inquiry for spares continues undiminished. The supply of machinery is more than adequate for requirements. For grain bags and wool packs quotations have been further reduced, 2½-lb. grain bags now being quoted at 77s. per 100, and 10-lb. wool packs at 3s. 4d. each, c.i.f.

THE SWEET POTATO AND ITS CULTIVATION ALONG THE SOUTHERN COAST BELT.

By CHAS. F. JURITZ, M.A., D.Sc., F.I.C., Agricultural Research Chemist, Capetown.

(The first part of this article, now concluded, appeared in last month's *Journal*.—EDITOR.)

CHEMICAL COMPOSITION.

KÖNIG gives the following as the average composition of the sweet potato, according to twelve series of analyses of tubers from different countries:—

Water	71.86 per cent.
Protein	1.00 ,, ,,
Fat	.20 ,, ,,
Nitrogen-free extract	25.05 ,, ,,
Fibre	1.03 ,, ,,
Ash	.86 ,, ,,

The above averages may be supplemented by the following figures obtained by individual investigators:—

	1.	2.	3.	4.	5.
Water	73.39	70.98	76.19	86.45	69.10
Protein	1.28	.92	2.81	.39	1.20
Fat	.28	.49	.12		
Gum, etc.	1.08	2.39	3.11	12.12	27.06
Sugar	6.86	2.69			
Starch	15.06	20.26	14.80		
Fibre	.98	1.20	1.79	.49	1.32
Ash	1.07	1.07	1.17	.55	1.32

1. S. W. Johnson: Annual Report, Connecticut Agricultural Experiment Station, U.S.A.

2. Neubauer and Oeconomides: Averages of three analyses of tubers grown in England.

3. Nagai and Murai: Japanese tubers.

4. Coremvinder: Tubers from the Azores.

5. Coremvinder: Tubers from Malaga.

Samples of each class of sweet potato grown by Mr. Robertson at Little Brak were collected for analysis. In the laboratory each lot of tubers was analysed in three parts. (1) An average sample was in each case taken of an entire tuber, including the skin. (2) Tubers representing each lot were rapidly and thinly peeled and the peel discarded; a surface layer about half an inch in thickness was then taken off for analysis all round these tubers. (3) The central core remaining after removal of the above surface layer was separately analysed.

The following percentage results were obtained by analysis:—

	Entire Tuber.	Outer Layer.	Central Core.
1. *Common six-months*—			
Original weight of tuber	307 gms.	360 gms.	360 gms.
Water	70.55	67.08	68.72
Protein (N × 6.25)	.94	.97	.77
Fat	.63	.40	.54
Nitrogen-free extract	26.22	29.93	28.58
Fibre	.61	.61	.47
Ash	1.05	1.01	.92
Sugars: Reducing	4.47	—	—
Non-reducing	1.59	—	—
Specific gravity of tuber	1.08	—	—
2. *Red-skinned three-months*—			
Original weight of tuber	110 gms.	710 gms.	710 gms.
Water	80.02	82.41	82.49
Protein (N × 6.25)	—	.65	.59
Fat	—	.42	.47
Nitrogen-free extract	—	14.66	14.97
Fibre	—	.68	.56
Ash	—	1.18	.92
Sugars: Reducing	2.68	—	—
Non-reducing	2.92	—	—
Specific gravity of tuber	1.04	—	—
3. *Yellow-skinned three-months*—			
Original weight of tuber	530 gms.	670 gms.	670 gms.
Water	77.06	73.72	78.66
Protein (N × 6.25)	.68	.71	.47
Fat	.21	.20	.15
Nitrogen-free extract	20.42	23.96	19.91
Fibre	.80	.59	.40
Ash	.83	.82	.41
Sugars: Reducing	.46	—	—
Non-reducing	2.69	—	—
Specific gravity of tuber	.90	—	—
4. *British East African white-skinned*—			
Original weight of tuber	470 gms.	520 gms.	520 gms.
Water	70.61	73.06	75.91
Protein (N × 6.25)	1.34	1.18	.89
Fat	.46	.33	.27
Nitrogen-free extract	25.54	23.83	21.73
Fibre	.77	.62	.45
Ash	1.28	.98	.75
Sugars: Reducing	5.24	—	—
Non-reducing	.81	—	—
Specific gravity of tuber	1.05	—	—

Samples Nos. 1 and 3 were analysed twenty-four hours after their arrival in the laboratory, and samples Nos. 2 and 4 five days after arrival. This may, to a certain extent, account for the fact that in

Nos. 1 and 3 the percentage of water was found to be higher in the unpeeled than in the peeled tubers.

With reference to the determinations of specific gravity, attention may be called to Martin's statement* that in Irish potatoes there is a connection between the specific gravity and the starch content, so that the percentage of starch in a potato may be calculated by means of a formula, or read off from a set of tables, when the specific gravity is known. In the sweet potatoes from Little Brak a similar relation appears to hold: the common six-months variety, which has the largest percentage of starch, is also highest in specific gravity. On the other hand, the old three-months variety showed the lowest specific gravity, the tubers readily floating in water, and the percentage of starch is also the lowest of the four. It must, however, be added that the tubers of this variety showed a number of internal air-spaces, the result apparently of excessive stringiness.

It will be noticed that the analyses show the two three-months varieties to be more watery than the others.

The sweet potato is, like all root crops rich in starch or sugar, pre-eminently a potash-loving plant, as the following table, giving an average of three analyses of the ash, according to König, clearly shows:—

Potash	50.31	per cent.
Soda	6.53	,, ,,
Lime	9.93	,, ,,
Magnesia	3.40	,, ,,
Iron oxide	.91	,, ,,
Phosphorus pentoxide	10.60	,, ,,
Sulphur trioxide	5.56	,, ,,
Silica	3.45	,, ,,
Chlorine	12.74	,, ,,

An analysis of the ash obtained from the red-skinned three-months variety grown on Mr. Robertson's farm gave the following percentage results—

Potash	46.15
Lime	7.50
Phosphorus pentoxide	7.96

The ash of the skin, peeled off to a thickness of one-sixteenth of an inch, from the British East African tubers, gave the following percentages on analysis:—

Potash	25.49
Lime	12.30
Phosphorus pentoxide	7.43

ROTATION.

The foregoing figures show what large proportions of potash, when compared with other inorganic plant food, the sweet potato needs. Hence sweet potatoes, grown continuously on the same lands without a potash fertilizer, naturally exhaust the soil even when manured with farmyard manure, the experience often being that,

* "Industrial Chemistry: Organic," Third Edition, page 181.

while yielding a good crop during the first year after planting on new ground, the second year the harvest is less and the third year very little is produced in the way of tubers, although there is abundance of foliage in response to treatment with farmyard manure. Such manure is admittedly very suitable for sweet potatoes, especially if previously thoroughly mixed with leaf mould and allowed to rot, turning over from time to time for some months, in order to secure uniformity of texture. Even then, however, continuous cropping of one piece of ground with a potash-loving culture like the sweet potato is bound to exhaust it, and rotation should therefore be practised. In the pre-war days, when the German potash syndicate used to furnish supplies of potash salts for fertilizing purposes, it is possible that exhaustion would have been prevented, even under such circumstances as those just quoted, by dressing the lands, say once every third year, with sulphate of potash, to the extent of from 80 to 100 lb. per morgen; but, in any case, such continuous cropping is not sound agriculture, and Mr. Robertson affords a good example to sweet potato growers by setting his face against it. The furthest one could go in the direction of continuous cropping is to vary the crop the third year by putting the land under peas or beans after having taken off two sweet potato crops, but Mr. Robertson—wisely—practises an even more rigid rotation.

For the sweet potato grower rotation is of advantage not only as a preventive of soil-exhaustion, and a consequent means of increasing the yield, but it is at the same time of service in controlling diseases of the crop and in generally improving the soil. In the United States it was found that a rotation which brought sweet potatoes on the land once every three or four years was most effective in preventing loss from disease. Moreover, if in the course of rotation green standing crops are ploughed under, particularly clover or vetch, the fertility of the soil is improved and larger yields of all crops included in the rotation result. Failing clover or vetch, rye and oats have been successfully employed in the States. It is, however, advisable in any case to include in the rotation, if at all practicable, a leguminous crop like cowpeas, soya beans, clover, or vetch of some kind, to furnish the soil not alone with humus, but above all with nitrogen, especially in a poor sandy soil.

Mr. Robertson, as already stated, invariably practises rotation and strongly advises against putting any field under sweet potatoes two seasons in succession, because, apart from any question of soil-exhaustion, voluntary growths from the previous year's crop are always apt to appear during the second season and to choke the newly-planted cuttings. He therefore considers it better to plant cereals after sweet potatoes, and when the cereals are harvested the ground is prepared afresh without any risk of voluntaries or *opslag*. For that reason too the suggestion to grow two crops of a three-months variety in succession is not favoured by Mr. Robertson. Hence he does not consider that larger annual harvests will thus be obtained than by the cultivation of a six-months variety; moreover, the keeping qualities of the latter have to be taken into account, as well as the time lost in double preparation of the ground.

MANURING.

The tables of analyses above set out give some indication of the lines whereon the manuring of the sweet potato should proceed,

bearing in mind always that neither crop requirements alone, nor soil requirements alone, should be taken into account, but both need to be studied together.

On the sandy loam soils, which constitute more particularly the abode of the sweet potato in this country, and where the climate specially suits its development, it is not essential invariably to supply high-grade complete fertilizers. Moderate proportions of basic slag on soils which have a tendency to sourness would furnish the crop with the necessary phosphate. In the eastern United States it is customary to apply fertilizers along the lines of the future ridges a week or more before planting by means of a one-horse single-row fertilizer distributor (fig. 6).

The sandy loam soils just mentioned are often deficient in humus, and consequently stable manure, always a suitable fertilizer for sweet potato soils, gives good results if applied, as it is in New Jersey, at the rate of 20 to 30 tons per morgen. Where this is not available, the humus-content of the soil is maintained by the ploughing under of cover crops as above indicated. In the Northern States it is the

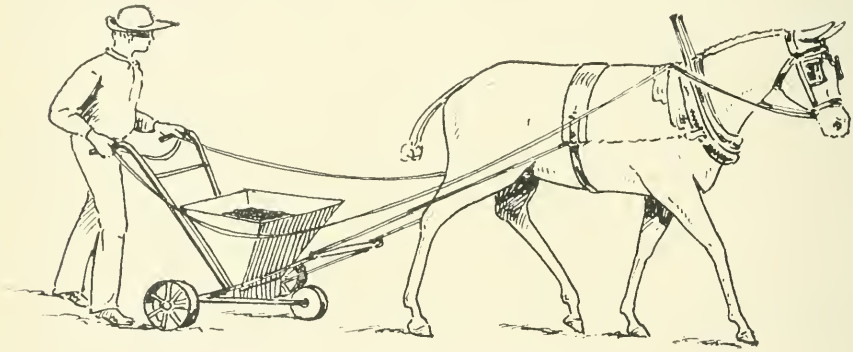


FIG. 6.—Single-row Fertilizer Distributor.

practice to sow crimson clover between the rows at the final cultivation, ploughing it under when preparing the land for the succeeding year's potato crop. In the South peanuts are used for a similar purpose, and afterwards hogs are sent into the land; they feed on the nuts, but leave the peanut vines and roots in the soil.

In view of the tendency of green crops when ploughed under to render the soil sour, and all the more when the soil itself has already that tendency, the phosphatic fertilizer to be applied should be basic slag rather than superphosphate, but agricultural lime at the rate of two to four tons per morgen, applied every three years, after ploughing under the green manure, is suggested, or else half those quantities of burnt lime.

As already shown, sweet potatoes need potash above all kinds of inorganic fertilizers. In the Northern States for growing a quick maturing crop a fertilizer used to be recommended, containing 2 to 4 per cent. of nitrogen, 8 per cent. of phosphoric oxide, and 8 to 10 per cent. of potash, but war conditions brought the proportions of potash down to 1 or 2 per cent., or deleted it entirely, the other constituents remaining as before.

YIELDS OF TUBERS.

During the meeting of the British Association for the Advancement of Science held in Cardiff last August, Captain A. P. H. Desborough, in a paper on "Industrial Alcohol," alluded to the potentialities of the sweet potato in the tropics in the following terms:—

> "According to good authority, the average yield amounts to 4-6 tons per acre, or barely that of the potato yield in England."

The average yield of sweet potatoes in the United States, where there were 940,000 acres under that crop in 1918, was a total of 87,924,000 bushels, equivalent to an average of 93.5 bushels per acre for that season. Taking a bushel of sweet potatoes as 53 lb., this yield amounts to about 5000 lb. per acre. In 1919 the acreage had increased to 1,029,000 acres, the total production to 103,579,000 bushels, and the rate per acre to 100.7 bushels or 5337 lb.

In the Union of South Africa, according to the 1918 Agricultural Census, the acreage under sweet potatoes in the four Provinces and the relative yields were as follows:—

Province.	Acres.	Production.	Yield per Acre.
Cape of Good Hope	12,162	46,089,450 lb.	3790 lb.
Natal	3,643	12,290,850 lb.	3374 lb.
Transvaal	4,411	10,529,250 lb.	2387 lb.
Orange Free State	176	231,600 lb.	1316 lb.
Total	20,392	69,141,150 lb.	3390 lb.

The annual production of ordinary (Irish) potatoes in the Union is about 117,000 short tons, the yield per acre being approximately:—Cape, 2700 lb.; Natal, 1200 lb.; Transvaal and Orange Free State each 1900 lb.; and average for the whole Union, 2200 lb. The chief Irish potato growing district is Thaba 'Nchu, in the Orange Free State, its yield being 17,354,100 lb. at the rate of 3128 lb. per acre. Sweet potatoes are not grown in the Thaba 'Nchu District, while in the principal sweet potato areas in the Union, such as George and Oudtshoorn, the production of sweet potatoes is more than double that of Irish potatoes.

The Division of Oudtshoorn, with its exceedingly fertile soil, yields heavier sweet potato crops than any other district in the Union. It has only 510 acres under that crop, but its yield in 1918 was 3,892,350 lb., an average of 7632 lb. per acre. Of the other sweet potato growing divisions in the Cape Province those giving highest yields per acre are, in order, Paarl, Worcester, Stellenbosch, Ladismith, and Knysna, their returns being as follows:—

Division.	Acres.	Production.	Yield per Acre.
Paarl	430	2,459,250 lb.	5719 lb.
Worcester	464	2,539,050 lb.	5472 lb.
Stellenbosch	381	1,842,600 lb.	4836 lb.
Ladismith	478	2,287,500 lb.	4785 lb.
Knysna	847	3,910,350 lb.	4617 lb.

In Natal the largest acreage is in New Hanover—817 acres—but the production of 2,595,900 lb. corresponds to a yield of only 3177 lb. per acre. The other large sweet potato districts in Natal are Durban and Lower Tugela, for which the statistics are given below:—

	Acres.	Production.	Yield per Acre.
Durban	580	3,800,400 lb.	6553 lb.
Lower Tugela ...	525	2,004,000 lb.	3817 lb.

The only really large sweet potato districts in the Transvaal are Barberton and Rustenburg, for which the figures are as follows:—

	Acres.	Production.	Yield per Acre.
Barberton	901	3,994,200 lb.	4433 lb.
Rustenburg... ...	658	2,027,400 lb.	3081 lb.

In the Division of George, the chief sweet potato growing district of the Cape Province and of the Union, 874 morgen (1850 acres) were under sweet potatoes in 1918, and produced 31,586 muids (4,737,900 lb.) of the tuber, equivalent to a rate of 2561 lb. per acre. It is a matter of common knowledge that the soils of George are much poorer than those of Oudtshoorn, but the relatively low yield of the former Division is not accounted for by that fact alone. To a large extent the method of cultivation is promiscuous and unscientific; with more intensive methods the area under cultivation in this division should obviously be capable of producing very much heavier crops, and as an illustration of what can be accomplished in the Little Brak District, Mr. Harold Robertson related the following: "From a piece of ground, measuring 425 yards long and 80 yards wide, a yield of 1800 50-lb. baskets of large tubers and approximately 450 baskets of small tubers was obtained during last harvest; that is say about 17 tons per morgen* in all. The soil was black alluvium and had been irrigated before ploughing. It was manured with half a ton of commercial "potato fertilizer," guaranteed of the following composition:—

Phosphoric oxide:	Total	8.0 per cent.
	Citric-soluble	7.5 ,, ,,
Nitrogen		3.5 ,, ,,
Potash		6.0 ,, ,,
Lime		16.0 ,, ,,

The season was dry, and the crops had received no subsequent water other than occasional showers.

* 16,300 lb. per acre. The difference between this return and the low census figures quoted above is both striking and significant, and seems to imply that the latter figures are in general much below the actual yields. Various causes seem to combine together towards this end. First of all, there is a liability to omit from the estimation of the yield any produce not sold off the farm but used for home consumption, and crops raised by *bywoners* may quite easily also remain unrecorded. Next, a natural tendency exists amongst agriculturists to over-estimate areas under cultivation. Then, too, they frequently have a reluctance to state their full yields lest such candour should prove the precursor of taxation. The farmer is apt, moreover, to include in his statements not only the areas actually sown during the preceding season, but also fallow lands previously under the same crop. All these circumstances contribute to lower the recorded yield per acre.

Sweet potato culture is carried on, on a large and increasing scale, in the United States, and in the Southern States the tuber constitutes one of the main vegetable foods of the people. The extent of land under cultivation, which averaged about 600,000 acres during the five years 1910-14, had increased, as stated above, to 1,029,000 acres in 1919, with a harvest in November, 1919, of over 103 million bushels, valued at 138 million dollars—an increase of 47 million bushels during the same period. The average yield per acre in 1916 was 91.7 bushels, and the average farm price of sweet potatoes, which was 51 cents per bushel at the beginning of the century, had increased to 67 cents per bushel in 1910 and to 133 cents per bushel in 1918. During 1918 only two States produced more than ten million bushels of sweet potatoes, namely, Georgia with 11,960,000 bushels and Alabama with 14,688,000 bushels; in 1919 Texas doubled its previous production, and both that State and Mississippi also exceeded the ten-million bushel record. Except New Mexico and California, in which the acreage of sweet potatoes was respectively 2000 and 6000 acres, there was not appreciable cultivation of the plant in any of the Western and North-western States, the area where it is cultivated extending from New Jersey southwards to Florida, and westwards by way of the southern regions of Texas, New Mexico, and Arizona into Central California.

EXPERIMENTS AT BARBADOS.

The *West Indian Bulletin*, Vol. V, No. 1 (1904), pp. 44-52, contained an account by Hall and Bovell of experiments carried out at Bardados in 1902 for the purpose of ascertaining the best varieties of sweet potatoes for cultivation. Twenty-eight varieties were planted, of which White Gilkes (six months) gave the best returns, the next three in order being Hurley, Minuet, and Vincelonian.

The White Gilkes was pronounced a variety of very good flavour and kept very well; white skinned with a white and floury centre surrounded by a yellowish-white layer. Hurley was dull yellow, fairly dry, and floury, with a pale red skin; inferior in flavour to White Gilkes. Minuet was a dull yellow waxy tuber with a yellowish-white skin, and Vincelonian a red-skinned fairly floury potato with a pale yellow centre, mottled with a darker shade of yellow.

The variety which gave the heaviest yield of tubers was a red-skinned tuber known as Moffard (11,209 lb. per acre), but its yield of starch (3284 lb. per acre) was below that of White Gilkes, and its food value was less than any of the above four varieties.

The results per acre obtained from these four varieties were as follows:—

Variety.	Total Weight.	Starch.	Potash.	Phosphorus Pentoxide.
	lb.	lb.	lb.	lb.
Tubers—				
White Gilkes	11,116	3,591	37	16
Hurley	10,275	3,039	48	18
Minuet	9,903	2,833	42	22
Vincelonian	7,823	2,642	24	15

Variety.	Total Weight.	Potash.	Phosphorus Pentoxide.
	lb.	lb.	lb.
Vines—			
White Gilkes	10,080	34	22
Hurley	6,421	25	13
Minuet	10,501	58	36
Vincelonian	3,678	15	10

Tubers—

	White Gilkes.	Hurley.	Minuet.	Vincelonian.
Water	63.79	66.03	66.83	61.36
Protein*	.99	1.75	1.58	1.88
Fat	.65	.42	.55	.76
Nitrogen-free extract† ...	32.30	29.58	38.61	33.77
Fibre	1.09	.92	.97	1.13
Ash	1.18	1.30	1.46	1.10
Vines—				
Ash	3.22	3.49	3.41	4.26

The following percentages of potash and phosphorus pentoxide were found in the ash:—

Tubers—

	White Gilkes.	Hurley.	Minuet.	Vincelonian.
Potash	27.97	36.15	28.77	28.18
Phosphoric oxide	11.86	13.85	15.07	17.27
Vines—				
Potash	10.56	11.18	16.13	9.62
Phosphoric oxide	6.83	5.73	9.97	6.57

PRODUCTION OF ALCOHOL.

In Germany, at the beginning of last century, most of the alcohol manufactured used to be derived from grain, that is to say, from starchy material, but as the common or Irish potato was found to give a heavier yield of starch, and at lower cost than any other crop, it came in course of time to replace grain, and was the general source of German industrial alcohol before the late war. The cultivation of potatoes for this purpose was carried out on the co-operative principle; there were what are called farmer-distilleries jointly owned by participating agriculturists, and the spent wash and still residues were returned to the farms, where they were utilized to feed the cattle, being rich in protein substances.

It is easy to see that this system of alcohol production encourages cattle breeding on the participating farms. Before the war there were about three-quarters of a million distilleries of the above type in Germany, turning out, in addition to their alcohol, huge quantities of cheap and nutritious cattle food, and the cattle thus provided for supplied the potato farms with proportionate quantities of a manure

* Appears as "Albuminoids" and "Amides" in original.
† Appears as "Starch" in original.

very suitable for soils deficient in humus, a type which prevails along our own southern coast belt.

The sweet potato, too, is already in use in other countries for the production of alcohol, and is stated to be so used in the Azores and West Indies* as well as in Brazil and Algiers. It is more easily raised, makes a larger yield per acre, is probably a heavier and cheaper starch producer, in regions where it can be cultivated, than even the common potato, and should serve excellently as a raw material for the production of industrial alcohol. The common potato (*Solanum tuberosum*, L.), containing about 75 per cent. of water, yields from 16 to 24 per cent. of starch, and in Germany 100 kg. of potatoes, containing 20 per cent. of starch, are reckoned to yield in practice from 11½ to 12 litres of absolute alcohol. The sweet potato (*Ipomœa batatas*, Linn.), with an average water content, according to König's compilations, of about 72 per cent., contains approximately 25 per cent. of starch and sugar, from 2 to 3½ per cent. whereof consists of sugar. A yield of sweet potato tubers of this composition at the rate of 8 tons of 2000 lb. per morgen (say, 4 tons per acre) should produce over 1000 litres (220 gallons) of absolute alcohol per morgen.

INVESTIGATIONS IN THE UNITED STATES.

A few years ago systematic investigations were begun under the administration of the United States Department of Agriculture for the purpose of determining the identity of different varieties of sweet potatoes and for developing the most suitable method of utilizing the plant as a stock food in regions where it can be cheaply produced. Efforts were also made to solve the problems and cultural difficulties of sweet potato growers. A general investigation was carried on at the same time of dry rot, stem rot, and other diseases of the sweet potato, and the remedial measures were studied and suitable treatment recommended.

The sweet potato tubers, after unearthing, are said to become sweeter on exposure to the sun's rays; tubers which have been so exposed are also believed to keep longer than others. Mr. Robertson informs me, however, that if unearthing is carried out later than October the tubers may be scorched by the sun's heat in a single day. On the other hand, exposure to frost is alleged to spoil unearthed tubers; the runners are easily injured by light frosts which do not appreciably affect the tubers, but if the runners become actually frozen the tubers are liable to injury from the frozen sap passing down into them, and this may cause speedy decay after as well as before harvesting. Hence when the runners have been killed by frost immediate action should be taken; either the sweet potatoes should be dug up, or else the runners should be cut away from the tubers and an additional protecting layer of soil thrown over the latter.

In North America there is a good deal of sweet potato culture carried on in the Eastern States, Florida, Georgia, South Carolina,

* *Vide* Simmonds, *op. cit.*, pp. 22, 23. Mr. H. H. Cousins, Director of Agriculture, Jamaica, however, informs me that, as far as he is aware, no alcohol has ever been made commercially in the West Indies, and certainly not in Jamaica, from sweet potatoes. At the present time, he says, the tubers are selling at about £20 per ton, with a gravely inadequate supply for the food requirements of the country.

North Carolina, Virginia, and Maryland, and there is a corresponding traffic in the tuber on Chesapeake Bay and the Tennessee River. Some years ago one steamboat alone was carrying 7000 barrels of sweet potatoes per week between the lower landings on the eastern shores of Virginia and Baltimore at a freight of 1400 dollars per week right through the autumn and winter.

Further inland, in Ohio, it is customary to take up the tubers before winter sets in, the experience there, as in some other localities, being that heavy frost injures the potatoes if they are left underground. If that happens they may nevertheless seem quite sound to all outward appearances, but when stored they rot badly. There are many other regions also where sweet potatoes arrive at maturity during or just prior to seasons of frost, and where for this reason the tubers cannot be allowed to remain underground. Plans have therefore been devised to preserve them, after digging out, for future use, particularly in the case of those varieties which do not keep well after harvesting. The care with which such varieties and, in fact, sweet potatoes in general have to be handled in winter has been compared with the care necessary in handling eggs, on account of the liability of the tubers to become bruised and to rot in consequence. That this is not the language of exaggeration may be gathered from the advice on the haulage of sweet potatoes given by the United States Department of Agriculture; it is recommended that the tubers be gathered in the field in *padded* baskets or boxes, and, if they have to be conveyed very far by vehicle, only wagons with *bolster springs* should be used. It follows that even the digging up has to be done with care and that machines employed for digging up Irish potatoes cannot be used, as they would bruise the sweet potato tubers and injure them in other ways. After being scratched out by hand they should be left loose on the land to dry; it is considered bad practice in the United States to throw the recently unearthed tubers from several rows in heaps, as they become bruised and more liable to decay. It is also advised that they should in any case be brought indoors before night, and carefuly stored in bins.

STORAGE.

To ensure satisfactory keeping of the tubers, four points have to be attended to: (1) The tubers must be thoroughly ripe, (2) they must not be bruised or the skin damaged, (3) they must be kept dry and well ventilated, and (4) not be subject to considerable temperature changes during storage.

For storing sweet potatoes when they have to be kept for a period of eight months or over the winter, a preliminary sweating process has been strongly recommended—two weeks' storage in a well-ventilated cellar, for instance, at a dry temperature between 80° and 90° F., so that they may sweat thoroughly. The temperature is then allowed to fall to about 65° F. and so maintained.

Probably the sweet potato would be more frequently cultivated from the tubers, but for the difficulty of storing the latter. Experience acquired in Florida showed that if they are not dug up until mature and are not bruised in handling, a great deal of this difficulty disappears. An American agricultural magazine advised as follows: "When digging they should be shaken from their stems and laid upon the top of the ground, not in piles, for in so doing they

may be unnecessarily bruised, and the piling would prevent the circulation of air necessary to dry them. When they come to storage, then they are supposed to be dry and as free from cuts and bruises as possible."

If a ripe tuber happens to be cut or broken, the cut dries and a sort of skin or crust forms over the injured part, and prevents access of air and the germs of fermentation and decay; in the immature tubers, on the contrary, the damaged part remains moist, turns black, and fails to secure immunity from micro-organisms. Damage to stored tubers by mice has been found to be a frequent origin of rapid spread of fermentation. The Florida sweet potato growers consequently construct store-houses of poles, notched up closely at the corners, and daub all cracks with clay. Dry sand is collected in summer and stored ready for use amongst the tubers when they are dug up, and the same sand is often used over and over again year after year. By adopting this method of storing, Georgia planters are said to have kept old potatoes until the new crop came in every year for forty years. The advice given in those States was: in order to minimize loss, exercise proper judgment as to the time and manner of digging up the tubers and as to handling and storing them.

A common method of storing sweet potato tubers practised in the Southern States consists in making about 20 or 30 bushels of them into a pile, which is then completely covered with straw. As long as the temperature does not fall below 40° F., the pile may be left thus for about a week during which the tubers will undergo a thorough sweating. After the sweating is over, the pile is covered with earth, lightly during the preliminary stages, but more thickly as the cold season advances until a thickness of from 4 to 6 inches has been reached. A shed of scrap timber may now be erected over the pile, or it may be constructed before making the pile, so that the latter is not exposed to rain while sweating.*

In the northern States, where the ground freezes and low temperature prevails for a lengthened period, the tubers are stored usually either in a warm basement or in a specially constructed house, whose walls are half above ground and half below, with the earth banked up to the eaves on the outside and ventilators on the top. There is room for a stove and fuel-bin in this house, and the tubers are piled in bins, with skeleton floors and hollow partitions for ventilation, up to 6 to 8 feet square and 8 to 10 feet deep, care being taken to prevent bruising. Until the sweating period is over, the temperature is kept up to 70° to 80° F., but although the temperature may be subsequently lowered, freezing has to be avoided.

USE OF SLICED, DRIED, AND POWDERED TUBERS.

The late Mr. J. B. Hellier, at one time Editor of the *Cape Agricultural Journal*, used to advise dipping the tubers into boiling water until the skin could be easily slipped off; they were then to be cut into slices, and dried naturally on shelves. When required for cooking they had to be soaked overnight before boiling for use.

To overcome the difficulties attendant upon storage of the tubers,

* This method is also practised in South Africa. Another local method of storage is carried out by digging a trench, filling it with the tubers and piling them up until they form a ridge three feet above ground; this is then neatly covered with a water-shed roof of sods, leaving an air-hole.

the North Carolina Experiment Station years ago suggested sun-drying, and it was said that few people realize how handy the dried sweet potato is about the house, being always on hand for use on the table at short notice. It was advised that the tubers should be sliced and dried, and, when required for use, be soaked to restore the evaporated moisture and baked in pans as the fresh ones are; or they could be ground into powder and put up in packets with directions for making puddings. The creation of a market for dried sweet potatoes, it was thought, would not be a difficulty, if an evaporating plant would undertake the putting up of sweet potato meal. In neat packages with attractive handbills and numerous recipes for the many delicious preparations that can be made from sweet potatoes, "a market could soon be made for a product that eastern North Carolina can supply in limitless quantities."

COST OF PRODUCTION.

The cost of production is naturally a very important item in sweet potato culture, especially if the ultimate aim is the manufacture of a cheap industrial alcohol. In order that those interested in sweet potato growing in South Africa may form some estimate of what is implied in this phase of our subject, a few figures may here be culled from agricultural practice in the United States, and the following cost of growing an acre of sweet potatoes has accordingly been compiled from published statistics for the eastern sweet potato section of that country, one dollar being taken as the equivalent of 4s. 2d.:—

Rent of land	£1	13	4
Ploughing and fitting the land	1	0	10
10,000 plants, at 4s. 2d. per 100	2	1	8
Fertilizers	3	2	6
Setting plants with tongs	0	5	2
Picking up tubers at 7½d. per barrel	3	2	6
100 barrels at 12½d. each	5	4	2
	£16	10	2

This, it will be seen, does not include the cost of hauling to market. In many sections of the southern States the corresponding cost would not exceed £8 per acre.

On the other hand, the produce of an acre has often realized as much as £20 to £30.

In connection with the cost of production in the Cape Province, Mr. Robertson has supplied the following information. Excluding ploughing and harrowing, the cost of cutting shoots on the land, dividing them into the required lengths, making water furrows, holes for plants, actual planting, closing up, and irrigating after ploughing, is approximately 18s. per acre, provided that the planting is done by boys, and other cheap labour is employed, such as old native women to do the cutting of the shoots. The crop on an average requires for adequate cultivation to be horse-hoed three times, hand-scuffled twice, and irrigated once, these operations involving a cost of about 24s. per acre. Digging up and bagging need an expenditure of about £4 per acre, so that the total cost approximates to £6. 12s., excluding costs of bags and cartage, cuttings, and manure.

THE SOUTH AFRICAN HONEY-BEE.

By S. H. SKAIFE, M.A., M.Sc., Entomologist, School of Agriculture, Cedara, Natal.*

INQUIRIES are sometimes received at Cedara as to whether it is possible to secure colonies of Italian bees or pure-bred Italian queens anywhere in South Africa. This race of bees is a prime favourite with beekeepers in Europe and America on account of their many good qualities, chief among which must be reckoned their powers of resistance to European foul-brood. Where Italian bees are available, this disease is not regarded as a very serious one, for dequeening a diseased colony for a few days and then requeening with a vigorous young Italian queen will generally effect a cure. The recent recognition of the presence of European foul-brood in South Africa renders the question of the availability of pure-bred Italian queens an important one to beekeepers in this country.

As far as is known to the Entomological Division of the Department of Agriculture no pure-bred Italian stocks are to be found to-day in the Union. Some years ago numbers of Italian queens were imported by private beekeepers, but the race seems to have been a failure under South African conditions, and most of the experienced beekeepers who tried them soon discarded them in favour of the race of bees indigenous to the country. The importation of bees, honey, and unsterilized bees-wax into this country is forbidden by law as a safeguard against the introduction of new diseases. Although it is known definitely now that European foul-brood, sacbrood, paralysis, and nosema disease are already present in the Union, American foul-brood, perhaps the worst scourge of all bee diseases, has so far not been found here. There is no known cure for this latter disease, and the prohibition of the importation of bees and honey into this country is fully justified as the only safeguard against its introduction into South Africa. Hence it is impossible for the South African beekeeper to obtain pure-bred Italian queens and the acquisition of a pure strain of this race is likely to remain impossible for some time to come. The question at once arises, what race or races of bees have we already in South Africa and how do they compare with Italians?

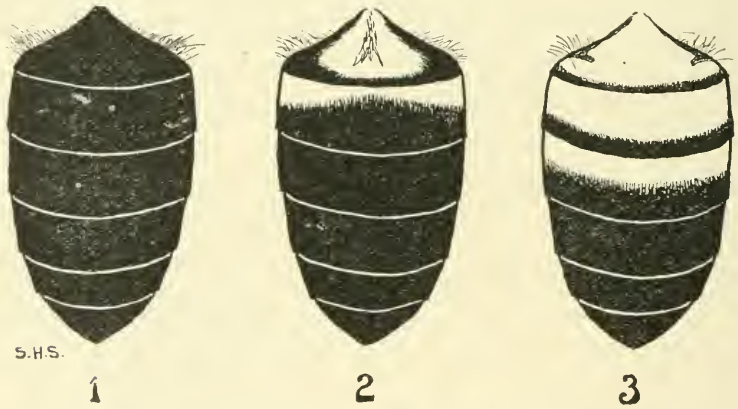
In order to answer definitely the first part of this question, it will be necessary to embark on a somewhat technical discussion. The true honey-bees all belong to the genus *apis*, of which there are several distinct species, but the question as to the exact number of different species of honey-bees there are in the world has long been in dispute. *Apis mellifica* is the common honey-bee of Europe and America, and this species is obviously quite distinct from, say, *Apis dorsata*, the giant bee of India, or from *Apis florea*, the dwarf bee of the same country. But whether some of the other so-called species are really

* Since this article was written, Mr. Skaife has accepted the post of Inspector of Technical Education, Cape Province.—EDITOR.

distinct species or are only varieties of the common honey-bee is doubtful.

In a catalogue of the bees contained in the British Museum (published in 1854), the author, Frederick Smith, gives a list of fifteen different species of honey-bees from all parts of the world, and of these fifteen, no less than six are recorded from Africa. It is generally agreed, however, among authorities to-day that these six so-called species from Africa, are really only varieties of the common bee, *Apis mellifica*. Of the six varieties, two are of particular interest to us here; *Apis adansoni*, Latreille, is a yellow-banded race of bees originally recorded from Senegal, and *Apis unicolor*, Latreille, is a black race recorded from Madagascar. These two races, or varieties, are those commonly found in South African apiaries.

The *adansoni* race closely resembles Italian bees in general appearance, but the workers are smaller and somewhat differently coloured. Figure 3 shows the abdomen of a typical *adansoni* worker, minus its pubescence or hairy covering. As is well known to bee-keepers, young bees have four bands of down on their abdomens,



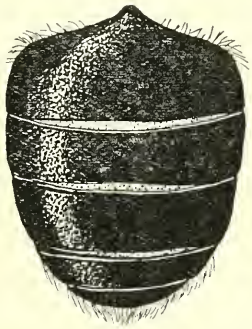
ABDOMENS OF WORKER BEES, DRAWN FROM OLD INDIVIDUALS DENUDED OF PUBESCENCE AND DISTENDED WITH HONEY.

FIG. 1.—*Unicolor* variety. FIG. 2.—Hybrid. FIG. 3.—*Adansoni* variety.

generally known as "fuzz rings," and this downy covering at first obscures the colour of the integument, but later on this pubescence wears off, and the older bees may be recognized by their bald, shiny appearance. The fuzz rings are not shown in any of the illustrations, hence in comparing the illustrations with bees in the apiary, allowance must be made for the presence of the rings of light coloured down on the younger bees. The abdomen of a typical *unicolor* worker is shown in figure 1, and it will be seen that this variety closely resembles the black or German bee of Europe. It is smaller than the European race, is often slightly smaller than the *adansoni*, and has a bad reputation for viciousness. The scutellum (the small, semi-circular shield at the base of the thorax, between the wings) is black in *unicolor*, but in *adansoni* it is yellowish brown in colour.

Adansoni is by far the commonest type of bee found in apiaries in this country, but often *unicolor* and *adansoni* varieties will be found side by side in the same hive, the progeny of one and the same queen. In such cases as these the queens must obviously be of hybrid origin, and hybrid workers marked as shown in figure 2 are frequently to be found among their progeny. The drones are black with narrow, yellowish brown bands on the hind borders of the four middle segments of the abdomen (figure 4), but some of the drones from hybrid queens are wholly black, as are also the drones of the *unicolor* variety. Queens vary considerably in colour, but they usually have leathery brown abdomens, deepening towards the hind end to deep brown or black (figure 5).

Thus we have at least two distinct races of bees in this country, and also hybrids between these two races. As is to be expected under such circumstances, the characteristics of colonies vary greatly. Some colonies are gentle, good honey gatherers, defend their hives well, and so on, whilst other colonies are vicious, prone to swarming, excessive users of propolis, in fact, are guilty of most of the faults of



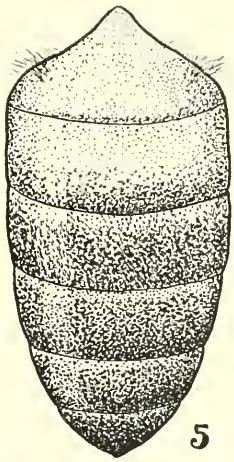


FIG. 4.—Abdomen of *adansoni* drone.
FIG. 5.—Abdomen of *adansoni* queen.

beedom. Usually the character of a colony falls somewhere between these two extremes, various combinations of the virtues and vices being found in the different hives. Interest in scientific beekeeping is rapidly increasing in South Africa, and we shall find, sooner or later, some commercial beekeepers going in for queen-rearing on a large scale. When this is done, opportunities will arise for fixing the desirable qualities and getting rid of the vices. There is little doubt but that in the *adansoni* race there are many latent qualities which, if developed and fixed by intelligent selection and breeding, would eventually evolve a race that could vie with the much-vaunted Italian bees, and which would probably be superior to them under South African conditions.

The main point of interest to us at present is, however, the question as to the relationship of the South African races of honey-bees and European foul-brood. American authorities recommend

dequeening a hive for a few days and then requeening with a vigorous young Italian queen. During the time the hive is queenless, the workers have an opportunity of removing all dead and dying larvae, and of thoroughly cleaning out the contaminated cells. When the young queen is introduced, she rapidly builds up the depleted colony and restores it to its normal strength. One of the essentials, then, for the success of this remedy is an instinct among the bees for keeping the hive scrupulously clean. According to the writer's experience, the *adansoni* race is excellent in this respect. In the observation hive at Cedara there is an army of bees constantly at work licking the glass and woodwork clean of all impurities. Frames containing mouldy pollen and perforated in all directions by the burrows of wax-moth larvae are cleaned up and repaired in a few hours when placed in the midst of a strong colony.

G. W. Onions, working alone and also in conjunction with the Rhodesian entomologist, R. W. Jack, has proved that the black or *unicolor* race of bees will often, during a queenless period, produce fertile workers capable of laying worker eggs and even of producing queens. Therefore, rendering a hive of these bees queenless would often prove useless as a remedial measure against foul-brood, for there would be little or no break in the brood-rearing to give the bees a chance to clean up. The yellow-banded or *adansoni* race does not seem to possess this characteristic, for in all queenless colonies inspected by the writer, where fertile workers were present, only drone brood was found. Furthermore, fertile workers are not common among this latter race and seem only to appear after a colony has been queenless for some days. Thus it would appear that, apart from their gentler nature, the *adansoni* bees are preferable as regards their powers of combating European foul-brood, and this race, by far the commoner one of the two, is the one that should be concentrated upon in breeding experiments.

One would imagine that the Italian blood imported years ago would have left its mark on the bees found here to-day, but such does not appear to be the case. The writer has carefully examined bees from Capetown, Durban, Pietermaritzburg, and Pretoria, and they were all found to belong to the types shown in the illustrations. In 1862 Dr. Gerstaecker, a German authority on bees, gave detailed descriptions of the different types of honey-bees found in South Africa, and these descriptions fit accurately the types found here to-day. Recently some bees were sent from Natal to T. D. A. Cockerell, an American authority, and he pronounced them to be *A. adansoni* and *A. unicolor*. Some specimens were also sent to Dr. Peringuey, the Director of the South African Museum, for comparison with the material in the museum, and his remarks concerning them are of such interest that they may be quoted here in full. In a letter to the writer he says, inter alia: "I received the bees you sent me for identification. The latter is not easy. As you are aware, there is in Southern Europe a race called *ligustica*, or in common parlance, Italian bees, as opposed to common black, or German bee, *mellifica*. According to H. von Buttel Reepen, a recent German authority, there are three sub-species of the common honey-bee, namely, *Apis mellifica*: sub-species *indica*, sub-species *unicolor*, and sub-species *mellifica*. The sub-species *indica* has six varieties, none of which occurs in Africa. *Unicolor* has five varieties, all of which are

native to Africa; *friesei* is recorded from Togoland, *unicolor* from Madagascar, Mauritius, and Bourbon; *intermissa* from Algiers, Kilimanjaro, Togoland, etc.; *fasciata* from Egypt; and *adansoni* from the whole of Africa south of Egypt.

"As to the European *mellifica* it is found in South Africa, and Friese, a very good authority, records it from the Cape Flats and Luderitzbucht.

"The queen of *A. fasciata* from Egypt (very nearly allied to our *adansoni*) was readily accepted in England by *A. mellifica*, but all the Egyptian workers were immediately put to death. Singularly enough, it is said that this variety, a most tractable one in Egypt, became of such a violent and intractable temper in England that its breeding had to be abandoned."

This last paragraph in Dr. Peringuey's letter is of particular interest in view of the statements made by R. W. Jack, the Rhodesian entomologist, in a letter to the present writer. He says: "I am no authority on the races of honey-bees and can therefore give you no further information than that the native Rhodesian honey-bee is so extremely vicious as to be dangerous to keep and handle and to constitute a serious household pest on account of the swarms that constantly take up their residence in any convenient cavity in buildings. Specimens of these bees were identified as *adansoni* at the British Museum. I have no experience of any other native variety or race in this territory. The race Onions worked with was that known as *unicolor*, the colonies for the Rhodesian experiments being imported from the Cape Province. I do not think this variety occurs wild in this territory. Onions' colonies from the Cape seemed very gentle and easily handled, but he had only a few. The first cross hybrid, Cape-Rhodesian (presumably *adansoni-unicolor*), were particularly gentle, and Onions thought them better workers than either of the pure varieties."

Thus it would seem that the yellow-banded race is the reverse in Rhodesia of what it is in most parts of the Union. Furthermore, the hybrids between the two races were found to be gentle and good workers, whereas it is well known that hybrids between the European races are, as a rule, vicious and intractable.

To sum up:—

1. The races of honey-bees kept in Europe and America do not commonly occur here. Italians have been introduced from time to time, but do not seem to thrive.

2. The commonest bees found here in apiaries are yellow-banded and belong to the *adansoni* race, a race indigenous to Africa and widely spread over the continent.

3. *Unicolor* is a black variety found chiefly in the eastern districts. It is not so common as *adansoni*, is not so gentle, and is prone to produce fertile workers.

4. The above two varieties cross freely, and workers of both types, with intermediates between the two, may often be found in the same hive, the progeny of one and the same queen.

5. The pure *adansoni* race is an excellent one for South African conditions, but its characteristics vary considerably in different parts of the country.

PRUNING OF DECIDUOUS FRUIT TREES.

By H. B. TERRY, Cert. R.H.S. (London and South Africa), Lecturer in Horticulture, School of Agriculture, Potchefstroom.

(*Continued from March*, 1921, Journal.)

THE PEAR.

Fig. 13 shows a pear, variety "Douglas," which has never been previously pruned. The height was beyond the reach of an average

FIG. 13.—Pear "Douglas" (before pruning).

man or an 8-foot ladder. Much fruit was lost in wind storms and by birds, and some difficulty was experienced in spraying.

Fig. 14 illustrates the same tree. An attempt has been made to shorten it back and open the head. A good deal was cut away, yet sufficient being retained to furnish the entire tree with leaves, produce a fine crop, and assist in producing fruit-wood on bare parts.

The pear when allowed to grow naturally takes the form of a pyramid; growth is usually excessive, and much difficulty is experienced in picking, pruning, etc. Generally the lines suggested for

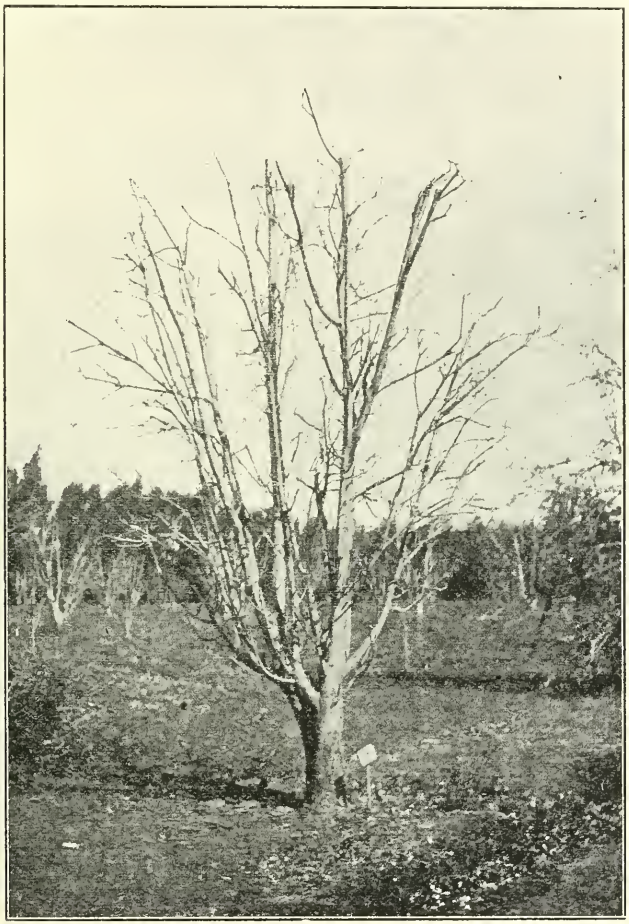


FIG. 14.—Pear "Douglas" (after pruning).

the training of the apple are applicable to this tree, except, perhaps, the treatment of the leaders. An example of a notoriously upright grower is found in "Keiffer Hybrid," and much difficulty appears to exist in getting the tree to open up. The terminal bud on the leader is certain to take a vertical direction and grow vigorously; the bud immediately below it sends out a weaker growth and takes a

wide angle; then let the second bud point in the direction of the desired growth and cut off over the bud above it. The terminal bud will grow erect as stated: the lower growth develops as required. At next winter's pruning cut the upright growth away, and a leader is formed from the second growth; this will give the tree all the spread

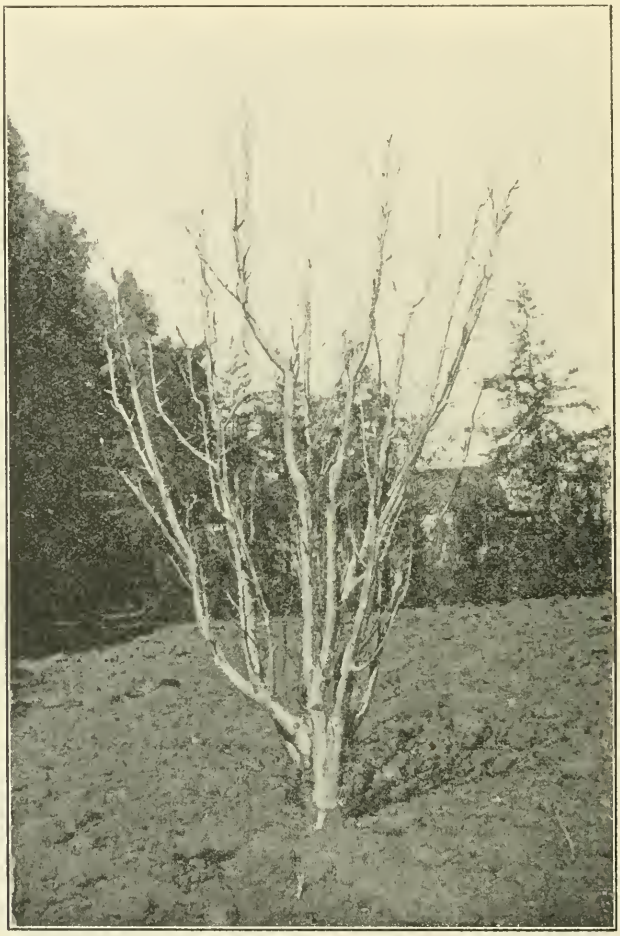


FIG. 15.—Pear "Keiffer Hybrid."

required. Care should be taken, however, when carrying this into practice to see that it is not overdone. Allowance must be made for the weight of fruit to do its share of spreading the branches. An illustration of "Keiffer" is given showing the spur development along the branches, and the opening up of the centre of the tree by removing several long poles.

The leaders have been pruned short to increase the vigour of this tree and fill up several sparsely furnished spaces with fruit spurs.

Fig. 15 shows a pear, "Keiffer Hybrid," grown as a hollow column; the fruit spurs inside the tree are clearly visible; a tree of this type requires practically no cutting

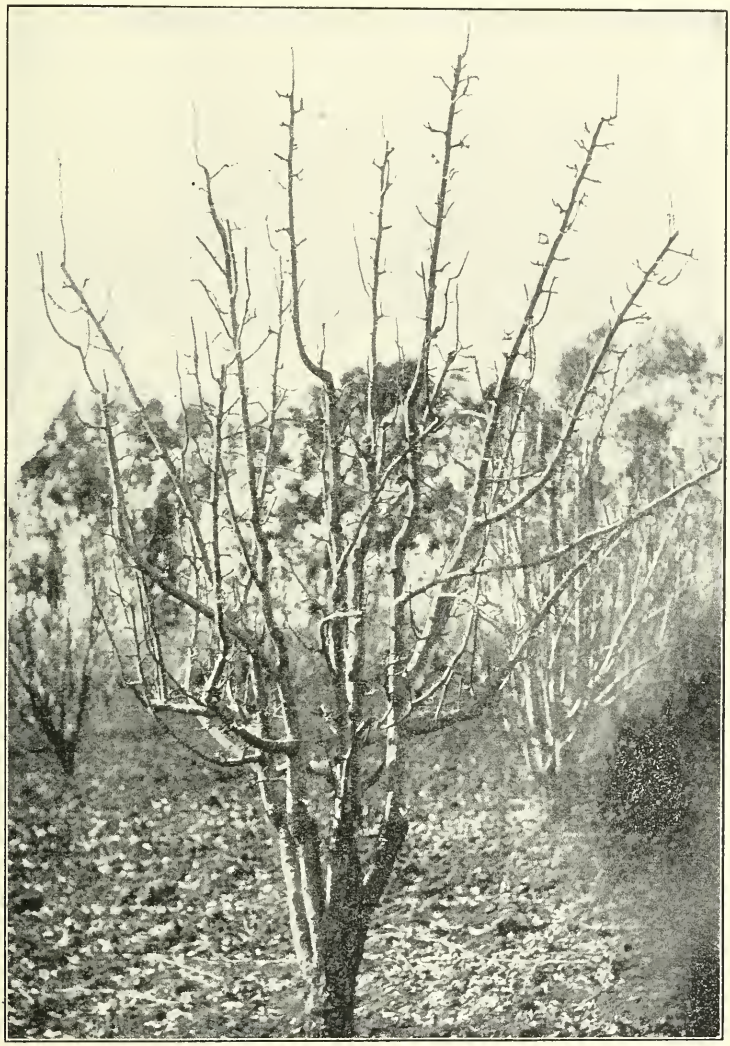


FIG. 16.—Pear "Le Conte."

Fig. 16 shows pear "Le Conte"; the spur development is remarkable; the amount of fruit produced by this variety was freely commented upon by visitors to the orchard. A few inside growths have been removed and the leaders reduced about half.

Most varieties of pears are easy to prune when the foundation has been correctly formed. As the trees develop into the fruiting stage it will be noticed that comparatively little new long wood is thrown out, except, perhaps, on the leaders or where a good-sized limb has

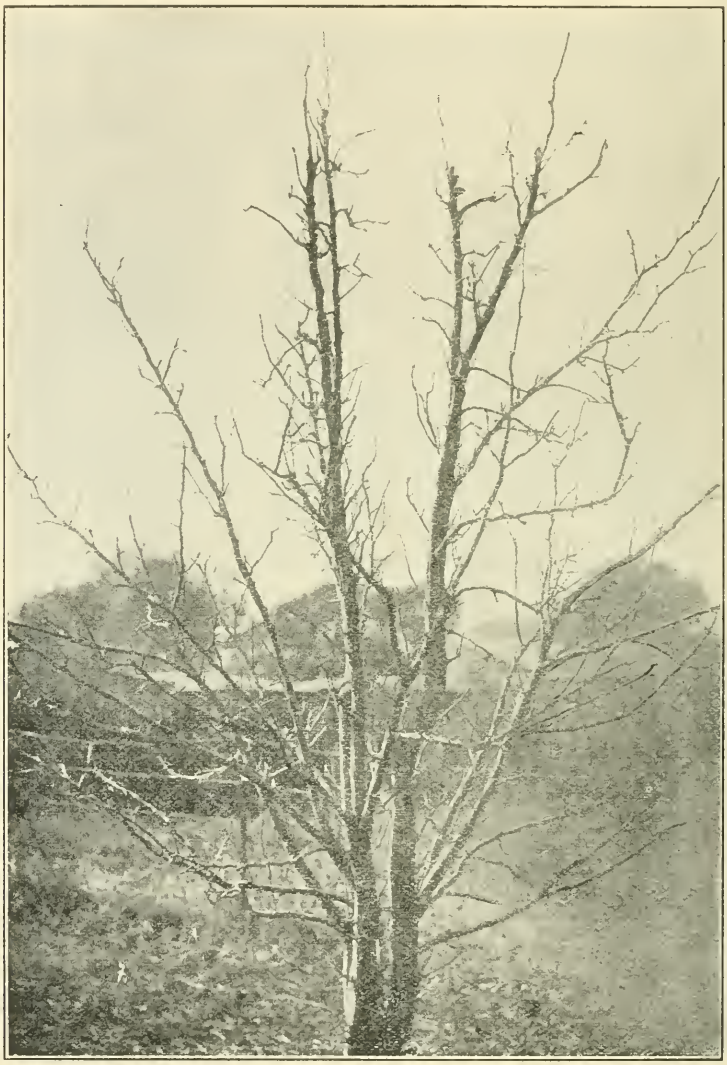


FIG. 17.—Pear "Bon Chretien."

been severed. The natural tendency is to form fruit spurs, so when a grower prunes his trees the major portion of the work consists in reducing the number and shortening the leaders and thinning out

spurs where too numerous. The writer has repeatedly been informed that, after pruning, some pear trees never bore fruit. The statement

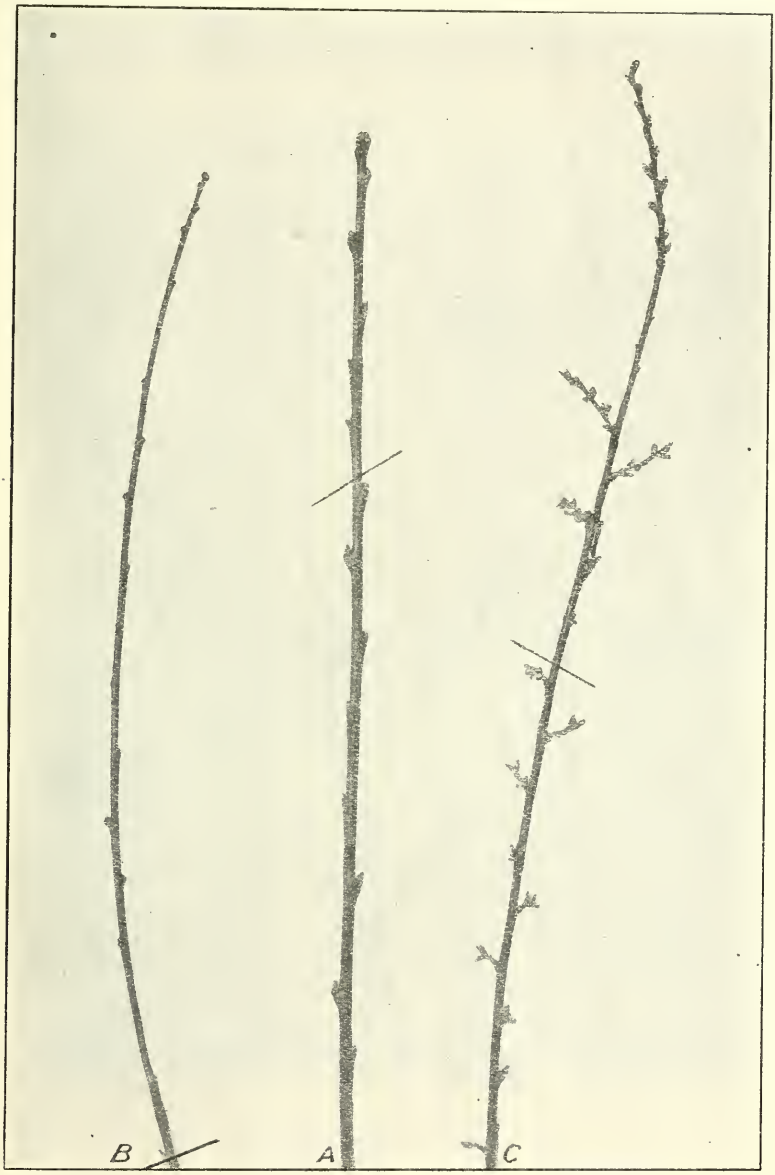


FIG. 18.—Peach, (*a*) blossom bud, (*b*) leaf buds, (*c*) fruit spurs.

is quite genuine. The variety may have had something to do with it. Some varieties require cross-fertilization with others which bloom

at the same time. Too much vigour is often infused by pruning, particularly when the crop has been killed by frost. Whilst systematic pruning is advocated, it should also be mentioned that when pears persist in putting out rampant growth and show little fruit wood, the leaders may be left unpruned for one season. This steadies the growth and causes the tree to develop spurs.

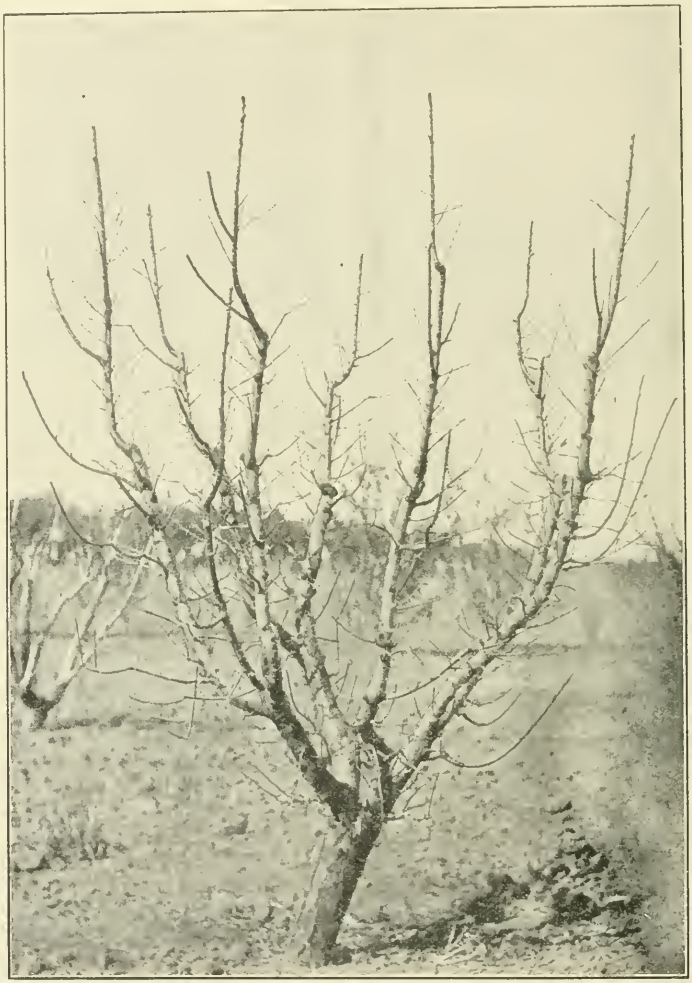


FIG. 19.—Peach, regularly pruned.

Fig. 17 shows a tree of Bon Chretien, which has been allowed to take its natural form, but pruned annually. It is furnished with fruiting wood throughout. The fruit has to be severely thinned each year.

PEACH AND NECTARINE.

These two fruits may be considered together. The nectarine is only a smooth-skinned peach, hence any remarks anent one is applicable to the other. The best form for these trees is undoubtedly the goblet or vase shape. The trees develop rapidly, are capable of producing large crops, and this quality is best maintained by intelligently distributing the weight of fruit over the whole tree.

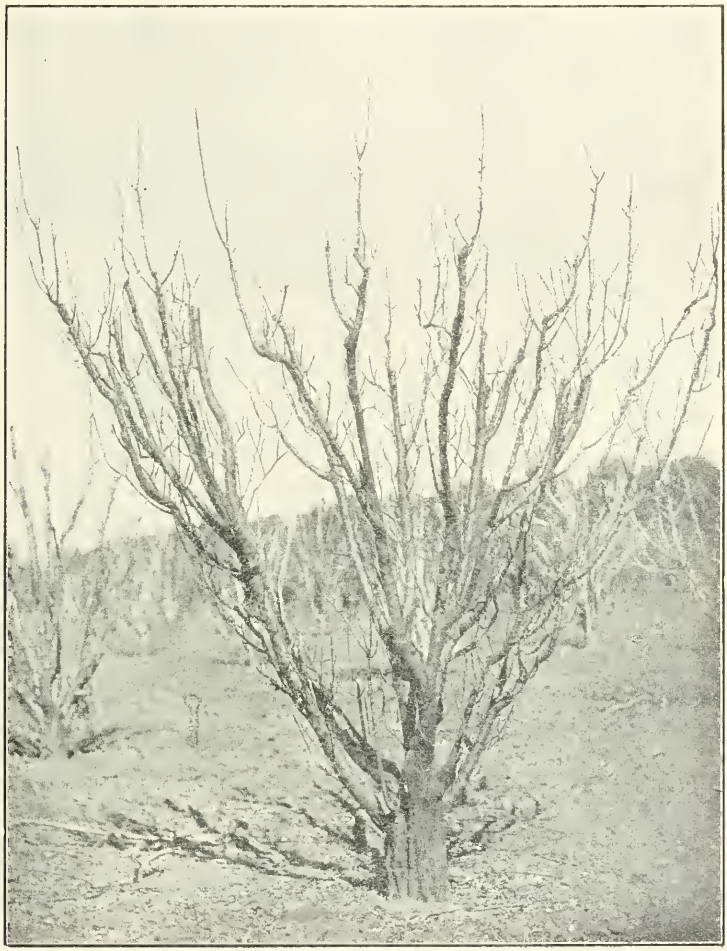


FIG. 20.—Japanese Plum "Wickson," an erect grower.

From observations it would appear that these trees are difficult to prune. One often notices trees trained as umbrellas, the centre so choked up with weak growths and dead wood that light cannot penetrate, consequently no fruiting wood is produced. The lower buds

become exhausted and perish, so that when fruit is obtained it is always high up on top of the tree. It should be remembered that

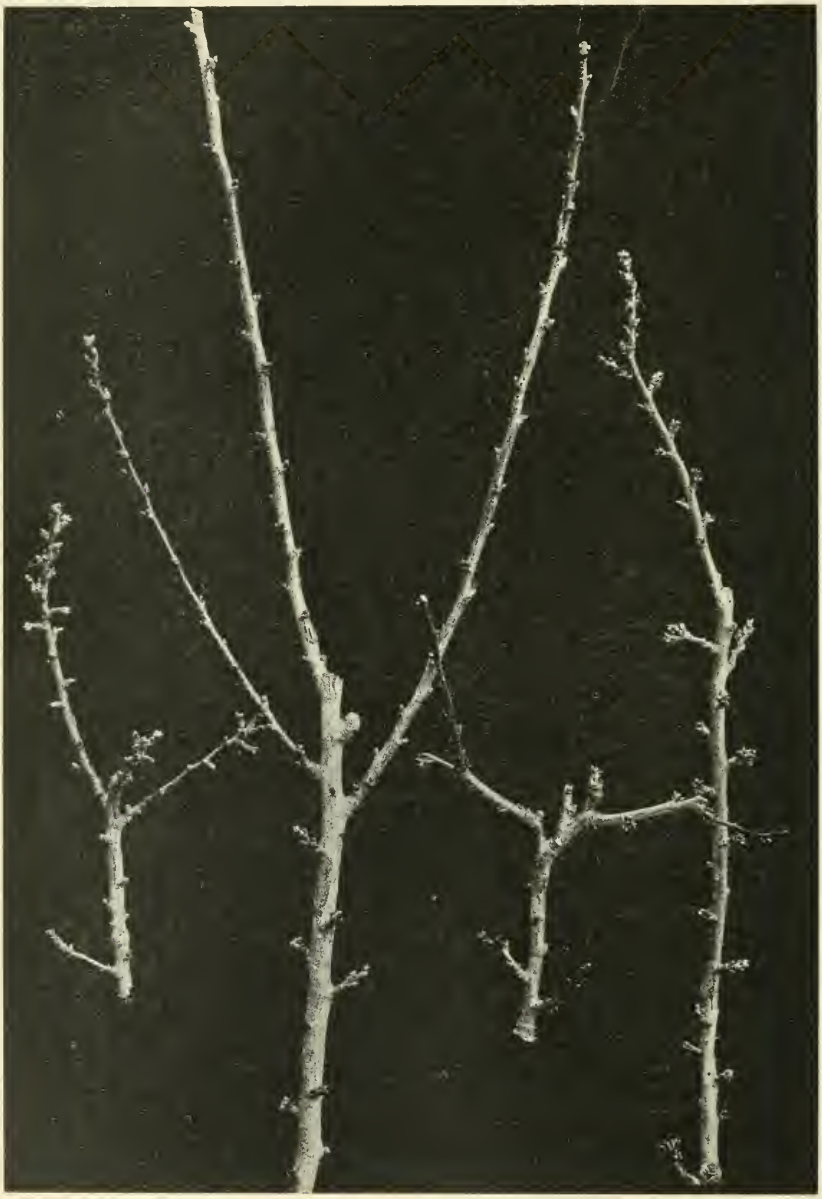


FIG.—21.—Bearing wood and spurs of Japanese Plums.

every branch needs sunlight to develop; where the top is sufficiently open so that light can enter there is less competition among the

branches than when the top is dense, consequently weak growth and dead wood are reduced. The peach bears its fruit on wood made during the previous summer. Any shoots barren of blossom buds should be cut back to their base bud to force new growth for subsequent fruiting. Laterals showing blossom buds are cut back according to their vigour and position, six, eight, or nine inches, so that

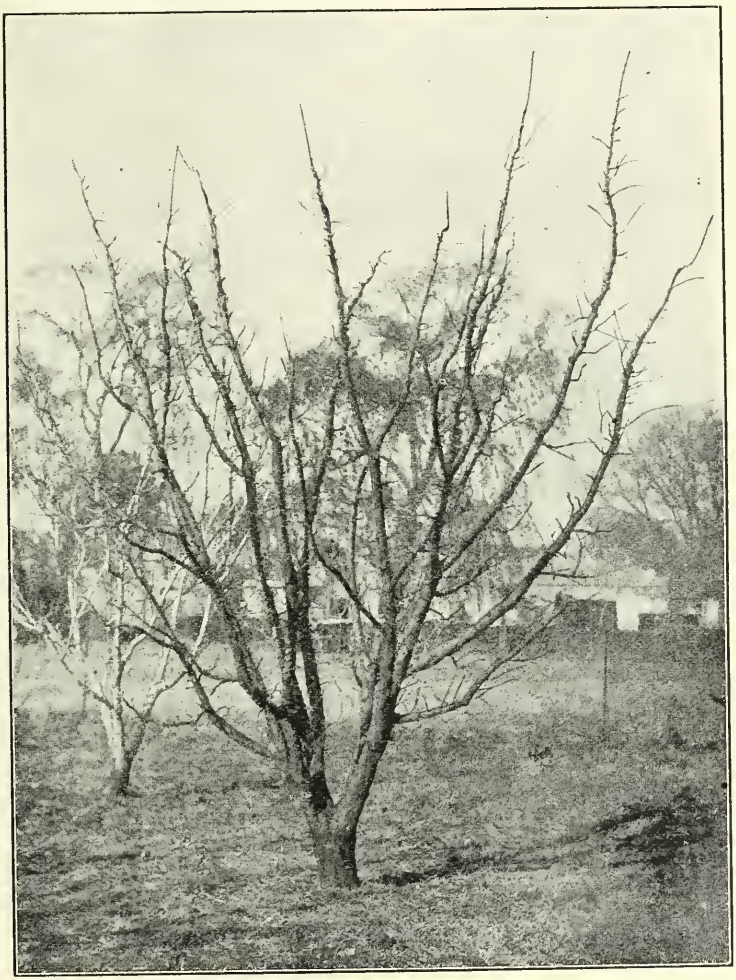


FIG. 22.—Japanese Plum, "Sutsuma."

the branches are always furnished with regular fruiting wood. All wood having previously borne fruit is removed—it is useless.

Fig. 18, showing (*a*) blossom buds, (*b*) leaf buds and manner of cutting back to base bud, (*c*) fruit spurs which are valued for immediate fruiting; varieties termed shy-bearers produce this class of wood owing to the practice of long pruning, and it only carries

fruit once; the lateral is then cut back to its base. Peach leaders should be thinned out to one at each pruning to maintain the shape of the tree, and shortened back to about half the previous season's growth. Erect, rank growths, known as water shoots, should be removed entirely from the centre of the tree. These are usually very

FIG. 23.—"Prune d'Agen."

immature (owing to the rapid growth in the late summer) and unproductive; they are, however, sometimes retained if required to replace an injured or dead branch.

Fig. 19 shows a peach which has been regularly pruned throughout its lifetime; the broad base gives ample security to the branches arising from it when loaded with fruit. The amount of fruit represented here by buds could never be brought to maturity by the tree;

the thining has to be resorted to after the crop has set. It will be noticed that the laterals are present close to the ground as well as near the top. These do not prevent constant cultivation with animals in the orchard.

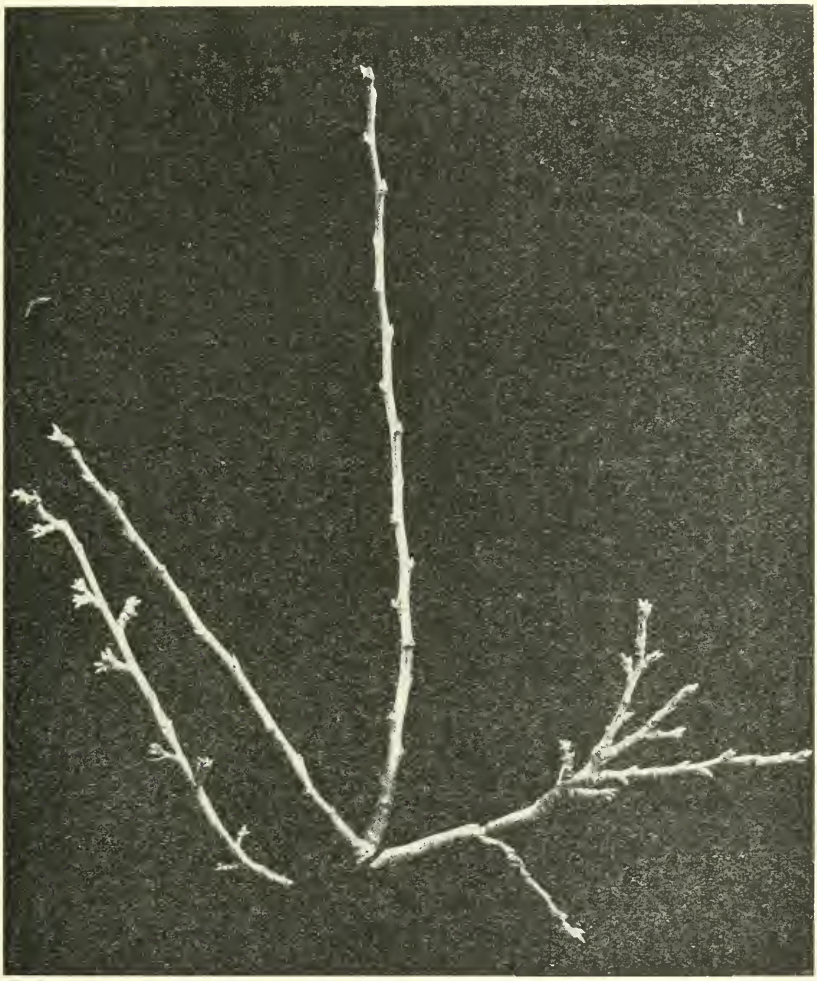


FIG. 24.—Illustrating two-year-old bearing wood (on the sides), also non-bearing wood of one year (centre) found on Domestic Plums.

THE PLUM.

The fruit is grown very successfully throughout the whole Union. The genus Prunus includes many types and hybrids, but so far growers have not given much thought to the scientific side of their culture. The Japanese hybrids have proved themselves so adaptable to our variable conditions that they are being planted to

the exclusion of all others. Generally speaking the Japanese plums are remarkable for their diversity in habit of growth; varieties such as Wickson, Kelsey, Santa Rosa, are vigorous upright growers and respond to annual pruning by developing into shapely trees; others, like Burbank Apple, are straggly growers and require special care to make strong compact trees; Botan, Red Nagate, and several others adopt a bushy habit and often require heavy pruning in some parts and light pruning in others. Owing to their rapid growth as a whole it is essential that the trees be started on correct lines from the time of planting. A short stem with a low head is the best form for the plum, as it enables the grower to keep the head of the tree open, thus minimizing the risk of creating too much density. The foliage is always very dense, so that when leaders become too numerous, preventing free access of light to the centre of the tree, plenty of barren and dead wood can be looked for. The lines suggested for building the frame of the apricot or peach are applicable to the Japanese plum —a good foundation must be obtained to withstand the strain and weight of fruit produced by these trees. About three and a half years after planting a small crop may be expected. The fruit is borne on spurs which are freely produced on the main branches and laterals older than one year; the new wood is also very productive and should be encouraged wherever possible without crowding, as spurs tend to arrest the vigour of the trees and restrict the yield as the trees get older. The leaders are annually reduced in number to retain the shape of the tree and permit light to act on the central bearing wood. The selected leaders should be cut back according to their strength and the needs of the tree; it is clearly a local matter for each pruner to decide. The laterals are shortened back to about eight inches if strong enough to carry fruit; any growths under six inches should be left uncut.

A word of warning is needed about keeping the plum tree open. When pruning, to open the top, it is *not* meant that all side growths are to be removed, otherwise the object sought for would be defeated and branches subjected to sun-scald. Japanese plums should be furnished with fruiting wood from the point where the branches leave the stem to the tip of the leader, and only annual shortening in is required to promote vigour, or a little thinning out of growth if too crowded.

Fig. 22 is a Japanese plum, "Satsuma," showing fruiting wood throughout the entire framework of the tree.

The domestic or European plum requires slightly different treatment. It cannot be said that this type of plum has given general satisfaction, still there are isolated parts where particular varieties have done well and are cultivated for reasons of association. The fruit is borne on spurs developed on wood two years old and older, and where hard cutting back of lateral growth is practised the tendency is to promote excessive growth and produce little fruit. Fig. 23 is a tree of Prune d'Agen showing long laterals with good spur development. It will be seen that the tree forms a perfect goblet; this allows of an even distribution of weight as well as permitting the fruit-bearing wood inside the tree to thoroughly mature.

The freedom with which laterals are produced throughout the tree calls for special attention to spacing and strengthening of the

main arms. The foliage of the domestic plum is never as abundant as on the Japanese plum, consequently a greater number of leaders may be retained for furnishing shade, still they should not be allowed to crowd. The same may be said of the laterals—thin out rather than cut back; only when the fruit is produced too far out from the main branches should cutting be done, and then with the object of producing new wood to develop spurs closer in to the tree.

(To be concluded in next month's issue.)

World Crops.

It is regretted that the expected cabled information from the International Institute of Agriculture, Rome, regarding the latest information on the world position of certain crops, has not yet been received, and publication is consequently delayed.

Private Training of Prospective Farmers.

The Department frequently receives applications, both from men in this country and overseas, who are prospective settlers and are anxious to gain a practical training on a private farm in the Union before taking up land. A limited number of the applicants are prepared to pay a premium to the owner of the farm, but the majority are willing to give their best services and in return expect to receive board and lodging.

In order to assist applicants as far as possible, the Department desires to compile a list of all farmers who are prepared to take pupils, and invites such farmers, therefore, to write to the Secretary for Agriculture, Pretoria, advising the number of pupils each is prepared to take and the terms and conditions under which they would be taken.

Citrus Canker: A Warning.

The embargo against the importation of citrus fruits into Australia has been lifted, though the usual quarantine regulations forbidding the entry of citrus fruit from any country where citrus canker is known to exist still remain in force.—*Australia Fruit World.*

Fruit-tree Nurseries.

Referring to the nursery inspection work of his Division during 1919-1920, Mr. Lounsbury, Chief, Division of Entomology, states that the total number of plant nurseries registered that year was 358, the same as for the previous year, and that, while the largest fruit-tree nurseries remain in the Cape Province, there are now several important and relatively high-class citrus nurseries in the Transvaal. The Cape for the year reviewed is credited with about three-fourths of the deciduous fruit trees and two-thirds of the citrus trees produced in the Union. The total acreage reported under nursery stock was 548.

THE VEGETABLE GARDEN.

April.

By H. B. TERRY, Cert. R.H.S. (Lond. and S.A.), Lecturer in Horticulture, School of Agriculture, Potchefstroom.

GARDEN crops must now be planted conveniently with a view to their being watered when necessary (except in Western Cape). Frost may be expected at any time now. Last month's notes dealt with the necessity of destroying all decaying crops to prevent harbouring insects and fungi and preparing the garden soil for spring crops; it is a general practice to leave too much to be accomplished in the spring.

BEETROOT.—A general sowing may be made.

BEANS, BROAD.—A good sowing should be made in richly manured soil; they are not averse to clayey soils. The rows should be two to three feet apart, and one foot apart in the rows.

BRUSSELS SPROUTS.—Too late to sow now on high veld, but may be transplanted. Further sowings permissible in Cape.

CABBAGE.—Sowing should be done for spring crop, using Early Jersey, Wakefield, Winningstad, Surehead, Enfield Market, Offenham.

CARROT.—The last sowing should be made to provide roots for spring. Sow Horn, Oxheart, Intermediate Stumprooted, Nantes Early.

CAULIFLOWER.—In Cape Province this may still be sown.

CELERY.—Under Cape conditions sowings may be made, and blanching should be continued elsewhere.

ENDIVE.—As a hardy succulent substitute for lettuce under severe conditions a sowing is advisable.

KNOL KOHL (KOHL RABI).—Can be sown generally.

LEEKS.—Make a good sowing in the Cape; small elsewhere. Deep well-worked soil is essential; treat similarly to onions.

LETTUCE.—A general sowing may be made; under severe frost conditions Cos varieties are to be recommended, being more hardy.

MUSTARD AND CRESS.—If sown in boxes under shade, will provide nice, succulent growths for salad.

ONIONS.—Sow in Cape and Natal; elsewhere transplant from now to June. All varieties mentioned last month may be sown.

PARSNIP.—Not suitable for high veld crop this month.

PEAS.—Sow in Western Cape and warmer parts of Natal; provide sufficient brushwood for staking the taller growing varieties.

POTATOES.—The majority of crops will be ripening from now on. Owing to the tuber moth attacking exposed tubers, do not dig out more than is required at one time. Never allow any potatoes to remain uncovered overnight.

RADISH.—These may be sown generally; germination and maturity will not be so rapid as formerly.

SPINACH.—May be sown, excepting on high veld.

TURNIPS.—Sow everywhere if water is available, as quick growth is essential; the crop matures in seven to nine weeks. Bagrada bug is troublesome on a starved crop. Superphosphate is a suitable fertilizer.

TOMATOES.—Under low veld conditions a further sowing may be made. Elsewhere keep plants off the ground and, if possible, reduce the side laterals. Should frost be experienced the green fruits may be ripened on shelves.

THE POULTRY YARD MONTH BY MONTH.

April.

By J. J. JORDAAN, Lecturer and Instructor in Poultry, Glen, Orange Free State.

Breeding Pens.—Breeding pens should be mated up. Put the hens in the runs a week or ten days before the male bird comes in, to have them settled down. Ten to twelve days after the male bird has been put in the eggs from the run can safely be considered fertile.

Incubation.—Incubation will be started in this or early in the next month. Incubators must be got out, disinfected, and placed in readiness for starting. Examine each part of the machine to see if it is in order and repair or replace any part necessary. Be sure that the machine is standing absolutely level when started, and kept so. See that there is abundance of wick in the lamp before lighting it. It will be found advantageous to soak the wick in vinegar for twelve hours and then allow it thoroughly to dry before lighting it. Test the capsule and thermometers before starting the machine. Do not put the machine in a draught, nor in a dead air corner, right up against a wall, nor where the sun can shine directly on it. See that the floor on which it stands is solid and does not vibrate. If possible fill the tank with rain water. Keep nothing else in the incubator room but the machine and accessories. Paraffin, tools, etc., must be stored elsewhere. Be as particular about keeping the incubator room clean and sweet smelling as the machine itself. Do not allow suspected broken yolk, stuck germs, eggs tested out, to remain in the room any longer than is absolutely necessary. Select for incubation only eggs two ounces and over, as even in shape, size, and colour as possible. Test for texture of shell as for fertility and discard all poor or thin shelled eggs. Remember standard size, shape, and colour are points lacking in South African eggs and this is the only way to remedy the fault. Turn eggs intended for incubation once every twenty-four hours and do not incubate any which are more than seven days old. When starting the machine, after having it thoroughly "set" and ready to receive the eggs, block up all ventilation holes and put a tablespoonful of formalin in a tin in the water-tray under the egg drawer, and then replace the drawer. Run the machine for twenty-four to thirty-six hours, then open the ventilation holes, take out the drawer, remove the formalin, and keep the machine open but lamp burning for twelve to eighteen hours, after which pack the eggs in the drawer and replace in the machine. Always endeavour to put eggs in the machine in the evening. Be sure to keep a chart of the readings of temperatures of room and machine during a hatch.

Chickens.—Brooders must be got out, overhauled, and made ready for chicks that are expected next month. Be sure to scald the drinking vessels and food receptacles used last year for chickens before using them again.

Eggs.—Stored eggs will find a ready market at good prices; but sell them as such.

Egg Production.—Force all hens and pullets for egg production, except those in recording and breeding pens. The price of new-laid eggs is worth it now.

Advertising.—Start advertising what you will have for disposal during the year. Let the people know what you have. Arrange for a standing advertisement so that your name is constantly before the public and see that the advertisement is "*catchy*" and well-worded but honest. Do not put anything in the advertisement that could arouse suspicion of sharp practice. Endeavour to book orders for later delivery.

General.—Not only is April the closing month of the poultry breeders' year, but it is the most exciting, the most interesting, and the busiest one of the year. Stock should be taken and balances struck to see what the year's profit and loss has been. The balance-sheet should be carefully scrutinized to see what savings might have been effected and can be effected in the coming year. In placing a value upon your stock do not allow sentiment or love of your birds to induce you to allot to them a higher value than they would obtain on the market (not necessarily the usual morning market). By so doing you will get a wrong impression of what your real position is. To obtain a fair estimate of the value of your stock, average the prices obtained for all birds disposed of during the preceding twelve months and value those on hand at that average price. From the first of the month records should be started of trap-nested or individually penned pullets. Do not be tempted into selling any but your surplus eggs from your breeding pen this month. Any hens going broody should be given eggs; they are useful in keeping chicks together later, but give them eggs the same time as a machine is started. All a broody hen requires is hard grain (mealies preferably), grit, and clean water to drink. Do not use young turkey hens' eggs for incubation; turkey hens should be at least two years old before their eggs are used for this purpose.

Students Spraying in Orchard, Cedara School of Agriculture.

Inspection of Imported Plants.

Mr. Lounsbury, Chief, Division of Entomology, states that during the year 1919-20 the finds of insects and evidence of disease on imported plants were few. As usual a variety of objectionable inclusions were discovered with fruit-tree stocks from France. In one consignment of 22,500 stocks, 590 plants with crown-gall swellings were taken, while several earthworms and sowbugs and many mites were also observed. In another, one of 80,000 pear stocks, there were 125 with crown-gall swellings, and a number infested with living scale insects. Some of the plants were quite badly infested. There was also a trace of woolly aphis on the roots, with several caterpillars, and a number of sowbugs, as usual. Various scale insects were found on importations from Japan, Australia, Mombassa, and Java. The importations of plants were small, largely owing to conditions brought about by the war.

NOTES FROM THE "GAZETTE."

Attention is drawn to the following matters of interest which appeared in the *Union Government Gazette*:—

(Abbreviations: "Proc."—Proclamation: "G.N."—Government Notice.)

Gazette. No.	Date.	*Items.*
1123	18/2/21	In connection with the proposed demarcation in the District of Mount Fletcher, the Chevy Chase and Thethelele Plantations have been declared to be demarcated forests. (G.N. Nos. 266 and 274.)
1123	18/2/21	Compulsory dipping of sheep and goats under the Scab Regulations and the Diseases of Stock Act has been ordered in the Districts of Umzimkulu, Mount Currie, and Matatiele for the period 1st March to 30th April, 1921; for the District of Rouxville within the period 1st March to 15th April. (G.N. Nos. 268 and 279.)
1123	18/2/21	The Minister has declared certain farms in the Transvaal to be in the Heidelberg District for the purpose of paragraph (*a*), section 16, of the Diseases of Stock Act (No. 14 of 1911). (G.N. No. 280.)
1123	18/2/21	The compulsory dipping period (scab) for the Districts of Wodehouse, Barkly East, and Elliot has been extended to the 30th April, 1921. (G.N. No. 281.)
1123 1125 1127	18/2/21 25/2/21 4/3/21	The compulsory dipping of cattle has been ordered (*a*) every three days (in the three-day dip) for portions of Zoutpansberg, Piet Retief, Barberton, and Wakkerstroom Districts; (*b*) every five days (in the five-day dip) for portions of Butterworth, Camperdown, Pretoria, Pietermaritzburg, Vryheid, Willowvale, Nqgeleni, Engcobo, Elliotdale, Umvoti, Eshowe, New Hanover, Utrecht, and Dundee Districts; (*c*) every seven days (in the seven-day dip) for portions of Heidelberg, Barberton, Pinetown, Nqamakwe, and Pretoria Districts. (G.N. Nos. 282, 322 and 356.)
1123	18/2/21	Certain piece of Crown land in the Division of Prince Albert, being portion of Bitterwater Outspan at Fraserburg Road, will be sold by public auction at Fraserburg Road, at 10 a.m., 27th April, 1921. (G.N. No. 194.) Applications will be received by the Secretary for Lands up to 18th April, 1921, for the disposal of the farm Longlands, Division of Impendhle, Natal. (G.N. No. 260.)
1127	4/3/21	The Secretary for Lands, Pretoria, advises the sale, in front of the Magistrate's Office, Paarl, at 10 a.m., Thursday, 16th June, 1921, of Crown lands in the Division of Paarl. (G.N. No. 362.)
1125	25/2/21	The Magisterial District of Rustenburg has been redivided into six Field Cornetcy Wards, the names and boundaries of which are published in Proclamation No. 29, 1921.
1125	25/2/21	The Minister has declared the District of Hoopstad a semi-protected area, and that of Mossel Bay a protected area, for purposes of the Scab Regulations. (G.N. Nos. 303 and 321.)
1125	25/2/21	The compulsory dipping period (scab) for the Caledon District has been extended to the 14th April, 1921. (G.N. No. 320.)
1125	25/2/21	Under the Stock Diseases Act no movement of cattle, other than pure-bred and grade cattle, bearing the owner's distinctive mark, will be allowed in the Rustenburg District unless bearing the registered brand of the owner. Restrictions are also placed on the movement of cattle purchased at sales. (G.N. No. 324.)

STAFF: APPOINTMENTS, TRANSFERS, ETC.

(1) AGRICULTURE.

1/2/21 *M. W. Henning*, District Veterinary Officer (Veterinary Department), transferred to Veterinary Research Division as a Research Officer (Applied Research and Routine).

14/2/21 *B. J. v. d. Vyver*, District Veterinary Officer, transferred from Umtata to Pretoria, *vice* R. Garraway, on six months' leave.

28/2/21 *W. E. Footner*, District Veterinary Officer, resigned.

25/2/21 *C. C. Froneman*, Area Sheep Inspector, Cathcart, appointed Senior Sheep Inspector, Engcobo.

1/2/21 *J. Horn*, Area Sheep Inspector, Parys, appointed Senior Sheep Inspector, Griquastad.

25/2/21 *F. J. Fuller*, Senior Sheep Inspector, Engcobo, superannuated.

(2) AGRICULTURAL EDUCATION.

1/2/21 *H. G. Rae*, Acting Lecturer in Dairying, School of Agriculture, Elsenburg, assumed duty, *vice* F. Joubert, transferred to School of Agriculture, Cedara.

15/2/21 *H. H. Cornell*, appointed Assistant Chemist, Glen School of Agriculture.

1/3/21 *G. V. Cutler*, Assistant Chemist, Glen School of Agriculture, transferred to Potchefstroom School of Agriculture.

22/1/21 *H. J. Every*, appointed Housemaster, School of Agriculture, Grootfontein.

22/2/21 *F. N. Battenhausen*, appointed Assistant Chemist, Elsenburg School of Agriculture.

26/2/21 *A. S. Canham*, who received a Government Grant to complete his studies, appointed as Lecturer in Veterinary Science at Potchefstroom.

MOVEMENTS OF OFFICERS.

Mr. P. J. du Toit, Secretary for Agriculture, left for Capetown at the end of February for attendance during the Parliamentary Session.

Mr. Melt van Niekerk, Principal Clerk, has for some time been engaged on special East Coast fever work in the Pretoria District. He personally visits and consults with the farmers, urging them to erect their own cattle dipping tanks in accordance with the East Coast Fever Regulations, failing which the work is done by contract.

Dr. Marchand, Chief, Division of Chemistry and Staff, have moved from their old quarters in Pretoria into their new quarters on the western side of Meintjes Kop and near the Union Buildings.

Mr. J. Chalmers, Government Veterinary Officer, who proceeded to Argentine in November last for the purpose of collecting information on the packing and export of meat from that country, and who subsequently visited England to study the meat trade there, has returned to South Africa. He has gathered much valuable information, and is about to visit the more important meat export centres in the Union for purposes of giving advice.

Mr. E. G. Hardy, the Assistant Superintendent of Dairying, left on leave for England on the 15th March. He will be away for about seven months, and it is expected will visit Holland for the purpose of investigating dairy matters there, more particularly in connection with the production of Gouda cheese, and to inquire into the methods obtaining in that country in regard to official milk records, having in view the possible export trade from the Union of Friesland cattle.

Mr. J. Fisher, Principal, School of Agriculture, Cedara, leaves on 21st April on a six months' holiday to Europe. Mr. E. Parish, Technical Assistant, Pretoria, will act during Mr. Fisher's absence.

Mr. E. J. Macmillan, Under-Secretary for Agriculture (Education), leaves about 15th April on a six months' visit to Canada.

THE WEATHER.

Extracts from the Monthly Report of the Chief Meteorologist for the Union.

MEAN barometric pressure lower than usual over the western half of the Union, but practically normal in the east and north-east; a mean monthly temperature one degree higher than usual on the whole, but sub-normal over the Orange Free State, Bechuanaland, and central Transvaal; an alternation of hot and cold spells, with some exceptionally warm days; "wintry" weather over the west and south-west Cape; an excess of rainfall over the western half of the Cape, with a deficiency over the east of the Cape, Free State, Transvaal, and greater part of Natal; frequent thunderstorms, a few hailstorms, and one or two destructive local windstorms, were the most noteworthy features of the weather of February, 1921.

Precipitation during the month was somewhat abnormal in distribution and character, partaking more of the nature of "winter" rains over the west and south-west than of the usual summer type. Precipitation was in excess of the normal, frequently by large amounts, over the west, south, centre, and north of the Cape Province and the western portions of the Free State and Transvaal. Surplus amounts were also registered in the north-east of the Orange Free State, in the neighbourhood of Harrismith and Lindley, the eastern portions of the Transvaal high veld, Piet Retief, and the south-central portion of Natal from Durban to Weenen. A sub-normal rainfall, on the other hand, occurred over the northern and eastern Transvaal, as well as the south-east of the high veld, the major portion of Natal, the extreme north and more easterly parts of the Free State, the more easterly parts of the northern Karroo, as well as the north-east and south-east of the Cape, including Kaffraria. The excess amounts in the Cape were commonly from 2-3 inches, particularly over the Karroo and Bechuanaland (even Namaqualand having an inch more than usual), and reaching plus 6.31 inches at Swellendam; over the Transvaal and Free State the surplus amounts were inclined to be somewhat lower, about 1½ to 2½ inches, but reaching plus 3.32 inches at Bloemfontein and 3.90 inches at Bethal; in Natal the excesses were lowest of all, in no case amounting to one inch. Over the eastern Cape the deficits were mostly less than an inch, but amounting to 3.03 inches at Port St. Johns and 2.16 inches at Umtata, both in the Transkei; in the Orange Free State the deficiencies were less than an inch, as was generally the case in Natal, except at Ladysmith and Hlabisa (Zululand), where it was between 1.25 and 1.5 inch. The shortage was generally greater in the Transvaal and Swaziland than in the other Provinces, varying mostly between 1½ and 2½ inches, but exceeding 3 inches at Mbabane.

The weather, as a whole, was close, sultry, and muggy, with thunderstorms in some parts of the Union every day of the month; as a result of this type of precipitation, the rainfall was unequal in distribution, being largely sporadic, particularly in Natal and the Transvaal, with a marked absence of those steady soaking rains so beneficial to crops. Crop reports are consequently of a rather varied nature, conditions being apparently most promising in the Rustenburg, Standerton, and parts of the Waterberg and Pietersburg Districts of the Transvaal, and parts of Natal and the centre of the Free State. Conditions generally have improved considerably over the Cape Province, but are still unsatisfactory over the greater part of Natal, Swaziland, the east of the Free State, and the greater portion of the low and middle velds of the Transvaal. Taken as a whole, the crops and veld did not promise at all well at the end of the month, having been too adversely affected by the drought of January.

THE OVERSEA MARKET.

MARKET PRICES OF SOUTH AFRICAN PRODUCE, CABLED BY THE TRADE COMMISSIONER, LONDON, ON THE 11TH MARCH, 1921.

Wool.—At the sales closed on the 5th March, 3139 bales of South African wool were offered, but, owing to the absence of American support, prices for the better sorts declined 15 per cent., and for others slightly less. The following are the prices quoted per lb.: Snow-whites, extra superior, 2s. 3d. to 2s. 9d.; superior, 1s. 11d. to 2s. 2d.; medium, 1s. 7d. to 1s. 10d.; inferior, 1s. 2d. to 1s. 6d. Grease wool, combing, long, 9d. to 1s. 4d.; medium, 6½d. to 10d.; clothing, light, 7d. to 10d.; heavy, 4½d. to 6½d. The Belgian price depends upon the London sales; no business was done owing to exchange difficulties.

Mohair.—The market remains unchanged.

Hides.—The market remains unchanged. Owing to the embargo on the export of local hides, it is impossible to sell to Belgium, where the equivalent to the South African best salted hide is being sold at 3½d. to 4d. per lb.

Skins.—At the auction on the 4th March, 540,000 Cape Merino sheep skins were offered, but only 10 per cent. sold, the demand being poor. The price, both for sound and damaged combing wool skins, was 1d. per lb. lower, and for long wool skins 2d. per lb. lower. Lambs and coarse woolled skins declined 1d. per lb. Of the common Cape glovers' sheep skins offered, only 12 per cent. were sold and at slightly lower prices than the previous sale.

Ostrich Feathers.—The sales have been postponed until April. There is a more hopeful tone noticeable owing to American inquiry.

Natal Wattle Bark and Extract.—The market is dull.

Maize.—For March-April shipments, 44s. 6d. (per quarter of 480 lb., c.i.f.) is quoted, and there is a disinclination to buy far in advance. La Plata maize, May-June shipments, are quoted at 39s.

Maize Meal.—There is little business. A small parcel was sold at £9. 5s. per ton, c.i.f., March-April shipment for Liverpool.

Cotton.—The Trade Commissioner advises that the price is low, being for Fully Middling (Liverpool standard, equal to Middling, American standard), future, 7.35d. March, 7.55d. May, 7.73d. July, 7.92d. October.

Some Farm Buildings, Elsenburg.

CROP REPORT.

February, 1921.

Maize.—The area under crop this season is estimated to be 5 per cent. less than last year's acreage, due principally to dry conditions prevailing at the usual sowing time and to a shortage of labour. According to Census statistics the actual crop reaped last year was 12,296,833 bags, but our crop correspondents reported that the return from the acreage that season was not an ordinary full (or normal) one, being considerably affected by the prevailing drought. Taking this into account, and allowing for the reduced sowings this year, it is estimated that the 1920-21 maize crop should produce 13,972,500 bags if the season proves to be a favourable one. Unfortunately, conditions have thus far been adverse, and at the end of January the crop was estimated to be 15 per cent. below normal, improving by 2 per cent. at the end of February, so that at the latter date the indications are that the originally estimated production of 13,972,500 bags (the normal yield for the acreage) will be reduced by 13 per cent.

Kaffir Corn.—Subject to the same conditions governing the maize crop, it is estimated that the area put under kaffir corn this season is 20 per cent. less than the previous season, the curtailed acreage being most marked in the Cape Province. The crop itself, unfortunately, is being seriously affected by the unfavourable weather experienced thus far during the growing season, and at the end of January the crop was estimated to be 18 per cent. below normal in condition. There was no improvement during February, the average crop condition for the Union still being 18 per cent. below normal. Both in respect of maize and kaffir corn, the Orange Free State crops are, on the whole, suffering most from adverse climatic conditions.

Tobacco.—The acreage planted out is reported to be smaller than that of last season's by 10 per cent., Rustenburg, the largest producing district of the Union showing a falling off of 15 per cent. The weather thus far has also been a retarding factor and, instead of an ordinary full crop being reaped, indications at the end of January pointed to a crop 17 per cent. below normal. There was, however, a marked recovery during February and, at the end of that month, the tobacco crop of the Union was estimated to be 7 per cent. below normal.

Sugar-cane.—The 1919-20 season was estimated to have produced 190,000 tons of sugar, a record for the Union, but the output during the current season is expected to be 140,000 tons as against an estimated consumption of 160,000 tons, so that the balance will need to be imported.

Plant Nurseries in Quarantine as at 1st March, 1921.

Name of Nurseryman.	Address.	Cause of Quarantine.	Extent of Quarantine.
Mrs. A. W. Godwin ...	Durban	Red scale, *Dictyospermi*, *Eriococcus araucariae*	Palms, Araucarias, Roses.
D. A. English & Co. ...	Pietermaritzburg	Red scale ...	Portion of citrus.
Municipal Nursery ...	St. George's Park, Port Elizabeth	*C. ficus*	Palms.
F. Grace	Berlin, C.P. ...	Red scale ...	Portion of citrus.
P. Gaylard	" ...	" " ...	" " "
J. Hobson & Co. ...	Kingwilliamstown	" " ...	" " "

LOCAL MARKET PRICES.

RATES OF AGRICULTURAL PRODUCE AND STOCK RULING AT THE 15TH MARCH, 1921.

CENTRE.	Wheat. Per 200 lb.		Wheat Flour. Per 100 lb.		Boer Meal. Per 200 lb.		Mealies. Per 200 lb.		Mealie Meal. Per 180 lb.		Barley. Per 150 lb.		Oats. Per 150 lb.		Oat-hay. Per 100 lb.		Lucerne Hay. Per 100 lb.		Potatoes. Per 150 lb.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Cape Province—																				
Aliwal North....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	15 0	15 0
Beaufort West...	35	40 0	32 6	5 0	42 0	42 6	18 0	19 0	20 0	21 0	21 0	22 6	14 6	15 6			5 0	6 0	20 0	21 0
Capetown.....	29 3	30 0	—	—	—	—	11 6	12 0	—	—	17 0	17 6	8 0	9 0	3 11	4 0	4 0	5 0	9 0	17 0
East London....	—	—	—	—	—	—	1 0	20 0	—	—	—	—	—	—	—	—	—	—	7 6	21 9
Grahamstown....	—	—	—	—	—	—	18 0	20 0	—	—	—	—	—	—	7 6	8 6	5 0	5 6	11 3	26 6
Kimberley.....	2 6	35 6	32 0	34 0	49 0	50 0	12 9	13 9	13 6	15 0	20 6	23 6	12 6	14 6	6 6	7 6	6 0	7 0	2 0	25 0
Kingwilliamstown	—	—	—	—	—	—	16 6	17 0	—	—	—	—	—	—	8 0	9 0	6 6	6 6	4 6	12 0
Port Elizabeth...	—	—	—	—	—	—	13 0	17 0	—	—	12 9	17 3	—	—	3 9	5 9	3 6	4 6	4 6	15 9
Queenstown.....	30	33 0	40 0	41 0	39 0	40 0	16 6	17 6	20 0	2 0	22 6	23 6	16 6	17 6	6 6	7 6	5 0	6 0	10 0	12 6
Natal—																				
Durban.....	—	—	—	—	—	—	10 6	14 0	10 0	13 6	—	—	—	—	5 0	7 6	3 6	7 0	8 0	17 0
Pietermaritzburg.	—	—	—	—	—	—	11 6	11 9	—	—	—	—	—	—	6 0	6 6	7 0	7 6	6 0	7 6
Orange Free State—																				
Bloemfontein....	29 6	33 0	36 6	40 0	52 6	57 6	12 6	16 0	14 6	22 0	16 0	25 0	12 6	16 0	5 0	7 0	4 6	6 6	4 0	12 0
Harrismith.....	27 6	30 0	30	30 0	58 0	58 0	9	10 6	2	2	6 0	16 0	12 0	13 0	5 0	5 0	—	—	7 6	11 0
Transvaal—																				
Pretoria.....	36 6	39 0	—	—	—	—	10 3	12 6	—	—	—	—	9 6	9 6	5 4	6 11	—	—	6 3	15 0
Johannesburg....	26 3	26 3	—	—	—	—	9 3	12 3	12 0	12 6	20 0	20 6	11 0	11	3 0	7 9	3 6	6 0	4 3	12 6

CENTRE.	Onions. Per 120 lb.		Tobacco (Boer Roll). Per lb.		Beans. Per 200 lb.		Beef. Per lb.		Mutton. Per lb.		Fresh Butter. Per lb.		Eggs. Per dozen.		Cattle (Slaughter). Each.		Sheep. Each.		Pigs. Each.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	£ s. d.	£ s. d.	s. d.	s. d.	s. d.	s. d.
Cape Province—																				
Aliwal North..	—	—	—	—	—	—	0 10	0 10	0 6	0 9	1 3	1 3	2 0	2 6	—	—	—	—	—	—
Beaufort West...	10 6	10 0	1 3	1 6	45 0	90 0	0 9	1 4	0 9	0 10	1 9	2 0	2 6	2 6	6 0 0	12 0 0	20 0	30 0	40 0	200 0
Capetown.....	5 0	10 0	0 9	1 2	64 0	90 0	0 10	1 3	0 9	1 2	1 6	2 0	1 9	2 6	16 0 0	18 0 0	32 0	34 0	40 0	80 0
East London....	10 9	17 0	—	—	30 0	33 9	—	—	—	—	1 0	2 1	1 4	3 11	—	—	—	—	—	—
Grahamstown....	12 0	19 2	1 3	1 6	36 0	50 0	0 4	0 11	0 9	1 0	1 3	1 9	2 0	3 4	—	—	—	—	—	—
Kimberley.....	7 0	17 0	0 5	1 2	20 0	60 0	0 6	1 0	0 8	0 11	0 11	2 1	1 2	3 5	12 10 0	16 0 0	20 0	25 0	*0 3½	*0 7
Kingwilliamstown	10 0	18 0	—	—	21 0	40 0	0 6	0 9	0 9	0 10	1 3	1 7	1 5	2 4	—	—	—	—	—	—
Port Elizabeth...	6 0	12 3	—	—	23 0	80 0	0 8	1 0	0 9	1 0	1 0	2 0	1 6	3 5	—	—	—	—	30 0	100 0
Queenstown.....	16 6	18 6	0 9	1 0	40 0	45 0	0 6	0 9	0 5	0 8	1 3	1 6	1 9	2 10	12 0 0	18 0 0	16 0	20 0	*0 4	*0 6
Natal—																				
Durban.....	16 0	16 0	—	—	28 0	48 0	0 3	0 7	0 5	0 8	1 8	2 9	2 0	4 9	—	—	—	—	—	—
Pietermaritzburg.	—	—	—	—	—	—	0 4½	0 7	0 7	0 11	2 3	2 9	2 6	3 0	—	—	—	—	—	—
Orange Free State—																				
Bloemfontein....	10 0	18 0	0 6	1 0	30 0	45 0	0 9	0 11	0 9	0 11	1 0	2 0	1 6	2 9	14 0 0	20 0 0	17 6	25 0	*0 8	*0 9½
Harrismith.....	7 6	15	—	—	—	—	0 6	0 10	0 6	0 10	1 4	2 3	1 9	2 6	5 0 0	15 0 0	8 0	20 0	5 0	30 0
Transvaal—																				
Pretoria.....	11 6	12 6	—	—	22 6	24 6	3·9d.	5·4d.	0 5	0 6¾	1 6	1 9	2 5	3 6	3 10 0	17 0 0	12 9	32 6	*0 5½	*0 8
Johannesburg....	4 0	10 0	0 3½	0 3½	12 0	50 0	†25 0	†45 0	0 5½	0 6½	1 3	1 9½	2 0	3 9	6 10 0	18 0 0	9 0	28 0	*0 3	*0 9½

* Live weight per lb. † Dressed weight, including hides, offal, etc., per 100 lb.

NOTE.—The rates quoted for produce sold in bags include, as a general rule, an additional 3 lb. for weight of bag.

THE LOCAL MARKET.

Position at Mid-March, 1921.

(NOTE.—The local market prices of certain other agricultural produce and stock are published elsewhere in this issue.)

WOOL.

THE market is again practically at a standstill and no business worth mentioning is being done. Since our last report American buyers, having filled their orders, have ceased to operate. In view of the fact that the new American tariff will come into force immediately it has been passed by Congress (which is expected to take place some time in April), it is doubtful whether American buyers will resume placing orders on the South African market.

There is no competition on the part of Bradford and Continental buyers at present. The prices given below must therefore be regarded as nominal quotations, viz. :—

	per lb.
1. Extra super combing, 12 months', skirted, choice	14d.
2. Superior combing, 12 months', skirted	12d.
3. Superior combing, 12 to 14 months' growth, skirted, deep stapled ...	12d.
4. Good average combing, 12 months' growth, skirted	10d.
5. Superior combing, 10 to 12 months' growth, skirted	10d.
6. Average combing, 10 to 12 months' growth, skirted	8d.
7. Extra super medium, 8 to 10 months', well skirted	8½d.
8. Superior medium, 8 to 10 months', skirted	7½d.
9. Average medium, 8 to 10 months'	6d.
10. Superfine shorts, 8 months' and less, skirted	7½d.
11. Good average shorts, 8 months' and less, skirted	7d.
12. Average shorts, 8 months' and less	6d.

MOHAIR.

The market remains inactive and business is very quiet. The following nominal quotations are given :—

	per lb.
1. Super summer kid	20d.
2. Average summer kid	17d.
3. Super summer firsts	12d.
4. Good average firsts	10d.
5. Good mixed hair	9d.
6. Ordinary mixed hair	8d.
7. Winter hair	7d.
8. Good winter kid	16d.
9. Summer locks	4d.
10. Winter locks	3d.

HIDES AND SKINS.

There is very little demand for hides and skins, and prices have declined by from 5 to 10 per cent. Damaged and inferior skins are practically unsaleable.

The following prices are quoted :—

HIDES.

	per lb.
Sun-dried, sound	6½d.
Sun-dried, damaged	4d.
Sun-dried, fourths	1d.
Dry salted, sound	6d.
Dry salted, damaged	4d.
Dry salted, fourths	1d.

SHEEPSKINS.

	per lb.
Sound, long woolled	4d.
Damaged, long woolled	2½d.
Short woolled, sound	2d.
Short woolled, damaged	1d.
Pelts, sound	2d.
Pelts, damaged...	½d.

GOATSKINS

	per lb.
Light	9d.
Sun-dried	7d.
Heavy	6d.
Damaged	2d.
Bastards	6d.
Angora, light	4½d.
Heavy and sun-dried	3½d.
Shorn	2½d.

OSTRICH FEATHERS.

The following particulars are furnished by Messrs. Dunell, Ebden & Co.:—

Four sales were held at Port Elizabeth during February, 1921, the total weight of feathers sold being 20,296 lb., which realized £32,548. Prices at the beginning of the month were practically the same as for January, but improved slightly towards the end, especially in respect of the better quality of feathers. The impending changes in the American Import Tariff, may be the cause of this improvement.

London sales were again postponed until early April—the reason being that American buyers have not yet arrived in London and that Continental dealers are hampered by the exchange problem.

Students Cultivating Potatoes, Potchefstroom School of Agriculture.

Meat Statistics.

EXPORTS.

	February, 1921.	Total for Period 1st Jan., 1921 to 28th Feb., 1921.
Beef (quarters)	286	723
Pork (carcasses)	1,139	1,592
Bacon and Ham (lb.)	8,200	42,334

CATTLE IMPORTED FROM ADJOINING TERRITORIES.

For Slaughter	2,995	6,556
For Breeding	163	240

SUMMARY.

Calendar Year.	Beef Exported.	Cattle Imported from Adjoining Territories for Slaughter and Breeding.
	Quarters.	No.
1916	115,992	26,580*
1917	309,211	53,410
1918	123,354	50,053
1919	285,367	57,267
1920	69,885	89,135

* 1st July to 31st December only.

RECENT AGRICULTURAL LITERATURE.

SELECTED LIST OF BOOKS ADDED TO THE DEPARTMENT'S LIBRARY.

[NOTE.—The first number is that of the class to which the book belongs; the last number is that of the book itself.]

GENERAL.

018 Sanborn, H. N. League of Library Commissions. Chicago, 1916. No. 7428.

040,68 S.A. Railways and Harbours, Publicity Department, Johannesburg. Travel in South Africa. London, 1921. No. 7441.

320 Baines, E. T. Pisé de Terre Construction. Johannesburg, 1920. No. 7435.

352 Cooper, Madison. Practical Cold Storage. 2nd Edition. Chicago, 1914. No. 7439.

361 Hannemann, E., and Kasack, Dr. Ziekenvoedsel—Recepten. Haarlem, 1909. No. 7437.

AGRICULTURE, LIVE STOCK, AND ALLIED SUBJECTS.

400,68.2 S.A. Railways and Harbours, Publicity Department. Farming Opportunities in the Union of South Africa, in 12 Parts, entitled as follows:—

Apple Growing; Dairying; Does Farming Pay?; Fruit; Maize Growing, Orange Growing; Poultry Farming; Ranching; Sheep; Sugar Growing; Cotton Growing; Viticulture. Suffolk, n.d. No. 7452.

412,42 Great Britain, Government of. Agriculture Act, 1920: An Act to Amend the Corn Production Act, 1917, and the Enactments Relating to Agricultural Holdings. (10 and 11, Geo. 5, Ch. 76.) London, 1920. No. 7424.

412,73 U.S.A. Department of Agriculture, Office of the Solicitor. Laws Applicable to the United States Department of Agriculture. Washington, 1913. No. 7427.

430.7 First World's Poultry Congress. Regulations of the World's Poultry Exhibition to be held 6th-13th September, 1921, at the Hague-Scheveningen on Occasion of the World's Poultry Congress. Floralia-Assen, 1921. No. 7422.

430.7 First World's Poultry Congress. Preliminary Programme of the First World's Poultry Congress, to be held under the High Patronage of their Majesties the Queen and the Queen-Mother of Netherlands at the Hague-Scheveningen, 6th-13th September, 1921. Assen, 1921. No. 7423.

431 Clayton, Wm. Margarine (Monographs of Industrial Chemistry). London, 1920. No. 7431.

431 Dean, Henry. Canadian Dairying. 5th Ed. Rev. Toronto, 1920. No. 7426.

465,67.6 Tanganyika Territory, Governor of. An Ordinance for the Regulation of the Cultivation and Sale of Cotton. Dar-es-Salaam, 1920. No. 7434.

466 Wuthrich, E. The Selection of Sugar-cane on Scientific Lines. Durban, n.d. No. 7453.

473 Fenzi, Dott, E.O. Frutti Tropicali E. Semitropicalo. (Esclusi gli Agrumi.) Firenze, 1916. No. 7440.

475 Robinson, W. Home Landscapes. London, 1920. No. 7429.

477 Baker, R., and Smith, H. G. A Research on the Eucalypts and their Essential Oils. Sydney, 1920. No. 7433.

477,42 Monteath, R. Miscellaneous Reports on Woods and Plantations. Dundee, 1827. No. 7442.

SCIENCE (GENERAL), PHYSICS, CHEMISTRY, GEOLOGY, ETC.

540.1 Molinari, Dr. E. Treatise on General and Industrial Organic Chemistry. London, 1921. No. 7430.

544 Morrell, R. S. Rubber, Resins, Paints, and Varnishes (Industrial Chemistry). London, 1921. No. 7448.

BIOLOGY, ZOOLOGY, BOTANY, MEDICINE, ETC.

600 Henderson, I. and W. A Dictionary of Scientific Terms. Edinburgh, 1920. No. 7425.

630.1 Sherrington, Ch. The Integrative Action of the Nervous System. London, 1916. No. 7451.

630.2 Droogleever, Fortuyn, Dr. B. Vergleichende Anatomie des Nervensystems. Haarlem, 1920. No. 7447.

671 Weaver, J. E. The Ecological Relations of Roots. Washington, 1919. No. 7448.

671.6,68 Bews, J. W. Some General Principles of Plant Distribution as Illustrated by the South African Flora. (Pamphlet) 1921. Nos. 7443 and 7446.

671.6,68 Bews, J. W. The Mont-Aux Sources National Park. N.d. No. 7444.

Lincoln Red-Shorthorn Herd, Potchefstroom School of Agriculture.

Outbreaks of Animal Diseases: February, 1921.

Disease.	Transvaal.	Natal.	Cape.	Orange Free State.	Transkei.	Total. February, 1921.	Total. January, 1921.
East Coast Fever	13	13	—	—	14	40	18
Mange	2	1	4	1	—	8	10
Anthrax	79	12	23	31	53	198	182
Dourine	—	—	2	—	—	2	1
Glanders	—	1	—	—	—	1	3
Epizootic Lymphangitis ...	—	—	2	—	—	2	1
Tuberculosis	—	—	—	—	—	—	—
Lungsickness	—	—	—	—	—	—	—

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PRINCIPAL CONTENTS.

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CONTENTS.

MAY, 1921.

Departmental Notice.

GOVERNMENT GUANO.

An allotment of guano will be made early in July next. The quantity which will be available for disposal will be about 1500 tons, and its distribution will be limited to bona fide farmers and gardeners only within the Union who are requiring supplies for use during the period July, 1921, to January, 1922, inclusive.

Applications must be made on the *prescribed form*, obtainable from the Superintendent, Government Guano Islands, 69 Strand Street (P.O. Box 251), Capetown, and these will be received and booked up to and including noon on Monday, the 30th May, 1921, after which date no further applications will, under any circumstances, be accepted or entertained in respect of this allotment.

Applicants are warned that, in making applications for guano, the purposes for which this fertilizer is required must be distinctly stated on the form of application, and that *only the quantity actually needed for those purposes must be asked for, as all inflated orders will be liable to be disallowed.*

No application will be accepted or considered from any person who is not actually farming on his own account, and only one application will be accepted in respect to any one farm, portion of a farm, or group of farms under one ownership, or partnership, as the case may be.

All applications must be signed by the individuals requiring the guano, and in no case will this fertilizer be supplied or consigned to any persons other than those for whose use it is actually required.

The price of guano will be £10 per ton of 2000 lb. or 20s. per bag of 200 lb., including bags, and delivered on rail at Capetown, or on board ship in Table Bay Docks, but no remittances will be accepted until after allotments have been made.

Railage in all instances is payable by the consignee and must be prepaid where guano is to be consigned to railway sidings.

All inquiries and applications for guano must be sent direct to the Superintendent, Government Guano Islands, Capetown.

P. J. DU TOIT,
Secretary for Agriculture.

AGRICULTURAL SHOW SEASON, 1921.

List of Agricultural Shows, compiled from details furnished by the Agricultural Unions, still to be held.

CAPE PROVINCE.

East London—4th and 5th May.

Komgha—6th and 7th May.

TRANSVAAL.

Pietersburg—24th, 26th, and 27th May.

Pretoria—31st May, 1st and 2nd June.

Barberton—10th June.

Rustenburg—15th June.

NATAL.

Dundee Agricultural Society (Dundee)—14th and 15th June.

Vryheid Agricultural Society (Vryheid)—7th June.

Klip River Agricultural Society (Ladysmith)—12th and 13th July.

Umvoti Agricultural Society (Greytown)—14th and 15th June.

Weenen Agricultural Society (Estcourt)—16th and 17th June.

Royal Agricultural Society (Maritzburg)—21st, 22nd, 23rd, and 24th June.

Newcastle Agricultural Society (Newcastle)—29th and 30th June.

Richmond Agricultural Society (Richmond)—13th and 14th July.

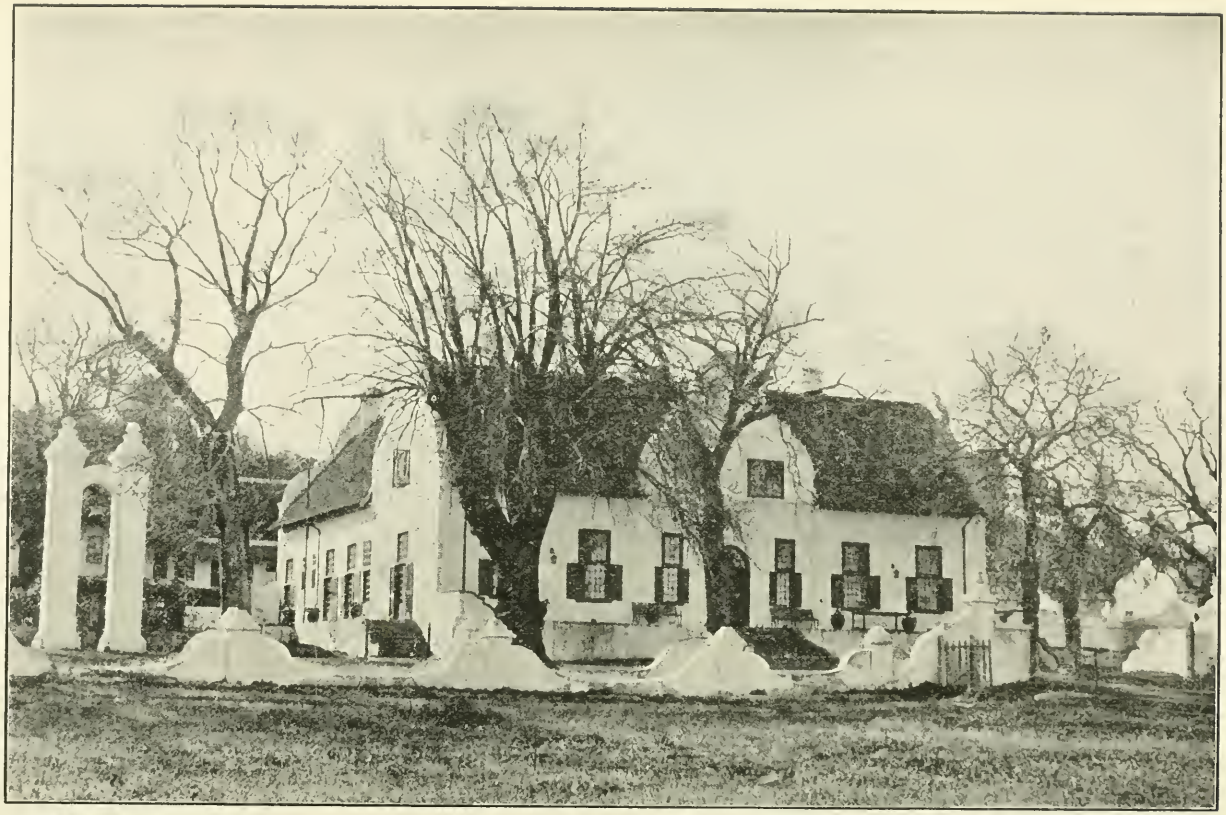
Victoria County and North Coast Agricultural and Industrial Society (Stanger)—14th July.

Dronk Vlei Agricultural Society—27th July.

Camperdown Agricultural Society (Camperdown)—20th July.

Ixopo Agricultural Society (Stuartstown)—7th July.

Alexandra County Agricultural Society (Umzinto)—15th July.



THE MANOR HOUSE, ELSENBURG SCHOOL OF AGRICULTURE.

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VOL. II. MAY, 1921. No. 5.

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Editor: G. W. Klerck.

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NOTES.

Turkish Tobacco.

It is estimated that the Union's 1920-21 crop of turkish tobacco will yield approximately 750,000 lb. The ruling prices for this class of tobacco range from 1s. to 2s. 9d. per lb., according to quality, but the large bulk of our production is fetching a price of about 2s. 3d. per lb., so that this section of the Union's agricultural industry, one confined solely to the western districts of the Cape Province, may be estimated as being worth nearly £85,000 this year. And it is a comparatively young industry. That the possibility of successfully cultivating turkish tobacco in South Africa had been thought of by individuals, and that in the course of time its introduction was ultimately certain, there can be no doubt, but it is an interesting fact that the inception of the industry in this country was due to a fortuitous circumstance. It was in 1903 that Mr. L. M. Stella, the well-known turkish tobacco expert in the Department, who was at that time farming near French Hoek, received a letter from a friend in Turkey containing a small quantity of tobacco seed of the Soulook variety. The envelope with the seed was put away and, in the many duties falling to the share of the farmer, forgotten. When the envelope was first opened, however, a few seeds happened to fall in the garden in front of the homestead. These seeds germinated, and, though very late in the season, Mr. Stella, who had experience with the industry in Turkey, was so taken up with the possibility of growing the tobacco locally as a remunerative enterprise that he managed to obtain forty plants from the seeds accidentally sown, which were planted out and eventually grew up, and matured.

This success, though small in itself, was the first fruits of the present expanding industry. Convinced of success, Mr. Stella obtained a further quantity of seed from Turkey, and with this he laid down, in 1904, the first experiment with turkish tobacco—so far as is known—in the Cape Colony. The experiment was successful, two acres of sandy loam producing nearly 1000 lb. of tobacco. Having demonstrated the possibilities of the plant, Mr. Stella came in touch with the Cape Department of Agriculture, and as a result of the negotiations which followed, his services as an instructor were obtained by the Government (in whose service he still remains), and the first supervised experiments were conducted under his supervision in 1906. From then the industry has steadily progressed. In 1908 we produced 10,000 lb.; in 1909, 16,000; in 1910, 56,500 lb.; and to-day our output is three-quarters of a million pounds. And throughout the infancy of the industry Mr. Stella's unceasing energy did much to steer it past all obstacles, and, together with the other officers of the Tobacco and Cotton Division as constituted to-day, he is still engaged in fostering the interests of those engaged in turkish tobacco growing.

Owing to the sensitiveness of the plant, tobacco culture is a highly specialized class of farming, being an operation requiring constant watchfulness from its inception to the time that it finally reaches the consumer, and before the latter is reached many steps, involving as many dangers, have to be taken. The Department has issued a good deal of literature on the subject, and we publish in this number an article on "Curing of Turkish Tobacco" by Mr. Koch, the Manager of the Elsenburg Tobacco Station, who is taking a prominent part in advancing the industry. This step of the process of tobacco culture calls for much experience and judgment, and Mr. Koch sets out very clearly the correct treatment of the leaf from the time of harvesting to the final stage of curing. Turkish tobacco growers are advised to study the article carefully, for while much progress is being made in the development of the industry, much has still to be achieved, and, among other things, the present methods in vogue in curing must be improved if growers wish to hold their own as competition becomes keener. And competition has to be expected.

Up to the present local production has fallen short of the demand, but turkish tobacco growing has recently been taken up on a large scale in Rhodesia, where it is reported that this season something like 500,000 lb. of this variety of tobacco will be produced. This is a factor to be considered by the local grower. When the market in this country is fully supplied, an outlet will need to be looked for overseas, and this market has not yet been tested to any extent. That the London market can absorb most of our surplus for some years to come is very likely, especially where the better grades of turkish tobacco are concerned, but it is a trade which has still to be developed, and it is with a view to the future that the grower must endeavour to produce an article of such quality that it will command a remunerative price in competition with the produce of other countries, and ensure that turkish tobacco growing will continue to be the profitable enterprise it now is. As an aid to this end Mr. Koch's article will be valuable, for improvement, the author says, "cannot be accomplished intelligently unless the scientific principles underlying the subject are thoroughly understood."

Restriction on Imports of Maize and Barley.

The public is reminded that, by virtue of Proclamation No. 33 of 31st January, 1920, a permit is necessary for the introduction of any maize or barley into the Union from oversea and, incidentally, from any part of South Africa outside the Union, except Southern Rhodesia, Bechuanaland Protectorate, Basutoland, and Swaziland.

Permits are given only in respect of such seed intended for *sowing*, and it has been decided that no permit shall be given to enable any person to import in any one calendar year more than ten pounds of the seed in any one variety. Any seed admitted has to be disinfected, under the supervision of an officer of the Department, by immersing it for fifteen minutes in a one-tenth of one per cent. water solution of mercuric bichloride. A disinfection fee of 2s. 6d. per hundred pounds or part thereof is charged.

Applications for permits should be addressed to the Chief, Division of Entomology, Box 513, Pretoria; each should state the name of the variety, the country of origin, the quantity desired, the port through which it would arrive, and the full name and address of both the proposed consignor and consignee.

Spineless Cactus Propagation.

To meet our constantly recurring droughts, the importance of providing reserves of fodder for stock is increasingly being brought home to the farmer, and, as a means to this end, many have in the past found prickly pear to be of considerable value. But the spines make it most difficult of handling, and are harmful also to the animals that eat them. These disabilities in a most useful fodder plant have been overcome, however, by selection and breeding, and the spineless varieties thus produced give every promise of becoming one of the foremost means, in parts of the Union, of safeguarding the stockowner against the onslaughts of drought. In particular the Karroo areas will benefit greatly by the establishment of the spineless cactus, and in this connection it is interesting to learn that experiments with the plants under Karroo conditions at the Grootfontein School of Agriculture, Middelburg, Cape, have been very satisfactory, and the following information obtained from Mr. Donkin, the experimentalist there, will prove very useful at the present time to those farmers who desire to propagate the spineless cactus as an insurance against seasons of drought and as a reliable fodder crop generally.

The feeding value of spineless cactus, Mr. Donkin states, is very low, and is approximately the same as "prickly pear," both having about 90 per cent. of water, a low crude fibre content (4 per cent. at most), ash 1 to 2 per cent., protein up to 1 per cent., fat about ½ per cent., and carbohydrates about 3 per cent. Its great value to the stockman lies in the permanency of its plants: it is always there even in times of protracted drought. Further, it is palatable, and stock can subsist on it without additional water. It grows successfully under conditions of low rainfall, needing only a good start in life. Its resistance to frost may be judged from the fact that only

two varieties (*Anacantha and Coccinillifera*) were badly frost-bitten at Grootfontein during the winter of 1920, when 17 degrees frost were registered above ground.

The two following methods of propagating have been tested extensively at Grootfontein; the first of them is recommended:—

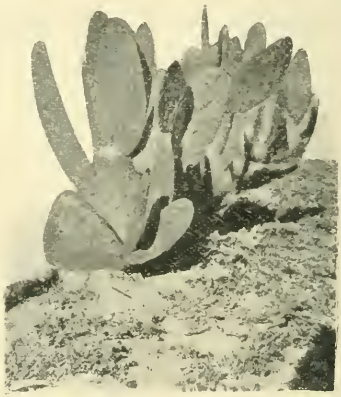
(1) The leaf is placed flat on the ground and a spadeful of soil is placed on the top of it (this is necessary to keep the leaf firmly fixed).

(2) The leaf is placed in the ground to the depth of about one-third of its length, the cut end being placed downwards.

The great objection to No. 2 method of planting leaves is that they frequently decay. Decay of the leaf has never been noticed when No. 1 method was used in planting, which also has the advantage that the roots strike out over a larger area and in an approximately circular manner, with the result that the plant is very firmly fixed.

Spineless Cactus Propagation.

FIG. 1. Method I. Roots have been cut off.



Spineless Cactus Propagation.

FIG. 2.—Method I. Leaves three months old.

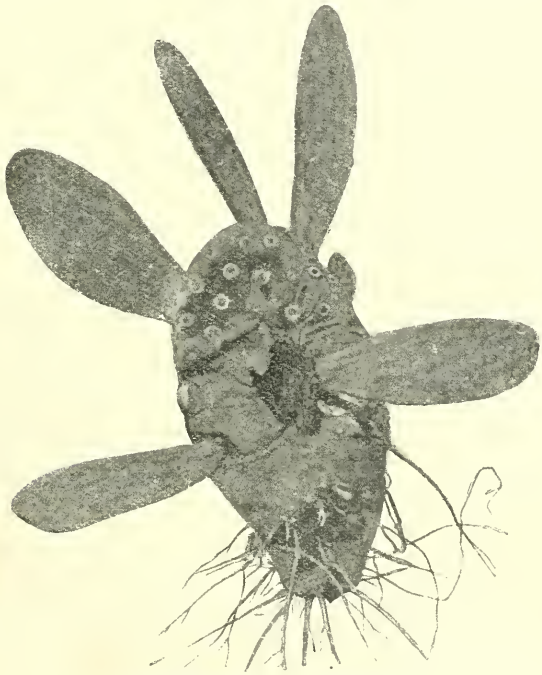
It would seem to be the general opinion that leaves should be cut several months before they are planted. To do so is not only unnecessary, but harmful, as the leaf begins to grow much sooner if it is freshly picked and has not been allowed to wilt before planting. Experiments carried out at Grootfontein during the spring of 1919, showed that leaves cut and planted at once gave better plants and fewer failures than when cut at intervals up to two months previous to planting; all the leaves used were of the same age and size, and from the same parent tree.

It has been found that for nursery purposes, planting 3 feet apart is suitable, but for permanent plantations 8 feet apart is satisfactory.

It is unnecessary to state that the best results are obtained where soil is well prepared, kept free of weeds, and the young plants given a good start.

September is the best time to start plantations in areas where frosts occur, because the older the young plant is when it experiences the first frosts, the better it withstands them.

Observations at Grootfontein showed that resistance to frost is to a great extent a matter of size and maturity. Well-grown mature leaves resist frost much better than poorly grown or young leaves. Although September in any area would seem to be the best month for



Spineless Cactus Propagation.

FIG. 3.—Method II. Moisture from irrigation water has entered the cut and decayed the plant.

planting (for this is the period when leaves are naturally inclined to start growing) plantations may be started at any period of the year in districts where frost is a factor of no account. As indicating the rapidity of growth obtained under Karroo conditions, it may be stated that at Grootfontein there have been plants 14 months' old with as many as 60 leaves.

Literature on the subject of spineless cactus as a fodder for stock has already been published by the Department, and further information on the subject is now being prepared for publication at an early date.

The Deterioration of Sugar in Storage.

The investigation of fungi and bacteria in their relation to the sugar industry has, for the past three years, been receiving the study and research of Dr. P. van der Bijl, of the Division of Botany, and his staff, at the Natal Herbarium, Durban.

The fungi responsible for disease in cane have been dealt with in a number of departmental publications, and in the February, 1921, number of the *Journal* a résumé was published of the diseases of sugar cane known in Natal and Zululand ("Notes on Some Sugar Cane Matters").

To the sugar industry fungi are, however, of further importance, for many of the common moulds are responsible for the deterioration of sugar during storage. In the Department's Science Bulletin No. 12,* Dr. Van der Bijl deals with the part played by fungi and bacteria in this deterioration, and the results of his further investigations into the matter have now been published in Science Bulletin No. 18.† While the investigation is being further pursued, it may be mentioned that the two bulletins referred to give the most comprehensive account of the subject thus far published in South Africa, and contain information and data which should be valuable to all interested in the manufacture or warehousing of sugar. Special stress is laid on cleanliness in sugar mills and sugar warehouses, the results of experiments with various disinfectants being recorded and practical suggestions given as to those best suited to the industry.

The proper drying of sugar before bagging is an important factor in the subject of deterioration caused by fungi. Along the Natal coast deterioration is at its worst during the hot summer months with high relative humidity. Next to cleanliness in the manufacture, the warehousing of sugar, its proper drying before bagging should carefully be taken into account, and every attempt made to keep the warehouses dry during the months of high humidity and temperature, both of which have an important bearing on the deterioration of sugar by fungi.

Fodder and Pasture Grasses of South Africa.

Dr. Pole Evans, in his presidential address to the South African Association for the Advancement of Science, said: "It is obvious that South Africa is first and foremost a pastoral country, and as such her stock-raising potentialities are mainly dependent on the veld. The greater portion of the natural grazing land throughout South Africa is subject to extremes of climate, periods of drought, and harsh treatment at the hands of man, but in spite of all, its recuperative powers are untold." The Department has always realized the importance of this matter and for some years past has been experimenting with many grasses, both indigenous and exotic, subjecting them to varied conditions and testing them for their value as fodder —either as hay, grazing, or ensilage. As a result, information of considerable value to the stock farmer has accumulated, and the

* "Preliminary Studies on Some Fungi and Bacteria responsible for the Deterioration of South African Sugar," obtainable from this office, price 1d., pre-paid.

† "Studies on Some Fungi and the Deterioration of Sugar," obtainable from this office, price 3d., pre-paid.

Division of Botany proposes to publish it in the *Journal* in a series of articles entitled "The Fodder and Pasture Grasses of South Africa," with the object of helping the farmer to improve his natural veld or to supplement it by the grass most suitable to his locality and conditions.

The farming community, it would appear, have become somewhat apathetic on the subject of the comparative merits of grasses and other forage plants and the improvement of the grazing lands. In earlier years there was a tendency to recommend and even wax enthusiastic over a grass before it had sufficiently been tested and before a complete knowledge had been gained of its habits and behaviour, etc., under varying conditions. And this tendency has led to many disappointments, which have doubtless damped the ardour of the farmer. By giving him now a full detailed account of the grasses that have so far been tested, their feeding value, and requirements as to soil, climate, and general treatment, etc., it is hoped to revive in him some of his lost confidence and inspire him to provide winter food for his stock.

While one cannot afford to discourage the introduction of certain exotic pasture plants that have proved their value and that, in certain districts, supply a need that no indigenous grass could supply, it must always be borne in mind that in the native grasses and their improvement and careful selection, lies the key to the great problem of the betterment of the veld, and thus to the greater production of our herds and flocks.

In the ordinary and sweet veld, where over-stocking, injudicious burning, or other harsh treatment has not been resorted to, nature provides the necessary ingredients for stock food in more or less the required proportions, but there are many instances where nature has been tampered with, and the veld ceases to be all that is desired; it is then that the farmer must seek for a way to improve his pasturage by cultivating other grasses. Even the best sweet veld will cease to provide food during long periods of drought or cold, but the progressive, far-seeing farmer will have his hay-stacks ready and his silos full, providing sustenance for his stock, and so amply repaying his trouble and expense.

In estimating the feeding value of a grass, too much importance must not be laid on the results of chemical analyses alone, since these results will differ greatly according to the locality, conditions of growth, stage of maturity, etc., while, in hay, to these ruling factors the method of curing and handling of the grass must be considered. In palatability and freedom from injurious effects, we have the surest guide to the desirability of a grass, and this, taken in conjunction with a chemical analysis of the grass made from samples obtained from the farmer's own pastures, will indicate very accurately its feeding value.

The first article of the series referred to above is published in this number and deals with Sudan grass, which, although an introduction of comparatively recent date, has proved itself well adapted to our dry conditions, and is growing in popularity as a dependable fodder crop. Miss Stent and Mr. Melle, of the Division of Botany, are the authors of the article and treat the subject very clearly, giving the history of the origin of Sudan grass and of its introduction into South Africa, and explaining its uses, feeding value, cultivation, etc.

Cyanide Gas Remedy for Scale Insects.

The citrus industry is rapidly growing in the Union and an important point for consideration in all large commercial plantings of citrus trees, is the suppression of Red Scale and other "hard" scale insects which are found in our citrus orchards. The matter has received much attention from the Division of Entomology, and we publish in this number an article by Mr. Lounsbury, the Chief of the Division, which gives concise directions for applying the treatment. Mr. Lounsbury states that fumigation with hydrocyanic acid gas is by far the most efficient and, in the end, the cheapest remedy, and it was through his efforts that it was employed as far back as twenty-five years ago in the Cape Colony. In recent years great difficulty has been met in obtaining the supplies for the treatment, and the remedy has fallen somewhat into disuse. Cloth for making covers for the trees has risen very considerably in cost and so has the price of cyanide, while suitable vessels for generating the gas, once quite cheap and easily obtainable, would now be unprocurable but for the efforts of the Division, which has been able to arrange for their manufacture in this country. Its attempts to interest leading manufacturers of chemicals, however, in the production and sale of the fumigation poison in liquid form, has not been equally successful. This is unfortunate, for it is highly desirable that the old, crude, and objectionable system of generating the gas in a pot placed beneath the tree to be treated, should be done away with. California has advanced far beyond that system, the gas now being secured by spraying a proper volume of the poison in liquid form under the cover where the liquid at once volatilizes. To Mr. C. W. Mally, our Cape Entomologist, is due the idea of employing it and the first practical demonstrations of its utility. But conditions in South Africa precluded the easy commercial development of the idea, and the onset of the war brought the matter to a standstill, great difficulty being experienced in importing the necessary apparatus. Though the country generally is not ready for this improved method of treatment, it is well that prospective fumigators should know about it, in order that they may consider its applicability to their individual conditions, and Mr. Lounsbury gives details thereof in his article. It is, however, to show how best the methods now in vogue in the Union are to be carried out that Mr. Lounsbury has written the article, which is helpfully illustrated, and the advice he gives, the outcome of much personal thought and practical experience, should receive the careful consideration of all those who are building up an industry likely to prove a big asset to the Union, the export of citrus fruit.

Maize Growers' Conference at Potchefstroom.

Maize, the staple crop of the Union, has its own problems, both of a cultural and economic nature, which are engaging the close attention of farmers, scientists, and others connected with the industry. With a view to conferring on several matters of importance to maize growers, Mr. Reinecke, the Principal of the Potchefstroom School of Agriculture, arranged a conference of farmers, merchants, and others concerned, which met at Potchefstroom on the 6th April last. That the Principal's object was achieved there can be no doubt, and those who were able to attend, some sixty visitors, were

unanimous in their opinion that conferences of a like nature should be held at regular intervals. In addition to the staff at the School, Mr. Williams, the Under-Secretary for Agriculture, and other officers (including Mr. Macmillan, Under-Secretary for Agriculture—Education) from the Department's Head Office in Pretoria were present, and the occasion afforded a welcome opportunity for farmers and officials to fraternize. The first part of the conference was devoted to a visit to the various experimental plots at the Potchefstroom School of Agriculture and Experiment Station, and the officers in charge of the experiments, most of which had a direct bearing on the greater production of maize, gave a brief account of the objects of the tests being carried out, and were able to show in a practical way the results thus far obtained from the experiments this season. After lunch at the School hostel, certain of the Potchefstroom staff delivered a number of short lectures on matters affecting maize growing and answered questions put by the visitors. For his lecture Mr. Reinecke chose the subject of crop rotation, one of the most important matters in the country, making special reference to the beneficial results of green manuring, as demonstrated by a series of experiments at the Station; Mr. Dawson discussed the value of "ear to row" tests in seed selection, pointing out the need of obtaining ears from plants showing superiority to others in the same field and under the same conditions; Mr. Puttick, who has recently returned from the United States, gave an interesting address on the subject of in-breeding, how it came about, its effect on production, and the means of revigorating the seed by the introduction, at intervals of about four years, of seed from other areas; while Mr. Schlupp spoke on the insect pests found in maize, making special reference to the grain weevil and the best methods of combating it. Mr. Bosman, Vice-principal of the School of Agriculture, Glen, was also present, and delivered a popular lecture on the subject of seed selection, which he characterized as being, after water and soil, the most important factor in successful maize production. He described a simple method of ascertaining the germinating qualities of seed, and urged that seed only showing a very high percentage of germination should be passed by the farmer as suitable for sowing.

After an adjournment for tea, the visitors were shown some of the stock and other items of interest on the farm.

In the evening the farmers attending the conference held a meeting, Mr. Horsfall, of Potchefstroom, presiding, at which important matters concerning the economic side of the industry were discussed. Mr. Williams and other officers of the Department attended for the purpose of conferring with the meeting on the Department's system of crop reports and the question of maize export, and it is gratifying to state that this meeting of prominent maize growers was united in confirming the importance of reliable crop estimates, and eager to assist the Department in perfecting the system which depends upon the assistance of farmers throughout the country.

As already stated, the conference served a most useful purpose, and the farmers who benefited by it expressed the hope that it would be the forerunner of others, recognizing the value of closer relationships between the grower and the official of the Department, whose aims were identical—the promotion of maize growing in South Africa.

The Weeds of South Africa.

A further contribution to that most useful series of articles on "The Weeds of South Africa," by Dr. Pole Evans and Miss K. A. Lansdell, of the Division of Botany and Plant Pathology, has now been published, and is obtainable, free of charge, on application to this office. It comprises the following articles, viz.: (x) The Sow Thistle (Bulletin No. 6, 1920), (xi) The Galinsoga Weed (Bulletin No. 7, 1920), (xii) The Upright Star-bur (Bulletin No. 8, 1920), (xiii) The Purple Stinkweed (Bulletin No. 9, 1920).

Like the earlier publications, the above are composed of a coloured plate illustrating the weed and its various parts, together with a description thereof and advice as to the best methods of eradication. The prevalence of weeds in the Union is a matter of economic importance, and the purpose of these bulletins is to enable farmers to recognize the presence of dangerous weeds on their farms and advise them how to extirpate them. The weeds dealt with in the series of bulletins published prior to the above are as follows, and are also obtainable from this office:—

(i) The Mexican Marigold, Khakibos, or Africander Bosje (L.S. No. 33); (ii) The Malta Thistle (L.S. No. 35); (iii) The Burweed or Boete-Bosjie (L.S. No. 36); (iv) The Mexican Poppy (L.S. No. 37); (v) The Dwarf Marigold (L.S. No. 38); (vi) The Khaki Weed (L.S. No. 73); (vii) The Cockle-bur or Kanker Roos (L.S. No. 74); (viii) The Jointed Cactus (L.S. No. 75); (ix) The Imbricate Cactus (L.S. No. 76).

African Horse-sickness.

A valuable article by Sir Arnold Theiler, K.C.M.G., Director of Veterinary Education and Research, on African Horse-sickness has just been published by the Department.* It reviews all our knowledge of this dreaded disease and gives a concise account of the problem as it stands at present. Every farmer should secure a copy of this bulletin and study it carefully. For the benefit of those who may find the subject-matter rather too technical, this short summary is given.

The introduction contains an interesting historical survey of the disease. It seems that horse-sickness was recognized in East Africa as early as the year 1569. In South Africa very severe outbreaks are on record at various intervals, e.g. in the years 1719, 1780, 1801, 1819, 1839, 1854, etc. Within recent years some very heavy outbreaks have again occurred, notably those of 1913-14 in Uitenhage, Humansdorp, and adjacent districts, 1918 in Clanwilliam, 1920-21 in Herbert and adjoining districts. All these outbreaks can indirectly be ascribed to peculiar climatic conditions that prevailed at the time. These conditions are discussed in the article.

The actual cause of horse-sickness is a virus, which is so small that it is invisible under the highest power of the microscope. A close study of the way in which the disease is contracted and spreads, leads to the conclusion that a blood-sucking insect is the carrier. All

* "African Horse Sickness." Science Bulletin No. 19, obtainable from this office, price 3d., prepaid.

the earlier observations of farmers and others can be explained on this assumption. The actual species that transmits horse-sickness is not yet known, but there are many good reasons for suspecting mosquitoes. One genus that appears to be particularly suspicious is Ochlerotatus, and observations in regard to its life-cycle and mode of living accord very well with the established facts regarding the appearance and spread of horse-sickness.

The question of the virus reservoir has not yet been settled. It appears that in some instances the immune horse may still harbour the infection. Possibly donkeys, dogs, and goats also serve as carriers.

The pathological changes in the various forms of horse-sickness are very fully described. Separate sections are devoted to the pulmonary or dunkop form, the cardiac or dikkop form, and the mixed form.

A further section deals with the clinical symptoms of the disease. Four types of horse-sickness are distinguished; the first type is the horse-sickness fever. The temperature curve is typical, but, apart from that, the animals show practically no clinical symptoms. The second type is the pulmonary or dunkop horse-sickness, which must be considered as the most dangerous form. The most striking symptom is the accelerated respiration. The third type is the oedematous or cardiac or dikkop form of horse-sickness, which is generally less deadly than the former type. This form owes its name to the swellings which appear on the head (especially above the eyes) and sometimes on the body. The fourth type, which is fortunately rare, is simply a combination of the two preceding types, and almost invariably ends fatally. Very full accounts of the symptoms in these different forms of the disease will be found in the article.

Complications are sometimes encountered in cases of horse-sickness. One of the commonest is a paralysis of the gullet (oesophagus); in severe cases the animals are entirely unable to swallow. Other complications are colics and paralysis of the optic nerve. The disease may be further complicated by an attack of biliary fever.

The nature of immunity in horse-sickness is very fully discussed, and mention is made of the breakdowns in immunity (relapses or aanmanings) that are of frequent occurrence. This question has received very careful attention, and the results of numerous experiments are detailed. It is of interest to note that even the so-called hyperimmune horses, i.e. horses that have received at least 10 litres of virus, may show relapses and about 5 per cent. of them may die. In the case of ordinary immune horses the mortality is higher (7.3 per cent.). The main difficulty in this connection is that immunity against one virus will not always protect an animal against another. A horse that has had a relapse (aanmaning) is better salted than one that has had only one attack of horse-sickness.

Treatment of horses with drugs has very little chance of success. As a matter of fact, it seems to be extremely advisable to leave the sick animal severely alone; such animals frequently choke when drenching is attempted.

The preventive treatment is of far greater importance. Two ways can be followed: (1) Precautions may be taken to prevent horses being bitten by infected carriers (possibly mosquitoes), or (2) the

animals may be immunized. The first method can be resorted to in cases where an insect-proof stable is available and only a comparatively small number of trained horses have to be handled. Such animals should then be stabled at night. If the stable is not mosquito-proof, it should be smoked out at night, or the animals should be rubbed down with some fly-repellant. Another way of preventing infection is to remove the animals to a high area. Attempts have also been made to dip horses regularly in a mixture that will repel biting insects. This method has met with partial success, but further experiments are necessary.

At the present time the immunization of mules and horses is the best preventive measure. The method of preparing an immune serum and the difficulties encountered in the course of preparation are described. The inoculation of mules has been carried out on a fairly extensive scale; more than 30,000 animals have been done since 1905, with excellent results. In horses the method is much more complicated. Three different inoculations are necessary. Nevertheless, the method has been employed on a great number of animals. On the whole the results (at any rate with horses inoculated at the laboratory at Onderstepoort) have been satisfactory. In the country certain difficulties have been encountered. The greatest setback was the outbreak of staggers (malsiekte) in the inoculated horses a few years ago. The cause of this disease has not yet been fully elucidated; but one of the main factors that seem to bring on this strange condition is work. If the animals are given a sufficiently long rest after the inoculation, the danger of their contracting staggers is very much reduced.

In this connection attention may again be drawn to the notes about the inoculation against horse-sickness that appeared in the March, 1921, issue of this *Journal* (p. 207). Attempts are continually being made to improve the method of inoculation, and the results obtained during the last few months at Onderstepoort have been so encouraging that the hope seems justified that in course of time this scourge will be brought under control.

The Oversea Market for South African Produce.

The recently issued report* of Mr. Canham, the Union's Trade Commissioner in London, for the year 1919, the first of its kind issued since the 1913 report of Mr. Chiappini, the former Trade Commissioner, gives valuable information on that matter of supreme importance to the South African producer, the progress made by his products on the oversea market. The report deals in detail with our principal products, and combines well-considered advice with most useful statistics While our interests are very largely centred in the London market, and the report is concerned principally with conditions existing there, Mr. Canham contributes an interesting chapter on the Continental market; in Holland he gained a decidedly favourable impression of trade possibilities between that country and the Union, dependent upon the establishment of proper shipping facilities. He refers also to the question of trade with France, Belgium, and

* "Report of the Acting Trade Commissioner for the year 1919," obtainable from the Government Printer, price 5s.

Spain. The importance of the American market is also brought out in a few striking figures, showing an increase in the value of our produce exported to the United States of from £540,826 in 1912 to £7,830,379 in 1919. The report forms a welcome addition to the existing information on the country's export trade, and from the wealth of its contents we wish to select and emphasize Mr. Canham's statement that "the United Kingdom is the greatest importing country in the world and that the standard of quality in the greater proportion of the goods received is of the highest. . . . While London is one of the best markets for good stuff, it is the worst possible for anything of an inferior quality. Exports from the Union have consequently to stand comparison with the best from almost every country in the world. A high standard of quality should, therefore, be aimed at by Union exporters, and anything which is calculated to lower the reputation of the Union should, as far as possible, be eliminated. . . . If the Union is to establish a reputation for good quality on the world's markets, a much greater degree of discrimination must be shown by exporters in the class of goods sent oversea. An equal amount of care is necessary in the matter of packing and 'get up.'"

Mr. Canham refers to the unqualified success which has attended the Government system of inspection and grading of maize, fruit, and eggs, showing that our products can hold their own in competition with those of any country when the necessary attention to quality and packing is given to them, and affording a happy augury as to the success which should attend the marketing of other of our products, if the requirements of the oversea trade are sedulously kept in view.

The Inter-School Stock Judging Competition of 1921.

The second annual inter-school stock judging competition for teams of students from the schools of agriculture, was held this year on the 17th and 18th March, 1921, at Bloemfontein, the Central Agricultural Society kindly providing all facilities for the conduct of the competition.

It was again a success, and proved to be of great value in stimulating interest amongst the students in this important branch of their work, in broadening their education by contact with critical authorities on the various breeds, and in furnishing a reward for deserving students.

Teams were sent in by Elsenburg, Glen, Potchefstroom, and Grootfontein, each consisting of five students taking the diploma course. Five classes of stock were selected for the competition, and the team of each school judged three of them. Three students from each team judged each class of live stock selected by the school they represented.

Each class of animals judged consisted of four animals of a specified sex, to be placed in order of merit, and a single animal of the opposite sex provided to enable the judges to ascertain the extent of the students' knowledge of the characteristics of true representatives of both sexes of the breed.

The classes of stock judged were: Friesland bulls, Hereford females, Clydesdale mares, Wanganella rams, large black sows.

The competition resulted in the school teams being placed as follows in order of merit: Elsenburg, Grootfontein, Glen, Potchefstroom.

In the 1920 competition the Grootfontein team was first and Elsenburg team last.

Student A. Starke, of Elsenburg, gained the greatest total number of marks, and Student Cloete, of Potchefstroom, obtained the highest number of marks in any class with 112 out of a possible 120 in the Friesland class.

The report of the judges was to the effect that the students on the whole showed that they had been well taught; there were evidences, however, that their theoretical knowledge was better than their practical experience; in some cases it was apparent that the competitors were not sufficiently familiar with the characteristics of perfect specimens of the breed, and that there was a tendency for competitors to use stock phrases without having a clear notion of their exact interpretation and application.

Balcony, Students' Hostel, Glen School of Agriculture.

Do not lose your copy of the *Journal*. A full index will be sent subscribers every six months. The *Journal* will prove a useful book of reference to every farmer. In time it will be a valuable compendium of advice and information on farming in South Africa.

DEPARTMENTAL ACTIVITIES

March, 1921.

(NOTE.—The work of the several Divisions and Schools of Agriculture covers a wide range of agricultural industry in the Union, and we give hereunder notes and observations from certain of them treating with matters of special interest coming under their purview during the month. The object of these notes, which are not concerned with general routine work, is to inform the farmer of such matters as are calculated to be of interest and helpful to him at the present time.—EDITOR.)

THE DIVISIONS.

ENTOMOLOGY.

Fruit Beetle.—The common fruit beetle (*Pachnoda impressa*) is one of the many, but probably the commonest, of the kinds of large, clumsy beetles that eat into ripening fruit, in particular peaches, throughout the greater part of the summer rainfall area of South Africa. They do not trouble commercial fruit orchards nearly so much as they do the few fruit trees in farm and suburban gardens. They also damage flowers and feed more or less on foliage. A short bulletin on them (No. 8 of 1916) was published by the Department about five years ago; and the present note is chiefly to acquaint readers of the *Journal* with definite information on the life-history of the common species recently determined by the Entomologist for Southern Rhodesia, and published in Bulletin No. 385 (February, 1921) of his department. The adult insect will probably be recalled by most readers from the statement that it is nearly an inch long by half as wide, has a glossy dark green back with yellow markings, and is generally found along with others of its kind with its head buried deep in the ripest peach. The mischief begins in November and is kept up for two to three months. Day after day, if the weather is fine, the beetle appears in the garden in the morning and leaves for parts unknown in the late afternoon. It has long been suspected that it bred chiefly in decaying matter amongst the bushes on stony kopjes, as it is from such places that it appears generally to come. Now the Rhodesian entomologists have traced the life-cycle. The bulletin referred to says: "Our earliest record of egg-laying is 2nd January. . . . The eggs are laid singly in rotted kraal manure, or soil rich in humus, at a depth of about one inch from the surface, They are white. . . . The grubs feed on rotted vegetable matter, including manure, and grow rapidly during the wet season. . . . Larvae from eggs laid in January have constructed pupal cells in August, the adults emerging from these in late November and December. . . . Under entirely natural conditions, the insect must breed mainly in collections of leaf mould and other detritus which accumulates in sheltered situations, particularly on the slopes of irregular rocky kopjes and outcrops where tree growth occurs. The cattle kraal and manure heap may probably be regarded as largely responsible for the abundance of these beetles in settled areas."

Tobacco Slug: Spraying Demonstrations.—Demonstrations have been carried out during the past season at four different places in the Piet Retief District to show that the tobacco slug can be economically controlled by spraying with arsenate of lead. On two of the plots the slug was kept thoroughly under control by two sprayings, with an interval of three weeks. At the other two places three sprayings were given, and yet there was some slug present at harvest time. The infestation was, however, considerably less than where no spraying was done. The difference in the results obtained seemed to be due to insects coming in from unsprayed tobacco or from weeds at the last two places, while at the first two places all the insects in the vicinity were killed off by the spraying, and there was thus no subsequent generation to give trouble. On the one farm the sprayed plot was more or less isolated, and on the other the owner regularly sprayed his whole field of tobacco.

These results show the efficacy of spraying. They also show the importance of thoroughly spraying the whole field, so that there will be no beetles breeding in one part to infest the sprayed portion later when the rains have washed off the poison. They also indicate that weeds on which the pest breeds should not be left to grow in the vicinity of the tobacco.

It does not seem possible to state definite times when to spray. The best advice that can be given at present is to keep watch and spray as soon as slugs make their appearance, not neglecting a slight infestation. In one case that came under observation there was an infestation of slug about the time the tobacco flowers were beginning to appear, which the owner did not think serious enough to spray for; but a more serious invasion followed when the tobacco was almost ripe and spraying had become inconvenient. A thorough spraying when the insect was first noticed would probably have prevented the late infestation. If a crop is harvested with the slugs serious damage in the shed is likely to occur.

One pound of arsenate of lead powder to 32 gallons of water was used for the demonstration spraying; but one pound to 50 gallons has been found amply strong to kill the insects. A knapsack pump was used, and on the whole it proved satisfactory, though a far larger mounted barrel pump would be better and do much quicker work. Some tobacco growers have purchased automatic compressed air sprayers, and are very pleased with them. It is evident that these pumps have advantages over knapsack pumps, and would be preferable, if they prove to last as long. Bucket pumps were given a trial, and it was found that a convenient way of using them was to have one man directing the nozzle, and another carrying the bucket and pumping. In this manner the field can be got over as quickly as with a knapsack pump, but it requires two men instead of one. Sprinkling with a small grass broom was found to take, on small plants, at least twice as much material and time as spraying with a knapsack pump, and can only be recommended where the need for treatment is urgent and a pump is not available.

With plants in rows, three feet apart and two and a half feet apart in the rows, it was found that when the tobacco was about a foot high, a quarter-acre plot could be sprayed with about fifteen gallons. When the plants were about two feet high, with leaves about two feet long, about 24 gallons would be required for the same

area, and the spraying would take about three and a half hours with a knapsack pump. After the plants have flowered, about 50 per cent. more material may be necessary for the spraying. For further information see article in the January, 1921, *Journal*.

Locusts.—The outbreaks of locusts (*Locusta pardalina*) in the Cape Province increased greatly in gravity during March. There have been unsubstantiated rumours of the migration into the Karroo of a swarm or swarms of flyers from Gordonia, but so far as is known to the division the present outbreaks are due solely to the spontaneous breeding-up of the insect in the now infested region, following on the break-up of the drought. Owing to November rains, the pest multiplied extensively along the upper reaches of the Sundays River and its tributaries; and some swarms of flyers, which formed there from voetgangers that escaped poisoning, moved into other districts early in February and have contributed to the trouble now (4th April) being experienced. But the trouble was brewing anyhow, and it seems doubtful if it has been much intensified in any district by the addition of swarms of flyers from other districts. There was not a single report to the division of any laying of eggs, or even of a swarm of flyers, last season; but the division was highly suspicious that serious trouble was coming in the part of the Karroo where the outbreaks are now most extensive, owing to an officer specially sent there in May last to make observations and inquiries finding that scattered flyers were very numerous in the veld. In some of the localities where the pest is being fought the voetgangers are in compact swarms, as is the rule in great visitations of the plague; but in many localities they are in such open formation, a small cluster sleeping in almost every bush for miles at a stretch, that effective poisoning is almost impossible. The whole infested area is sparsely populated pastoral country, with little of any of the farms under cultivation. Farms of upwards of 20,000 acres, with only one white family and only a few native servants, are numerous; and it has to be expected that under such conditions some swarms of voetgangers escape detection even when the official locust officers are most vigilant and the farmers not unwilling to carry out their duty, under the law, of destroying the swarms.

The March outbreaks were most severe in the Murraysburg and Beaufort West districts, but also quite bad in Victoria West, Carnarvon, Williston, Prince Albert, Willowmore, Aberdeen, and Jansenville. The other present infested districts include Laingsburg, Britstown, Calvinia, Prieska, Kenhardt, and Namaqualand. Small outbreaks, the most northern that have come to light this season, are reported near Pella, both on the Union and South-Western Protectorate sides of the Orange River. A small outbreak also occurred during the month in the Cradock district, and a more serious one in the Middelburg district, far to the east of the main outbreaks. The Middelburg outbreak is close to the Doornberg, a part of the district in which locusts incline to breed up and where swarms were particularly expected to appear when the drought broke. In the middle of the month a Johannesburg newspaper published a telegraphic dispatch from its East London correspondent to the effect that winged locusts had just been blown there in numbers by a heavy north-west wind. There may have been no mistake, but the magistrate, when approached by the division, was unable to get the report

confirmed. However, there is much reason to fear that in the coming year there will be extensive outbreaks of voetgangers from Namaqualand on the west to Tarka on the east, and the Orange River on the north to Laingsburg and Uitenhage on the south. The districts along the Orange River east to and including Colesberg will probably all be more or less infested. Had the rains come a couple of months earlier, migratory locust birds would probably have been a very decided help in the districts now heavily infested with the pest, as they were about Graaff-Reinet, where good rains came in November; but the birds departed weeks ago, and the destruction of the voetgangers is dependent almost wholly on the poisoning operations. It is inevitable that the numerous scattered locusts escape, and the conditions are such that the escape of many swarms is practically certain. Winged swarms will probably be migrating in easterly directions in early May. That some penetrate into Basutoland is not unlikely.

The voetgangers are being combated energetically on the customary lines. Each infested district has a district locust officer and from one to six local locust officers hard at work supervising destruction measures. To no small extent the exceptional rains of the month have handicapped the work. Supplies and officers have often been held up by flooded rivers and deep mud in the roads. The Britstown district officer narrowly escaped drowning in attempting to cross a flooded drift.

Mystery (Army) Worm.—Since the last note on this insect appeared in the *Journal*, outbreaks have occurred at Taungs and at Hlabisa, in Zululand, whilst swarms of young caterpillars were observed during the last week of March on the outskirts of Pretoria. In the latter instance, the insects were found to be nearly full grown at the end of the first week of April. Further, eggs were deposited in town on the 4th of April.

Caterpillars on Lupins.—Some spring-grown lupins suffered considerable damage from caterpillar attack in Pretoria, during November last. The caterpillars concealed themselves very successfully by webbing together the leaflets, so that each leaf was transformed into a bower or cradle, in which the insect lived. These caterpillars were the larvae of that cosmopolitan butterfly popularly known as the "Painted Lady" (*Pyrameis cardui*).

Geranium Butterfly.—Geraniums, pelargoniums, and ivy geraniums are often injured by small green caterpillars, which burrow into and destroy the stems, especially the terminals. These insects are quite notorious for the damage they do to geraniums and the like when grown in tins and pots as stoep plants. Complaints of their damage frequently reach the division. The caterpillars doing the damage are spiny and slug-like, and are the progeny of a small brown butterfly known as *Lycaena palemon*, a relation of the bean-pod butterfly. The eggs are laid by the butterflies upon the young tips of the plants, and it not infrequently happens that the mischief is traceable to one female. These eggs are very small and white, but although so minute, can be easily detected when once recognized. The best treatment is several days' attention to the catching of the butterflies that are ovipositing, the removal of eggs and of feeding larvae.

Woolly Bears.—From reports reaching the division there appears to have been quite an extensive recrudescence during March of one of the native woolly bears or hairy grubs. It has been abundant at Beaufort West and Prieska, in the Cape, and also in the Free State, being especially destructive in the Bloemfontein District. These are very hairy, quick-moving caterpillars, readily recognized by the succession of rings composed of distinct white spots around their black bodies and the longish black and brown hairs with which they are clothed. They are said to feed upon a variety of weeds, many vegetables, sunflowers, and carnations, and to have been noticeably partial to potatoes and maize. The caterpillars do not appear to attack grass very much. The parent moth has not been identified, but there is no relationship between this insect and the mystery worm, as has been suspected. Two years ago this woolly bear was reported as abundant and injurious to maize in the Free State, but the caterpillars were then so greatly parasitized that not one could be reared to the moth state. It may be added that during 1919 a different woolly bear (*Teracotoma submaculata* Wk.) was noticeably abundant and mischievous in the gardens at Port Elizabeth.

Tobacco Slug Again.—This pest is now reported from Queenstown, Salem, and Fairburn, Balfour, in the Cape Province. The damage of the slug is said to have been observed at the lower end of the Kat River Valley (Mancazana and Lower Blinkwater) early in 1920 and to have spread since then to every part of the Stockenstrom district. Very few fields seem to have escaped severe attack during the drought; but, after the rains arrived, the insects, so we are informed, turned their attentions to the stinkblaar.

Bean-stem Gall Weevil.—In the *Rhodesian Agricultural Journal* for October, 1920, Mr. Rupert Jack describes, as a minor pest, a native weevil attacking the stems of beans. The adult weevil places its eggs in the stems of the bean-plant near to the base, and an elongated swelling or much callused gall forms within which the grub feeds and undergoes its transformations, finally escaping as a weevil. For a number of years past the attack of a weevil of the same genus, a variety of *Alcides erythropterus* Cheo., has been under observation in Pretoria upon the stems of climbing beans. The attack is of the same nature as that of the Rhodesian insect, the galls being usually near to the base of the vine, although it is not uncommon to find them as high as three feet from the ground. The attack has been observed upon three varieties of beans, but has not in any one case under notice been found to interfere with the vigour of the plant. The same weevil also attacks climbing beans on the coast of Natal.

Bean-pod Butterfly.—During February and March complaints were received of the presence of green and spiny grubs in green beans. These proved to be the larvae of one of those small butterflies commonly spoken of as "blues." The species *Cupido* (*Lycaena*) *baetica* (L.) is distributed fairly well throughout the Union, and its attack on green beans, whilst ordinarily of no great moment, may at times become quite mischievous.

VETERINARY EDUCATION AND RESEARCH.

Veterinary Education.—About eighteen months ago the Government decided definitely to start a veterinary college in South Africa. Details were worked out and a scheme was arrived at according to which students would complete the first two years of their course at one of the existing university colleges or universities and the last three years at Onderstepoort. The scheme was carried into effect immediately, and at the beginning of last year students were enrolled in Pretoria, Johannesburg, and Stellenbosch for the study of veterinary science. The first year's course comprised the natural sciences (zoology, botany, chemistry, and physics) and elementary veterinary anatomy (osteology). These students are now in their second year and are devoting most of their time to more advanced anatomy and physiology. In addition to this, they have to take a further course in chemistry and botany, a thorough knowledge of these two sciences being absolutely essential for veterinary surgeons in South Africa.

There are at present about a dozen veterinary students in their second year. This number should just about meet the normal yearly requirements of South Africa. They will complete their course at the end of 1924, and will then be ready to take up their duties either in Government Service or as private practitioners.

Every stock farmer to-day realizes the value of veterinary surgeons. The days are over when farmers viewed every veterinarian with suspicion, and in many cases even accused him of spreading disease! All enlightened farmers know now that South Africa saves millions of pounds annually through the activities of the two Veterinary Divisions. The relationship between farmers and Government veterinary officers is improving year by year. This relation will no doubt develop into a harmonious co-operation as soon as the South African farmer sees his own sons taking up veterinary science and assisting the Government in its fight against animal diseases.

BOTANY.

Pasture Grasses.—At the agricultural shows numerous inquiries were received with regard to various pasture grasses. Star grass is attracting special attention, and a number of applications have been received from farmers who wish to be supplied with cuttings. The division is now in a position to supply a limited quantity of this grass, and it is proposed to publish in the *Journal* a description of star grass and the terms on which it will be supplied to the public.

At the Drylands Station four additional acres have been planted with various grasses, and twenty-acre plots are being fenced for the veld improvement and grazing experiments.

Tomato Canker.—This disease, which was described in the November, 1920, issue of the *Journal*, is again very prevalent around Pretoria. The humid conditions caused by the late rains have been particularly favourable for its development, and tomato growers are referred to the article in question for preventive measures.

Citrus Canker Eradication.—The situation may be regarded as very satisfactory. Since the beginning of the campaign, in June, 1918, a total of 12,705 trees have been found infected. Of these, 9652 were destroyed during the nine months ending March, 1918, 2818 during the twelve months ending March, 1919, and 224 from April, 1919, to March, 1920; only eleven infected trees were detected during the twelve months ending March, 1921. These figures show that the situation is well in hand and that the disease may be completely eradicated if the present system of inspection and destruction of infected trees is continued.

Advisory Work.—During the month of March advice was given to correspondents on the following diseases:—

Potato diseases: Scab, early blight, bacterial wilt, dry rot (*Fusarium* sp.). *Grape-vine diseases*: Anthracnose, mildew, berry blotch. *Diseases of fruit trees*: Crown gall and *Corticium lactum* (a pink fungus attacking the branches) on apple trees; rust and storage rot of peaches; core rot of white winter Pearmain apples; pear-leaf spot; anthracnose of citrus; physiological troubles in quince, apple, peach, and plum trees. *Diseases of field and garden crops*: Wild-fire and die-back of tobacco; angular leaf spot and boll rot of cotton; wilt and leaf spot of watermelons; storage rot of winter melons; stem rot of cauliflowers; bacteriosis of beans; spinach leaf spot; *Fusarium* disease of carnations. A root and crown rot of pine seedlings has been investigated for the Forest Department, and advice has also been sought with regard to fairy rings appearing on lawns.

TOBACCO AND COTTON.

The officers at the experiment stations have been finishing the harvesting of the tobacco crop. The work has been considerably retarded on account of the unusually heavy rainfall during the month; and, on account of the moist conditions, it is quite likely that there will be a large percentage of dark and damaged tobacco when the crop is ready to market.

Cotton harvesting has been commenced; but on account of wet weather, little progress is reported. The cotton farmers earlier in the season had little or no insect troubles till the heavy rains set in; since then complaints are made of considerable bollworm infestation. Unless dry, clear weather sets in almost immediately, the cotton crop is likely to be considerably curtailed. The services of itinerant officers have been in great demand, and they have been unable to meet all requirements.

The breeding and selection work in connection with tobacco and cotton has occupied the attention of the station managers for some time. A good number of selections and strains are at present under observation.

A conference of the officials of the division was held at head office on the 29th and 30th. The various papers read and discussed at the conference will appear in the *Journal* later on. Mr. H. W. Taylor, Tobacco and Cotton Expert for Rhodesia, and Mr. W. B. Wilson, Agricultural Adviser to the Agricultural Co-operative Union, Ltd., were also in attendance, and took part in the discussions.

THE SCHOOLS OF AGRICULTURE AND EXPERIMENT STATIONS.

CEDARA, NATAL.

Over sixty varieties of legumes, comprising dwarf and runner beans, soya beans, and cowpeas, have been planted for observation and comparison.

Twenty varieties of dwarf beans were planted and ten varieties have matured and been harvested. Most of these flowered in 45 days, commenced to pod in 55 days, and attained full maturity in 90 days.

The plants flowered profusely, but only podded moderately well on account of attacks from black and yellow beetles (*Mylabris* sp.). After the formation of the pod, anthracnose appeared and affected some of the varieties. African Wonder, Burpeas, Stringless, and White Dwarf showed up particularly well, making a rapid growth of healthy foliage, and producing a fair yield of seed. During the period of growth the total rainfall was 9.5 inches, with an average sunshine of 7 hours per day.

Kikuyu grass has not made as much growth during the present year as in former years. It appears as though the very large growth in previous years has more or less exhausted the ground, which is very full of large roots. Manuring of this grass appears to be necessary, the soil being unable unaided to continue to produce such heavy yields as are obtained in the past season or two. Experiments have shown that a very good response is made by Kikuyu if manures be applied, and that continued heavy crops may be obtained by judicious fertilizing.

Rhodes grass is proving a very good second to Kikuyu and is making excellent growth. Erect in habit, with strong runners, and good covering capacity, this grass is very suitable either for cutting for hay or for grazing.

Rottboellia compressa is showing up very satisfactory under hill conditions. Though a vlei grass, it has done much better than was expected under hillside conditions, and may prove to be a grass worthy of further trial.

Paspalum has again been badly affected with ergot, and paspalum pastures have twice been mown to get rid of the ergot-infested seed heads.

GLEN, ORANGE FREE STATE.

The question of winter feed should seriously engage the attention of farmers, particularly in districts in the eastern part of the Free State where the maize crop has been a partial failure. The most economical way to make use of a maize crop which is partially destroyed by drought or too late to reach maturity before the frost comes, is to turn it into silage. The investigations of the Drought Commission have clearly shown that there is a serious shortage of silos in the country. Every farmer cannot build a silo, but every one can make a pit silo. When once the advantage of silage is realized a properly constructed silo will be considered an essential on a farm. Provision must be made not only for the winter, but also for dry periods during the summer months.

GROOTFONTEIN, MIDDELBURG (CAPE).

Poultry Week at Port Elizabeth.—A very successful short course of instruction in poultry culture was held during March by the Lecturer in Poultry, under the auspices of the Poultry Society at Port Elizabeth. The course extended from the 1st to the 5th of the month, and was attended by a very appreciative audience; the average attendance at the lectures and demonstrations, which were given each afternoon and evening, was eighty-six. The following subjects were dealt with:—

Lectures.—(1) Breeds of poultry suited to South African requirements; (2) management of stock; (3) selection and mating; (4) incubation and rearing of chicks; (5) foods and feeding; (6) housing; (7) handling, storage, and marketing of eggs; (8) common diseases of poultry and their treatment.

Demonstrations.—(1) Egg testing and grading; (2) killing and trussing of poultry for market; (3) caponizing.

The most pleasing feature of the short course was the keen interest displayed by the audience, and it was noted that a number of men and women who attended took notes of all the chief points at the lectures and demonstrations. Such courses should be of great value in stimulating interest in this and allied branches of farming, by giving a large number of those interested an opportunity of gaining first-hand information, which otherwise could only be obtained by attending the short vacation courses at one of the schools of agriculture. This is not always convenient or possible, by reason of important business obligations. Evening lectures are of great value to many business men who are unable to attend lectures given during the day.

A useful educational exhibit from the School was staged, consisting of various "home-made" appliances, graded eggs, eggs packed for export, poultry foods, and models of test pens, also a number of birds of various breeds. These were used throughout the course in connection with the lectures and demonstrations.

A good exhibit of incubators, appliances, and foodstuffs, which contributed towards the success of the course, was also staged by local firms, who are to be congratulated on their enterprise.

We are indebted to the Port Elizabeth Poultry Society for the excellent arrangements made in connection with the course, and to the local Agricultural Society for its valuable assistance.

Co-operative Wheat Experiment, Gamha River.—On the 25th May, 1920, 50 lb. of South African Medeah and 50 lb. of Red Egyptian Wheat were sown broadcast on the loamy river-soil of the Gamha River. The soil was not fertilized, nor was the crop treated in any way different to the usual treatment accorded to wheat in that area. On the 18th December, 1920, the crop was harvested. The Red Egyptian gave a return of 3600 lb. of first-class grain, which is equivalent to a return of 72 bags from one sown. The South African Medeah gave a return of 2400 lb., which is equivalent to a return of 48 bags from one sown.

No rain fell during the growing period, and the soil was only irrigated twice. This is considered to be almost a record yield.

POTCHEFSTROOM, TRANSVAAL.

The month was a noteworthy one in that the total rainfall up to midnight of the 31st March amounted to 10.88 inches, which is the record for March at this station.

The weather has been most unfavourable for hay-making. The growth of weeds has been amazing, and crops such as mangels and potatoes have demanded considerable hand-hoeing, thereby greatly increasing the cost of growing these crops. The mangel crop is an expensive one to grow at the best of times, and it is thought that if the labour, fertilizers, and irrigation water which it requires were put into a maize crop, grown for silage purposes, the farmer would produce his succulent winter feed a good deal more economically. With this object in view, it is proposed to reduce the area under mangels, and instead to utilize the manure, irrigation water, and labour in growing at least one heavy crop of maize silage.

When extreme moisture conditions prevail, as in this month, and enough fodder is not available to more than fill a pit silo, silage material might with advantage be stacked. In making stack silos with maize as the crop, layers of fine material, such as blackjacks, veld-grass, etc., should be placed along the outer edges of each layer of maize laid down, in order to prevent air from penetrating too far into the stack. After covering the stack with straw, grass, etc., the whole should be weighed down by means of wires to which weights are attached.

The late season has demonstrated the disadvantage of following with roots on a land which carried teff the previous year. "Volunteer" teff plants in a mangel or potato crop have proved most difficult to eradicate.

A paddock, consisting of about 24 acres paspalum and a strip of 4 acres kikuyu, was ploughed up and thereafter cultivated as thoroughly as conditions would allow. These grasses were laid down in April, 1917, and were both becoming unthrifty, the kikuyu especially appearing sod-bound. It is considered that the thorough loosening of the ground by ploughing and harrowing will result in more vigorous growth of both these grasses.

The egg-laying competition, running for forty-eight weeks, from the 1st April, 1920, resulted in the creation of several South African records. A record of 262 full-weight (2-oz.) eggs in the period of forty-eight weeks was made by a White Leghorn, followed by two other Leghorns with 261 full-weight and 1 underweight eggs, and 254 full-weight and 11 underweight eggs, respectively. One Leghorn hen was allowed to complete the full period of twelve months. This hen created a record in laying a total of 301 eggs, of $1\frac{3}{4}$ oz. weight and over, during the period 1st April, 1920, to 31st March, 1921.

Seed Wheat.

It is not the intention of the Government to purchase seed wheat for distribution to farmers this year.

CURING OF TURKISH TOBACCO.

By PIETER KOCH, B.Sc.Agr., Manager, Elsenburg Tobacco Station, Mulders Vlei, Cape.

Introduction.—Tobacco culture is a highly specialized subject, the plant being very sensitive to conditions of soil and climate. Even should these be favourable, much depends on the fertilizers used and the treatment the crop receives in the field at the hands of the grower. If all these requirements are fulfilled, then it is most essential, if a first-class product is to be turned out, to harvest the leaves at the proper stage of ripeness and to cure them under as ideal conditions as possible.

Luckily, climatic conditions in the Western Province during summer, and the method of harvesting the leaves of turkish tobacco singly as they ripen, make the proper curing of this class of tobacco comparatively simple, and the results far more certain than is the case with other tobaccos. In the areas where summer rainfall prevails and the Virginian types are grown, the crops of a whole district are often spoiled through continuous rains during curing. If the tobacco does not actually rot in the shed, the damp atmosphere darkens the leaves to such an extent as to make what otherwise might have been a high-priced, yellow tobacco unfit for cigarette manufacture, and it has consequently to be sold at a much lower figure as pipe tobacco. Also flue-curing, whereby the effects of unfavourable weather are to a large extent counteracted, entails much expense in shed construction and fuel, and requires a high degree of efficiency and skill to manipulate and constant attention every hour, day and night, until the crop is cured.

Tobacco growers in the Western Province do not always realize what a great advantage they have over other growers in the Union in the matter of weather conditions during curing. However, unfavourable conditions do prevail sometimes, and it is to the benefit of the grower to know why certain operations are conducted. In any case, the intelligent farmer has greater control over the final results of his labours should he be acquainted with the changes which take place in the tobacco during the ripening and the curing of the leaves.

In order to be able to cure tobacco properly the leaves must be harvested at a certain stage of ripeness. A second requirement is that the conditions in the wilting room, where the leaves have to undergo the important stage of yellowing, should be controlled in such a manner that certain desired chemical and physiological changes can most readily take place. The subsequent drying in the curing camp in the sun is, with the present system in vogue, to some extent a matter of luck, but with our usual favourable summer weather the drying tobacco generally turns out fairly well.

Ripening.—Soon after the flower-head of the turkish tobacco plant begins to develop, the lower leaves undergo a decided change in colour. This change in colour and other properties constitutes the process of ripening. Garner states that "the young growing leaf has an intense green colour, showing that it is quite rich in the nitrogenous constituents which go to make up the living or vital part of the leaf and which are active in building up the food supply of the plant. This food supply, consisting of starch and other similar substances, is carried from the leaf into the seed-head to furnish the necessary food for the development of the seed. This accomplished, the leaves have completed their full task, and they now pass into a period of gradual decay. . . . The principal indication that the above-mentioned processes are taking place is a decided change of colour. When the reserve food supply of the mature leaf is no longer required for the nourishment of the other parts of the plant, it is deposited in the leaf tissue in the form of starch granules, while the green colouring matters are dissolved and carried to the younger, growing parts. This interchange causes the appearance of light-tinted flecks so characteristic of the ripe leaf. Moreover, the accumulation of the starch granules in the leaf causes it to become brittle, so that it snaps when folded between the fingers, another characteristic sign of ripeness. Now, the replacement of the complex nitrogenous constituents, including the green colouring matter, by starchy matter has a most important effect on the colour, flavour, elasticity, and finish of the leaf. Indeed much of the success in curing tobacco depends on harvesting it just at the right time, when it is neither too ripe nor too green." If the leaves are harvested too green, the colour will be dull and dark, because they contain too much of the green colouring matters, and if they are harvested too ripe the colour will be uneven, mottled, and lacking in freshness, because they contain too little of the green colouring matter. For these same reasons green leaves when cured are tough and leathery, and over-ripe leaves strawy and lifeless to the touch.

As the lower leaves on the plant contain a greater percentage of moisture and are less tough than the higher-placed ones, and, being nearer the ground, suffer to a greater extent from the reflected heat of the sun's rays, they have a tendency to ripen very quickly during hot spells. Unless the grower has many extra pickers during such hot spells in December and the beginning of January his loss from over-ripe and shrivelled lower leaves is often considerable. To prevent this, it is advisable to commence harvesting the bottom leaves slightly on the green side, and so be prepared for the second picking, i.e. the middle-seconds, which also ripen all too soon. The lower leaves, even if harvested slightly green, turn a better colour than the top leaves. The grower, however, is cautioned not to overdo this. As a rule, the bottom leaves are ripe a few days before the flowers begin to open (see fig. 1). (Unlike most other tobaccos, turkish tobacco is not topped.) Different types of turkish tobacco differ in appearance on ripening. Samsun, for instance, has a very yellowish appearance, and the leaves seem unusually translucent, not unlike White Burley, when held, even when it is still quite green, against the light. Ripe Kavalla leaves show marked light-tinted flecks when fully ripe, and leaves which are still rather green are generally yellowish in appearance. Ripe Dubek, on the other hand, seems green to the

layman. Soulook, the type universally grown in the Western Province, appears much less transparent and yellow when ripe than either Kavalla or Samsun. Fig. 1A illustrates the shape and size of these varieties.

Harvesting.—About ten days before harvesting commences, the two or three sand-leaves from each plant are removed and discarded. This is known in this area as "priming." Turkish tobacco is harvested leaf by leaf from the bottom up as it ripens, about three or four leaves from a plant with each picking. To complete harvesting, it requires five to six pickings, consisting of first picking or bottoms, second picking or middle-seconds, third picking or first middles, fourth picking or middles, fifth and sixth pickings or tops. These are marked on the reeds or sticks con-

[*Photo by P. Koch.*

FIG. 1.—Field of Turkish Tobacco. The ripe bottom leaves had just been picked.

taining the strung leaves, as 1, 2, 3, 4, and 5. It is preferable to harvest only a few leaves from every plant at each picking at intervals of about twelve days, more or less, and to gather them at the proper stage of ripeness, as such tobacco can easily and scientifically be controlled in the wilting room. If too many leaves are harvested from a plant at each picking at longer intervals, these leaves are likely to be in different stages of ripeness, and this is very undesirable.

Most farmers pick from sunrise, after the dew has evaporated from the plants, until ten or eleven o'clock, during which time a sufficient quantity of leaves is harvested for threading during the remainder of the day. The leaves are carefully packed in boxes or baskets, care being taken not to bruise them, and are then taken to the threading-room, where they are sorted according to size and ripeness, threaded on flat tobacco needles of some 15 inches long, all

leaves facing the same way, and then strung on to twine which is tied to a reed or stick. Four-and-a-half to five needles' full are strung on a 7-foot reed. The loose end of the twine is then tied tightly to the other end, and at every foot of the distance it is fastened to the reed with bits of string to prevent sagging (see fig. 2). If the twine is tied loosely, there is risk of the leaves packing in places, with the result that mould generally sets in. Every full reed is marked with a label bearing the date and the number of the picking. It may be added that every reed should contain leaves only of the same size and ripeness. After a rain the grower should wait a day before continuing to harvest, as certain oils are washed off the plant by rain, and at least a day of sunny weather is required to allow the plant to replace them. It takes about three months to complete harvesting.

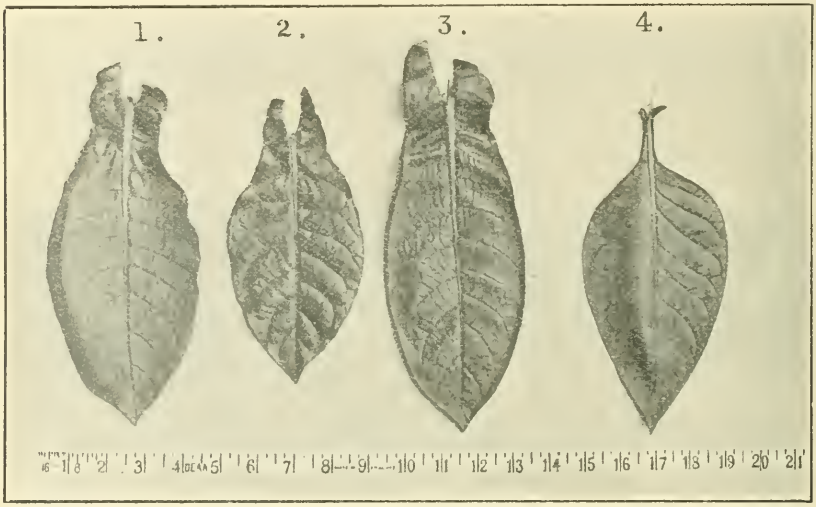


Photo by P. Koch.

FIG. 1A.—Leaves of the four principal types of Turkish Tobacco :—

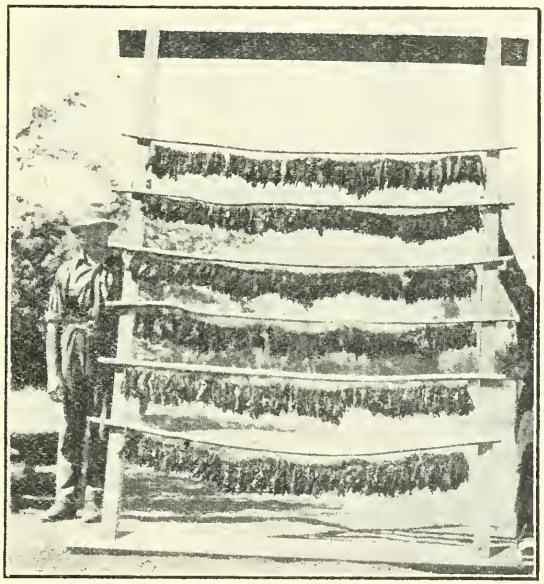
1. Soulook ; 2. Kavalla ; 3. Dubek ; 4. Samsun.

Compare size of leaves with inches on tape measure on photo.

The Curing Process.—By curing of tobacco is meant not only drying, but drying under certain combined conditions of temperature and moisture, whereby necessary chemical and physiological changes in the constituents of the leaves take place, which will improve the colour, aroma, flavour, elasticity, and other desirable properties of the cured product. If freshly harvested tobacco were dried in a hot oven and subsequently made into cigarettes, the habitual smoker would scarcely recognize it as tobacco, and would, moreover, find it nauseating. (The writer has, however, seen certain natives in the Eastern Province dry their tobacco quickly over a fire and afterwards consume this "stuff" with apparent relish.) There are different ways of curing, but the principles are more or less the same, though

the conditions are often considerably modified with different types of tobacco, in order to turn out an article which will suit the different uses for which it is intended.

When the leaves are harvested they continue to live for some considerable time, under favourable conditions, from the accumulated starch and nitrogenous substances present in the cells. By drying the tobacco rapidly, in a hot oven for instance, the leaves are killed almost at once, and the life activities of the cells stop. Consequently such tobacco will never develop the properties for which the article is valued, no matter what treatment it is subjected to afterwards. In order, therefore, to get the desired characteristics, it is not only necessary that the tobacco be harvested at the proper stage of ripeness, but it is also essential that it be wilted and yellowed under certain required conditions.



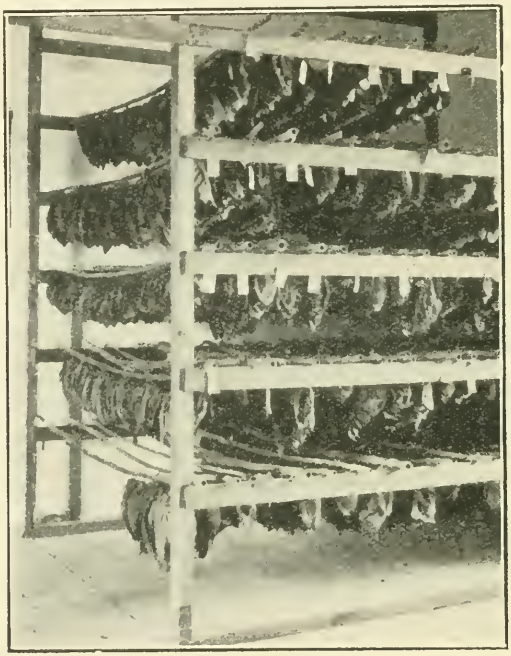
[*Photo by P. Koch.*

FIG. 2.—Reeds of Turkish Tobacco showing method of stringing and tying.

First Stage of Curing.—A definite ratio as regards temperature and humidity must be maintained during the yellowing of tobacco. Accordingly the reeds with their load of leaves are taken into and placed in tiers in a fairly air-tight, dark, moderately cool room or shed, called the wilting-room (see fig. 3), in which the ratio between temperature and humidity can be readily controlled by suitable ventilators. In this room the tobacco is left for three to four days, never longer, unless it rains continuously which is a very rare occurrence in summer in the Western Province.

If the leaves have been strung too tightly, there is danger of mould setting in; if on the other hand they are strung too loosely,

much space is wasted, and they often dry out too rapidly. Furthermore, should the atmosphere in the wilting-room be excessively dry, the tobacco will lose its moisture far too quickly before the desirable changes have taken place in the cell-contents of the leaves, and the product will be sickly looking, ashy-green in colour; should the humidity, however, be too great, the result will be a spotted, mouldy tobacco. In order, therefore, to secure a satisfactory yellowing the conditions must be such that the leaves starve gradually. It can thus be seen that they must remain alive just long enough to allow the necessary changes to take place.



[*Photo by P. Koch.*

FIG. 3.—Arrangement of Tobacco in wilting-room. First stage of curing.

As stated, ripe leaves contain a large amount of starch. This starch is broken up into sugars by certain complex chemical compounds known as enzymes. Small quantities of enzymes can produce very extensive chemical changes without themselves suffering alteration in the process. The resultant sugars form the principal sustenance of the harvested leaves. In the meantime the green colour changes to a lemon-yellow. During the period of starvation in the wilting-room, which lasts three to four days, the green colouring matter or chlorophyll is changed into a colourless substance. This marks the approaching death of the yellowing tobacco and the end of the first stage of curing.

Blistering by the sun, bruising, or allowing it to dry out too rapidly will partly kill the tobacco and prevent the green colour from disappearing, and no after-treatment will remove this. If the tobacco has been harvested more or less ripe, and is allowed to remain in the wilting-room for three or four days under favourable conditions, even though the green colour does not disappear altogether, this will be removed further in the drying camp (curing camp), and subsequently in the bulk and bale during fermentation and ageing.

The yellowing of the tobacco is dependent on the temperature and humidity of the wilting-room. If the temperature is below 40° F. practically no changes takes place, and should it be above 120° F. then the cells of the leaves are killed too soon for the necessary changes to take place. The most favourable temperature is between 60° F. and 100° F., but only provided the relative humidity is about 85 per cent. The amount of water-vapour in any given space depends entirely upon the temperature. By raising the latter by 20° F. the capacity of the air for holding water-vapour is doubled. Thus, by raising the temperature in the wilting-room by 20° F. without the addition of water, the relative amount of humidity is diminished by 50 per cent. On the other hand, if the temperature is lowered by 20° F., the relative humidity per cent. is doubled. In other words, the capacity of a definite volume of warm air for holding water-vapour is greater than that of the same amount of cold air. Hence, should the relative humidity be very great, and there is a sudden drop in temperature, the atmosphere becomes saturated with water-vapour, and moisture forms on the tobacco, which simply means that the dew-point is reached.*

In order to know whether the relative humidity is about 85 per cent., a wet and dry bulb hygrometer is used. It consists of two precisely similar thermometers, mounted at a short distance from each other, the bulb of one of them being covered with muslin, which is kept moist by means of a cotton wick leading from a vessel of water. The evaporation which takes place from the moistened bulb produces a depression of temperature, so that this thermometer reads lower than the other by an amount which increases with the dryness of the air.

* The air is at all times more or less moist, and the degree of moisture is spoken of as its hygroscopicity, and this is measured by instruments called hygrometers. As the amount of water which can exist as vapour in a given volume of air is dependent upon its temperature, by lowering the latter sufficiently, the moisture which existed as invisible vapour is rendered visible in the form of dew. The greater the amount of water vapour in the air, the less is the amount of cooling required to form a deposit of dew, or the higher is the dew-point.

The dryness or moisture of the air is related to the degree of its saturation with water vapour, and not to the actual amount of water vapour present in it. Thus we may have air holding much vapour, but, from its warm temperature, capable of holding much more. Such air feels and is drier, or more drying, than air holding far less moisture, but, due to its coldness, is more nearly saturated with all the vapour it is capable of holding at such a low temperature.

The following table for obtaining the relative humidity per cent. will suffice for the Western Province turkish tobacco grower:—

Relative Humidity Per Cent.—Fahrenheit Temperatures. Barometric Pressure = 30.0 inches.

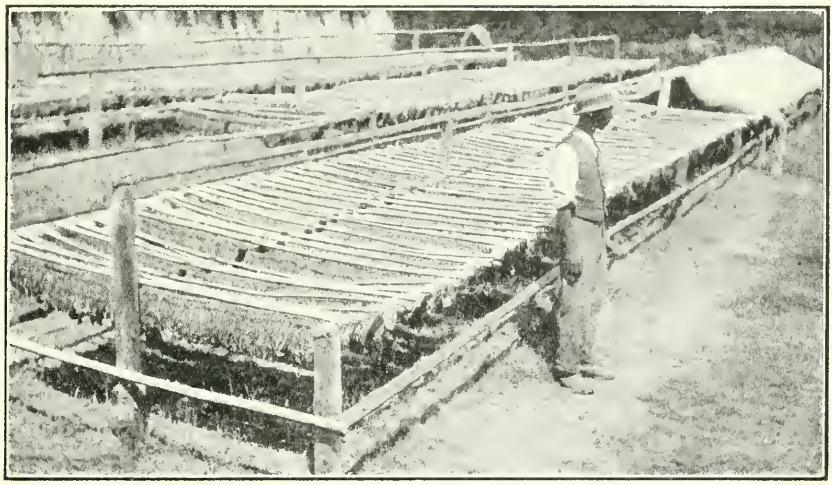
Temperature.	Depression of Wet Bulb Thermometer.									
	0·5	1·0	1·5	2·0	2·5	3·0	3·5	4·0	4·5	5·0
60 degrees ...	97	94	91	89	86	83	81	78	75	73
62 „ ...	97	94	92	89	86	84	81	79	76	74
64 „ ...	97	95	92	90	87	84	82	79	77	71
66 „ ...	97	95	92	90	87	85	82	80	78	75
68 „ ...	97	95	92	90	88	85	83	80	78	76
70 „ ...	98	95	93	90	88	86	83	81	79	77
72 „ ...	98	95	93	91	88	86	84	82	79	77
74 „ ...	98	95	93	91	89	86	84	82	80	78
76 „ ...	98	96	93	91	89	87	84	82	80	78
78 „ ...	98	96	93	91	89	87	85	83	81	79
80 „ ...	98	96	94	91	89	87	85	83	81	79

From this table it will be seen that one is quite safe in keeping the difference between the wet and dry bulb thermometers at from 2.5 to 3.5 when dealing with temperatures of 60° to 80° F., the usual temperatures encountered in regulated Western Province tobacco barns in summer. A depression of 2.5 to 3.5 degrees registers at such temperatures a relative humidity of 81 to 89 per cent., which is near enough for all practical purposes in yellowing tobacco. However, these limits should not be exceeded.

The above table will not always give accurate results if readings of stationary wet and dry bulb thermometers in stagnant air are employed. In such a case it might be necessary to substitute a sling psychrometer (hygrometer). Furthermore, certain precautions must be observed in preparing and fitting or renewing muslin covering of the wet bulb.

As it is difficult to control the required relative humidity per cent. when the temperature is high and wilting-room is continually opened on account of freshly strung tobacco being taken in all day, and on account of few sheds being absolutely ideal in practice, the temperature in a turkish tobacco shed is kept in the vicinity of 70° F. This temperature can easily be controlled in any fairly well constructed barn. By experience the grower soon learns without the aid of a hygrometer whether the shed contains approximately the right amount of moisture, simply by looking at and feeling the tobacco, and by roughly judging the condition of the atmosphere by its effects on the senses.

The reeds remain in the wilting-room until the tobacco is yellow, but not longer than four days. Should the weather be very dry and windy, and the tobacco gets a sickly ashy-green colour, it will be necessary to empty a few buckets of water on the floor to increase the humidity. The grower should be careful not to increase the moisture-content too much, and great care should be exercised in this respect. If the shed is kept full of tobacco, it is not likely that water will ever have to be added. There is danger of insufficient moisture only when the shed is not properly closed, or when there is little tobacco in it. During the daytime the shed remains closed to prevent rapid drying of the tobacco, and during the night the ventilators are opened to cool the room and gradually to get rid of the superfluous amount of water-vapour the tobacco gives off. If it should rain, the shed is closed at night and opened during the day, just the reverse of the

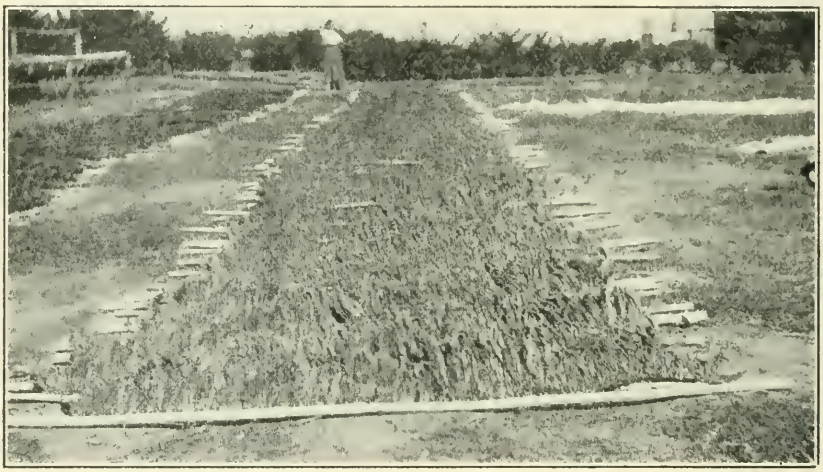


[*Photo by P. Koch.*

FIG. 4.—Tobacco exposed to the sun in drying-camp.
Second stage of curing.

usual practice in dry weather. The reason is self-evident. (Continuous rains during summer in the Western Province are such an abnormality that it is unnecessary to discuss the steps which should be taken in such a contingency.) Depending on the condition of the tobacco, the reeds are removed to the drying camp in the open after the third or fourth day, including the day of harvest. Here the tobacco is placed about 4 inches apart on a trellis, so that the leaves from one reed do not touch those from another (see fig. 4), and covered for a day or two with hessian cloth, except when the weather is cool or the sky cloudy, when it can be left open. If the weather is very hot and windy, and the tobacco is not covered for the first day, it is liable to scorch badly in the sun. After the first or second day the tobacco is left uncovered, but closed during rainy weather and at night to prevent it from getting wet with rain or heavy dew.

Second Stage of Curing.—As the tobacco leaves on the reeds are closely packed, preventing to some extent very rapid drying of the central portions of the leaves, which might not have yellowed completely in the wilting-room, a certain degree of yellowing of those portions will continue to take place in the drying camp for a few days. The full development of the yellow colour marks the end of the first stage of curing. The second stage is in reality only a rapid drying, and the changes which take place then are not dependent on life processes. When the leaf is quite yellow it is to all intents and purposes dead, and no more starch and (or) other foods are consumed. After the first or second day in the drying camp the object is to dry the tobacco as rapidly as possible without scorching it, and thus fix the yellow colour. During the second and epecially the third stages of curing the changes which occur are mainly a further breaking up of the products formed during the first stage. The reddening or



[*Photo by P. Koch.*

FIG. 5.—Reeds of tobacco placed flat on the ground in drying-camp to dry out more rapidly and to obtain better colour. Continuation of second stage of curing.

darkening of the tobacco which takes place in the drying camp is due to oxidation when there is too much moisture in the air as during rainy weather or when it is exposed to heavy dews.

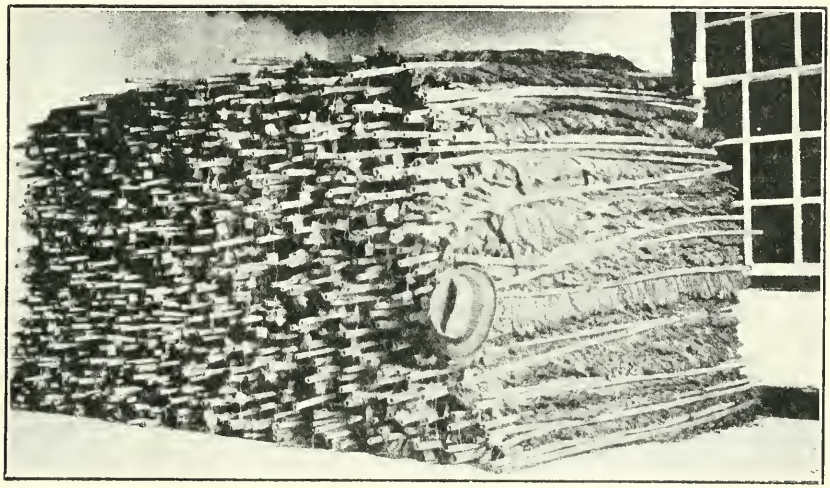
When the mid-ribs are half dry the reeds are removed from the trellis and placed flat on the ground on hessian cloth or grass (see fig. 5) and turned every day until the tobacco is quite dry. Though this practice is not absolutely essential, except within about twenty miles from the coast, tobacco treated in this manner dries out more rapidly, develops as a whole a better colour, and much space is saved on the trellis.

During the first two stages of the curing of turkish tobacco about 70 to 80 per cent. of its green weight is lost, and by far the largest amount of this is water. In order, therefore, to cure tobacco successfully this amount of water has to be removed under such conditions

as will most readily permit the chemical and physiological changes to take place.

It is further necessary that the drying camp be sheltered from strong hot winds, otherwise broken leaves and unsatisfactory drying might result.

Third Stage of Curing.—It takes approximately twenty days for a particular picking of tobacco to dry out entirely in the curing camp. When it has reached this stage it is brought into a cool dry room early in the morning, when it is soft and pliable, and bulked, i.e. stacked or placed in a heap, on a board floor or wooden platform (see fig. 6). If it is brittle to the touch and cannot be handled without breaking, it is carefully taken to and hung in the wilting-room with the green tobacco for about a day, where it will absorb the moisture given off by the latter and "come in case," i.e. become soft. It is then bulked. This marks the third stage in curing.



[*Photo by P. Koch.*

FIG. 6.—Dry Tobacco packed in a bulk to undergo fermentation. Third stage of curing.

The process of bulking can be modified to advantage. Instead of bulking the tobacco at this stage, the reeds may be hung closely together on wire supports in a moderately cool shed, where the tobacco is exposed to the changes of the atmosphere. This considerably improves it, provided precautions are taken during very hot windy weather, or during heavy or continuous autumn rains. Such tobacco has the added advantage that it will not heat while hanging, and certain obnoxious odours are probably eliminated before it is later bulked or baled. Should the tobacco be hung close under an iron roof, the heat is often so intense on hot days that some of the essential oils in the leaves are volatilized and lost, and the tobacco will be lighter and inferior by this amount of oil lost. The method of detaching the strings of leaves from the reeds and hanging them in the form of wreaths in the shed has the same advantages, but there

are several disadvantages as well, which preclude it from being adopted. When the early winter rains set in the shed should be kept closed to prevent the tobacco from absorbing too much moisture, until it can be taken down and bulked or baled.

As cured tobacco leaves are very hygroscopic, i.e. absorb and give off moisture readily when the atmosphere is moist or dry respectively, the heap is covered with bucksails or other suitable material. After a week or two the bulk commences to ferment, and it must be restacked into another heap as soon as an increase in temperature is noticed. Each reed is shaken and thus aired, to cool it before being restacked. Every few days the bulk must be examined to find out whether it is heating. By placing one's hand in the heap, one can feel whether its temperature is normal or not. A bulk will ferment violently if there is too much moisture present in the leaves, and this action is detrimental to the quality unless steps are at once taken to

Photo by P. Koch.

FIG. 7.—"After-fermentation" and ageing in bales in the warehouse. Continuation of third stage of curing.

reduce the moisture-content. (Dark, heavy tobaccos can be subjected without detriment to much higher temperatures in the heap than can light-coloured cigarette tobaccos.) It is thus obvious the tobacco should be neither wet nor dry when it is bulked: slightly moist, so that it can be handled without breaking, is the correct condition. If it is too moist, it must be hung in the sun for a while until the moisture is sufficiently reduced. The heap is restacked every two or three weeks. When it has been restacked twice there is little danger from again heating. By properly controlled fermentation the colour, aroma, flavour, texture, and combustibility improve wonderfully.

"After-fermentation" and ageing in the bales (see fig. 7) are in reality a continuation of fermentation. Though fermentation and ageing are phases in curing, they are not considered to fall within the scope of the present article. The chemical and other changes

which the tobacco undergoes during these periods will therefore not be discussed.

Conclusion.—As can be seen from the foregoing, it requires much experience and judgment to cure tobacco satisfactorily. It must be admitted that the turkish tobacco growers in the Western Province have made substantial progress in the development of the industry, but much remains to be done. The present methods in vogue in curing, among other things, can and must be improved considerably if the growers wish to hold their own against coming competition. These improvements, however, cannot be accomplished intelligently unless the scientific principles underlying the subject are thoroughly understood.

[*Acknowledgments.*—An article by Dr. W. W. Garner, Chief of the Division of Tobacco Investigations and Plant Nutrition, under whom the writer had the pleasure and privilege of studying for a time in Washington, U.S.A., was consulted for certain facts and expressions. The relative humidity table was extracted from "Psychrometric Tables," by Professor C. F. Marvin, Weather Bureau, also of the Federal Department of Agriculture at Washington.]

Grass Fires: A Warning.

Extensive damage is caused every year through the spread of grass fires and, with the near approach of the grass-burning season, farmers and others are urged to exercise the greatest care in the controlling of such fires.

Penalties are provided in regard to malicious and negligent burning of grass by section 10 of the Criminal Law Amendment Act (Transvaal), No. 16 of 1908, and also by section 67 of the Provincial Council Ordinance, No. 5 of 1912 (Transvaal). In the former case a fine not exceeding £100 is provided for or, in default, imprisonment with or without hard labour for a period not exceeding one year, or both such fine and imprisonment; and in the latter a penalty of not exceeding £50 or, in default, imprisonment with or without hard labour for a period not exceeding three months.

There is room for considerably more care on the part of the farming and travelling public generally in lighting and controlling grass fires, and attention is drawn to the penalties to which they are liable.

Fruit Export.

Shipments of fruit for overseas during the month of March, 1921 were as follows:—*Ex* Capetown (boxes): Grapes, 41,463; pears, 60,942; plums, 347; nectarines, 16; peaches, 855; melons, 64; tomatoes, 4; pomegranates, 2; persimmon, 15. *Ex* Port Elizabeth (boxes): Pears, 18; pines, 835. Total boxes exported during the month: 104,561.

Total shipments from all ports during 1920-1921 deciduous fruit season: November, 1920, 42 boxes; December, 1920, 27,422 boxes; January, 1921, 76,286 boxes; February, 1921, 141,424 boxes; March, 1921, 104,561 boxes. Total, 349,735 boxes.

Exports for the 1919-1920 deciduous season amounted to 265,300 boxes.

EXPORT OF SOUTH AFRICAN EGGS, 1920.

Report by R. BOURLAY, Poultry Instructor, School of Agriculture, Potchefstroom.

THE year 1920 constitutes a record in the export of eggs from the Union of South Africa. Ample space was offering on the outward bound steamers during October and November, and had the eggs been available for export, many more could have been shipped.

The shipments for 1920 were as follows: September, 702 cases; October, 19,821 cases; November, 3017 cases. In addition, 45 cases were shipped in September as part of the South African exhibit at the Dairy Show, London, held on 19th October, 1920. These eggs were awarded a gold medal. The total of 23,540 cases represents 8,474,400 eggs, being an average of 1.005 eggs per bird, based on the last Census returns of poultry in the Union.

The shipments for the past seven years were as follows:—

Year.	No. of Cases.
1914	1,927
1915	5,968
1916	14,959
1917	12,189
1918	Nil.
1919	16,180
1920	23,540

This steady increase in the egg export is a most satisfactory indication of the progress of the poultry industry in the Union.

The Cape Province supplied the greater quantity of export eggs, its share being 84 per cent. The Transvaal and Natal together supplied only 16 per cent., this, however, being an increase in the proportion shipped from these two Provinces in former years.

Grading.—Whilst the grading and packing of most of the shippers were good, those of certain packers were very unsatisfactory, and necessitated extra work in rehandling the eggs. This is a very short-sighted policy: the extra expense involved is an entirely unnecessary one, and would be avoided were the eggs properly graded in the first instance.

In some consignments it would appear that the bad packing was due to a misinterpretation of the export regulations. These, however, are perfectly clear and precise on the matter. First-grade eggs must weigh 15 lb. or over, per long hundred (120), and no individual egg may weigh less than 1⅞ oz. Frequently mixed parcels of

eggs are packed in which the total weight is 15 lb., but in which some of the eggs do not come up to the $1\frac{7}{8}$ oz. standard. The packing of small eggs in the centre and bottom of the cases with large eggs on the top does not deceive the inspector.

Packing.—The packing in the majority of instances was decidedly good, but in certain lots it left much to be desired. The use of brown cardboard sheets and fillers must be discontinued and proper white strawboard used in all cases. In certain cases too thin a layer of wood-wool was used at the top and bottom of the box.

Cases.—Perhaps the most important defect requiring remedy at the hands of some of the packers is that of the cases used. A certain amount of latitude has been allowed in this respect during recent years owing to the difficulty during the war of obtaining suitable packing cases, but with the return to more normal conditions, this difficulty is being removed. In the future only eggs which are packed in clean, new, suitable cases of required regulation dimensions will be passed for export.

The use of cases which are of larger dimensions than those laid down in the regulations is unfair both to other shippers and to the shipping company, as an extra inch in height may mean that instead of being able to stow the cases in tiers of four, it is only possible to stow them in tiers of three, thus wasting considerable space in the chambers and upsetting the calculations as to the capacity of the ship's accommodation. It will be wise for shippers to bear this matter in mind when packing for export next year, in order to prevent unnecessary expense and disappointment, for under no circumstances will eggs packed in old, dirty, or unsuitable cases be passed for export.

Allocation of Space.—The method of allocating space in proportion to the holdings in store would appear to be the most satisfactory method of procedure. Some shippers appeared to think that new men should take a back place, but fair treatment for all is the only method that can be adopted.

Market Reports.—The following extracts from London market reports from the Trade Commissioner (28th October, 1920) are of much interest in this connection:—

"The first consignment of this season's eggs, totalling 2722 cases, reached the London market during the last week of October.

"The condition and grading of the eggs were in every way satisfactory, but I regret that complaints have reached me through both the wholesale and retail trade that the eggs are badly tainted, both in smell and taste, with oranges.

"The market demand for eggs has been very good during the past week, and the prices for South African eggs have ranged from 43s. up to 46s. per great hundred (120), the latter price being for first grade."

From Trade Commissioner (11th November, 1920):—"Further to my report of the 28th ultimo, I have to inform you that since that date the market price for South African eggs has declined, and although small parcels have been sold at prices ranging from 42s. to 44s., the bulk has realized from 40s. to 41s. I am informed by the

trade that there is still a large quantity of both the 'Armadale' and 'Walmer' shipments on hand, and sellers are asking 40s. per great hundred, but it is doubtful whether this price will be secured, and it might be possible that, in order to effect sales, a figure round about 38s. will have to be accepted. The high price of 46s. was only obtained for a small proportion of the "Kenilworth Castle" shipment, which reached the market at a time when prices for all eggs were ruling exceedingly high. Latterly, with the large supplies of Roumanian, Argentine, Canadian, and American eggs arriving, prices have naturally declined, but the trade opinion is that they will not go lower than about 38s. per great hundred."

From Trade Commissioner (2nd December, 1920):—"The demand for South African eggs has been somewhat quiet of late, and this is attributed to the condition of the eggs on arrival, but for the finest quality 42s. to 43s. per great hundred has been obtained, whilst good quality and common have made 40s. to 41s. and 37s. to 38s. respectively."

A prominent firm of dealers made a general report as follows:—

"We have found shippers to be very misleading in their descriptions, as from time to time we receive communications from them stating that such and such consignments are absolutely new-laid, whereas, when we examine them on receipt, we find them to be quite the reverse. This question of storing eggs is a matter which is likely to have quite a serious effect on the South African trade. One of the greatest assets of the colony, regarding eggs, is that they are able to export considerable quantities of *fresh* eggs when this class of egg is scarce in other countries of production; but, if shippers go in for storing eggs themselves, the value of their produce must be judged in comparison with other stored eggs, as, for example, Canadian, States, and Irish."

A special small consignment of 50 cases of eggs by the s.s. "Armadale Castle" was reported to have arrived in splendid condition The eggs were large and well selected and quite full, showing that they were new laid. The cases were very clean, and altogether presented a very nice appearance. If South Africa continues to ship eggs in this way, it is stated there is no doubt a large and profitable trade will be built up.

It is desired to direct the attention of shippers to the unfavourable report concerning eggs tainted with oranges, and also to the want of freshness found in many consignments. Careful inquiry has shown that the eggs were not exposed to any fruit taint on board ship, and the arrangements made by the Union-Castle Company were very satisfactory. Neither were eggs and fruit stored in contact in the general cold storages in Capetown. The injury appears to have been due to the holding of eggs in proximity to fruit in the ordinary store in the course of collection, and the greatest care is necessary to avoid the handling of eggs under such conditions. The market reports show clearly that the aim should be to build up an export trade in *fresh* rather than in *stored* eggs, and shippers should not anticipate forwarding eggs which have been in store for any considerable time. If eggs of the latter grade are necessarily exported, they should be plainly marked and sold as stored eggs.

FODDER AND PASTURE GRASSES OF SOUTH AFRICA.

I.—Sudan Grass

(*Sorghum Sudanense* Stapf).

By HENRY A. MELLE, B.A., and SYDNEY M. STENT, Division of Botany, Pretoria.

HISTORY.

THE following account of the introduction of Sudan grass into the United States is taken from the pamphlet issued by Messrs. F. H. Brunning, Melbourne:—

"Sudan grass is the result of a search for forms of wild andropogons which do not have root-stocks. It is acknowledged by agriculturists that Johnson grass, which belongs to this group, would be a valuable hay plant for hot dry areas if it were not supplied with aggressive underground stems. Recognizing this fact, an organized search for forms lacking these root-stocks was begun under the auspices of the U.S.A. Bureau of Agriculture, the result being a grass obtained under the name of 'Garawi' from the Director of Agriculture to the Sudan Government at Khartoum in 1909. The seed was tried at an experiment station in Texas the following spring. The grass looked very promising there, and plans were immediately made for extending the plantings in other parts. In order to give it distinctiveness the name 'Sudan grass' was applied to it."

As the name implies, the grass is a native of tropical North Africa, and is not known to grow spontaneously south of the Equator. It was first introduced into the United States, as stated above, in 1909. In June, 1914, Dr. I. B. Pole Evans, Chief of the Division of Botany, procured a quantity of the seed from the U.S.A. Department of Agriculture, which was sown the following season at the experiment station at Groenkloof, near Pretoria, where excellent crops have been secured.

NOMENCLATURE.

Sudan grass has been described by Prof. Piper, of the Department of Agriculture, U.S.A., under the botanical name of *Andropogon sorghum*, var. *Sudanensis*, but O. Stapf, of the Royal Botanic Gardens, Kew, who has recently made a very thorough and scientific examination of the tropical grasses, has revived the generic name of *Sorghum* for this section of the Andropogonae, and Sudan grass must henceforth be known botanically as *Sorghum Sudanense* Stapf.

In parts of North Africa where this plant occurs naturally it is known to the natives under the name of "Garawi," but in the U.S.A. it was given the name of "Sudan grass," by which name it is now popularly known.

DESCRIPTION.

Annual (occasionally, under certain conditions, behaving as a bi- or triennial). *Stems* slender, seldom exceeding a lead-pencil in thickness, up to 10 ft. high, and about 9-jointed; whole plant smooth except for the finely silky hairy joints of the sheaths; *leaves* 6-24 in. long by ½-¾ in. broad, upper ones slightly narrowed at the base, the lower ones long, attenuate and sometimes reduced at the base to the stout mid-rib; *ligule* (membraneous scale at the junction of the leaf-blade and the sheath) about 1/12th of an inch long; *flowering-head* pyramid shaped, erect, 6-14 in. long and up to 10 in. wide at the base; flowering branches usually in whorls of two to four, or sometimes solitary at the joint of the rachis (stem), bare for from

SUDAN GRASS, GROENKLOOF.
Planted 14th November, 1920. Date of Photograph 10th January, 1921.

1-2½ in., or occasionally with a long single branchlet springing from very near the base; lower branches up to 9 in. long; *flowers* arranged close together in pairs on the short branchlets, the larger of the two bearing the seed is sessile (without a short stalk) and has a slender twisted awn or bristle from the tip; the other is narrower on a short slender stalk, without an awn; it is sometimes much reduced and empty, but usually contains fully developed stamens.

For the benefit of those who know a little botany and understand the construction of the grass flowers, the following more or less technical description of the inflorescence is given; it refers to the cultivated specimens:—

Panicle ovate, pyramidal, erect, 6-14 in. long, and up to 10 in. wide at the base; *branches* obliquely ascending, recurving; whorled or sometimes solitary, the longest up to 9 in. undivided for from 1-2½ in., occasionally with a long slender branchlet from near the base; rachis, branches, and branchlets very scabrid; *racemes*

fragile, few to 5-noded, and up to 1 in. long, joints slender up to 2 lin. long, sparsely ciliate, cilia whitish; pedicels similar and of equal length; *sessile spikelet* lanceolate to elliptic-oblong, sub-acute up to 3 lin. long; *lower glume* dorsally flattened towards the tip, sides sharply inflexed and keeled in the upper part, rounded lower

A Sheaf of Sudan Grass.

down; about 13-nerved and shortly hairy; *upper glume* 7-nerved, with hyaline inflexed margins; *lower valve* empty, hyaline, 2½ lin. long, 2-nerved, ciliate, bidentate at the tip; *upper valve* 2 lin. long, hyaline, ciliate, deeply bifid, with a fine awn from the sinus; *lodicules* truncate, and long ciliate from the broad tips, pale 1 lin. long, ciliate,

delicately hyaline; *ovary* narrow-oval, stigmas and styles quite separate; anthers 2 lin. long on short filaments; *pedicelled spikelet* 3½ lin. long, glabrous, rather narrow; *lower glume* up to 13-nerved, with scabrid inflexed keels, in the upper part; *upper glume* 7-nerved; *upper valve* entire, ovate, hyaline, mucronulate, and ciliate; *lower valve* pale, stamens and lodicules as in the sessile spikelet.

A PERNICIOUS RELATIVE.

Sudan grass is related to the broom corns, "Imphee," and Kaffir corns, all of which are species of *Sorghum*. It is also very nearly related to the pernicious Johnson grass; in fact, so near is its resemblance to the last named that the casual observer will often mistake one for the other.

The main character that separates Johnson from Sudan grass, and the character that has stamped the former as a pernicious weed in spite of its other excellent qualities, is its stout stoloniferous rootstock. Whereas Sudan grass is an annual, Johnson grass is a perennial, and by means of these stout underground stolons takes firm possession of the ground, spreading rapidly, resisting all attempts at eradication, and choking out all other growth. In California, so thoroughly is the danger of Johnson grass realized that it has been proclaimed a noxious weed, and the law strenuously enforced against it.

Johnson grass seed is one of the commonest impurities found in Sudan, and buyers should be careful to buy only guaranteed clean seed. The seed of Johnson grass resembles that of Sudan, but is smaller and usually darker in colour.

COMPARISON WITH TEFF.

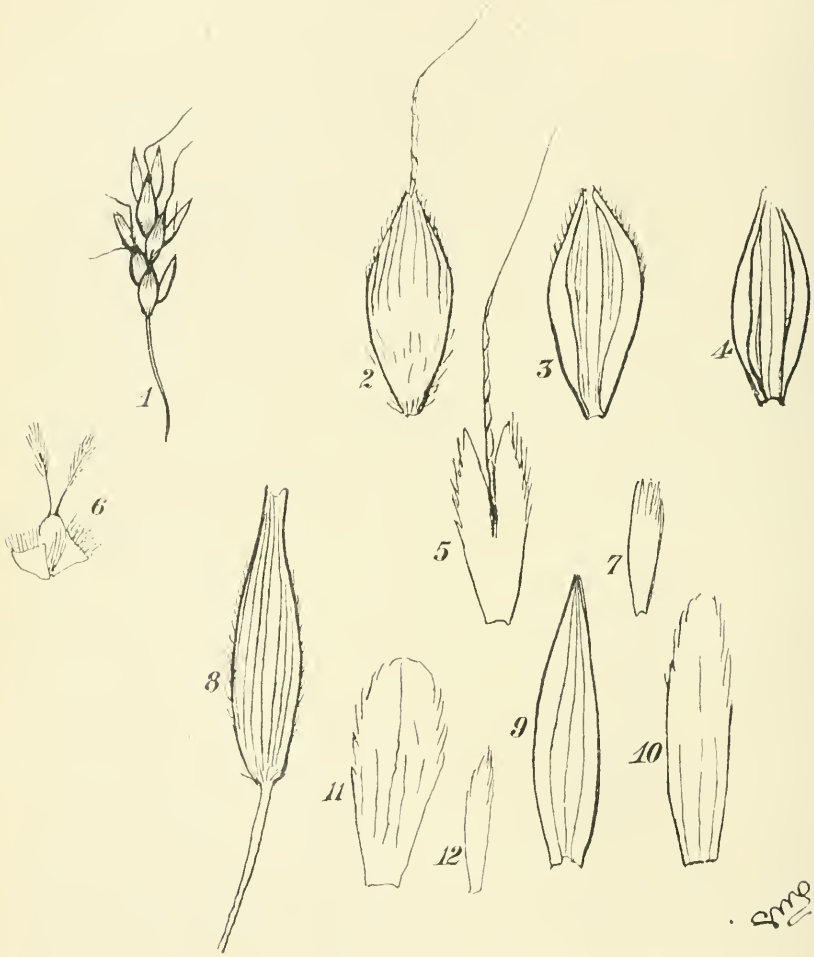
With the introduction of teff it was thought that an ideal hay-grass had been procured, and one best suited to the adverse conditions of this country. The feeding value of teff is certainly higher than that of any other known grass, but experience has shown that its adaptability is very limited. Sudan grass, on the other hand, is not only a palatable grass of high feeding value, but is not so precise in its requirements as teff. This season, at the station at Groenkloof, an experiment was carried out with the two grasses: a piece of land was thoroughly ploughed and brought to a fine tilth, and was sown broadcast, half with Sudan grass and half with teff, on the same day. The Sudan came up evenly and commenced growing vigorously; the teff germinated poorly and only in odd patches. At the time of writing (two months after sowing) there is to be seen a beautiful stand of Sudan grass just coming into flower, even, well grown, densely leafy, and devoid of weeds. Beside it is a piece of ground covered mostly with a fine crop of weeds, and with poorly grown patches of teff at intervals. The Sudan is now about 3 ft. high, and has smothered all the weeds; but these pests have quite got the better of the teff, which, where it is seen, is poorly grown and nowhere more than 1 ft. high.

ADAPTABILITY.

Sorghum Sudanense adapts itself to soil and climatic conditions such as suit other cultivated species of sorghums, including kaffir corn, but will mature earlier than any of these species. It does best on

Sudan Grass (*Sorghum Sudanense*).

a rich loam, but has been grown successfully on practically every type of soil. In favourable seasons, where the growing period is long, as many as four cuttings have been obtained in one year, but at the Groenkloof Station it has not been possible to get more than two cuttings a season.



SUDAN GRASS.

1 Raceme—natural size.
2 Sessile spikelet.
3 Lower glume.
4 Upper glume.
5 Upper valve.
6 Ovary and lodicules.
7 Pale.
8 Pedicelled spikelet.
9 Upper glume.
10 Lower valve.
11 Upper valve.
12 Pale.

DROUGHT RESISTANCE.

Sudan grass is recognized as one of the most drought-resisting hay-crops known.

Mr. A. E. Schlenker, of Pietersburg, wrote as follows in the *Farmer's Weekly*, 19th September, 1917:—

"Near Pietersburg a plot of six acres virgin soil was broken up in the autumn of 1916 about 5 in. deep, harrowed, and in November, after the first good rain, again ploughed 8 in. deep and harrowed. Three acres were drilled in rows 2½ ft. apart, using about 3½ lb. of seed to the acre; as the ground was fairly dry it was immediately rolled after sowing. Then a light rain fell, and the seed germinated in eight days. From the time of the second ploughing to the end of March, 1917, 8 in. of rain fell, and the field was a waving field of Sudan grass four or five feet high, heavy with ripe, plump seed. The drilled acres were cultivated once. In spite of that the broadcasted three acres looked better and gave a much more even stand of seed. Mealies grown in the neighbourhood gave at most half a bag to the acre. Most of the teff sown had to be grazed, being too poor to cut. The first cutting of Sudan grass weighed a little over 2 tons per acre. The second growth (1½ ft.) was grazed down."

YIELD.

Sudan grass is a very fast grower. Mr. Bosman, Vice-Principal, School of Agriculture, Glen, records that, planted on 10th November, at Potchefstroom Experiment Station, the flowers appeared on 12th January, and the crop was cut shortly afterwards, when it was nearly 6 ft. high. The yield was 26,200 lb. of green fodder per acre; the second cutting was taken off on 11th March, when the crop was again 3½ ft. high, and yielded 12,900 lb. of green fodder. The total weight of green fodder from the acre was 39,100 lb., or approximately 19.2 tons. This yield was obtained under very favourable conditions. Sown for seed purposes on 10th November and harvested on 11th March, it was 8 ft. high and yielded 900 lb. of seed, as well as 20,900 lb. of straw per acre.

PALATABILITY.

Sudan grass, if not allowed to grow too coarse, makes a hay of excellent quality, and all stock eat it readily. Even if the stems become thicker than a lead-pencil, if cured and chaffed it will be greedily eaten by cattle. It is suited admirably as a soiling crop, since it makes a large yield and is very palatable in the green state as well as when cured for hay.

In the following analysis the most important point, perhaps, is the comparison between the mature plant with that cut in bloom:—

	Cut 7th August.				Cut 1st September.	Cut 1st October.
	Before Heading.	Heads just Appearing.	Just beginning to Bloom.	In Full Bloom.	Before Heading.	Fully Mature.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Moisture... ...	4.13	3.54	3.46	3.51	4.82	4.38
Ash	6.61	5.55	5.02	5.64	7.12	5.59
Ether extract	1.72	1.39	1.23	1.27	1.49	1.48
Protein	7.75	6.06	5.16	4.66	5.63	4.19
Crude fibre ...	30.68	31.94	33.23	35.62	34.30	34.44
Pentosans ...	21.82	24.01	24.70	24.51	23.38	26.70
Undetermined	27.29	27.51	27.20	24.19	23.26	26.70

USES.

Sudan grass may be compared to the millets in that it makes a large crop of hay in a short season of warm weather. It is preferable to millets, however, in that the hay is much superior and can be fed to all kinds of stock without injury to them. While it is closely related to other cultivated sorghums, it has much finer stems, enabling it to be readily cured as hay. It is an excellent crop to sow with cowpeas for hay and silage. It grows strictly erect, with a stem stiff enough to support the vines characteristic of most legumes, and it makes the harvesting easier by keeping the legumes off the ground. It also allows them to cure quickly by preventing the leaves from matting.

PREPARATION OF THE SEED-BED.

The land should be ploughed early in spring, or preferably in the winter months, with a subsequent cross-ploughing or cultivation in spring so as to get the seed-bed into a fine tilth before the seeding takes place, and also to destroy what weed-growth there is.

Although the plant is very hardy and can withstand a great deal of drought it can be readily understood that to obtain the maximum yield it requires moisture and plant food. In order to store moisture in the ground where the crop can make use of it during dry spells, it is necessary to plough deeply and to harrow immediately after ploughing, so as to establish a mulch which will prevent the moisture from escaping.

SEEDING.

Sudan grass seed is best sown after the soil has warmed somewhat, about the same time or a little earlier than maize or millet.

The seed can be either sown broadcast or planted with an ordinary seed-drill. For seed production it is best sown in rows 3 ft. apart; a mealie-planter can be used. In moist soils seed should be sown at a depth of from ½-1 in. For hay production it is best sown broadcast, as by a thick sowing finer stems are secured, resulting in a more palatable fodder.

The rate of seeding per acre varies from 2-30 lb. according to the method employed. When sown broadcast 15-20 lb. of seed per acre are necessary. In districts with a low rainfall a light seeding is more profitable, while in humid regions or under irrigation 20 lb. is not too heavy. If the ground is weedy or the seed-bed poorly prepared, 30 lb. is better. For seeding in cultivated rows, 36-44 in. apart, 2-4 lb. seed per acre are sufficient, while in rows 18-24 in. apart 4-6 lb. per acre will be required, the less quantity being used, as in the broadcast seeding, for regions of light rainfall.

CULTIVATION.

The crop should receive a harrowing soon after it shows above ground, and where it is planted in rows far enough apart to allow inter-tillage it should receive regular cultivations to keep down the weeds and to conserve moisture until the crop has become well established and is shading the ground.

HARVESTING.

In choosing the best time for cutting Sudan grass consideration should be given to the fact that three or four cuttings are expected, and it would be, therefore, as well to make the first cutting as early as possible, giving the grass plenty of time to make fresh growth. It must also be borne in mind that the very best Sudan hay is made when the grass is cut after full bloom and just before it sets seed. For the last cutting, therefore, the grass can be left till this stage is reached.

Harvesting should be done with a mower, and, if the weather is hot and bright, the grass can be cut in the morning and raked up that afternoon or the following day. If cut at the right stage of maturity and handled properly a bright, leavy, sweet hay will result.

When cut for seed the first heads should be fully ripe, as the stools mature somewhat later than the main stem and there is little loss from shattering.

SUMMARY.

1. Sudan grass is closely related to the kaffir, broom, and sweet corns, but yields superior hay to these and is free from pernicious qualities as a soiling food.
2. Three or four cuttings can be obtained from it under favourable conditions.
3. The yields vary from two to eight tons of hay per acre.
4. It is a heavy yielder of grain.
5. It grows well in districts suitable to kaffir corn.
6. It is a crop that can be recommended for cultivation in areas where it is too hot and dry for teff to grow successfully.

World Cotton Conference.

The first conference of its kind known as the "World Cotton Conference" took place in New Orleans, U.S.A., in 1918, about 500 delegates, representing thirty-two countries, being present, and was attended by Mr. W. H. Scherffius, Chief of the Tobacco and Cotton Division, who happened to be in that country at the time. Following the success which attended the conference, a second one has been arranged to take place in Liverpool and Manchester during June, 1921, at which it is expected that representatives from most places where cotton is grown or manufactured will attend, and at the time of writing more than one hundred delegates from the United States alone have booked their passages for England. Unfortunately, circumstances do not permit of the Union being represented at the second conference, but it is hoped that much valuable information will be derived from the published reports of this noteworthy gathering of experts, and from the papers which will be read at the conference by the world's leading authorities on the various branches of the great industry. The Division will keep in close touch with the conference and apply its lessons to the budding cotton industry in South Africa, which should share in the impetus to the industry throughout the world which will doubtless result from the conference.

EXPORT OF CITRUS FRUITS.

Investigations into the Cause of Wastage.

DURING the past season the Division of Botany and Plant Pathology continued its investigations into the wastage of fruit, begun at Capetown in 1919 and which included an examination of the railway trucks, Government cold stores, ships' cool chambers, and the chambers of the Imperial Cold Storage at Capetown,* the investigations this year covering the handling of the fruit from the orchard to the London market. The results of these observations are now published in Bulletin No. 2, 1921,† under the title "Further Investigations into the Cause of Wastage in Export Citrus Fruits from South Africa."

The investigations show conclusively that, with ordinary care and intelligent handling, it is possible to place South African citrus fruits on the oversea markets with a minimum of waste. The precautions necessary to attain this are clearly set out in the bulletin referred to, which should be in the hands of all concerned, and hereunder we give in summary form certain of the points brought to light.

Orchards.—The percentage of citrus-rotting organisms shown by the plates exposed was small. To reduce this, growers are advised to remove and destroy all fallen fruits.

Packing Sheds.—The examination in the packing sheds varied with the condition in which the sheds were kept. In those sheds where mouldy fruits had not been removed, and where returned boxes showing evidence of rotten fruit were stacked, the contamination was greatest. Although a certain amount of contamination due to citrus-rotting organisms was found, this was by no means great, and with moderate care in the removal of all contaminated fruits and used fruit boxes, it is reasonable to suppose that these organisms could be practically eliminated from the atmosphere of the sheds. The practice of using packing sheds as stores when no packing is going on is to be condemned. It is suggested that the packing sheds be disinfected before packing begins and after packing has stopped.

Trucks.—In those examined no citrus-rotting organisms were found, although in one case the truck was half filled with sacks of oranges. The trucks could, with advantage, be kept free of kaffir beans, coal, and straw, and be disinfected before loading and after off-loading, and used for nothing but fruit traffic.

Boxwood.—Inoculation experiments showed that of all the fungi obtained from the boxwood only two species produced a rot, and then only when the wound through which inoculation was made was sufficiently deep to allow the escape of juice from the fruit. These rots were never detected naturally in the packs. No danger is, therefore, likely to occur from the use of the new wood, but a real danger exists in reusing boxes which have carried any single mouldy fruit.

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* See Bulletin No. 2, 1920, "Wastage in Citrus Fruit shipped for Export," also Report on "Cold Storage Conditions for Export Fruit at Capetown," in February, 1921, *Journal*.

† Obtainable on application to this Office: Price 1s. 6d.

Fruit Packs.—In the preliminary examination of the first packs the outstanding features were: (1) Boxes badly constructed of roughly sawn wood; (2) protruding nails in the centre partition; (3) escape of juice from the orange peel, making a yellow oily mark on the wrapper, and resulting in a dried patch on the fruit; (4) wrappers torn where the fruit had come in contact with the wood; (5) damp wrappers, excessive in cases where fruit had been packed directly after picking; (6) splinter wounds and imprints; (7) fruits badly misshapen owing to pressure; (8) occasional split and cracked fruits; (9) occasional completely mouldy fruits (as the examination was made within four days from the packing, it is very probable that some indication of incipient mould was present, and should have been detected in wrapping); (10) fruit-fly punctures, all of which developed mould; (11) mechanical injuries, due to thorns, nails, finger nails, cutters, and besides these very many minor injuries were found on the rind; (12) scale: fruits were packed showing a small amount of purple scale and much more red scale; the puncturing of such fruit by these scale insects must render it more liable to attack by mould; (13) thrips: navel oranges were very badly marked. (*Note.*—Nos. 3, 4, 5, 6, and 7 are the result of packing with a bulge.)

Arising from the above, it was decided to employ specially chosen men to handle the fruit in every process from the orchard to the railway truck. These men were advised through Mr. Hobson, the Chief Citrus Canker Inspector, as to the various precautions which should be taken in handling the fruit. As a result mechanical injuries in the fruits were reduced to almost microscopic dimensions.

A Laboratory Experiment.—Some interesting experiments were carried out in the laboratory, and the following is instanced:—A navel orange, when first unpacked, showed a soft spot which was obviously an early stage in mould infection. This orange was rewrapped in two new sterilized wrappers and placed with four sound oranges similarly wrapped in a sterilized, well-ventilated jar. After 21 days, although the affected orange was entirely disintegrated and the wrappers of the other fruits were wet and thickly covered with spores, no infection of any one of the four fruits had taken place. At the end of two months they remained unaffected by mould (but one fruit showed a brown spot at the stalk-end), and were then discarded. Similar experiments were repeated with the same results. This shows that these contact oranges which remained sound for such a length of time must have had uninjured skins.

Examination at Capetown.—On arrival at Capetown each individual orange in every consignment was examined by the Government Mycologist. In all 37,000 individual oranges were inspected, and of this number 26 fruits were discarded, 7 showing blemishes, and 19 mould, and the observation made at Pretoria that mouldy and stained boxes did not show a higher percentage of waste than clean boxes was confirmed. It was observed also that the bulge on the experimental packs was not sufficient to do any damage.

The following observations were made at Capetown:—(1) A pack of navel oranges (150) from Rhodesia showed 39 infected with mould. Almost every single orange in the case had a small cut in the rind, possibly caused by an exposed nail in the grader. (2) A case of navel oranges from Rhodesia, which showed a high percentage of mould, was put into cold stores after the mouldy fruit had been removed.

Inside the case there must have been millions of mould spores, yet after three weeks not a single other fruit was wasty. The only conclusion is that the remaining fruit must have been free from injury in the skin. (3) Citrus fruit from Clanwilliam showed a higher percentage of waste than citrus from other parts of the Union.

On the London Market.—Observations were made during September on citrus fruits offered for sale on the London markets, and special emphasis is laid on the following points:—(1) The extremely unattractive appearance of South African packs compared with those from other countries. (2) Disregard in packing South African blemished fruit and lack of careful selection with regard to quality. (3) The blemished fruit noticed included brown spots, nail marks, large scars, and even thorns themselves. (4) Navel packs with a very pronounced bulge showed up to 25 per cent. waste. (5) Badly ventilated cases also showed excessive waste. (6) The presence of perfectly sound fruits adjacent to a mass of mouldy ones, again showing the importance of an uninjured skin. (7) About 20 cases of navels packed in fungus-infected boxwood and carelessly wrapped showed no wastage. Such unattractive packs would sell at a loss to the grower. (8) Absence of steady demand for large, light thick-skinned fruits. (9) The importance of developing a trade in early and late varieties of South African citrus fruits and not specializing on navels only. (10) The poor keeping qualities of fruits from certain areas. (11) On the voyage, citrus fruits in the cool chambers showed a smaller percentage of waste than those in ventilated holds, but broke down more rapidly after unloading.

From observations and results independently obtained, it appears that with the greatest possible care in picking, grading, and packing, all other conditions being favourable, South African fruit could be put on the London market in a practically sound condition. On attaining this, it only remains for growers to set up sufficiently attractive looking packs for South African fruits to hold their own with competitors from any part of the world.

Export of Grain, etc.

During the month of March, 1921, the following quantities of grain, etc. (in bags), were exported: Maize, 396,216; maize meal, 74,376; hominy chop, 1920; oats, 4399; rye, 2067; bran, 1000; lucerne seed, 115; kaffir corn, 564; total, 480,657.

The total number of bags exported for the period 1st July, 1920, to 31st March, 1921, was: Maize, 952,207; maize meal, 362,548; maize flour, 1199; maize grit (rice), 3111; hominy chop, 57,311; kaffir corn, 1715; oats, 16,478; beans, 1213; lucerne seed, 481; rye, 4836; millet, 11; bran, 1500; total, 1,402,610 bags.

Stocks in hand at all ports at 31st March, 1921, were (in bags): Maize, 274,784; maize meal, 16,651; oats, 233; hominy chop, 130; rye, 1698; kaffir corn, 166; total, 293,662.

CYANIDE GAS REMEDY FOR SCALE INSECTS.

By C. P. LOUNSBURY, Chief, Division of Entomology.

Outline of Treatment.—Fumigation with hydrocyanic acid gas is by far the most efficient and, in the end, the cheapest remedy for the suppression of Red Scale and other "hard" scale insects in commercial plantings of citrus trees. The operation of fumigating trees is very simple. The tree to be treated is covered with an approximately air-tight cloth, and gas then generated within the enclosed space by the action of dilute sulphuric acid on potassium cyanide or sodium cyanide in an acid-proof vessel placed near the foot of the tree. The gas diffuses throughout the space under cover, and thus the whole surface of the tree becomes enveloped in one of the most deadly of poisonous substances. An exposure of forty-five minutes is considered ample for the destruction of the common scale insects, and by the expiration of this period most of the gas has disappeared by leakage through the cover and in other ways. The cover is then removed, and may be at once employed for enclosing another tree. It takes only a few minutes to cover a tree and start the gas. Hence as many trees can be done at a time as there are covers available and as can be covered and uncovered in the exposure period. Experienced fumigators in California working under favourable conditions on trees about 12 to 14 feet high can operate thirty to forty covers and do three hundred to four hundred trees in one night; but in South Africa it is highly exceptional to have over twenty covers to work, and many private "outfits" consist of less than half a dozen and some consist of single covers.

Cyanide Details.—The cyanide used is the same chemical that is employed in enormous quantities for gold extraction. Either potassium cyanide or sodium cyanide may be used for fumigation, but because it is now cheaper and more easily procurable the latter is generally employed. Pure sodium cyanide contains about one-third more cyanogen than pure potassium cyanide; and it is a somewhat unfortunate common trade custom to quote the grade of a sodium cyanide on the basis of the cyanogen in it compared with pure potassium cyanide. While high-grade potassium cyanide is termed 96-99 per cent., the similar grade of sodium cyanide is often termed 126-130 per cent. One has to be careful to avoid accepting an impure mixed cyanide, containing the amount of cyanogen there should be in commercially pure potassium cyanide, under an impression that he is getting cyanide that is 96-99 per cent. pure; much such impure mixed cyanide has been sold as potassium cyanide. The Californian fumigation of citrus trees (by the method used in South Africa) is done chiefly with "Cyanegg." This is a sodium cyanide said to be of 96-98 per cent. purity and therefore equivalent in purity to what in the South African trade is called 126-130 per cent. cyanide. Cyanegg is manufactured by the Roessler and Hasslacher Chemical

Co., 709-717 Sixth Avenue, New York City, and the firm now offers it in 100-lb. and 200-lb. cases at a price that compares favourably with the price that has to be paid for other cyanide in South Africa. It is preferable because made in rounded lumps weighing about one ounce each, the convenient size for fumigation. Ordinary cyanide is in irregular chunks that may weigh a pound or more and which, therefore, requires much breaking to prepare it for fumigation doses. The pieces for fumigating had best be from the size of loaf sugar to that of turkey eggs, according to the weight of the dose for the tree. In breaking a lump, it should be tapped smartly with a hammer so as to detach pieces of the size wanted with the least possible formation of powder and small chips, very small pieces being undesirable because of the rapidity with which acid acts on them and the consequent great liability of splashing acid on to the cloth. It follows that a dose should not contain a high proportion of small pieces. Sodium cyanide may be bought by fumigators from most wholesale chemists. Lennon Ltd. has long made a specialty of supplying it in lots of 7 lb. and upwards, while a considerable saving can sometimes be made by purchasing it in bulk from the Johannesburg merchants who import it in huge quantities for the mines. For the mines it comes in 2-cwt. zinc-lined cases and largely via Delagoa Bay. Before the war it cost only about 1s. a pound in Johannesburg, but in recent years it has generally cost 1s. 6d. or more.

The exceedingly poisonous nature of the cyanide should never be forgotten, and the precaution to put a "poison" label on every receptacle in which any of it is put away should invariably be taken. If left exposed to the air, especially damp air, cyanide deteriorates rapidly; and it is unwise, as a rule, to purchase more at a time than will be used in the same season. It should always be stored in dry, air-tight vessels; and lever-top tins, such as some grocery supplies come packed in, answer admirably for preserving it if kept tightly closed.

Acid Details.—Sulphuric acid is used in large quantities for various commercial purposes, and may generally be procured without difficulty and at a fair price from wholesale chemists. "Commercial" sulphuric acid should be asked for. The New Transvaal Chemical Co., Delmas, Transvaal Province, the B.S.A. Explosives Co., Modderfontein, Transvaal Province, and the Cape Explosives Works, Somerset West, Cape Province, all manufacture the acid and will sell it in bulk to fumigators. Fumigators who need large quantities are likely to save much by buying direct from these or other manufacturers. The acid costs least when half a ton or more is bought in a steel drum, but the makers can generally supply it in cases holding four 2-gallon jars. The two gallons weigh 27 lb. The cost of small lots at a chemist's is generally at least 6d. a pound, even when two gallons are taken. Great care should be exercised to prevent any of the acid being spilled on to the skin or clothes, as it is extremely corrosive. One pound measures only about nine fluid ounces, and about two and one-quarter pounds by weight are required for use with a pound of sodium cyanide. Receptacles containing it should be labelled "poison," and should be kept closely stoppered to prevent the acid from absorbing moisture and thereby becoming weakened.

Many fumigation covers have been entirely ruined by storage in contact with jars of acid or on a floor where acid has been spilled. Many more have been damaged by being handled with hands fouled with acid. It pays to take care to avoid such accidents. The men who measure out the acid and dose the trees and attend to generating vessels had best not even touch the covers before washing and drying their hands.

The Generating Vessel.—The vessel in which the chemicals are mixed had best be rounded and somewhat narrowed at the bottom inside, as it is necessary that the acid-water mixture be deep enough to cover the lumps of cyanide. China pudding-basins and china bedroom utensils make as good generating vessels as are commonly procurable in this country. Enamel dishes are excellent until the enamel chips, which quickly happens if the quality is not of the best. A cover or very loose-fitting lid is desirable to check the direct ascent of the gas and to stop minute splashes of acid that otherwise may soon burn innumerable tiny holes in the cloth; a bottomless paraffin tin with large perforations in the sides is often very suitable. A large coffee-cup will answer as a generating dish for a half-ounce charge, and a quart pudding-basin for a two-ounce charge, while for a ten-ounce charge a vessel that will hold about a gallon is needed. Jug-shaped glazed earthenware generating vessels, patterned after those commonly used in California, may now be procured made-to-order from the Trent Potteries Ltd., P.O. Box 1825, Johannesburg (works at New Muckleneuk, Pretoria), and from Consolidated Rand Brick, Pottery, and Lime Co., Olifantsfontein. The cost is about 7s. each.

Improved Methods of Generating the Gas.—The open vessel method of generating the gas under the fumigation cover was almost entirely superseded about six years ago in California by what may be called the cyanofumer method, which, in the past few years, has given way to the use of liquefied hydrocyanic acid gas. South Africa is not ready for the general adoption of either of these improvements, but it is desirable that prospective fumigators should know about them in order that they may consider their applicability to their individual conditions.

"Cyanofumer" is the name applied to a patented machine generator that is moved from tree to tree, and from which the gas is delivered through a hose. The body of the apparatus consists of two air-tight metal vessels fixed one above the other. In the lower one is carried a large volume of acid-water mixture, and in the upper a large volume of cyanide dissolved in water. By working a pump the exact quantity of the cyanide solution necessary to yield the volume of gas wanted for a tree is run into the acid. The chemicals react at once and the resultant gas is discharged through the hose. The method is free of the risk of damaging the cover by splashing, and it effects economies in the chemicals and labour when there are many contiguous trees to be treated. Three sizes of the machine are manufactured: the "Junior," holding the equivalent of about 7 lb. of cyanide; the "Standard," the equivalent of about 40 lb.; and the "Jumbo," the equivalent of about 60 lb. Until recently only the Junior was sold outright, the other sizes being leased and a royalty charged in respect of each tree treated; but it is understood that the

larger sizes are now on sale. Only one machine, so far as is known to the writer, has been imported into South Africa. It is a Standard, the price for which in 1920 was 250 dollars in New York. The American price for the Junior four years ago was 125 dollars. Purchases may be made of the Braun Corporation, Los Angeles, California, or from the New York firm mentioned in connection with cyanegg in the second section of this article. The advent of the cyanofumer marked a very distinct step forward in Californian fumigation; but many circumstances will probably long tend to retard the adoption of machine generation of the gas in South Africa. The initial cost of a machine is not the greatest obstacle. The difficulty of effecting repairs and replacements on the farm and at such a great distance from the makers is more serious.

The Senior Entomologist, Capetown, Mr. C. W. Mally, experimented with liquefied hydrocyanic acid gas for plant fumigation and advocated its use for this purpose before the idea of employing it was developed in California; but the conditions for getting the liquid prepared and used were very favourable in California while the reverse here. Commercial production of the liquid was speedily perfected in California, and satisfactory apparatus soon evolved for injecting the liquid under the cover, where it instantaneously volatilizes. The gas is generated in great closed retorts in open-air factories, run through chilled pipes to convert it to liquid, and then packed in special drums for transport to the orchard. The liquid is highly volatile and, being intensely poisonous, immense care has to be exercised in all operations with it. The railways refuse to transport it, and it is conveyed by motor-trucks fresh from the factories to the orchards, where it is used practically at once. Under the Californian conditions, comprising great stretches of well-kept citrus plantations along tar-surfaced motor roads, the liquefied gas has proved a great boon to the fumigators; but many difficulties, experienced only in minor degree, if at all, in California, will have to be overcome before the liquid can be brought into commercial use for orchard fumigation in South Africa. However, a company to prepare the liquid has been formed at Capetown which hopes to supply it in hermetically sealed glass tubes or flasks at a price which fumigators can afford to pay. The filled glass is to be packed in material that will render the gas harmless should breakage occur, and therefore the railway department is not expected to raise any objection to transporting it. The one or more tubes containing the quantity which is decided to be requisite for the tree is to be placed in a special generator of simple design and the glass crushed by a simple device when all is ready.

Kinds of Covers.—Two types of cloth covers, sheet covers and dome covers, are used for fumigation. Sheet covers are flat covers designed to envelop trees as a wagon-sail envelops a load of goods. They may be used for large and small trees, and in California have entirely superseded dome covers. In shape they are made a regular octagon, any waste in cutting the cloth being thus avoided. One will cover as large a tree as will a square sheet of the same diameter, while it needs only five-sixths as much cloth. It is helped over the tree by two long poles, one hooked into a ring tied near the front of the sheet on each side thereof. Dome covers are shaped like the crown of a hat, that is, they have a cylindrical base surmounted by a rounded top.

They take less cloth than sheets, but for use on trees over 6 feet high they require the addition of a ring of piping to keep the mouth distended, and they are much more difficult than sheets to enlarge if

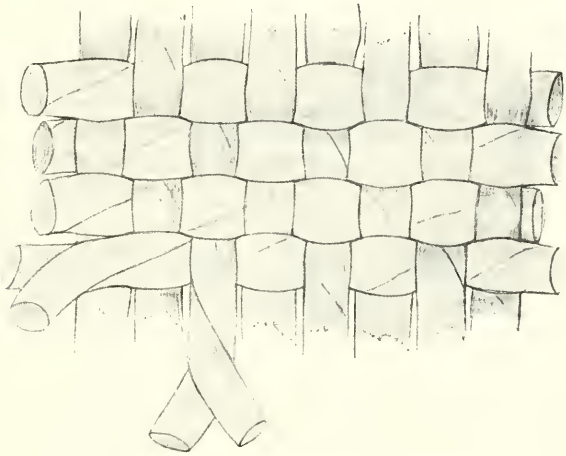

FIG. 1.—*Cloth for Fumigation Covers.*—Sketch to show weave of desirable type of duck.

(Illustration by R. S. Woglum.)

the trees outgrow them. It is more difficult to get them made than sheets, and they are too cumbersome for trees over 12 feet high.

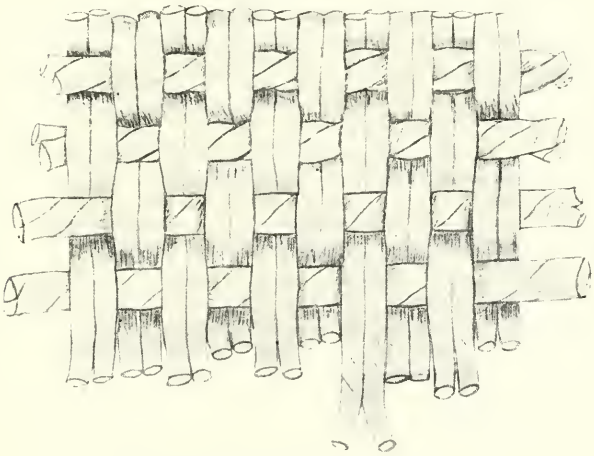

FIG. 2.—*Cloth for Fumigation Covers.*—Sketch to show weave of undesirable type of duck.

(Illustration by R. S. Woglum.)

Cloth for Covers.—Ordinarily water-shrunk covers are used. In the dosage tables given hereunder, it is assumed that the covers will be water-shrunk and made of a closely woven cotton cloth that for trees up to 12 feet high and 12 feet wide weighs 12 ounces or more

to the square yard, and for larger trees at least 9 ounces. Good quality so-called "10-oz." duck is suitable for the smaller trees, and "8-oz." or "9-oz." or heavier duck for the larger ones. By a good quality duck is meant one through which few direct rays of light are seen to penetrate when it is held to the sun. Formerly good quality No. 10 duck, weighing over 15 ounces to the square yard,

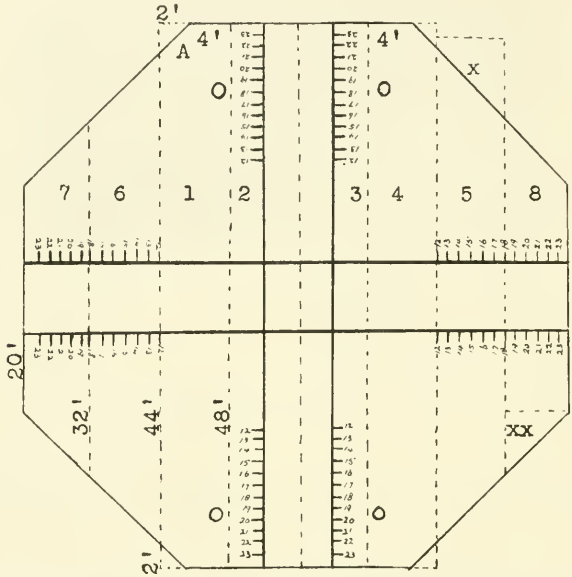

FIG. 3.—*48-foot Fumigation Sheet.*—Sketch to show how 72-inch cloth is cut and the length of the various pieces. The four full-length middle strips, 48 feet long, are first cut; then a right angle (A), 2 feet on the straight sides, is cut from each outside corner of Nos. 1 and 4, thus leaving these pieces 44 feet long on their outside edges; next No. 5 is cut with its long side matching the short side of No. 4. The piece "x" is cut away on the bias with one inch of the full width left on it so that as "xx" it may be joined on to the last width to be cut. The inch is allowance for the seam. The other end of No. 5 is cut on the bias from the roll of cloth, the proper slant being easily secured by doubling the cloth on itself to the right angle. The roll is then turned over to start No. 6, which is finished on the bias as was No. 5. Nos. 7 and 8 are similarly cut except that the roll of cloth is cut straight across from the end of the short side of No. 8, and this width completed with the mitre "x" taken from No. 5. Sheets of other sizes are cut similarly, the length of a side being made to approximate five-twelfths of the diameter. Thus each of the eight sides of a 72-foot sheet should measure close to 30 feet. The small circles near the ends of the sheet in the sketch mark the approximate position for "catch places." The heavy lines and small figures show how the sheet is marked for showing the distance over a covered tree; commonly, however, the marking is done lengthwise only and the work further reduced by having one row of figures, placed midway between the lines, serve in place of the two rows.

was used for all sizes of covers in South Africa, but the cost of this cloth makes it practically prohibitive at present. Twenty years ago it cost only about one-fourth of what a duck two-thirds as heavy does now. Practically all duck used in South Africa for fumigation covers is 72 inches wide; but for many purposes duck cloth is made 28½ to 30 inches wide, and it is ordinarily designated by its weight, e.g.

"10 oz." or "8 oz.," to the linear yard in this narrow width. The Division of Entomology (Box 513, Pretoria) would be pleased to advise prospective fumigators on the comparative merits of different samples of duck on which they have received quotations.

Sizes of Fumigation Sheets.—It has become customary in South Africa to call fumigation sheets by the gross length and width of the cloth. Thus a "48-foot sheet" is made of eight 72-inch widths of duck, the full length ones of which are cut 48 feet long. The exact number of yards of 72-inch duck, without any allowance for waste, needed for sheets of the common sizes is as follows: 24 feet size,

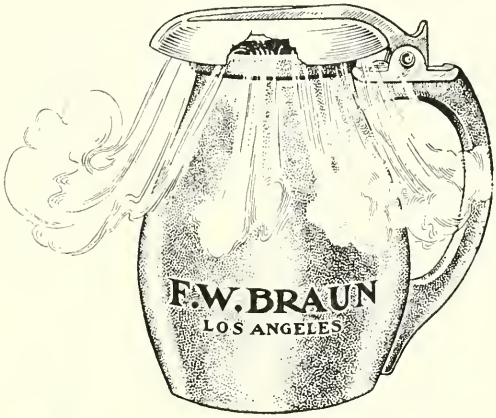

FIG. 4.—*Generating Vessel.*—Type commonly used in California. Cover is of cast-iron and has a raised pad of rubber at the front where it rests on the edge of the jar, thus leaving the space through which the gas escapes. Similar earthenware jars are made to order in South Africa, but covers have to be improvised or specially imported.

$26\frac{2}{3}$ yards; 27 feet, 34 yards; 30 feet, $41\frac{1}{2}$ yards; 33 feet, $50\frac{1}{4}$ yards; 36 feet, 60 yards; 42 feet, 82 yards; 48 feet, $106\frac{2}{3}$ yards; 54 feet, 135 yards; 60 feet, 166 yards; 66 feet, 200 yards; 72 feet, 240 yards. The size of a sheet necessary for a tree depends, of course, on the width of the tree as well as its height, but a sheet is usually large enough for an orange tree one-third as high as its so-called size. Thus a 48-foot sheet may be reckoned large enough for any ordinary orange tree 16 feet high. It would do for many 17 to 18 feet high. The charge for making fumigation sheets varies from maker to maker, but may be roughly calculated as 4d. per square yard of cloth, or 8d. per yard for the yardage given above. Ten-ounce duck at the time of writing costs about 10s. 6d. to 12s. per 72-inch yard.

Makers of Fumigation Covers.—Owing to the small demand for fumigation covers in South Africa, no one firm gets much experience in making them. The Gourock Ropework Export Co., of Port Elizabeth, probably supplies as many as any firm. This company has branches at Capetown, Johannesburg, and other centres. Other firms who have long made some covers or who are known to have quoted relatively reasonably are: V. S. Simpson, Church Street, Pretoria; Alex. Cameron & Co., Loop Street, Capetown; M.E. Stores,

Strand Street, Capetown; and Bach & Hickson, Dock Road, Capetown. To compare a quotation from one firm fairly with that from another it is necessary to compare the cloths on which the quotations are based. Commonly one duck cloth is heavier and stronger, and sometimes more closely woven, than another that is designated to be of the same weight.

Changing Poles and Uprights.—Sheets up to 45 feet in diameter are drawn over the tree, and dragged from one tree directly on to another, with the aid of "changing poles." These poles should be about a foot longer than the trees are high. Two are needed, but it is desirable to have several spare ones on hand. Bamboo poles are

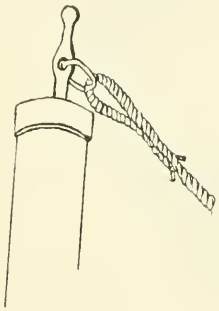

FIG. 5.—*Changing Pole.*—Top fitted with projecting blunt tipped rod to hook in a metal ring at the "catch place" on the sheet. The guy rope is attached to the same rod, and an iron band strengthens the top of the pole.

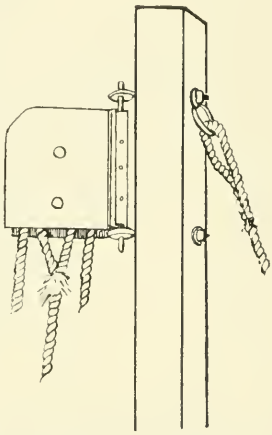

FIG. 6.—*Derrick Pole.*—Top fitted with a specially made metal pulley hinged on supporting bolts that pass through the pole. The guy rope is attached to a ring clamped under the nut holding one of the bolts.

generally utilized for the purpose in South Africa. If cut from lumber the poles should be 2 to 3 inches in diameter. Straight grained Oregon pine is desirable. The foot of the pole should be pointed to keep it from slipping on the ground, and about six inches from the top a guy-rope should be secured. The rope should be about half as long again as the pole. The top of the pole above the rope should be narrowed so as to slip into a loop of rope tied to the sheet near its front, or some other easy means of attachment should be provided for. Commonly the top of the pole is smoothly rounded, and the simple plan followed of drawing a fold of the cloth over the end and fastening it by a half-hitch of the guy-rope. After the poles are attached, one on each side of the tree and lying parallel, they are raised by pulling on the guy-ropes, thus drawing the cover upwards and forwards. If the perimeter of the cloth does not lie heavy on the ground after the tree is covered, soil is shovelled on to it.

Sheets too heavy to be raised with changing poles are lifted with the aid of uprights. Two are used, one at each side of the tree, as

with changing poles. Essentially an upright is a changing pole rigged with pulleys and having a braced cross-piece at the bottom to prevent slipping. It should be four to six feet longer than the highest tree. The main pole should taper from about $2\frac{1}{2} \times 4$ inches at the bottom to $1\frac{1}{2} \times 4$ inches at the top. Cross-pieces, 1×3 inches and 6 feet long, are spiked or bolted to each side a few inches from the bottom; and 2×4 inch brace-pieces, spiked or bolted in place, are used to hold the cross-pieces firmly at the right angle. The base of the upright is thus a triangle-shaped frame, with the main pole arising through its middle. The ends of the main pole and of the braces project a few inches below the cross-frame and act to keep the structure from slipping on the ground when it is raised. A $\frac{5}{8}$-inch or thicker guy-rope 35 to 50 feet long is attached to the top of the upright. About 75 to 90 feet of similar rope is needed for tackle. This rope is passed through a fixed pulley-block secured at the top of the upright, then through a swinging pulley-block and thence back

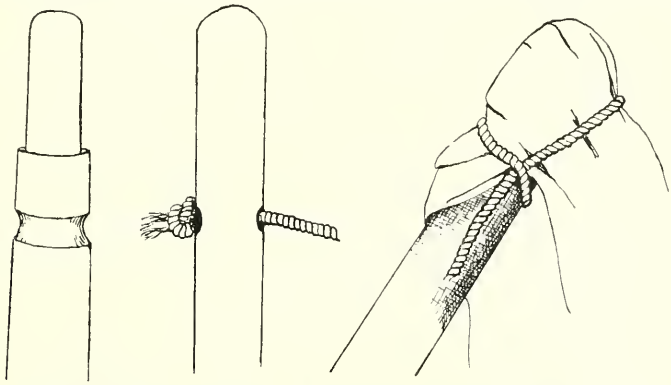

FIG. 7.—*Changing Poles.*—Tops of two simple types. The end of the one at left is narrowed for insertion in a rope loop attached to the "catch place" on the sheet. The end of the other is merely rounded; it is shoved under the sheet and held in position by a half hitch of the guy rope as shown by the sketch at the right. The guy rope may be tied about a groove in the pole or knotted through a hole.

to the top, where it is firmly attached. The swinging block must have a hook.

Four men at least are needed to place a sheet over a tree with the uprights. The sheet is first thrown down back of the tree and the catch-places made ready if not in place. The uprights are laid parallel, one on each side, with the tackle towards the tree, the feet in a line near the middle of the tree, and the poles near enough so that when raised they will just pass. Two of the men hold the ropes and foot the poles while the other two raise them, as they would ladders, to the vertical. The two on the feet next steady the poles while the other two connect the tackle with the catch-place loops; the latter two then take the guy-ropes and, running forward, hold the tops of the poles steady while the two at the feet haul away on the tackles which, rising, carry the front of the sheet upward and forward. When it is raised sufficiently above the tree, the tackles are held taut, and the tops of the poles pulled forward by means of the guy-ropes until enough cloth is over the top to cover the front side; the

tackles are then allowed to run out, the poles fall, and the cloth drops in place.

The catch-places on the sheet are made equidistant from the middle, not quite so far apart as the width of the tree, and from four to twelve feet back from the front edge, according to the size of the sheet and other circumstances. The cloth is simply gathered about a wad of cloth, a green orange, or other rounded, soft body, and a hitch made back of the lump thus formed with a short loop of rope. The hook of the swinging block takes the free end of this loop.

FIG. 8.—*Dome Fumigation Covers.*—Sketches to show how one is placed over a tree.

Other Equipment Required.—Measure glasses graded for fluid ounces are needed for measuring the water and acid. They are easily broken, so it is well to have several. Four, ten, and twenty ounce sizes are usually the most convenient. Most chemists stock measure glasses.

Ordinary kitchen scales and weights, with the pans protected by paper, do well enough for weighing out charges of cyanide of more than a few ounces. For very small charges letter-balances are superior.

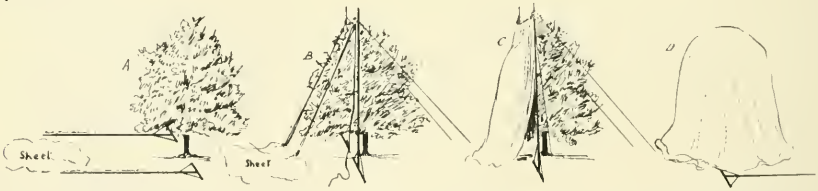

FIG. 9. *Sheet Cover and Derrick Poles.*—Sketches to show how a sheet is placed over tree with derrick poles. *A*, poles and sheet in first position; *B*, poles raised and tackle connected; *C*, sheet raised to top of tree and ready for pulling forward; *D*, sheet completely over and poles in final position.

Lanterns, lantern rests, spades, buckets, a hammer, an enamel funnel, an enamel jug for temporarily holding acid, and air-tight tins for similar use with cyanide, are all more or less necessary and may have to be provided; also cloth and sail needles and twine for use in patching covers. A 60-foot tape line is needful for measuring the trees.

Measuring the Tree for Dosage.—The approximate size of a tree covered for fumigation may be judged by measuring the height and diameter as with a marked pole, but the element of error is less if the determination is based on the distances around and over the tree, and

the latter method of judging the size is now recommended. The present dosage table may be used with either method. The distance around should be measured by a tape line, or by carefully checked pacing, and the distance over by the aid of marks painted on the covers. The marking had best be done along two seams, about six feet apart, across the middle part of the cover, the distance in feet outward from the middle being indicated by bold figures. When a marked sheet covers the tree, the distance over the top can be told very closely by noting the figures and where they are. For example: if one of the lines of

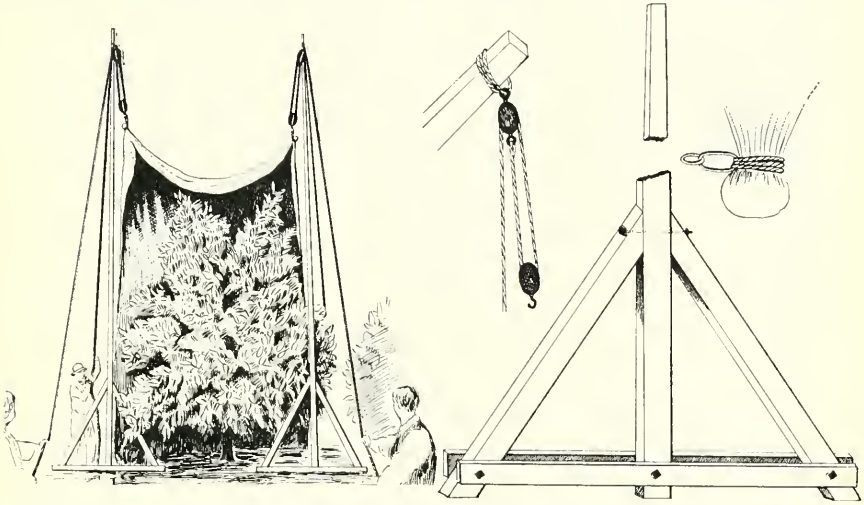

FIG. 10.—*Sheet Cover and Derrick Poles.*—At left, sketch to show lifting of a sheet with derrick poles. Commonly it is necessary for the guy rope men to stand in front of and with their feet on the base of the poles to keep these from slipping forward. At right, sketch to show construction of derrick pole. The small sketch in the middle shows the simplest tackle fittings for a derrick pole; the pulley blocks are such as are regularly stocked by ship chandlers, etc. The small sketch at right shows a "catch place," a gathering of the sheet enclosing a soft ball to give size with a ring into which the pulley hook or top of changing pole is inserted; the sole object of the second ring is to jingle when the sheet is moved and thus help to locate the catch place in the dark.

figures is directly over the highest part and the figure 15 on this line is at the ground-level on one side while the figure 17 is on the ground-level on the other side, it is evident that the measurement wanted is 32 feet. If the highest point lies between the two lines, it will be easy to judge what should be added to the distance shown by the figures.

Proportions of the Chemicals.—The proportions of the chemicals for a charge should be:—

Sodium cyanide (126-130 per cent.) ... ... 1 oz. by weight.
Sulphuric acid (94 per cent. or higher) ... $1\frac{1}{4}$ oz. by measure.
Water ... ... 2 oz. by measure.

The water should be put in the generating vessel, next the acid, and then before the mixture cools the cyanide dropped in, the dish covered, and the cloth dropped. Great care should be taken not to touch the cloth with acid or with a hand that has come in the least

FIG. 11.—*Top Photograph.*—Sheet being placed over tree with the help of footless bamboo derrick poles. The poles in this case are needlessly long. *Middle Photograph.*—Sheet being placed over tree with the help of footless derrick poles. In this case the poles are a little shorter than is desirable. *Bottom Photograph.*—Dome cover placed over a tree withithe help of bamboos.

contact with it. If the cloth does not lie heavily around the tree a little soil should be shovelled on it to prevent the escape of any gas

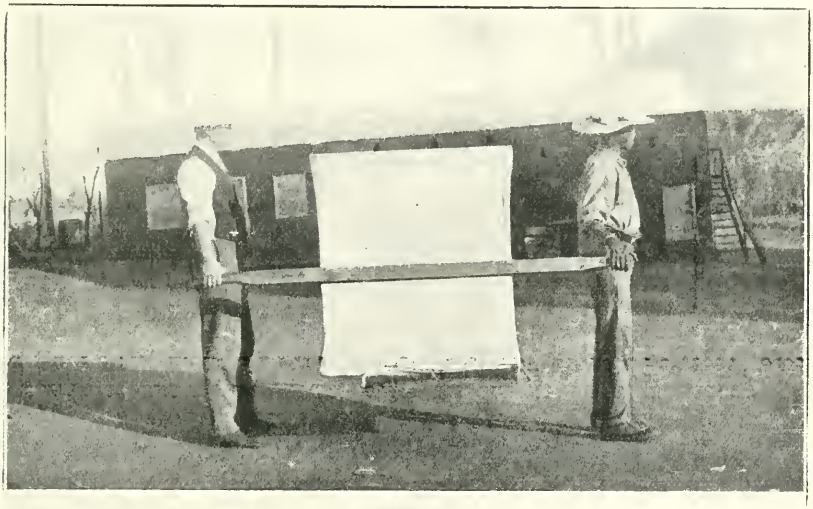

FIG. 12.—*Upper Photograph.*—A desirable type of box cover for fumigating small trees. The treatment of very small trees under sheet or dome covers is not advisable unless a frame is used to expand the cloth to definite dimensions. *Lower Photograph.*—Putting a charge of chemicals under a dome cover. The man at the left is supporting on his shoulder the iron hoop used to keep the mouth of the cover expanded. The man who handles the chemicals should not touch the cloth.

from beneath. The cover should be left on for three-quarters of an hour at least, and for an hour when there is no need to hurry and

the gas is still strong, as should be the case with large trees. The residue in the generator should be buried. It should not contain any blackened lumps of cyanide. The presence of any is indicative of some fault, as the use of too little acid. If potassium cyanide (96-99 per cent.) is used in place of sodium cyanide, the quantities of cyanide and of water shown in the table should be increased by one-third, while the quantity of acid is kept unchanged.

Basis for Calculating Dosage.—The amount of cyanide necessary to kill a scale insect on a cloth-covered tree varies with quite a number of factors, but two only need to be considered in framing a dosage table for fumigation. These are the volume of the enclosed space and the area of cloth through which the gas will leak. The leakage factor is highly important; but the rate of leakage varies greatly with varying little circumstances, and it follows that a dose just about right for a tree of a given size on one occasion may be much too large or too small on another occasion. At best a dosage table can only be roughly approximate. The table given below was carefully calculated for use with sound covers of such cloth as is recommended in this article. It provides a uniform strength of gas on the basis of volume with what is thought an ample allowance for leakage. The allowance is proportioned to the area. The ratio of the volume to the enclosing surface varies with the size of a space, becoming less as the size increases, and hence the allowance for leakage has to be greater for a small than for a large tree. The relative difference for large and small trees in the area through which the gas has to escape is surprisingly great. For instance, the surface area of a tree four feet high by four feet wide is about five times as much in proportion to the volume as is the case with a tree twenty feet high by twenty feet wide. It follows that the smaller the tree to be fumigated the greater is the importance of having the cloth as gas-tight as it is practicable to have it and the greater is the risk of a materially serious over-dose or under-dose. Oil increases the gas-retaining property of a cloth, but it decreases the durability of the cloth so much that oiling is little practised on fumigation-covers.

As the cost of fumigating in South Africa lies largely in the outlay for the equipment and in the labour, it is generally good policy to make the destruction of the scale as certain as possible by giving the tree as heavy a dose as it will stand without serious loss of foliage or damage to the fruit. The killing back of tender twigs for several inches and the dropping of some of the oldest leaves is to be expected; and when this damage does not occur it is advisable to increase the dosage in further work.

The common brown or soft scale, the oleander or white scale, the circular purple scale, and the false circular purple scale, all seem to be as easily killed by the gas as the common red scale. The mussel scale is considered more difficult to kill, and in California it is customary to use a dosage stronger by one-third for this species than for the other common ones. Not uncommonly, the mussel scale dosage, called the full schedule or 100 per cent. dosage, is also used for red scale. There has been very little experience in South Africa in fumigating for the mussel scale, and it may be advisable always to use a stronger dosage for it than is given in the table that follows.

The Californian ordinary, or 75 per cent., schedule dosage is approximately the same for large trees as that shown in our table, but in general it is increasingly stronger as the size decreases, and it is very considerably stronger for small trees. According to the Californian table trees under twelve feet high should get two or three times as much as our table indicates. The Californian dosage for the larger trees is easily calculated. The "full schedule" number of ounces of sodium cyanide given for a tree is three-fourths the number of feet over the tree multiplied by the number of feet around the tree divided by one hundred. The number of ounces ordinarily used for red scale is three-fourths the figure thus obtained. Thus the Californian full schedule number of ounces for a tree 40 feet around by 40 feet over is $\frac{3}{4} \times 40 \times 40 \div 100$, or 12 oz., and the ordinary red scale dose is three-fourths this figure, or 9 oz.

STANDARD DOSAGE TABLE.

Diameter (app.).	Height (app.).	Distance around Tree.	Distance over Tree.	Sodium Cyanide, 126–130 per cent.	Sulphuric Acid Fluid.	Water Fluid.
ft.	ft.	ft.	ft.	oz.	oz.	oz.
3	4	9	10	$\frac{1}{4}$	$\frac{1}{2}$	1
4	4	12	10	$\frac{1}{2}$	$\frac{3}{4}$	1
4	6	12	14	$\frac{3}{4}$	1	$1\frac{1}{2}$
6	4	18	11	$\frac{3}{4}$	1	$1\frac{1}{2}$
6	6	18	15	1	$1\frac{1}{2}$	2
6	8	18	19	$1\frac{1}{2}$	2	3
8	6	24	16	$1\frac{1}{2}$	2	3
8	8	24	20	$1\frac{3}{4}$	$2\frac{1}{2}$	4
8	10	24	24	$2\frac{1}{4}$	3	5
9	12	28	31	3	4	6
10	8	32	22	2	$2\frac{1}{2}$	4
10	10	32	26	3	4	6
11	14	34	34	5	7	10
12	10	38	27	4	5	8
12	12	38	31	$4\frac{1}{2}$	6	9
12	16	38	39	6	8	12
14	14	44	36	$6\frac{1}{2}$	9	13
14	18	44	44	9	12	18
15	12	46	32	6	8	12
16	16	50	41	$9\frac{1}{2}$	13	19
16	20	50	49	13	17	26
17	14	54	38	9	12	18
18	18	56	46	$13\frac{1}{2}$	17	27
20	16	62	43	14	18	28
20	20	62	51	18	23	36
20	24	62	61	22	28	44
22	18	70	49	19	24	38
22	26	70	65	28	35	56
24	20	76	54	24	30	48
24	28	76	70	34	43	68

The charge for a tree with dimensions different than those recorded should be estimated from the charges set down for the trees with the nearest measurements. The cyanide should always be carefully weighed and the acid and water carefully measured.

Time for Treatment.—The treatment should be carried out in the absence of sunlight and preferably at night. It should be stopped if the wind is strong enough to sway the covers, but there is no need to stop on account of dew until the covers become too heavy to handle.

The covers are remarkably more gas-tight in damp air, even when the dampness is hardly perceptible, than they are in very dry air or in sunlight, and this is one reason why trees are more injured on some nights than on others. The late summer and fall months is the best time of year for the treatment, and the use of specially heavy dosage had, as a rule, best be restricted to these months. Little damage is done to blossoms; but in its first few months fruits are injured more readily than they are later, and the least desirable time for fumigation is considered to be the period from the setting of the blossom until the fruit is about the size of a fowl's egg. Injury to fruit generally takes the form of serious spotting and seems most likely to occur just after irrigation or a heavy rain. Heat accentuates the risk of injuring the tree. Fumigation in sunlight, or even having the covers over the trees in sunlight, is likely to be highly damaging to foliage and fruit. It is said the gas is apt to do much injury to trees sprayed with bordeaux mixture within several months.

Effect on the Scale.—When generated in the ordinary way the gas acts best high in the tree. Scale on branches near the ground is most likely to escape, and for this reason it is a good practice to precede fumigation by trimming away any branches that rest on the ground or that would be pressed to the ground by the cover. Scale on the fruit is much more likely to survive than scale on the twigs or foliage.

It is not easy to tell within a week or two after fumigation whether or not the treated scale has been destroyed. The scales do not fall off at once, but remain attached to the tree by the thread-like sucking apparatus through which the sap is drawn in life, and they hang there until torn away by wind, rain, or other means. The dead scales soon dry up, however, and may be told from live scales by a difference in colour and by being much more easily rubbed off. Moreover, live scales when broken as with the finger-nail or knife-point exude a drop of oily-looking matter, the body contents.

Handling of Export Fruit.

On the 17th March last a number of prominent fruit growers, together with Mr. Tribolet, Chief, Division of Horticulture, visited the Capetown Docks, where the important question of the handling of export fruit at the docks was discussed with Sir William Hoy and other officials of the Railways and Harbours Administration. The system at present in operation is rendered cumbersome on account of the approach to the cold stores being very inconvenient. The meeting discussed the matter at the cold stores, where the needed alterations were pointed out, and fruit growers will be pleased to learn that Sir William Hoy undertook to take in hand at once the necessary improvements.

EXPORT OF SOUTH AFRICAN PRODUCE.

Present Freight Rates.

In the marketing of South African produce overseas in competition with the produce of other countries, the cost of placing our goods on those markets is a matter, of course, for careful consideration, and in this respect the chief item of expense is that incurred in the long voyage. As is well known, freight rates are not stable, indeed they are subject at times to great fluctuations, and the soaring charges for freight during the years of the war will be fresh in the memory of all. With a return to something approaching normal conditions and a freer supply of freightage, the question of freight rates, which enters so largely into the calculations of the producer in the Union, is becoming a more stable one, and there has recently been a very appreciable reduction in these charges.

It must be remembered, however, that freightage is affected, like other commercial enterprise, by competition, and circumstances may arise which will so alter the position as to necessitate alterations in the rates without notice. It is a matter, therefore, which must closely be followed by all those concerned in this country—and it is necessary, for freight plays a most important part in the development of South Africa through the expansion of our oversea markets.

The principal carriers of South African produce are known as the "South African Steamship Lines," which embrace the following steamship companies, viz., the Union-Castle Steamship Co., Ltd., Messrs. Bullard, King & Co., Ellerman-Bucknall Line, Clan Line Steamers, Ltd., Ellerman-Harrison Line, Harrison-Rennie Line. There are certain other steamship lines which do not belong to this combination, and the rate at which they will undertake to carry our cargo is a factor which will always need to be considered, but in view of their importance, it seems that the rates charged by the South African Steamship Lines will form the basis of those ruling generally for South African produce.

We are indebted to the Union-Castle Steamship Company for kindly furnishing us with the rates now ruling for freight, on the commodities shown below, from Union ports to the United Kingdom and Continent, carried for direct discharge only by the steamship lines enumerated above (known also as the "Conference Lines"), and publish them for the information of farmers following the trend of oversea prices for their produce.

It should be understood that in some cases the class of commodity exported is such that it will be to the benefit of the shipping company

to charge freight by weight instead of by the space occupied in the ship's hold, and vice versa; these are shown in the table below. Then, also, the packing of several of our products varies, no standard pack having been introduced; where such commodities are charged for at the space occupied, the rate has been reduced to the equivalent of per one cubic foot, and farmers wishing to apply the rate to their products exported can easily do so by calculating the cubic contents of their package (length × breadth × depth) and comparing the result with the rate at one cubic foot.

In regard to cereals, the rates of freight are calculated on the space occupied as compared with that occupied by maize. Generally speaking, oats occupy 32½ per cent. more space than maize, barley (which varies considerably) 10 per cent., and rye 5 per cent. more space than maize. It is usual to measure each consignment.

Cargo carried in Ship's Hold.

Commodity.	Rate.	Rate per Unit.
Pastoral products.		
Wool—Grease	1⅛d. per lb.	1⅛d. per lb.
Washed	1⅛d. per lb.	1⅛d. per lb.
Kempy and scoured	2d. per lb.	2d. per lb.
Mohair	1⅛d. per lb.	1⅛d. per lb.
Dry hides and hair	1⅛d. per lb.	1⅛d. per lb.
Wet hides	112s. 6d. per 20 cwt.	·6d. per lb.
Skins	1⅛d. per lb.	1⅛d. per lb.
Articles of food and drink.		
Arrowroot	in bags, 87s. 6d. per 20 cwt.	in bags, ·17d. per lb.
	in cases, 102s. 6d. per 20 cwt.	in cases, ·55d. per lb.
Maize...	32s. 6d. per 2000 lb.	3s. 3d. per 200 lb.
Maize meal	32s. 6d. per 2000 lb.	2s. 11·1d. per 180 lb.
Hominy chop and feed ...	32s. 6d. per 2000 lb.	2s. 11·1d. per 180 lb.
Kaffir corn	32s. 6d. per 2000 lb.	3s. 3d. per 200 lb.
Rice	127s. 6d. per 20 cwt.	·68d. per lb.
Ground (monkey or pea) Nuts, with shells	130s. per 20 cwt.	·70d. per lb.
Ground (monkey or pea) Nuts, without shells	90s. per 20 cwt.	·18d. per lb.
Coffee	135s. per 20 cwt.	·72d. per lb.
Oatmeal (South African) . .	77s. 6d. per 40 c. ft.	1s. 11½d. per c. ft.
Onions (in cases)	102s. 6d. per 40 c. ft.	2s. 6¾d. per c. ft.
Potatoes (S. African) in cases	72s. 6d. per 40 c. ft.	1s. 9¾d. per c. ft.
Tapioca	127s. 6d. per 20 cwt.	·68d. per lb.
Raisins, in bags	87s. 6d. per 20 cwt.	·47d. per lb.
Raisins, in boxes	75s. per 40 c. ft.	1s. 10½d. per c. ft.
Tea (South African) ...	102s. 6d. per 40 c. ft.	2s. 6¾d. per c. ft.
Bush Tea	1⅜d. per lb.	1⅜d. per lb.
Beans...	110s. per 20 cwt.	·59d. per lb.
Jams, in tins	102s. 6d. per 40 c. ft.	2s. 6¾d. per c. ft.
Jams, in bottles	135s. per 40 c. ft.	3s. 4½d. per c. ft.
Wine, spirits, etc.		
Wine	102s. 6d. per 40 c. ft.	2s. 6¾d. per c. ft.
Brandy	102s. 6d. per 40 c. ft.	2s. 6¾d. per c. ft.
Rum	90s. per 40 c. ft.	2s. 3d. per c. ft.
Vinegar	102s. 6d. per 40 c. ft.	2s. 6¾d. per c. ft.
Sugar, white...	57s. 6d. per 20 cwt.	·30d. per lb.
Sugar, low-grade	52s. 6d. per 20 cwt.	·28d. per lb.
Golden syrup	87s. 6d. per 40 c. ft.	2s. 2¼d. per c. ft.

Commodity.	Rate.	Rate per Unit.
Miscellaneous commodities.		
Argol	87s. 6d. per 20 cwt.	·47d. per lb.
Asbestos	100s. per 20 cwt.	·54d. per lb.
Bark, wattle	70s. per 20 cwt. or 36s. 3d. per 40 c. ft., at shipper's option	£3. 10s. per ton of 2240 lb., or 10¾d. per c. ft. at shipper's option.
Wattle extract	100s. per 40 c. ft. or 20 cwt. at ship's option	1s. 6d. per c. ft. or ·54d. per lb. at ship's option.
Buchu leaves	3⅜d. per lb.	3⅜d. per lb.
Cotton	60s. per 40 c. ft.	1s. 6d. per c. ft.
Cotton seed	87s. 6d. per 20 cwt.	·47d. per lb.
Dagga	1⅜d. per lb.	1⅜d. per lb.
Dried herbs	1⅜d. per lb.	1⅜d. per lb.
Ostrich feathers	170s. per 40 c. ft. or 67s. 6d. per cent. at ship's option	4s. 3d. per c. ft. or £3. 7s. 6d. per £100 of the value, at the ship's option.
Fibre	72s. 6d. per 40 c. ft.	1s. 9⅜d. per c. ft.
Everlasting flowers	87s. 6d. per 40 c. ft.	2s. 2¼d. per c. ft.
Jute	87s. 6d. per 40 c. ft.	2s. 2¼d. per c. ft.
Aloe leaves	1⅜d. per lb.	1⅜d. per lb.
Liquorice root	135s. per 20 cwt.	·72d. per lb.
Linseed	87s. 6d. per 20 cwt.	·47d. per lb.
Lucerne seed	112s. 6d. per 20 cwt.	·6d. per lb.
Mafureira seed	120s. per 20 cwt.	·64d. per lb.
Melon seed	102s. 6d. per 20 cwt.	·55d. per lb.
Oil seed	87s. 6d. per 20 cwt.	·47d. per lb.
Quince seed	135s. per 20 cwt.	·72d. per lb.
Sunflower seed	120s. per 20 cwt.	·64d. per lb.
Soap, common	87s. 6d. per 20 cwt.	·47d. per lb.
Soap, n.o.e.	87s. 6d. per 20 cwt. or 10 c. ft. at ship's option	·47d. per lb. or 2s. 2¼d. per c. ft. at ship's option.
Sisal	60s. per 40 c. ft.	1s. 6d. per c. ft.
Talc	77s. 6d. per 20 cwt.	·43d. per lb.
Tallow	102s. 6d. per 20 cwt.	·55d. per lb.
Tobacco, manufactured ...	102s. 6d. per 40 c. ft.	2s. 6¾d. per c. ft.
Tobacco, unmanufactured ...	72s. 6d. per 40 c. ft.	1s. 9¾d. per c. ft.
Starch	72s. 6d. per 20 cwt. or 40 c. ft. at ship's option	·39d. per lb. or 1s. 9¾d. per c. ft.
Beeswax	170s. per 40 c. ft.	4s. 3d. per c. ft.
Berry wax	102s. 6d. per 40 c. ft.	2s. 6¾d. per c. ft.
Filter wax	112s. 6d. per 40 c. ft.	2s. 9¾d. per c. ft.

Produce carried in Cold Storage.

Under the Mail Contract the Union-Castle Steamship Co. undertakes that the freights on produce, etc., in cold or cool chambers of their mail and intermediate steamers shall not exceed the following rates:—

Commodity.	Rate.	Equivalent to.
Peaches, Nectarines, Pears, Plums, Grapes, Apricots, and other soft fruits, graded and passed by the Government Inspector	40s. per ton of 40 c. ft.	1s. per c. ft.
Ungraded fruit	50s. per ton of 40 c. ft.	1s. 3d. per c. ft.
Citrus Fruit and Pines, graded and passed by the Government Inspector	25s. per ton of 40 c. ft.	7½d. per c. ft.
Ungraded	35s. per ton of 40 c. ft.	10½d. per c. ft.
Butter	½d. per lb.	½d. per lb.
Mutton and Lamb (frozen)	⅜d. per lb.	⅜d. per lb.
Beef	Not to exceed current contract rates from Argentine. Present rate 1¼d. per lb.	

Other Produce carried in Cool Chamber (present rates).

Commodity.	Rate.	Equivalent to.
Apples	120s. per 40 c. ft.	3s. per c. ft.
Bacon	150s. per 40 c. ft.	3s. 9d. per c. ft.
Eggs	150s. per 40 c. ft.	3s. 9d. per c. ft.
Fish	120s. per 40 c. ft.	3s. per c. ft.
Pork	1¼d. per lb.	1¼d. per lb.
Cheese	120s. per 40 c. ft.	3s. per c. ft.
Poultry	2d. per lb.	2d. per lb.
Goods, n.o.e. ...	150s. per 40 c. ft. or 20 cwt. at ship's option	3s. 9d. per c. ft. or ·80d. per lb.

Crops of the Northern and Southern Hemispheres, 1920-1921.

THE latest bulletin received from the International Institute of Agriculture, Rome (February, 1921), furnishes all information available at the time concerning the yields of the principal crops in the Northern Hemisphere for 1920, combined with the Southern Hemisphere yields of 1920-21. Owing to various reasons, statistics are not available from certain countries (notably Russia and China), while several newly organized States, such as Poland and Czecho-Slovakia, cannot furnish comparative data for earlier years and, therefore, are not taken into consideration. The returns obtained, however, are sufficiently full to furnish a good indication of the world's yield for 1920-21. As a guide to the figures given below the total of the world's annual yield of each produce is added (a comparative estimate on the basis of 1914-18 figures). Comparison between this estimate and the other figures will serve to show the relative importance of the countries included in the latter in regard to the whole production of the world.

(NOTE.—1 cental = 100 lb.)

Crop.	World's Estimated Yield.	Yield of Countries from which Statistics are available (in thousand centals, i.e. × 100,000 lb.).			Percentage.	
		(1) 1920 and 1920-21.	(2) 1919 and 1919-20.	(3) Average 1914-1918 and 1914-15 1918-19.	(1) Compared with (2). (2) = 100.	(1) Compared with (2). (3) = 100.
	(Thousand centals)				Per cent.	Per cent.
Wheat	2,650,000	1,610,257	1,545,193	1,618,206	104·2	99·5
Rye	840,000	255,051	287,276	321,869	88·8	79·2
Barley	840,000	415,370	361,730	425,446	114·8	97·6
Oats	1,400,000	1,082,048	902,053	1,014,618	120	106·6
Maize	2,300,000	1,961,164	1,765,934	1,703,198	111·1	115·1
Potatoes	2,760,000	1,677,683	1,135,495	1,833,802	116·9	91·5
Sugar Beet... ...	950,000	540,185	403,435	509,788	133·9	106
Cotton	111,550	82,337	83,343	82,030	98·9	100·4
Hemp (fibre) ...	15,200	6,300	5,806	5,919	108·5	106·4
Linseed (seed) ...	50,000	15,371	37,312	37,108	121·5	122·3
Tobacco	53,000	19,497	18,310	15,323	106·5	127·2
Hops	1,400	1,063	751	1,154	141·7	92·1
Wines (in thousands of Eng. gallons)	2,860,000	2,937,512	2,561,720	2,300,044	114·7	127·7

PRUNING OF DECIDUOUS FRUIT TREES.

By H. B. TERRY, Cert. R.H.S. (London and South Africa), Lecturer in Horticulture, School of Agriculture, Potchefstroom.

(Conclusion.)

THE QUINCE.

The quince is not generally regarded here as an orchard tree; usually the only place allotted to it is the hedge or break-wind. Fruit

FIG. 25.—Quince "Mammoth."

under such conditions can scarcely be hoped for. When grown in the orchard as a tree, well headed back, and kept thinned out to counteract its natural bushy habit, the tree will produce large sized fruits

of good quality, very superior to the average specimen one sees on hawkers' carts.

The tree is not difficult to prune in winter. The leaders are carefully selected, allowing plenty of space between each for lateral

FIG. 26. Illustrating typical bearing wood of Quince.

development; the tree itself should be kept fairly open to encourage the growth of laterals inside for fruit-bearing. The laterals older than one year often indicate by a short blunt spur (see Fig. 26) where

fruit has been borne, and where it is again likely to be produced; laterals of the past season's growth, though not showing spurs or even pronounced buds are, when lightly pruned, equally as capable of producing fruit as older laterals. All weak, thin laterals must be thinned out each year, and all reasonably stout growths which, in the opinion of the grower, are capable of carrying fruit when produced, should be slightly shortened in if occupying a horizontal position on the tree. In the spring the apparent dormant wood buds will push into growth, and when about 1 inch to 3 inches in length a blossom is produced on each short growth. As this takes place more frequently near the tip of the lateral it will be readily seen that too much hard cutting is liable to reduce the number of spurs thrown out. All gross water shoots which arise on the main arms in the centre of the tree should be cut clean away—they serve no useful purpose, except to replace an injured branch if suitably placed. Suckers are also freely produced, and these, too, should be rigorously suppressed.

THE PERSIMMON.

This tree has, up to the present, been grown for ornamental rather than commercial purposes. However, the interest displayed in the fruit wherever exhibited indicates more extensive cultivation than formerly. It is thought by some to be a tender tree. This is a mistake; it thrives well in the Transvaal. The writer once had the pleasure of observing a tree covered with snow, the fruits appearing as fairy lights on a Christmas tree. The habit of growth varies according to the variety; some are inclined to become shrubby and difficult to get into shapely trees, others, again, develop into stately specimens naturally. It is difficult to say just at which height the year-old tree should be encouraged to form its main arms, for, as previously mentioned, the habit of growth varies a good deal; 20 inches to 24 inches is considered a safe height for the stem. The treatment given to other fruit trees to form an open head can be greatly modified with the persimmon. Allow the tree, after the main arms have set, to develop along natural lines. The pruner can check any tendency towards branch weakness by thinning out or cutting back at winter pruning. The pruning of persimmons must be regularly performed each winter, not only to ensure the production of fruit-bearing wood, but to give the growths strength to carry the fruit. The bearing wood of the persimmon is produced in much the same way as the grape or quince, that is to say, the fruit is borne on short growths resulting from the development of buds on the past season's wood. The same piece of wood never fruits twice. Any shoot showing fruit scars should be removed to base buds near to the point of its origin.

In this way old exhausted wood is annually removed and provision made for new growth, density is minimized, and strength given to the tree, the wood itself being very brittle. Thinning the fruit after setting is necessary to obtain a uniform size and reduce the tendency to overbear. During pruning operations it is essential that secateurs and knives be kept very sharp, so that little or no bruising takes place. The sap of the persimmon is very acid, so much so that pruners are required to wash and strop the knife blades after several

cuts have been made; if this precaution is neglected the steel will develop small holes termed "pits" and thus many good knives are spoilt.

TREATMENT OF NEGLECTED TREES.

An individual taking over an orchard generally has many problems to contend with. If the trees have any semblance to form or shape the position is not a difficult one, but usually the grower realizes that it will take him more than one year to get the trees in order. The trees are, as a rule, bare of laterals for about 4 feet from the ground, the top resembles a grass broom, the centre full of dead wood—it is a dismal picture, but a real one. The first work to be done is to clean out the head of the tree and define the leaders, next clear all dead wood from the whole framework, remove any suckers from the base of the tree, and leave it; do not attempt to do too much the first season, as the removal of any large limbs will only give rise to many smaller ones, so that at the next winter's pruning you will be no better off. As new wood is forced out along the arms, old barren wood may be removed, and the top gradually reduced and correctly spaced by utilizing new shoots in desirable positions. Never cease pruning these renovated trees, otherwise they will speedily revert to a hopeless tangle, causing loss of time and money in fruit; trees pruned annually do not show any marked difference between production and non-production, for it is obvious that a balance between root and top is maintained. Trees pruned periodically, say every three or four years, are liable to have more large wood removed than would be the case in annual pruning. This naturally disturbs the root balance, and heavy growth of an unproductive type is obtained, which has to be treated each winter to restore the fruiting habit. All this is extra work.

WOUNDS AND THEIR TREATMENT.

During the first three or four years in which the young trees are being trained into shape, most of the cutting will be done with a sharp knife or secateur, consequently few, if any, wounds above half an inch will be made; these heal over very quickly on the return of activity in spring. No danger from insect pests or fungoid diseases need be feared. In well-trained trees it is seldom that one has to remove a large branch, still this does happen occasionally, and in this case the saw should be used. All removals should be severed close to the main branches without injuring the growths in the immediate vicinity. After a saw-cut, trim the rough edges smooth with a knife to facilitate the healing over process; wounds over half an inch in diameter should be covered (after smoothing) with medium thick paint to prevent the attack of moulds or insects and keep moisture out; by taking this precaution many trees will be maintained for a much longer period of usefulness.

EFFECT OF WIND.

In many parts of the Union much damage is done annually by wind blowing continuously from one quarter; its influence is particularly noticeable on young trees not protected by established windbreaks. The only remedy one can suggest is to plant quick-growing

trees, suited to the locality across the track of the prevailing winds before any fruit trees are set out, otherwise the soft, young shoots will continually be deflected from their normal direction of growth. Keeping the leaders well cut back, limiting their number, maintaining an open tree, and cutting to buds pointing to the wind may

FIG. 27.—Showing effect of strong wind on young growth.

help for a time. A glance at Fig. 27 will convince most people that the only complete counteracting influence against strong winds is a well-established shelter belt.

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WHITE ANT NOTES.

By CLAUDE FULLER, Assistant Chief, Division of Entomology, Pretoria.

I.—LETTERS OF ADVICE.

THROUGHOUT each year the Division of Entomology has occasion to deal with numerous inquiries relating to white ants and the damage these insects do. It may be said, very truthfully, that a constant stream of letters reaches the office directly or indirectly, bearing on these pests, and it is, ordinarily, no small pleasure to the writer to answer the letters to the best of his ability. Unfortunately, complaints are usually stated very vaguely, and in the minds of most correspondents there seems to be a fixed idea that there is but one and only one white ant. At most, I find our correspondents discriminate between two sorts. These are those implicated in the destruction of woodwork, trees, etc., and those which attack green crops, cutting, and carrying off pieces into holes in the ground.

As a matter of fact, there are twenty-one distinct groups of white ants in the Union, and each group has one to five representatives. We may then be said to possess between forty and fifty different kinds of white ants. It is equally true that the members of each group differ from those of others in their habit, and, in some groups, each kind exhibits characteristic habits that are peculiar to it.

Hence it follows that when a vague question is submitted, it is impossible to give a clear answer. Further than this, the successful control of a given type may depend entirely upon a knowledge of its habit, especially the manner in which it makes its nest. Again, although a good deal may have been learned about the ways of white ants in South Africa, there is very much more knowledge still to be acquired.

For these reasons a special appeal is made to readers of these notes who may wish to seek advice to state carefully the conditions of attack and to send with their complaints specimens of the culprits. In sending specimens, they would make the task of the entomologist lighter if they took the trouble to collect a few soldiers rather than a number of the more easily obtainable workers; when practicable, such specimens should be sent in some alcoholic fluid. It may be added that care is always necessary to secure the culprits in the very act of their mischief and, where it is a question of plants being destroyed, to get the primary mischief maker, and not one following in the pathway of another.

II.—WHITE ANT ATTACK ON LIVING TREES.

If we set aside casual injury to foliage, noticeably that of young Casuarinas, by the Grasdraers or Harvesters, and that which is done to transplants, especially gum trees, by the Carton Nest Makers, all

white ant damage to living trees is traceable to members of the group of Fungus Growers.

The Grasdraers are too familiar, where they exist, to call for any description, and all that one needs to say is that, although these white ants may collect wind-blown fragments of dung, they never turn their attention to woodwork.

As regards the Carton Nest Makers, these are white ants with which very few are acquainted, and although they are spread over the length and breadth of the Union, it is not often they do any mischief. Their nests are really small hives of a somewhat black and cardboard-like material set in the surface of the soil and seldom protruding above it. The hives, for the most part, vary in size from that of the egg of a goose to that of an ostrich, and the workers stand apart from those ordinarily met with on account of their pale white heads and slender bodies. Their attack upon transplants is quite characteristic, seeing that they do not gnaw away the surface, but burrow or channel in the tap-root and stem.

There are, at least, twelve different kinds of Fungus Growers, and all have their homes in subterranean cavities wherein fungus gardens are cultivated to provide suitable food for the developing young. As far as the nature of the nests of these is concerned, they may be divided into two sections. First come those making a large cavity within the confines of which the breeding couple (the king and queen) are imprisoned in a cell of clay and closely associated with a large amount of fungus garden. Second are those whose nests consist of a tangle of fine tubes in the soil, none of which has a diameter regularly greater than that of a piece of coarse string. There is no large central cavity, such being replaced by numerous small cells, each having its own connecting gallery with the general system. In each cell a small garden is cultivated. Few of these gardens are larger than a hen's egg, and most are no bigger than the kernel of a walnut, to which they bear some structural resemblance. As a rule the nests of the former can be located and treated, but one can do neither successfully with the nests of the latter.

Concerning the attack of white ants upon live trees, frequent though it be, we may say it is not a normal matter. These insects do not make a practice of feeding upon live roots or stems, as is commonly supposed; and, ordinarily, their attack upon grown trees is never serious, being limited to dead parts of the bark, to decayed interiors, and to dead limbs.

The natural provender of our white ants, excepting those insignificant kinds sustaining themselves on the humus of the soil, is pre-eminently dead grass; nearly all, however, evince a great partiality for the droppings of animals, especially when in pellet form, and for dead wood when such is obtainable.

White ants may be said to turn their attention to the live parts of plants only when circumstances compel them to do so. Their attack upon orchard trees or forestal transplants is, as a rule, due to a radical disturbance of the surface conditions of their natural habitat, accompanied by the removal of all their normal food supplies. There is nothing vicious in the onsets that follow even when, as in the Transvaal bushveld, fruit trees are damaged over a period of years as against the more common killing of trees recently, or more or less recently, set out.

In the bushveld, during periods of drought, the living parts of wild bushes and shrubs are attacked, sometimes the whole of a small limb being eaten away. This is explainable first because such bushes are contiguous to nests and, secondly, on the ground that the insects cannot otherwise, and readily, obtain the moisture essential to the well-being of their communities. In this probably also lies the explanation of their attack year after year on fruit trees growing under similar sub-arid conditions.

It may also be mentioned that white ants do not in the usual run of events attack green maize plants. Even when their nests are in the lands they do not touch the growing plant, although when dead and dry it forms a favourite food. Yet in the bushveld it is no unusual thing for green maize to be eaten, and by the very same kinds which elsewhere do not touch it. This behaviour may only be set down to a dearth of the much-desired moisture.

Experience goes to show that fruit trees under irrigation, if not originally exempt from attack, become so. The reason for this seems to lie in the repeated watering of the soil setting up a state of affairs unsuited to the economy of the principal culprits, the Fungus Growers. These require a certain amount of soil moisture for the development and maintenance of their gardens, but, when that moisture is continually in excess, the fungi they cultivate grow out of their control and thereby virtually eliminate the colony. An occasional watering or even flooding does not have this effect. There is, however, some evidence to show that excessively wet summers have led to the destruction of many colonies, especially in spots where there has been a considerable rise in the water table.

When white ants are troublesome in lands regularly under irrigation, their nests will be found located in the drier headlands or in the banks of water furrows.

III.—Attack upon Citrus and Peach Trees.

Leaving out of consideration a peculiar white ant which, on occasion, isolates its nest in the dead stubs and limbs of citrus trees on the Natal coast, any attack upon citrus and peach trees is due to one or another of the Fungus Growers, and is not to be regarded as a regular matter in the Union, but rather as something quite unusual.

Even when growing under serious disadvantages, the peach, lemon, orange, naartje, avocado, and mango are left alone by white ants. I have never received even a suggestion that the two last-mentioned trees are attacked, and yet I have a case in mind where all here listed were eaten when set out in land from which the thick scrub, that characterizes the sea-board of Natal, was quickly removed and at once planted to such trees. In this case there were so many nests present in the soil, owing to the previous superabundance of food, that the insects had to attack something or die.

So immune is the peach accepted as being, even where Fungus Growers are quite numerous, that this tree is generally recognized as the stock to graft plums and apricots upon, so that they may escape attack. However, I have seen peach trees severely injured. The worst case was one that should never have taken place, although the nests of the marauding insects were quite contiguous to the trees. These trees, and there was quite an orchard of them, had long been

sadly neglected. They were of good sorts, but quite untrained, so that all exhibited several main stems or limbs starting out of the trunk at ground level. Such pruning of the orchards as had not been done with a chopper by a native had been accomplished by oxen. Quite a number of limbs had been hacked off or broken off six to twelve inches from the ground, and had died. Then again, through general neglect, the bark was in a poor state and presented much dead outer tissue. The dead stubs attracted the white ants in the first place, then they passed to the hide-bound bark, and finding this palatable, gnawed deeply into it to the wood. This then was not a vicious attack, but one that had been invited.

Within the Union, I have never seen typical white ant attack on citrus trees. If such does occur, it is in restricted parts or when conditions are very unfavourable to the trees. I am led to qualify my statement regarding white ant attack on citrus mainly because I am told that a white ant, not known to occur in the Union, commonly injures young citrus in Rhodesia. It is true also that damage has been reported from the bushveld, but this, in the light of what has already been said, is not surprising. A report has also been received from Thabina, in the low veld of the Leydsdorp District. Unless some kind not common to other parts of the Union is involved, this may turn out to be quite a casual matter, resulting from the planting of trees in a sickly condition or planting directly upon a white ant mound.

IV.—IN WELLS AND BOREHOLES.

When the first complaint reached me concerning white ants in boreholes, I confess I felt very doubtful about the matter. But since then the pollution of boreholes and wells by white ants has proved to be by no means uncommon. The insects are either drawn up in buckets or pumped up. I have been fortunate enough to see two of the kinds so found, one lot from a well, the other from a borehole; also, in both instances, to secure some direct evidence showing how the insects got themselves into such a predicament.

There is a considerable amount of interest attaching to this matter, since it goes to show the extremes these insects will go to or may be instinctively led to, in order to secure water. The insects from the well were Harvesters or Grasdraers; those from the borehole were Fungus Growers (*Termes badius*). When we consider that these two, or closely allied termites, manage to exist in the Kalahari, so far even as Lehutulu, 300 miles west of Mafeking, it becomes fairly obvious that they must at times have to go deep into the soil to obtain such moisture as we know they require for the well-being of their communities, especially for the upbringing of their young.

The only positive evidence I have of white ants boring to any depth was found in a limestone quarry in the bushveld. There the downward tunnels of Harvesters were seen passing along faults in the stone to a depth of fourteen feet. That these insects bore to greater depths is often asserted by those farmers who have had occasion to dig deep wells, and their statements are borne out by the case of the insects that were taken from a well. These had a tunnel which opened into the wall of the well, much deeper than fourteen feet. I am told they could not go deeper because a layer of stone barred the way. From the mouth of their tunnel the insects emerged and

eventually fell into the water from which they could not recover themselves. They had, no doubt, been led towards the water by their instinct, which there failed them; for they could not judge the distance. Such then is the difference between instinct and intelligence, for, had they posssessed the latter, they would have crawled down the wall of the well, got such water as they wanted, and returned to their burrow.

The Fungus Growers pumped up with water from the borehole belonged to a nest on the surface near by. These insects gained a passage to the bore by way of the stone packing around the outside of the casing. Whether on coming directly over the water they fell into it or not, could not be ascertained. Possibly they did not, as they differ from the free-living Harvesters, and tend to creep over surfaces rather than to walk boldly forward. Hence is is quite likely that they reached the water-level safely and returned regularly to the nest, except on such occasions when the water was being pumped. This would wash them off the wall and, drowning them, their bodies would later come up through the mouth of the pump.

Outbreaks of Animal Diseases: March, 1921.

Month.	East Coast Fever.	Mange.	Anthrax.	Dourine.	Glanders.	Epizootic Lymphangitis.	Tuberculosis.	Lungsickness.
Feb., 1921 ...	40	8	198	2	1	2	—	—
March, 1921...	34	8	231	4	—			—

DISTRIBUTED AS FOLLOWS:

Disease.	Transvaal.	Natal.	Cape.	Orange Free State.	Transkei.	Totals.
East Coast Fever	13	14	—	—	7	34
Mange	—	—	7		1	8
Anthrax	100	11	15	40	65	231
Dourine	—	—	4	—	—	4
Glanders	—	—	—	—	—	—
Epizootic Lymphangitis ...	—	—	—	—	—	—
Tuberculosis	—	—	—	—	—	—
Lungsickness			—	—	—	—

THE VEGETABLE GARDEN.

May.

By H. B. Terry, Cert. R.H.S., Lecturer in Horticulture, School of Agriculture, Potchefstroom.

Much can be done to augment the supply of vegetables for winter and spring use. Digging, trenching, and manuring are of the greatest importance at this time of the year. All decaying matter from passing crops should be destroyed and buried to prevent the breeding of insect pests.

The following may be sown in open ground, not to be transplanted:—

Broad Beans.—Sow in drills 2 feet 6 inches apart and place the beans 12 inches apart in the rows. They like a fairly heavy soil that has been well manured. Do not attempt to cramp this crop, otherwise the pods will not set.

Lettuce.—Cos varieties such as White Paris, etc., should be sown. This popular salad requires rich moist ground and cannot be well grown without. Do not sow too thickly, and thin out to about 9 inches apart.

Parsnip.—A small sowing may be made. Deep well worked soil is essential; thin out the seedlings before they choke one another by overcrowding.

Peas.—May continue to be sown. Stratagem, Pride of the Market, Dr. McLean, Sutton's Matchless are all useful. Where very severe frosts are experienced, the peas are liable to become frosted.

Radish.—Make continuous sowing of Turnip Rooted, French Breakfast, and other quick maturing sorts. The reason radishes become puffy, hollow, and hot is because they are not used fast enough.

Spinach.—Given some well manured ground and a plentiful supply of water, together with plenty of hoeing later, a sowing of Prickly Winter may be made.

Turnips.—Make good sowings of Six Weeks, Red Top White Globe, Jersey Lily; thin the seedlings out when strong enough to prevent them falling over; failure to thin out ruins the crop.

Onions.—Transplant seedlings from sowings made in February or March; the ground should have been prepared some time ago. Before planting, the soil should be made firm, as onions dislike a spongy soil to root in. Make the rows 15 inches apart, and set the plants 6 to 8 inches apart in the rows. Do not plant deeper than 1 inch, as good bulbs are only produced at or on the surface.

Leeks.—If available, may be transplanted in a similar manner to onions.

Celery.—Should be making good progress, and will need to be tied up with paper before earthing up to blanch the stalks. Water should be generously given to enable this crop to become crisp.

Cabbage.—May still be transplanted, and provided the soil is rich they will make good growth during the winter and provide a certain crop for spring use when most vegetables are scarce.

Cauliflowers.—Will soon be fit for cutting, that is the early sorts; as the heads appear it is advisable to break in a few of the inner leaves to protect the flower from the weather. Provide copious supplies of water if good heads are desired.

Mustard and Cress.—May be sown in tins and boxes under cover or on the stoep. When grown in the open it does not attain sufficient length for cutting, but under partial shade it easily reaches 3 to 4 inches quickly.

(The writer will be pleased to give further information on application to him.)

THE POULTRY YARD MONTH BY MONTH.

May.

By J. J. JORDAAN, Lecturer and Instructor in Poultry, School of Agriculture, Glen, Orange Free State.

THE following points, which constitute the main principles of poultry breeding and are applicable to the whole year, may here be mentioned in order to avoid repetition month by month, viz.:—

Fresh, sweet soil in the runs.
Abundance of cool, clean, drinking water.
Suitable and sufficient housing accommodation.
Correct and regular feeding.

Egg Production

New laid eggs are very expensive during this month. Endeavour therefore to obtain all eggs possible from pullets and hens not in the breeding pens, using forcing foods and spices if necessary; the price of new laid eggs will warrant this at this time of year.

Warm housing at night, exercise during the day, abundance of green food and drinking water, and warm mash in the mornings, to which a liberal amount of meat meal, Crayferine, or cut green bone has been added, and good wholesome grain food dug into the ground, giving as much variety as is obtainable, should produce eggs if the birds are of a laying strain.

Feeding.

The following will be found a good laying mash:—

3 parts bran (wheaten).
2 parts crushed oats.
6 parts lucerne-hay or meal.
1 part pollard.
¼ part meat meal, Crayferine, or green bone.

Breeding Pens.

The same mash, minus the meat meal, Crayferine, and green bone, fed "dry" to the breeding hens in the morning, and the grain food fed at night with liberal supplies of green food at midday, should suffice.

Specially see to the feeding of the male bird; he must be kept in good condition; feed him separately from the hens at midday with a little table scraps.

Do not allow the temptation of high prices for new laid eggs to lead you into forcing the breeding-pen birds to produce abnormally, for this will only be at the cost of fertility and will result in weakened chicks.

Nor should eagerness to fill the incubator, or to supply orders for day-old chicks or settings of eggs lead to the above, as it is a poor policy in the end.

Again, do not put more hens to the male bird than he can possibly fertilize. The following are safe numbers as a guide. Heavy varieties, 3 to 6. Light varieties, 5 to 9.

This is one of the best months of the year to hatch chicks, but they must be from eggs produced normally.

All eggs should be gathered daily, as eggs if exposed to frost are liable to give poor hatching results and are not so good for eating owing to evaporation being so much more rapid.

Incubation.

Visit your incubator room at night just before retiring, and note the temperature of the room as well as that of the drawer; a little attention in this direction may prevent losses from "dead in shell."

If the hens go broody, give them eggs; they are useful in looking after incubated chicks as these hatch. In spite of all the abuse showered on the old broody hen in regard to broken eggs, insects, etc., there are few of our large breeders who do not hatch their show and competition winners under the hen.

When the machine is due to hatch, do not open the drawer to show every friend the little things coming out. *Once* a day is the most it should be done. The drawer should on no account be opened more than once daily during the hatching period.

Chickens.

After being hatched do not feed the chicks for 36 to 48 hours or bowel trouble will result.

Their first feed should be coarse sand or very fine flint grit. Therefore, for the first three or four weeks coarse oatmeal and chicken groats are best, with liberal feeds of finely chopped green food and ants, but no damp or moistened food should be given them.

Milk to drink will also be found excellent, but it should always be given either sour or fresh. The former is better.

The feeding should be a little at a time, but often, about every three hours as much as they will clean up readily.

Do not pamper or attempt to rear weak chicks, as these are a fruitful source of trouble even if they do live.

Visit your small chicks after having been to the incubator house and see that they are comfortable; observation and interest will soon show if they are, and if not, what is wrong.

Should the air smell foul on opening the lid of the brooder, the ventilation is bad. If the chicks are swarming upon each other they are either cold or seeking fresh air. If screaming and shivering, they are cold, wanting warmth. If gasping and drooping wings, they are overheated and need more ventilation. If sleeping and spread out over the floor, they are contented and comfortable. Feel their crops; at night these should be hard and full.

NOTES FROM THE "GAZETTE."

Attention is drawn to the following matters of interest which appeared in the *Union Gazette*:—

(Abbreviations: "Proc."—Proclamation; "G.N."—Government Notice.)

Gazette. *No.*	*Date.*	*Items.*
1128	11/3/21	The Xorana Plantation, Reserve No. 111, in the Mqanduli District, has been declared a demarcated forest in terms of the Forest Act, No. 16 of 1913. (G.N. No. 383.)
1128	11/3/21	In terms of the Regulations for the Control and Management of Crown Forests, the tariff of charges for forest produce, such as trees available for sale, grazing, etc., and the felling and slipping seasons in Crown forests in the Midland Forest Conservancy, are laid down in G.N. No. 402.
1128	11/3/21	The farm Mountain Side, Weenen County, Natal, is to be disposed of by the Secretary for Lands, Pretoria, to whom application, with supporting documents, should be made. (G.N. 397.)
1133	24/3/21	A revised tariff of charges for blue tongue and anthrax vaccines, as prepared by the Veterinary Research Division, with effect from 1st April, 1921, is published. (G.N. No. 475.)
1133 1137	24/3/21 1/4/21	The distinfection and compulsory dipping of cattle is prescribed as follows: (*a*) Every three days in the three-day dip for portions of Pietersburg and Zoutpansberg Districts; (*b*) every five days in the five-day dip for portions of Richmond, Pietermaritzburg, Emtonjaneni, Vryheid, Pretoria, Umzimkulu, New Hanover, Lions River, Utrecht, and Eshowe Districts; (*c*) every seven days in the seven-day dip for portions of Lydenburg District. (G. N. Nos. 486, 511).

Gazette. No.	Date.	*Items.*
1133	24/3/21	In terms of the O.R.C. Brands Registration Ordinance, 1903, a list of brands registered in the Orange Free State is published for the three months ended 31st December, 1920. (G.N. No. 496.)
1133	24/3/21	The farm foods and fertilizers registered with the Department of Agriculture during the year 1920 in accordance with the requirements of the Fertilizers, Farm Foods, Seeds and Pest Remedies Act, 1917, appear in G.N. No. 497.
1133	24/3/21	A revised tariff of fees has been laid down, which will be levied as from the 1st April, 1921, for the inspection and grading of grain and other cereals intended for export. (G.N. No. 498.)
1133	24/3/21	The South African Stud Book Association, incorporated under the Registration of Live Stock Act, No. 22 of 1920, has had conferred on it certain rights for the registration of pedigree stock bred in, and imported into, the territories of Basutoland, Bechuanaland, and Swaziland. (Proc. Nos. 9, 10, 11, *Official Gazette* No. 1023 of 24/3/21.)
1137	1/4/21	By virtue of the Stock Diseases Act, No. 14 of 1911, Upington has been proclaimed a port of entry for stock other than sheep and goats. (Proc. No. 59.)
1137	1/4/21	Portions of the Kentani Western Reserve (No. II), Kentani Eastern Reserve (No. III), and Kentani Plantation (No. IV), in the Kentani District, have been declared demarcated forests. (G.N. No. 513.)
1137	1/4/21	Under the various Brands Registration Acts (Cape of Good Hope), a list of brands registered for the quarter ended 31st December, 1920, is published in G.N. No. 519.
1137	1/4/21	It has been ordered that all sheep and goats entering the Districts of Jacobsdal, Fauresmith, and Philippolis from any area except protected and semi-protected areas, are subject to certain dipping restrictions. (G.N. No. 520.)
1137	1/4/21	The conditions of control, registration, etc., under which the Imperial Government have offered to purchase a portion of the Union's wool clip for the season 1st August, 1920-15th April, 1921, are detailed in G.N. No. 533.
1137	1/4/21	Applications will be received by the Secretary for Lands, Pretoria, for the disposal on conditional purchase lease of certain holdings in Standerton, Bethal, Ermelo, and Vrede Districts, all applications to be in not later than the 13th May, 1921. (G.N. No. 536.)

SEED FOR DISPOSAL.

There is a quantity of the following wheat, barley, and early rye seed available for disposal at the School of Agriculture and Experiment Station, Potchefstroom. Applications, with remittance, should be forwarded to the Principal:—

Wheat.—American No. 8 (a medium late variety of good milling quality and resistant to attack by birds), to be sold in quantities not less than or exceeding 1 bag at £2. 10s.; Comeback, Spring Early, Fourie, Bombay (very similar to Klein Koren), and Lalkasarwali (an early, bearded variety, short-strawed, and a very good yielder under irrigation), in quantities not less than or exceeding 60 lb., at 18s.

Early Rye.—In quantities not exceeding or less than 60 lb., at 12s. 6d.

Barley.—Variety, Smyrna (an early, high yielding, six-row barley), in quantities not exceeding or less than 50 lb., at 10s.

THE WEATHER.

Extracts from the Monthly Weather Report of the Chief Meteorologist for the Union.

MEAN barometric pressure lower than usual in the west, south, centre, and east of the Union, but practically normal over Rhodesia and the Transvaal; a warm spell of short duration at the beginning, preceding a continuous period of cloudy weather with cool days and mild nights; frequent spells of steady, soaking rains, intermingled with light thunderstorms, causing an excess of precipitation over the country except in part of the west coastal area and the south-west of the Cape and the Natal coast; frequent showers of small hail with one or two destructive storms of larger hail or wind; such were the most striking features of the weather of March, 1921.

Precipitation during the month was considerable, being about 2¾ inches in excess of the average. The surplus was greatest over the Transvaal, where it averaged about 4½ inches more than usual; in the Orange Free State the rainfall exceeded the normal by roughly 2¾ inches; in the Cape by approximately 2 inches; and in Natal by about 1½ inch. Small shortages, averaging about ½ of an inch, occurred over the southern half of the west coastal area, the south-west, parts of the east central Karroo, of Gordonia, and the coast of Natal, where Durban showed a deficit of 1.95 inch. The excess varied commonly between 3 and 6 inches over the greater part of the Transvaal, Swaziland, the Transkei, and north-east of the Cape; decreased to plus 2-3 inches in the south-west Transvaal, Bechuanaland, portion of the Orange Free State, and parts of the Karroo; decreased to 1-2 inches in Natal, the greater portion of the northern Karroo, and part of the southern Karroo; and to less than an inch over Namaqualand and the east of the south coast; precipitation fell below the average over the south-western portions of the Cape, Natal coast, and Gordonia. The greatest excess was 8.37 inches at Potchefstroom. Rain occurred in some parts of the Union every day of the month, frequently in continued spells of three and up to seven days, usually of steady, soaking rains, but with occasional heavy thundershowers. The result of these abundant rains seems to have been to allay anxiety as to the winter pasture for cattle, to ensure a good supply of water from springs, dams, etc., during winter, and, in some cases, materially to improve growing crops and the prospects for winter crops, whilst all stock are in excellent condition. On the other hand, certain crops that were about to be harvested suffered from the superabundance of water (e.g. hay, monkey nuts), whilst in the Rustenburg District the cotton crops in low-lying lands died out, tobacco was drowned, and red rust appeared—the latter also in the wheat crops in Kingwilliamstown District. Insect pests have also made their appearance, e.g. boll-worm in cotton in Rustenburg, locusts in the Carnarvon and Murraysburg Districts of the Cape; black and green caterpillars are doing damage in Swaziland, and cutworms and moths in the Fauresmith District, Orange Free State. Rivers were running frequently, and some lands, particularly those of "black turf," were under water for days, so that harvesting of hay, etc., was delayed. Some heavy falls of rain, and occasionally hail, occurred.

The cumulative rainfall since the 1st July of last year is well above normal over the Transvaal, the centre and north-east of the Orange Free State, the central and coastal portions of Natal, the central, south, and west parts of the northern Karroo, the central and southern Karroos, the west and south-west of the Cape, and the middle parts of the Transkei. The most extensive areas over which there is a shortage extend from Bloemhof in the south-west Transvaal and Bechuanaland to Prieska and Hopetown in the northern border of the Cape; along the south and south-east coastal areas as far as Port St. Johns, with Zululand and the north, east, and south of Natal. The aggregate precipitation since the commencement of the current year is less than usual over much more limited areas, which include the more easterly and south-easterly parts of the Transvaal, the north and east of Natal, the northern border between Kuruman and Hopetown, the south-east portion of the northern Karroo, and part of the north-east of the Cape, as well as the south-east coastal areas. Elsewhere it is above the average by amounts varying between a few tenths to 7 inches.

THE OVERSEA MARKET.

MARKET PRICES OF SOUTH AFRICAN AND OTHER PRODUCE CABLED BY THE TRADE COMMISSIONER, LONDON, ON THE 9TH APRIL, 1921.

Wool.—At the sales which opened on the 6th April, the offerings of the Australian Wool Growers' Association were withdrawn owing to the reserve price not being reached. Private sales of wool continue. At the date of cabling there were no sales of South African wool, the bidding for Merinos being from 10 per cent. to 20 per cent. lower than at the previous sales, while the demand for cross-breds was poor, showing a decline of from 5 per cent. to 10 per cent. Continent, wool, c.i.f. German ports, superior greasy, 12 months, 2s. 10d.; good, 10 to 12 months, 2s. 5d.; superior, 6 months, 2s. 1½d.

Mohair.—There were no transactions.

Bacon.—The following prices are quoted, per cwt. (112 lb.): Danish, £9. 15s. to £11; Canadian, £7. 10s. 6d. to £8. 10s. 6d.

Cheese.—Prices at per cwt. (112 lb.): New Zealand, white, £7. 2s. to £7. 4s; coloured, £8. to £8. 2s.

Butter.—The following prices are quoted per cwt. (112 lb.): New Zealand, £13. 6s. to £13. 10s.; Australian, £12. 8s. to £12. 10s. 6d.; Argentine, £12. 4s. to £12. 12s.; Danish, £12. 16s. to £14. Butter is being retailed at from 2s. 6d. to 2s. 8d. per lb.

Maize.—Prices are easier owing to the La Plata maize crop. For South African maize the following prices are quoted: No. 2 White Flat, 38s. to 39s.; Round Yellow No. 6, 43s. (per quarter of 480 lb.), April shipments. There is no demand for forward shipments.

Ostrich Feathers.—The market remains quiet pending the forthcoming sales.

Meat.—All exported meat now free from control prices; wholesale and retail market is overstocked owing to supplies diverted from the Continent.

Cotton.—Closing prices on 7th April: American Fully Middlings, April, 7.51d.; May, 7.67d.; July, 7.87d.; October, 8.09d. per lb.

CROP REPORT.

March, 1921.

Maize.—In last month's *Journal* it was shown that the area under maize this year was estimated to be 5 per cent. less than that of last year, and that this decreased acreage was estimated to produce 13,972,500 bags if the season proved to be an ordinary favourable one. The crop, as at the 31st March, has been affected by adverse conditions, and at that date was estimated to be 11 per cent. below normal in condition. Thus the present prospects are for a crop of 13,972,500 bags, less 11 per cent. The growing period is not over, however, and the crop will be subject, of course, to the vagaries of the season still to be completed, so that it is likely that the above estimate will need to be amended as the season progresses according to the nature of the conditions met with.

Kaffir Corn.—The area under this crop is estimated to be 20 per cent. less than it was last year, and the growing crop, affected by adverse conditions, is reported to be 16 per cent. below normal in condition as at the end of March.

Tobacco.—The acreage under tobacco has fallen off this season, compared with 1920, by an average of 10 per cent. over the whole Union, the area under crop in Rustenburg, the largest producing district in the Union, being estimated to be 15 per cent. less than that of last year. Instead of a normal crop being obtained from the acreage this season, that is an ordinary full yield such as could be expected in an ordinary favourable season, indications at the end of March point to a crop 10 per cent. below normal in appearance.

WORLD CROPS.

Approximate Position at Mid-April, 1921.

SPECIAL CABLED ADVICE FROM THE INTERNATIONAL INSTITUTE OF AGRICULTURE, ROME, ON THE 14TH APRIL, 1921.

Crop.	Season.	Estimated Production and Percentage it Represents of the World's Total Yield.		Percentage of Season's Estimated Production compared with	
		Production (1 metric ton = 2200 lb.).	Percentage.*	The Previous Season (which = 100).	The Five Years' Average prior to Previous Season (average = 100).
Northern Hemisphere—		metric tons.	per cent.	per cent.	per cent.
Wheat ...	Oct., 1920–Aug., 1921 (Autumn sown)	63,389,000	53	101	97
Oats ...	Do. do.	48,150,000	76	121	107
Tobacco	April–Sept., 1920 (Summer sown)	906,000	37	107	130
Maize ...	Do. do.	88,956,000	85	111	115
Southern Hemisphere—					
Wheat ...	April, 1920–Jan., 1921 (Winter sown)	9,725,000	8	127	121
Oats ...	Do. do.	931,000	2	86	91

In the United States the condition of the autumn sown wheat crop is estimated to be 9 per cent. above the average crop condition at this date during the past ten years.

* The estimated production is based on reports sent to the Institute by certain producing countries. At the date of the cablegram the estimated production of the group of countries from which advice was received (as shown above), represented approximately the stated percentage of the world's yield.

Plant Nurseries in Quarantine as at 1st April, 1921.

Name of Nurseryman.	Address.	Cause of Quarantine.	Extent of Quarantine.
Mrs. A. W. Godwin ...	Durban	Red scale; *C. dictyospermi*, *Eriococcus araucariae*	Palms, Araucarias, Roses.
D. A. English & Co. ...	Pietermaritzburg	Red scale ...	Portion of citrus.
C. Starke & Co. ...	Mowbray, Capetown	Red scale: *Eriococcus araucariae*	Veronicas, Euonymus, Balsam, Araucarias.
Chas. Ayres & Co. ...	Capetown ...	*C. dictyospermi*: Red scale	Block "B," Courville St. Nursery.
W. H. Oliver	Amalinda, East London	Red scale ...	Whole nursery (Apples).

THE LOCAL MARKET.

Position at Mid-April, 1921.

(NOTE.—The local market prices of certain other agricultural produce and stock are published elsewhere in this issue.)

WOOL.

The market remains very quiet, and practically no business is being transacted, nor does there seem to be any indications of an improvement in the near future. In view of the American tariff, which, as previously reported, is expected to come into force this month, American buyers have ceased to operate. Japan buyers are obtaining the bulk of their requirements in Australia. The Union is depending, therefore, on Bradford and Continental buyers. At the present time no fixed basis of prices can be given, and nominal quotations are approximately the same as those published in last month's *Journal*.

MOHAIR.

The market continues to be very inactive. There is a small demand only for good, free summer firsts at from 8d. to 9d. per lb., and for superior summer kids at from 17d. to 20d. per lb., according to quality. All other descriptions are neglected.

HIDES AND SKINS.

The market, which remains dull and lifeless, is reported to show a further decline in prices.

OSTRICH FEATHERS.

Messrs. Dunell, Ebden & Co. report as follows: The weight of feathers disposed of at the last four local sales was 30,020 lb., valued at £56,476. The weight of unsold feathers was 7535 lb., valued at £10,976. There was a drop of from 15 per cent. to 20 per cent. in sale prices on 23rd March, and the market remained about the same till middle of April when medium to common wings were even lower. The coal strike has had a depressing influence on London sales. Compared with the September sales, the published results are 10 per cent. to 15 per cent. lower for super-wings, and 35 per cent. lower for medium to common. No demand for shorts.

It is impossible to say for certain whether the London results will have any effect locally, though such is not at present anticipated.

SALE OF PURE-BRED STOCK.

An unreserved sale of pure-bred stock will be held at the School of Agriculture and Experiment Station, Cedara, on Saturday, 25th June, 1921.

FRIESLANDS	about 7 Bulls	and 4 Cows and Heifers.
SHORTHORNS	„ 9 „	„ 10 „ „ „
ABERDEEN-ANGUS	„ 6 Bulls.	
AYRSHIRES	„ 4 Cows and Heifers.	

Also a number of pedigree Large Black and Berkshire Pigs, and pens of pure-bred Poultry, as well as a few individual birds, will be offered.

All animals sold will be forwarded carriage paid to buyer's nearest railway station.

For catalogue and further particulars apply to the Principal at the above address.

THE UNION'S EXTERNAL TRADE.

I.—IMPORTS.

(Excluding Removals from Rhodesia.)

Article.		Twelve Months ended 31st December. 1919. Quantity.	1919. Value.	1920. Quantity.	1920. Value.
(1) *Animals, Living.*			£		£
Horses, mares, geldings ...	No.	183	20,215	298	37,990
Bulls and oxen	„	19,972	243,197	16,614	208,170
Cows and calves	„	375	26,516	409	29,375
Mules	„	—	—	60	853
Goats	„	—	—	958	958
Sheep and lambs	„	86,100	143,022	110,879	235,055
Pigs...	„	28	680	64	2,117
Poultry	„	365	852	598	1,415
All other	„	—	638	—	1,710
Total		—	435,150	—	517,673
(2) *Certain Articles of Food and Drink.*					
Butter	lb.	356,035	32,226	621,920	76,721
Cheese	„	20,334	2,037	1,199,988	93,672
Coffee, raw	„	17,525,617	690,871	28,724,885	1,151,159
Condiments	„	504,868	32,651	499,708	53,610
Confectionery, etc. ...	„	2,636,120	223,435	6,606,524	541,330
Corn, grain, meal, etc.—					
Beans and peas	„	2,519,350	22,208	13,231,069	137,494
Dholl	„	2,762,569	30,491	2,293,239	33,010
Maize	„	1,299,961	4,319	18,606,888	94,620
Malt	„	2,132,927	22,159	6,455,097	98,358
Oats	„	—	—	5,743,086	41,408
Wheat	„	45,199,647	278,466	239,358,613	2,669,835
Flour (or meal), wheaten	„	54,390,182	460,377	144,192,235	8,038,418
Dripping and fats for food	„	749,238	30,861	2,126,999	112,868
Farinaceous preparations...	„	4,740,832	109,429	7,458,834	184,218
Fruit, Fresh	„	—	2,343	—	4,703
Almonds and nuts ...	„	1,666,915	36,334	2,848,586	68,524
Dates	„	1,771,686	32,295	3,355,990	82,401
Dried and others ...	„	1,531,806	57,503	2,768,115	120,287
Bottled and tinned ...	„	71,296	4,065	311,893	16,386
Lard and substitutes ...	„	32,571	2,537	521,957	12,087
Meats—					
Fresh or Frozen ...	„	183,839	1,680	2,318,096	65,578
Salted (bacon, ham, etc.)	„	109,820	6,654	145,619	11,480
Tinned	„	1,680,359	88,003	2,124,182	162,802
Milk, condensed	„	8,647,689	342,553	12,377,025	647,599
Pickles and sauces... ...	„	1,150,756	64,900	1,720,904	111,658
Rice...	„	40,981,699	381,040	47,701,889	807,225
Spices	„	3,593,330	112,539	1,258,507	56,631
Spirits (potable) ...	gals.	271,747	303,312	641,243	726,750
Sugar and products ...	lb.	8,257,834	73,677	5,020,977	113,361
Tea	„	7,346,990	421,601	6,672,975	507,268
Vegetables, tinned... ...	„	1,271,181	28,147	5,725,026	88,756
Vinegar	gals.	24,007	8,519	75,686	20,968
Wines	„	47,542	73,411	100,785	164,793
(3) Total *all* articles of food and drink (including other items not enumerated above)		—	4,851,859	—	13,099,189

I.—IMPORTS—(*continued*).

(Excluding Removals from Rhodesia.)

Article.	Twelve Months ended 31st December. 1919. Quantity.	1919. Value.	1920. Quantity.	1920. Value.
(4) *Miscellaneous.*		£		£
Fencing materials ... cwt.	—	331,767	—	1,152,523
Fodder and forage ... lb.	1,577,180	5,300	1,398,870	11,089
Hides and skins ... ... "	2,566,313	143,406	1,199,419	118,752
Hops ... ... cwt.	4,695	37,596	4,077	68,047
Agricultural machinery and implements ... ... No.	—	765,992	—	1,300,270
Water boring machinery	—	2,687		13,298
Windmills...	—	71,323	—	153,836
Wool presses		4,390	—	7,954
Leather and Leather Goods		1,763,950	—	3,850,771
Manures and fertilizers ... lb.	25,234,777	52,937	65,457,789	239,779
Oil	—	1,782,437	—	2,997,741
Seeds, garden and vegetable lb.	258,809	27,791	441,387	38,265
Sheep and cattle dips ... "	—	156,348	—	160,951
Tobacco, Unmanufactured "	354,812	42,369	268,271	38,922
Cigars, cigarettes "	141,836	107,341	218,959	219,320
Other manufactures "	56,255	9,688	51,716	7,762
Wood and timber cub. ft.	—	1,247,180	—	3,412,331

GRAND TOTAL IMPORTS, BEING MERCHANDISE (INCLUDING IMPORTS FROM RHODESIA, S.A. GOVERNMENT IMPORTS AND SPECIE).

1919	£53,418,612.
1920	£105,927,107.

[NOTE.— The Grand Total of imported goods (including specie) re-exported in 1919 was £4,014,875, and £5,833,312 in 1920.]

II.—EXPORTS OF SOUTH AFRICAN PRODUCE.

(Excluding Removals to Rhodesia and Ships' Stores.)

Article.	Twelve Months ended 31st December. 1919. Quantity.	1919. Value.	1920. Quantity.	1920. Value.
(1) *Animals, Living.*		£		£
Horses, mares, and geldings No	263	9,563	127	12,144
Mules and donkeys ... "	260	5,129	332	7,052
Pigs ... ... "	3,762	8,896	1,144	6,455
Sheep and lambs ... ... "	1,849	2,221	1,512	2,817
All other ... ... "	—	21,172	—	35,349
Total	—	46,981	—	63,817

II.—EXPORTS OF SOUTH AFRICAN PRODUCE—(*continued*).
(Excluding Removals to Rhodesia and Ships' Stores.)

Article.		Twelve Months ended 31st December.			
		1919.		1920.	
		Quantity.	Value.	Quantity.	Value.
(2) *Certain Articles of Food and Drink.*			£		£
Butter and substitutes ...	lb.	434,914	35,259	111,490	44,633
Cheese	„	1,525,638	80,417	296,137	21,953
Confectionery and jams ...	„	8,950,031	235,335	1,799,994	148,056
Eggs	No.	7,132,481	61,456	9,223,055	95,440
Fruit, dried and preserved	lb.	6,731,895	199,219	3,978,034	176,230
Fruit, Fresh—	No. of				
Citrus	boxes	54,677	38,973	135,184	93,251
Deciduous	„	71,698	14,398	220,830	48,655
Grapes	„	14,253	1,156	77,370	23,501
All other...	„	—	7,598	—	6,534
Corn, grain and meal					
Maize	lb	246,265,197	1,115,408	69,675,591	344,268
Maize meal	„	367,875,772	1,836,180	81,097,024	141,755
All other...	„	82,081,307	451,751	15,971,345	167,017
Meats, fresh and frozen ...	„	41,670,938	1,084,745	12,917,098	318,546
„ preserved and cured	„	1,347,716	86,228	691,941	62,731
Spirits, potable ...	gals.	295,698	62,173	226,591	61,323
Sugar	lb.	37,918,058	430,603	32,606,439	131,998
Sugar products	„	8,917,253	56,599	8,774,951	82,459
Vegetables	..	—	33,865	—	52,666
Wines	gals.	102,656	106,349	186,809	187,837
(3) Total *all* articles of food and drink (including other items not enumerated above)		—	6,330,248	—	3,214,031
(4) *Miscellaneous.*					
Aloes	lb.	1,202,982	13,522	796,515	15,607
Bark, wattle	„	126,645,584	386,096	157,822,087	662,515
„ extract	„	13,761,262	216,086	18,997,125	323,969
Buchu leaves	„	149,166	37,130	139,149	67,243
Cotton, raw	„	289,890	19,251	997,238	69,830
Hair, Angora	„	16,942,021	1,654,235	6,289,888	518,973
Hides and skins	„	—	4,985,353	—	1,233,894
Horns	„	1,861,116	24,565	1,597,390	34,555
Manures	„	10,723,606	127,799	7,989,816	73,946
Ostrich feathers	„	904,611	1,646,014	285,144	547,336
Tobacco, all kinds... ...	„	1,603,672	137,326	1,946,075	182,063
Wool	„	184,927,986	17,919,088	119,504,747	15,988,103

TOTAL MERCHANDISE OF SOUTH AFRICAN PRODUCTION EXPORTED (INCLUDING GOLD AND DIAMONDS AND REMOVALS TO RHODESIA AND EXCLUDING SHIPS' STORES.)

1919 ... ... value ... ... £97,803,661.
1920 ... ... „ ... ... £77,799,172.

(NOTE.—The difference is found principally in the export of raw gold, wool, sugar and grain.)

The *Journal* is the Department's medium of making known its activities. It contains information of value to every farmer in the Union Keep it for reference.

LOCAL MARKET PRICES.

Rates of Agricultural Produce and Stock ruling at the 15th April, 1921.

Centre.	Wheat. Per 200 lb.		Wheat Flour. Per 100 lb.		Boer Meal. Per 200 lb.		Mealies. Per 200 lb.		Mealie Meal. Per 180 lb.		Barley. Per 150 lb.		Oats. Per 150 lb.		Oat-hay. Per 100 lb.		Lucerne Hay. Per 100 lb.		Potatoes. Per 150 lb.	
	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.
Cape Province—																				
Aliwal North‡...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Beaufort West...	35 0	40 0	30 0	35 0	40 0	42 6	17 6	18 0	19 0	20 0	21 0	22 6	15 0	15 0	6 0	6 6	5 0	6 0	18 6	22 6
Capetown	28 0	28 6	—	—	—	—	16 6	17 0	—	—	17 0	17 6	9 6	10 0	5 0	5 6	7 0	7 6	9 0	10 0
East London....	—	—	—	—	—	—	12 0	15 0	—	—	—	—	—	—	—	—	—	—	12 0	31 6
Grahamstown....	—	—	—	—	—	—	16 5	18 0	—	—	—	—	—	—	9 6	10 0	4 6	5 6	12 0	21 0
Kimberley.....	29 0	33 0	30 0	32 0	45 0	48 0	13 6	14 6	11 0	13 0	21 0	23 0	12 6	14 6	6 3	7 0	5 6	6 6	3 0	20 6
Kingwilliamstown	—	—	—	—	—	—	13 6	15 0	—	—	—	—	—	—	7 6	9 0	4 6	4 6	7 6	19 6
Port Elizabeth...	—	—	—	—	—	—	11 0	15 0	—	—	14 3	16 6	—	—	5 0	7 3	4 0	6 3	4 6	21 0
Queenstown	30 0	31 0	39 0	40 0	17 6	39 6	12 6	14 0	19 0	20 0	21 0	22 6	14 6	15 6	5 0	7 0	4 6	4 9	10 0	18 0
Natal—																				
Durban.....	—	—	—	—	—	—	9 0	13 6	9 0	13 0	—	—	—	—	5 0	6 0	3 0	7 0	10 0	21 0
Pietermaritzburg.	—	—	—	—	—	—	11 3	11 6	—	—	—	—	—	—	6 6	7 0	7 0	7 6	10 6	18 0
Orange Free State—																				
Bloemfontein....	28 6	31 0	36 6	40 0	35 0	53 0	10 6	13 6	13 6	16 0	22 0	26 0	10 6	14 6	6 0	7 6	5 6	6 6	8 6	18 6
Harrismith.....	27 6	30 0	27 6	27 6	54 0	54 0	9 0	10 0	12 0	12 0	16 0	16 0	10 0	11 6	5 0	7 6	—	—	8 0	11 0
Transvaal—																				
Pretoria.....	34 0	39 0	—	—	—	—	9 7	14 0	—	—	15 0	19 0	7 8	10 0	6 0	8 0	3 7	6 0	6 6	19 0
Johannesburg....	22 0	32 6	—	—	—	—	9 6	13 0	10 2	10 8	19 0	20 0	7 9	9 6	3 6	7 0	2 6	8 3	4 6	14 0

Centre.	Onions. Per 120 lb.		Tobacco (Boer Roll). Per lb.		Beans. Per 200 lb.		Beef. Per lb.		Mutton. Per lb.		Fresh Butter. Per lb.		Eggs. Per dozen.		Cattle (Slaughter). Each.		Sheep. Each.		Pigs. Each.	
	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.	Min. £ s. d.	Max. £ s. d.	Min. s. d.	Max. s. d.	Min. s. d.	Max. s. d.
Cape Province—																				
Aliwal North‡...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Beaufort West...	10 0	12 6	1 3	1 6	45 0	70 0	0 9	1 4	0 8	0 9	1 9	2 0	3 0	3 0	7 10 0	13 0 0	20 0	30 0	30 0	210 0
Capetown	6 0	11 0	0 6	1 0	37 0	65 0	0 6	1 3	0 9	1 2	1 6	1 9	2 0	2 9	13 0 0	18 0 0	25 0	30 0	30 0	100 0
East London....	10 0	15 9	—	—	25 0	33 9	—	—	0 4	0 11	1 0	2 0	2 0	5 1	—	—	—	—	—	—
Grahamstown....	18 0	22 2	0 11	1 0	40 0	50 0	0 8	0 11	0 9	1 0	1 2	1 5	2 0	3 7	—	—	—	—	—	—
Kimberley.....	3 6	18 0	0 6	0 11	42 0	60 0	0 6	1 3	0 6	1 0	1 0	1 7	1 10	3 9	12 0 0	15 10 0	18 0	25 0	*0 4	0 9
Kingwilliamstown	9 6	12 0	—	—	30 0	35 0	0 7	0 8	0 9	0 10	1 1	1 6	1 6	3 0	—	—	—	—	—	—
Port Elizabeth...	9 0	15 0	—	—	35 0	76 0	0 8	1 0	0 8	1 0	1 1	1 5	2 4	3 8	—	—	—	—	25 0	80 0
Queenstown.....	17 0	17 6	0 9	1 0	39 0	43 0	0 5	0 6	0 5	0 7	1 0	1 4	2 6	4 0	12 0 0	18 0 0	14 0	15 0	*0 4½	0 6½
Natal—																				
Durban.....	13 6	23 0	—	—	25 0	56 0	0 3	0 6	0 5	0 8	1 6	2 6	2 6	5 3	—	—	—	—	—	—
Pietermaritzburg.	—	—	—	—	—	—	0 4	0 8	0 9	0 10	1 9	2 6	3 6	5 0	—	—	—	—	—	—
Orange Free State—																				
Bloemfontein....	8 6	14 0	0 6	1 0	25 0	35 0	0 7	0 11	0 6	0 11	1 6	2 0	2 0	3 6	12 0 0	14 5 0	16 6	25 0	*0 6	0 8½
Harrismith.....	8 0	8 0	—	—	—	—	0 4	0 9	0 5	0 7	1 7	2 6	2 6	4 0	8 0 0	12 0 0	7 6	15 0	15 0	40 0
Transvaal—																				
Pretoria.....	8 0	15 0	—	—	18 0	48 0	—	—	—	—	1 3	2 0	2 9	4 3	—	—	—	—	—	—
Johannesburg....	9 9	13 0	0 2	0 2	8 0	58 0	†38 0	40 0	0 5	0 6	1 0	2 0	2 9	3 7	6 0 0	17 0 0	7 6	28 0	*0 2	0 9

* Live weight per lb. † Dressed weight, including hides, offal, etc., per 100 lb. ‡ Information not available.

NOTE.—The rates quoted for produce sold in bags include, as a general rule an additional 3 lb. for weight of bag.

RECENT AGRICULTURAL LITERATURE.

SELECTED LIST OF BOOKS ADDED TO THE DEPARTMENT'S LIBRARY.

[NOTE.—The first number is that of the class to which the book belongs; the last number is that of the book itself.]

GENERAL.

018 Vitz, Carl P. Loan Work (Preprint of Manual of Library Economy Chap. XXI). 2nd Edition, revised. Chicago, 1919. No. 7482.

240,68.2 Union of South Africa. Conference on the Future Constitution of the Senate. (U.G. 65.20.) Capetown, 1920. No. 7475.

290 Cumberland, Wm. W. Co-operative Marketing. Princeton, N.J., 1917. No. 7454.

350 Henley, N. W. Twentieth Century Formulas, Recipes and Processes. New York, 1920. No. 7460.

351 Sindall, R. W. Paper Technology; An Elementary Manual on the Manufacture, Physical Qualities, and Chemical Constituents of Paper and of Paper-making Fibres. 3rd Edition. London, 1920. No. 7465.

361 "The Canning Trade." Reprinted from a Complete Course in Canning. Baltimore, 1919. No. 7463.

380,49.2 South African Exhibition, Amsterdam, 19th March-10th April, 1921. Prospectus. London. No. 7474.

AGRICULTURE, LIVE STOCK, AND ALLIED SUBJECTS.

400 Doyle, K. D. Agriculture and Irrigation in Continental and Tropical Climates. London, 1921. No. 7467.

412,42 Great Britain, Government of. Ministry of Agriculture and Fisheries. Agriculture Bill. Memorandum on Financial Resolution. London, 1920. No. 7476.

430 Wilson, James. The Breeding and Feeding of Farm Stock. London, 1921. No. 7464.

472,68 Visscher, Joh. Ooftbouw in Zuid-Afrika. 's Gravenhage, 1921. No. 7469.

477,68 Wilmot, G. A. Boomplanting. (Pamflet No. 3.) Pretoria. No. 7461.

477,68 Wilmot, G. A. Tree Planting. (Bull. No. 3.) Pretoria. No. 7462.

SCIENCE (GENERAL), PHYSICS, CHEMISTRY, GEOLOGY, ETC.

530,70 Huntington, E. The Climatic Factor, as Illustrated in Arid America. Washington, 1914. No. 7470.

542 Spoehr, H. A. The Carbohydrate Economy of Cacti. Washington, 1919. No. 7468.

544 Audley, James A. Silica and the Silicates. (Industrial Chemistry.) London, 1921. No. 7457.

545.2 Perold, A. I. Die Alkoholvraagstuk. Kaapstad, 1920. No. 7481.

546 Wood, T. B. The Chemistry of Crop Production. London, 1920, No. 7459.

BIOLOGY, ZOOLOGY, BOTANY, MEDICINE, ETC.

630.68 Haagner, Alwin. South African Mammals. A Short Manual for the Use of Field Naturalists, Sportsmen, and Travellers. London, 1920. No. 7173.

632 Marcinowski, Dr. K. Parasitisch und Semiparasitisch an Pflanzen lebende Nematoden. (Arbeiten Kaiserl. Biolog.) Anstalt fur Land- und Forstwirtschaft. Berlin, 1909. No. 7155.

635.1.42 Great Britain, Government of. Report on the Imperial Entomological Conference. June, 1920. (Cmd. 835.) London, 1920. No. 7471.

671 Weaver, John E. The Ecological Relations of Roots. Washington, 1919. No. 7484.

671.8 Institut International d'Agriculture. Service des Maladies des Plantes. L'Organisation Actuelle du Service de Protection Contre les Maladies des Plantes et les Insectes Nuisibles dans les Divers Pays. Monographie Redigee á l'aide des Renseignements fournis par les Etats Adherents á l'Institut. Rome, 1911. No. 7177.

671.8.42 Great Britain, Government of. Colonial Office. Plant Pests and Diseases. An Abstract of the Legislation in force in the British Dominiens, Colonies, and Protectorates. Dealing with Plant Pests and Diseases. London, 1920. No. 7472.

675 Britton, N. L., and Rose, J. N. The Cactaceae. Descriptions and Illustrations of Plants of the Cactus Family. Vol 1. Washington, 1919. No. 7183.

Meat Statistics.

EXPORTS.

	March, 1921.	Total for Period 1st Jan., 1921, to 31st March, 1921.
Beef (quarters)	433	1,156
Bacon and Ham (lb.)	9,157	51,491

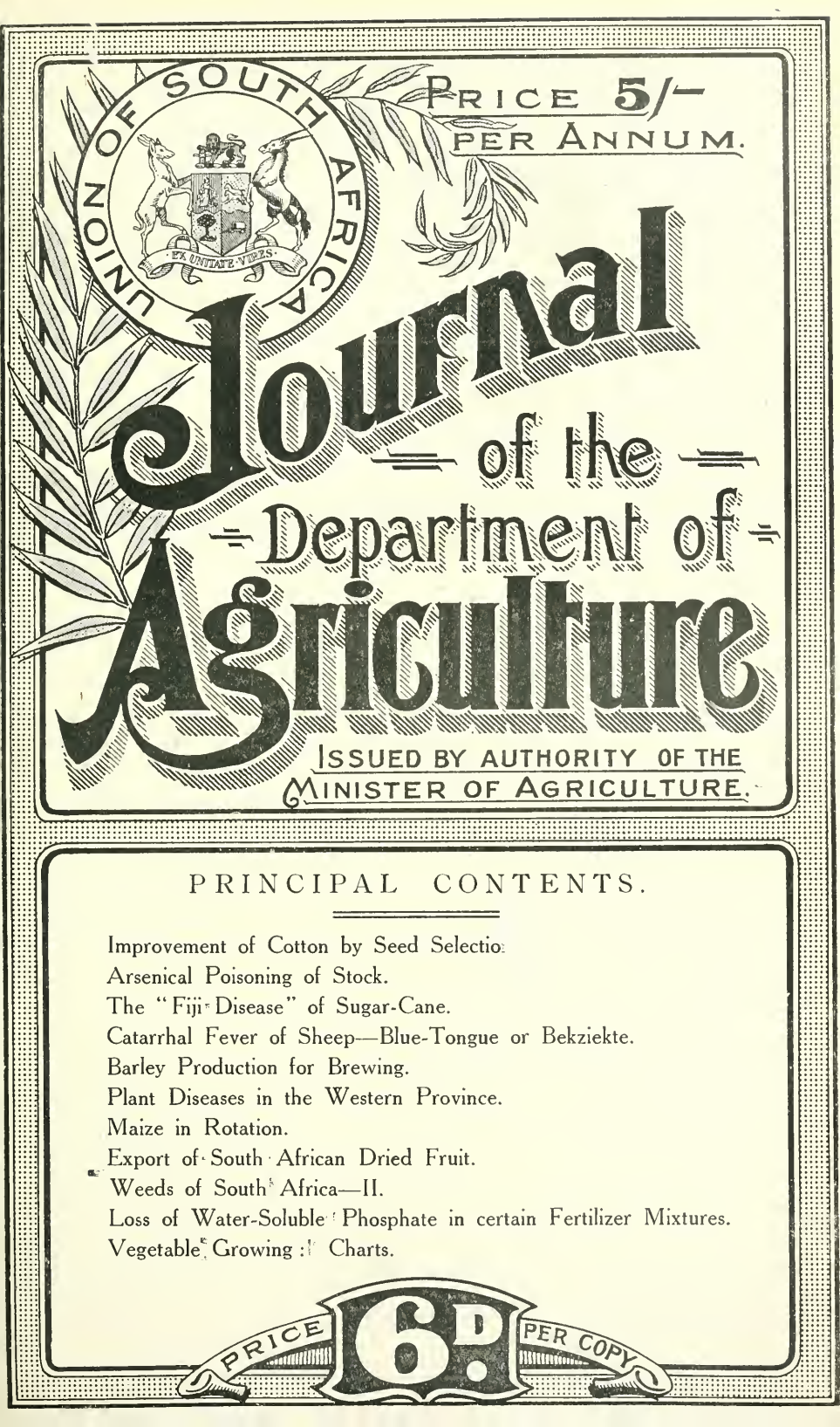
CATTLE IMPORTED FROM ADJOINING TERRITORIES.

For Slaughter	2,907	9,463
For Breeding...	1,410	1,680

SUMMARY.

Calendar Year.	Beef Exported.	Cattle Imported from Adjoining Territories for Slaughter and Breeding.
	Quarters.	No.
1916	115,992	26,580*
1917	309,214	53,410
1918	123,354	50,053
1919	285,367	57,267
1920	69,885	89,135

* 1st July to 31st December only.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Plant Diseases in the Western Province.
Maize in Rotation.
Export of South African Dried Fruit.
Weeds of South Africa—II.
Loss of Water-Soluble Phosphate in certain Fertilizer Mixtures.
Vegetable Growing : Charts.
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CONTENTS.

JUNE, 1921.

DEPARTMENTAL NOTICES.

SHORT COURSES OF INSTRUCTION

will be held during the 1921 Winter Vacation at the Schools of Agriculture, as follows:—

Grootfontein, Middelburg, Cape Province.—21st June-1st July: Course "A"—Dairying, Horticulture, Poultry, Domestic Science. 18th June-24th June: Course "B"—(*a*) Sheep and Wool. 25th June-1st July: Course "B"—(*b*) Sheep and Wool. 5th July-15th July: Course "C"—Cattle, Crops, Veterinary Science, Agricultural Engineering, Zoology. 5th July-15th July: Course "D"—Agricultural Chemistry, Botany, Entomology.

Potchefstroom, Transvaal.—16th June-25th June: Course 1—Dairying, Horticulture, Poultry, Domestic Science. 28th June-13th July: Course 2—Animal and Field Husbandry, Veterinary Science, Agricultural Engineering, Chemistry, Botany, Entomology, Trees and Tree-planting, Agricultural Legislation.

Elsenburg, Mulders Vlei, Cape Province.—20th June-29th June: Course 1—Horticulture, Poultry, Dairying, Apiculture, Turkish Tobacco, Domestic Science. 4th July-20th July: Course 2—Animal and Field Husbandry, Veterinary Science, Agricultural Chemistry, Botany and Entomology, Dairying, Viticulture, Turkish Tobacco.

Glen, Orange Free State.—20th June-1st July: Course 1—Animal and Field Husbandry, Agricultural Chemistry, Botany and Entomology, Agricultural Engineering, Veterinary Science, Trees and Tree-planting. 4th July-8th July: Course 2—Sheep and Wool. 4th July-8th July: Course 3—Poultry and Domestic Science. 11th July-15th July: Course 4—Sheep and Wool. 11th July-15th July: Course 5—Horticulture, Dairying, and Domestic Science.

The Courses in Poultry, Horticulture, Dairying, and Domestic Science are specially designed for women, but they will be admitted to all the Courses, provided suitable accommodation is available.

Candidates must be over 18 years of age.

Fees (inclusive of instruction, board, and lodging) are at the rate of about 5s. per day. Smaller charges are made for those who may be able to make their own arrangements for board and lodging.

Reduced railway fares, at single rate for return journey, will be granted.

Further particulars and conditions may be obtained from, and applications for admission should be made to, the respective principals of the institutions above mentioned.

P. J. du Toit,
Secretary for Agriculture.

AGRICULTURAL SHOW SEASON, 1921.

List of Agricultural Shows, compiled from details furnished by the Agricultural Unions, still to be held.

TRANSVAAL.

Barberton—10th June.

Rustenburg—15th June.

NATAL.

Dundee Agricultural Society (Dundee)—14th and 15th June.

Vryheid Agricultural Society (Vryheid)—7th June.

Klip River Agricultural Society (Ladysmith)—12th and 13th July.

Umvoti Agricultural Society (Greytown)—17th and 18th August.

Weenen Agricultural Society (Estcourt)—16th and 17th June.

Royal Agricultural Society (Maritzburg)—21st, 22nd, 23rd, and 24th June.

Newcastle Agricultural Society (Newcastle)—29th and 30th June.

Richmond Agricultural Society (Richmond)—13th and 14th July.

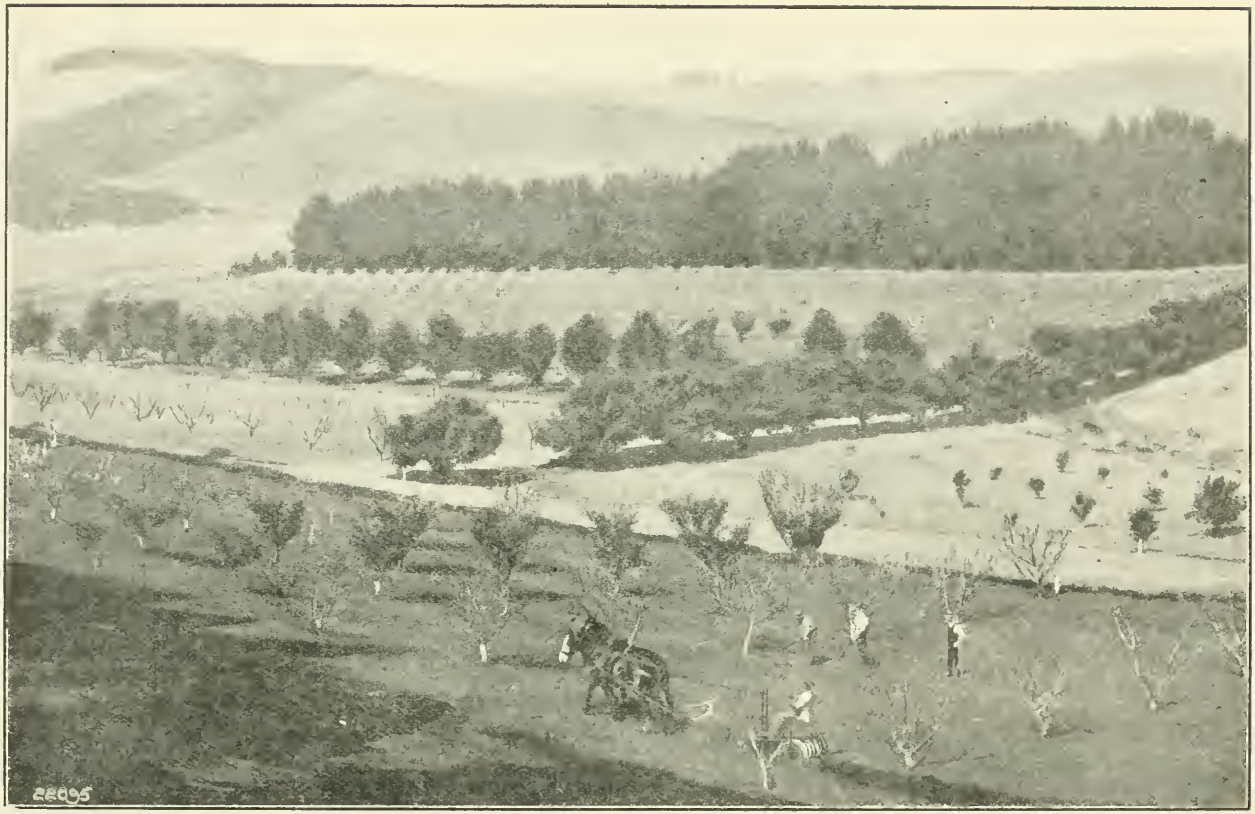
Victoria County and North Coast Agricultural and Industrial Society (Stanger)—12th to 14th July.

Dronk Vlei Agricultural Society—27th July.

Camperdown Agricultural Society (Camperdown)—20th July.

Ixopo Agricultural Society (Stuartstown)—7th July.

Alexandra County Agricultural Society (Umzinto)—15th July.



GENERAL VIEW OF ORCHARD, CEDARA SCHOOL OF AGRICULTURE.

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VOL. II. JUNE, 1921. No. 6.

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NOTES.

Wool and Hair: Canadian Importations.

In connection with the measures taken by the Canadian Government to prevent the introduction of disease into Canada, farmers of South Africa will be interested to learn, bearing in mind the unfortunate spread of anthrax in the Union, that certain amended regulations have recently been passed regarding the importation of wool and hair into Canada. Introductions of these articles have to be accompanied by a sanitary certificate certifying (*a*) in the case of clipped wool and hair that they have been clipped from live, healthy animals and have not been in contact with any other class of wool likely to convey infectious diseases; (*b*) in the case of scoured wool and hair that they have been scoured and dried at a temperature sufficiently high to secure safety from contagious or infectious disease; and (*c*) in the case of pulled wool and hair that they are derived from animals free from anthrax or other infectious disease. There are certain countries in the enumerated list, among which South Africa, happily, does not figure, respecting which the sanitary certificate must show that the wool and hair imported have been derived from animals in a district in which no anthrax or other contagious disease of animals has existed during the three months preceding the date of the certificate.

The volume of the Canadian import trade in these commodities may be gauged by the returns (according to the Annual Report of the Trade of Canada for 1919) of imports into Canada of "wool and the hair of the camel, alpaca, goat, and other like animals, not further prepared than washed," which were, in round numbers, 13 million lb. in 1915, 21 million in 1916, 15 million in 1917, 12 million in 1918, and 16 million in 1919 (fiscal years). The bulk of these supplies was drawn from the United Kingdom, the United States, New Zealand, and Australia. The Union's direct share in this trade was comparatively small.

The Improvement of Cotton by Seed Selection.

The first attempt at cotton growing in South Africa was just after the American Civil War had ended, when production in the United States had ebbed to a very low figure and prices as a consequence were high. These prices fell, however, before the industry had established itself, and this, together with other disabilities, led to the wane and ultimate cessation of cotton growing in South Africa. We are now witnessing the country's second attempt at establishing the industry, and while our progress has been such as to justify our faith in the wide field of successful enterprise for South Africa which lies in this direction, a note of warning has been raised by Mr. Oosthuizen, the manager of the Tobacco and Cotton Experiment Station at Rustenburg. Whereas formerly most of the reports on the quality of our cotton received from European manufacturers have been very satisfactory, the same manufacturers have recently severely criticized our product, on the grounds chiefly that the staple is too short and is mixed, and that the cotton is not properly graded. This is a serious complaint, and unless we succeed in removing it the second attempt to make South Africa a cotton-growing country is likely to follow the fate of the first. But happily the problem which now faces the industry is not insuperable. It is within the power of the grower to overcome it by sowing better seed and by the proper grading of our cotton. Trouble in regard to the latter matter, it is anticipated, will soon be removed, for the Department has secured the services of an officer, Mr. Hesse, with a full knowledge of the commercial side of the industry, who will devote most of his time to the grading of cotton at the various ginneries. With the present disability of improper grading removed, the vital need for good seed has to be met; it is, therefore, in this direction that Mr. Oosthuizen urges attention, and in view of the tremendous danger of devastating insect pests lurking in imported seed, he deals at length with the better method of seed selection on the farm. This method entails considerable care and attention, but the labour is amply rewarded by a high standard cotton, and the correspondingly high price it will command. Mr. Oosthuizen's advice is opportune, and calls for the earnest consideration of all engaged in cotton growing. And the urgency of the matter is patent. No success can be achieved with poor and mixed seed; indeed, we are already hearing the first rumbling of a storm of complaint gathering around an industry of which such high hopes are entertained in the Union. Without a determined effort on the part of the grower to secure by careful and judicious selection an adequate supply of good seed, and thereby raise the standard of his product to the requirements of the trade, the industry is likely to lag and fall behind, and in time stand discredited. The position is undoubtedly serious, but it can be remedied by foresight and energy on the part of the grower. It seems also, as is practised in the United States to-day, that at this juncture the opportunity exists for enterprise in the establishment of cotton-seed stations or farms, for the purpose of raising the seed requirements of the country. So far as the Tobacco and Cotton Division is concerned, it may be stated that there are no facilities for carrying out such an activity, for the only station—that at Rustenburg—suitable for seed production is limited in extent; even if a portion of the station were set aside for the purpose, the seed produced would be very far short of the quantity

required by growers. But whatever (if anything) may be done by Government or private enterprise in this direction, the industry is faced with a danger, and growers are besought to start right away in raising their seed requirements according to the directions given in Mr. Oosthuizen's article.

As a matter of general interest, we may mention here that the Department has arranged for weekly reports to be cabled from Manchester, showing the spot and future quotations for cotton on the English market. This information will be disseminated for the information of all engaged in the industry in the Union.

Government Scholarships.

Reference to the various reports of the Department issued from time to time in recent years, will show how the need for additions to the technical staff has been urged in every direction and how difficult it has been to meet that need. It is generally recognized by the farming community that never in the country's history has the time been riper for agricultural development, and that in a large measure the extent of such development will be limited unless the number of scientific officers able to cope with the many branches of farming is adequate. One of the means adopted by the Government for building up a strong body of technical officers, has been that of granting scholarships to promising South Africans for study oversea. This has been in vogue for several years, and as a result the Department's staff has been strengthened by a number of officers well qualified to carry out their respective duties, and farmers will be interested to learn that in addition there are at present 48 scholarships in operation, of which 11 are for study specially in sheep and wool, 9 in veterinary science (4 being due to return this year), 5 in field husbandry, 4 in horticulture (1 being due to return in September next), 4 in tobacco and cotton, 4 in entomology, 4 in dairying (1 due to finish in September next), 1 in chemistry, 1 in mohair, 1 in viticulture, 1 in animal husbandry (has now completed scholarship), and 3 in domestic science. And it is proposed by the Government, subject to applicants of suitable calibre offering themselves, to award a further eleven scholarships for study abroad, to take effect from about the beginning of September next. These scholarships will be for study in field husbandry (2), horticulture (1), dairying (1), entomology (2), agricultural chemistry (3), poultry (1), and viticulture (1), and will be to the value of £200 per annum, with a temporary allowance (subject to revision from time to time) up to a maximum of £50 per annum. The terms and conditions of these scholarships were published in the *Government Gazette* of the 29th April, 1921, and the information may also be obtained on application to this office. Those desirous of securing a scholarship are reminded that applications close on the 15th June, 1921. It is confidently anticipated that these scholarships will be the means of greatly strengthening the personnel of the Department and of materially assisting in the forward movement of agricultural production in South Africa.

Locusts in Canada.

It is not yet generally realized that the Union is again at grips with the locust scourge. During the season just past swarms of voetgangers of the brown locust were fought with Government poison in twenty districts, most of them in the Karroo; and it is expected that there will be very extensive outbreaks over a huge area in the coming spring. In this country, the law requires the occupier of any land to destroy any swarm of voetgangers that appears there, while the Government undertakes to provide poison free of charge. The occupier is obliged to report the appearance of voetgangers and the laying of eggs. Enormous swarms of flying locusts such as used to ravage South Africa will, there is reason to hope, never again be allowed to develop, but such visitations of the pest as have occurred in recent years seem inevitable. Swarms arise, it is now known, by the gathering together of individuals that have bred in a scattered condition. There always will be scattered locusts, and when seasonal conditions are favourable to their great increase they will form swarms.

Half a century ago the central region of the United States of America suffered terribly from swarms of locusts; but there have been no large swarms since the country where the pest chiefly bred has been put under crops. However, almost every year farmers there have much trouble with scattered grasshoppers, and remedial poisoning measures are used on a stupendous scale. In general a "bait" of bran sweetened with molasses or other sweetening agent, flavoured with fresh lemons or oranges, and poisoned with an arsenical, is scattered over the infested fields. Canada shares the trouble with the United States, and the fight put up against the pest in the great western wheat-growing region involves the spreading of bait over millions of acres. The area is one of appalling cold in the long winter, there commonly being over seventy degrees of frost, but locusts and insects are amazingly abundant in the short, hot growing season. The locust destruction work is a matter for provincial and local, not federal, action, but the officials of the central Government render very valuable aid by their advisory and propaganda work on the subject. In a recent address, the Dominion Entomologist, Mr. A. G. Gibson, told of the work carried out in different provinces in the 1920 season. The following paragraphs are taken from a report of the address published in *Scientific Agriculture*:—

"During the height of the infestation from 12 to 14 tons of poisoned bait were mixed at some of these mixing stations ('mixing stations' for the preparation of poison bait were established throughout the Province of Manitoba). On one occasion at Deloraine as much as 18 tons were mixed, and those in charge of this station worked day and night. . . . The provincial officials have been able to secure definite information as to the actual value of this campaign, and their figures show that the enormous amount of $17,000,000 was actually saved by the farmers. . . . The Manitoba Government supplied the bait to the farmers free of charge and the cost to the Province in this respect was $155,000. . . .

"The organization in Saskatchewan was of a somewhat different nature and was more of a semi-military character. The provincial officers worked in close co-operation with the municipalities. In general the provincial officers directed the campaign, and the municipal officials

actually carried out the instructions. It is interesting to note that the following ingredients were purchased by the Province of Saskatchewan at a cost of over $300,000: 2720 tons of bran, 225 tons of sawdust, 12,636 gallons of molasses, 2805 cases of lemons, 166 tons of white arsenic, and 34 tons of paris green. As a result of the work in Saskatchewan the provincial officials have estimated that no less than 1,400,000 acres of crop have been actually saved by the applications of poisoned bait. . . .

"Mr. Gibson also outlined briefly some work which the federal department had conducted in Saskatchewan in connection with testing out new remedies for grasshoppers, which consisted chiefly of the application of dusts to infested areas, the spraying of contact insecticides, the application of poisoned gases and the testing of new poisoned baits. . . . Speaking particularly of . . . work with poison gases, reference was made to experiments conducted with chlorine gas, which certainly indicated that the insects could be destroyed by such a method, but on the whole this was too expensive for practical use."

Cotton Pink Bollworm in the West Indies.

The greatly dreaded pink bollworm, the Department is informed, has now reached the islands of Montserrat and St. Kitts, in the West Indies. The infestations were discovered in November last. How they originated will probably never be known with certainty; but it is said that a steamer with 50 tons of Brazilian cotton seed in its hold discharged cargo at both islands in June last, and sundry circumstances lead the authorities to think, Brazil being an infested country, that moths must have escaped through the open hatches and succeeded in reaching growing cotton, thus establishing the pest. Extermination of the insect is already considered out of the question.

The Union Division of Entomology has some fear that the insect may reach South Africa in a similar manner. No cotton grows near the wharf area at any of the ports, but weeds of the cotton family are common, particularly at Durban, and it is suspected that the insect might be able to subsist on them. Fortunately cotton seed is a highly unusual cargo for vessels to carry along the South African coast. Yet a few months ago some cotton seed arrived at Lourenco Marques from Angola, on the west coast, and was found actually infested with the pest. The Union plant import regulations prohibit the introduction of any cotton seed without a permit, and it is a strict rule that permits are only given to secure the admission of small quantities of specially selected seed for experimental sowings.

The countries suffering most from the pink bollworm are Egypt and Brazil. Most cotton growing countries are now under suspicion of the pest having become established in them. The United States of America have been putting up a most strenuous and expensive fight to keep it out, but in the last season outbreaks were discovered in Louisiana and at several places in Texas. Mexico has been considerably infested for years. Almost needless to say, the cotton growing countries that keep free of this terrible pest have a decided advantage over the infested ones. The surreptitious introduction of a few ounces of cotton seed might easily destroy for ever the freedom from the insect now enjoyed by South Africa, and we would again emphasize the need for extreme vigilance in keeping out this devastating pest.

Vegetable Growing.

We publish elsewhere in this number two charts showing the times of the year when various kinds of vegetables should be sown, transplanted, reaped, etc., under high and low veld conditions respectively. These charts have been drawn up by Mr. Terry, the Horticulturist at the Potchefstroom School of Agriculture, and, combined with the very useful advice by this officer on the vegetable garden which is published monthly in the *Journal*, should prove a valuable guide to all those interested in vegetable growing for home consumption and enable them to arrange for a supply of fresh vegetables throughout the year.

Blue-tongue.

Catarrhal fever of sheep, commonly known as "blue-tongue" or "bekziekte," is a disease affecting sheep over a wide area of the Union, and its outbreaks vary in intensity according to the season, being most prevalent in seasons in which there has been an abundance of rain. It is fortunately not a contagious disease, but is the cause of much mortality at times, and most sheep farmers of the Union have suffered loss through its presence. There are preventive and curative measures for dealing with the disease, and a bulletin on the subject by Mr. Dixon, the Senior Veterinary Officer for the Cape Province, was published by the Department in 1915. The demand for it has been such that the stock is now exhausted, and Mr. Dixon has revised it for further publication in the form of an article appearing in this month's issue. The article gives clear, practical advice which is designed to assist farmers in diagnosing and treating the disease; and in regard to preventive inoculation, proved to be a successful measure, it is pointed out that the vaccine, with full directions for use, can be obtained on application through any Government veterinary officer, magistrate, or from the Veterinary Research Laboratory at Onderstepoort, the telegraphic address of the latter being "Microbe."

Poor-grade Australian Cheese.

We referred in our December, 1920, number (page 804) under the above caption, to a quantity of Australian cheese of an inferior quality exported to the Union during 1920, part of which was shipped to Great Britain, and commented on the danger to the reputation of South African cheese on the oversea market this was likely to have, as there was reason to believe that the inferior cheese coming from the Union was taken as being a product of this country. It may now be added that the particular consignment of cheese referred to came from Victoria, where it was officially graded and shipped as first-grade cheese. But owing to the importers preferring to take the commercial risk involved in shipping the cheese as ordinary cargo to save the expense of sending it in cool chamber, it was found on arrival that the cheese had "sweated" badly during the voyage, and in many instances had so completely collapsed that it was impossible to certify what its quality was before shipment. The cheese was shipped during the heat of summer, and it will be seen, therefore, that much of the trouble that arose must be attributed to the procedure of shipping the cheese as ordinary cargo instead of in the proper cool chambers.

Preventives of Anthrax Infection.

Of all the animal diseases in the Union that retard our progress towards the goal we have set before us, South Africa a meat-exporting country, the one presenting the greatest difficulty is that of anthrax, which is not only the cause of serious mortality in live stock, but is also a menace to human life. It is a matter which concerns the whole community, for the interests of public health as well as those of the stock owner are involved. And the disease is spreading unfortunately, constituting a serious danger to our export trade, for the prevalence of anthrax in a country is viewed with mistrust by other countries importing its products, as such products (wool, hides, etc.) may carry the germ of the disease. In this country the disease is being perpetuated through carcasses of animals dying of anthrax being left to lie on the veld, or, worse still, being cut up for the sake of the meat and the hide. It is surprising that more deaths do not occur through the careless handling or the consumption of anthrax carcasses, unless it is that the native community, who are the greatest offenders, enjoy a considerable degree of immunity from the disease. In the latter respect it is well known that natives addicted to eating the meat have a strong belief in the efficacy of certain herbs as preventives of infection, but despite this the disease is frequently communicated to the eaters, to the great danger of its spread throughout the neighbourhood.

The efficacy of these alleged preventives of anthrax infection has engaged the attention of Dr. Lewis, the Assistant Government Analyst at the Government Laboratories, Bloemfontein, and of Mr. Gibbs, the Pathological Assistant there. Specimens were obtained of certain of the herbs used by Transkeian natives when eating anthrax-infected meat, who contend that by taking these herbs or infusions thereof with or before the meat, all danger of infection is destroyed. Indeed the belief in the efficacy of these herbs is not uncommon among magistrates, missionaries, and traders who have lived for any length of time in native districts, and colour is lent to the natives' claim by the low mortality among them, so far as is known, in comparison with the general practice of infected meat eating carried out. The specimens of these herbs obtained for experiment at the Bloemfontein laboratories were identified by Dr. Schonland, Albany Museum, Grahamstown, as follows, the name by which they are known to the natives being given in each case:—

1. *Rumex ecklonianus*, Meisn. (i-Dolo lenkonyana.)
2. *Acocanthera venenata*, var. *spectabilis*. (Ntlunga Nyembe, Ubuhlungu benyoka.)
3. *Teucrium Africanum*, Thunb. (Buhlungu benyusha.)
4. *Clutia heterophylla*, Wild. (Buhlungu benambo.)

Very careful tests of the herbs were carried out by Messrs. Lewis and Gibbs, from the results of which they conclude that numbers 1 and 2 have no practical effect on the growth of anthrax; and that numbers 3 and 4 prevent growth in dilutions of 1:50, but not in a dilution of 1:100, and can have little or no effect in that direction under the conditions which they are used by natives. Thus

the claim by the natives as to the immunity conveyed by the consumption of these herbs is not established, and some other reason must be sought for the usually innocuous results attending the widespread practice of eating anthrax-infected meat among natives in this country.

South African Exhibition at Amsterdam.

Advice has been received from the Trade Commissioner, London, that the South African Exhibition held at Amsterdam from the 19th March to the 10th April, 1921, was very largely attended throughout, and that as an outcome numerous inquiries relating to trade and other matters concerning the Union are being received by him. The objects of the exhibition, it may be remarked, were, according to the official catalogue, "primarily to bring to the notice of the people of the Netherlands the variety of South African products, ... to stimulate a wider interest in all phases of South African life, and to direct attention to the advantages which it offers as a field for the investor, the industrialist, the agriculturist, and the tourist." Producers in the Union have well responded to the requirements of the exhibition, and it is gratifying to learn that already there is evidence of its success, and we have reason to anticipate that the laudable objects of the exhibition will amply be realized.

Any movement which is likely to make known the possibilities of agricultural South Africa and open wider avenues for an oversea trade is to be welcomed by farmers whose interests are directly served thereby, and the extent to which the exhibition at Amsterdam will conduce thereto may be gauged by the wide range of products exhibited and the numerous awards received.

A copy of the list of awards has been received from the Trade Commissioner, which shows the following main sections of exhibits and the awards in each, viz.: Wool, mohair, sealskins (one gold medal in each, all awarded to the Department); hides and skins (2 gold medals); leather (1 gold medal); wattle bark and extract (4 gold medals); cotton (1 gold and 2 silver medals); ostrich specimens and chicks (1 gold medal); manufactured ostrich feathers (1 gold medal); sugar (2 gold medals); bush tea (1 gold medal); tea (1 bronze medal); canned fish (5 gold medals); minerals (1 gold medal to the Department of Mines); coal (2 gold medals); chemicals (1 bronze medal); timbers (1 gold medal to the Forest Department); gold exhibit (1 gold medal to the Transvaal Chamber of Mines); tobacco (6 gold and 5 silver medals); bacon and hams (3 gold medals); eggs (3 silver medals); butter (4 gold and 1 silver medals); cheese (2 gold, 3 silver, and 1 bronze medals); four companies received a gold medal each for the excellence of their private stands, and a similar award was given to the firm carrying out the staging effects, the Publicity Department for an outstanding exhibit of South African pictures, and the Trade Commissioner for the general excellence of the exhibition, the success of which was due in no small degree to his supervision and the efforts of his staff. The awards for wines have not yet been advised.

It may be explained that these awards were given only in a remote sense on a competitive basis, and should be regarded rather in the light of awards of merit for the general high quality or degree of interest of the particular exhibits.

Marking, Addressing, and Packing of Goods for conveyance by Rail.

The indifferent marking and addressing of packages tendered for conveyance by rail is causing the Railway Administration considerable difficulty, and the result is that loss of goods in transit frequently occurs and heavy claims have to be met.

This is an important matter, and consignors of goods are urged, in the public interest, to give it their special attention and carefully carry out the requirements of the Railway Administration, whose officials in charge of stations and goods depots have been instructed to accept consignments for railage only when the following conditions have been complied with:—

1. All old labels or marks must be removed or obliterated, marks denoting the original contents of packages being deleted; as far as possible, the actual contents must be marked on each package, i.e. paraffin-oil, soap, candles, petrol, and such like cases used for conveyance of other traffic should have the old brands obliterated, and the nature of the repacked contents branded or stencilled on the cases.

2. Each article or package must—

(*a*) be fully addressed, the method of marking being preferably by means of paint and brush, or alternatively by means of a strong tie-on (linen label for preference), or adhesive label firmly secured.

(*b*) bear a distinguishing mark together with the official code mark of the destination, legibly and durably stencilled or otherwise shown thereon.

3. Goods consigned to sidings and stopping-places where there is no resident staff must bear the consignee's name, address, and destination in full, no abbreviations being used.

4. Small consignments must have the name of sender and dispatching station legibly shown on each package.

5. Consignments of such traffic as hides, skins, and metal bars and rods in bundles, must have zinc, strong galvanized iron, or wooden discs, giving consignee's name, address, and destination in full, securely affixed thereto, preferably by wire, or alternatively the address should be painted on each package. Bales of wool must be clearly marked with consignee's initials, destination, station code, bale number, and either sending station's code mark or station number, whichever sender prefers. Hides and skins must be bound with hempen rope.

6. Consignments of bagged traffic in full direct truck loads to one consignee must have the top layer marked by stencilling, or alternatively one bag in every ten must be labelled; but each label must show the total number of bags in the consignment.

7. Motor-cars—not packed—must have strong labels attached. (Make of car and number must be endorsed on consignment note.)

It is also desired to draw attention to the use of packages and packing which do not sufficiently protect the contents. Consignments not securely or adequately protected, also where unsuitable receptacles

are used, will only be accepted at owner's risk, and senders will be requested to subscribe to such endorsement on the consignment note. With a view to preventing pilferage, it is recommended that small meshed wire-netting be used for the packing of baled goods, binding wire being used round the edges of cases, and in order to assist in identification all packages should contain at the top a card or docket showing the name and address of both sender and consignee and contents, or a duplicate address label.

The preparation for market of South African produce in an attractive manner is a matter which will need the special attention of the farmer if his article is to successfully compete with the produce of other countries on the oversea market. But improvement should commence in our local methods of marketing, and be the precursor of the wider field of oversea trade so essential to the development of the country. The requirements of the Railway Administration indicate that each step in the process of marketing calls for its special attention as to the correct means of ensuring ultimate delivery of the article, and at the outset of its journey by rail, whether the article be for local or oversea trade, care in its marking, addressing, and packing is essential. This is of special importance in a country where most of our transport is done by rail, and every consignor should be acquainted with the correct way of preparing his produce for transport. In this respect it is pointed out that the official list of station code marks is exhibited at every station throughout the Union, and copies may be purchased from the railway bookstalls.

A Dreaded Cane Disease.

The sugar industry of Natal and Zululand holds an important place in South African enterprise, and it is fortunate that no pests of any serious nature are found at present in our cane plantations. But the possibility of the introduction of disease is ever present and calls for the greatest vigilance on the part of all concerned in the industry. We hasten to publish in this issue, therefore, an advance report (received by the Division of Botany from the Imperial Bureau of Mycology), forwarded by Dr. G. R. Lyman, Pathologist in charge of the Plant Disease Survey, Bureau of Plant Industry, United States Department of Agriculture, on one of the most serious cane diseases hitherto reported, that of the Fiji disease of sugar-cane.

At the same time we would take the opportunity of pointing out the important work which is being done by the Imperial Bureau of Mycology. The advance report on the Fiji disease, which is of such concern to our sugar growers, was made to this Bureau, and is an illustration of its value. The primary object of the institution is to act as an information bureau and to assist in every possible way the advancement of the study of plant pathology in the overseas dominions of the British Empire. The Bureau keeps records of all literature on mycology and plant pathology, and undertakes the identification of specimens; it also keeps in touch with current developments in spraying and similar appliances, and with recent legislation for the prevention of plant disease. All this information is at the service of plant pathologists in the overseas Dominions, the Governments of which contribute to the support of the Bureau.

Inspection of Vine Nurseries.

In the November, 1920, number of the *Journal* (p. 711) the Department made an appeal to farmers and nurserymen to avail themselves, in their own interests, of the facilities afforded them in respect of the inspection of mother-plantations of American vines and nurseries of grafted vines, arranged by the Department on the recommendation of the Commission on Grafted Vines. The great advantage of establishing a vineyard on stocks true to name is patent and need not be emphasized, and all nurserymen, as well as farmers who have mother-plantations for their own use, were urged to seize the opportunity of having their stocks inspected so that the interests of the public could be secured, in that stocks true to name only would be supplied: the farmer also could be sure that his stocks were true to name and not a mixture of varieties very closely related and difficult to distinguish.

The Government Viticulturist, who is in charge of the inspection, has now forwarded his first report, to the effect that two farmers who do not sell stocks had their plantations inspected, and that the following nurseries were inspected and the mother-plantations found to be true to name, viz.:—

NAME.	ADDRESS.	AMERICAN VARIETY.
Warden	Porter Reformatory, Tokai. Retreat	Jacquez, Metallica, Rupestris du Tot, Riparia x Rupestris 101-14, Aramon x Rupestris No. 1, Mouvedre x Rupestris 1202.
J. A. Gerber ...	Darling Brug, Breede Rivier ...	Jacquez.
W. A. Gerber ...	Klaarfontein, Breede Rivier ...	Jacquez.
D. J. le Roux ...	La Rome, Tulbagh	Aramon x Rupestris No. 1, Jacquez.

Trekking of Sheep and Goats.

The trekking of sheep to and from winter grazing and also on account of drought has been a fertile source of scab infection in the past. In view of the excellent condition throughout the Union of both stock and veld, the Minister of Agriculture feels that prevailing circumstances offer an exceptional opportunity for a sustained effort to eradicate scab. He wishes, therefore, to warn all those concerned that no facilities for the movement of infected small stock will be given under any circumstances, and trusts that every stockowner will do his utmost to assist in preventing the spread of the disease and co-operate in a determined effort to cleanse the Union's flocks, seeing that the present favourable conditions will be conducive to that end.

DEPARTMENTAL ACTIVITIES

April, 1921.

(NOTE.—The work of the several Divisions and Schools of Agriculture covers a wide range of agricultural industry in the Union, and we give hereunder notes and observations from certain of them treating with matters of special interest coming under their purview during the month. The object of these notes, which are not concerned with general routine work, is to inform the farmer of such matters as are calculated to be of interest and helpful to him at the present time.—EDITOR.)

THE DIVISIONS.

ENTOMOLOGY.

Codling-moth.—Apple and pear growers in the areas into which the removal of apples, pears, and quinces, and of receptacles that have contained such fruits is prohibited, had better try to get their local farmers' associations to urge the maintenance of the prohibitions, if they wish them maintained. It is full time the present regulations were amended, and it seems probable that unless there is strong opposition they will be altogether withdrawn. A few years ago the Department wrote to each Natal association to learn its views on the subject; and as only one association took the trouble to reply, it is naturally assumed there would be no serious objection to throwing open the whole of the Province to unrestricted traffic in the fruits concerned. The protected area in the Western Transvaal is now infested in several places, and the restrictions are no longer justified there. Recently it was discovered that a large apple orchard at Ermelo, in the eastern Transvaal, is infested; and as Ermelo is the chief centre there concerned, it seems as if the restrictions might as well be taken off the whole of that area. The pest is said to have got to Ermelo with old fruit boxes. The boxes must have been introduced in violation of the regulations. The public is cautioned that the removal of apple and pear boxes, etc., into a closed area may involve both sender and receiver in very serious trouble. Neither professed ignorance of the prohibition nor negligence on the part of railway officials is accepted as excusing a violation.

Locusts.—The public in general is hearing very little about locusts, but it has probably been thirty years since there was anything like so widespread and rapid a breeding up of the pest as there has been in the present season. Time after time since 1913 locust outbreaks that threatened very seriously to achieve immense proportions have been "nipped in the bud"; but the records of the past fail to suggest any "bud" of such magnitude and vigorous growth as has showed this year. The nipping process is still proceeding vigorously at the time of writing, 7th May, long after voetganger locust trouble for a season is generally over. March and April were wonderful months for the growth of vegetation in the Karroo, but the months were still more astonishing in their effect on the locust. It was rather exceptional for the insect to occur in distinct generations. One generation followed another in quick succession, and hatching

appeared to be a continuous process. Commonly swarms were made up of voetgangers in different stages, amongst which fliers were mingled; and in some places the veld for many miles together was reported to be seething with hoppers, the outbreak more resembling an extraordinary superabundance of non-swarming grasshoppers than an occurrence of a gregarious locust. In Canada and the United States, non-swarming grasshoppers often occur in prodigious numbers and are very successfully poisoned over hundreds of thousands of acres of grain land, a bran or saw-dust bait being used; but the scarcity of material and of labour renders efficient action of the sort quite impracticable on the South African veld. Apart from its occurrence in many thousands of swarms, most of which have been poisoned, the locust this season appears to have been living after the manner of a grasshopper over an enormous area. Swarms have been reported here and there all the way from Warmbad, South-West Protectorate, south-eastwards into the Willowmore and Jansenville districts, 500 miles away in a direct line. Single large farms have had hundreds of swarms in many cases. Last year no swarms were reported. So far as is yet known to the Department there have been only a few swarms of voetgangers in Gordonia and none in the Transvaal, Griqualand West, or the eastern Bechuanaland districts. The outbreak during April was most intense in the Murraysburg and Aberdeen districts, but also was quite bad in Beaufort West, Carnarvon, Victoria West, Prieska, and Britstown. It extended from Hofmeyr and Cradock districts on the east to the Clanwilliam borders and into Namaqualand four hundred miles to the west. Some swarms of fliers were reported near Graafwater, in Clanwilliam. On the whole, the farmers have worked well, and there has been a notable absence of religious scruples being urged as an excuse for neglect and little resort to other measures of destruction than through the use of the Government locust poison. The poor, ill-educated class of farmer has, generally speaking, needed less attention to get to carry out the requirements than the well-to-do educated class.

The outlook for the coming season is for a much more intensive visitation of the pest over a much larger area. A great number of swarms of voetgangers naturally escaped detection in thinly populated parts, and, as already intimated, there has been an extraordinary prevalence of solitary locusts. The solitary locusts appear, from reports, to be now more numerous in many districts outside of this season's region of swarms than they were last season inside this region. They have been reported abundant in the Kimberley, Herbert, Fauresmith, Philippolis, Hopetown, De Aar, Richmond, Philipstown, Bethulie, Colesberg, and Albert districts, and further observed in the Wodehouse and Oudtshoorn districts, respectively far east and south of this season's swarm region. The examination of specimens has removed any doubt that the insects observed were true brown locusts, while the variableness in size and colouration of the specimens has indicated them as individuals reared in comparative solitude. Were they typical of the insect as it occurs in swarms, it would be thought they were wanderers from swarms bred at a distance, whereas the chances seem they developed near where they were found.

It should be stated, however, that, while one is deemed probable and will be prepared for, there is no certainty that we will have a greater outbreak next season. The great reduction in the pest wrought

by the poisoning operations may chance to have brought it down to the point where natural enemies can deal with it in many or even most localities where eggs are laid. The help of birds during April was trifling, but parasitic flies in great numbers were observed at work amongst eggs and at the fliers in widely separated localities.

Bad as the outbreak has been, there has been little loss of crops and, except in a few places, no serious loss of veld. Ordinarily the insect restricts itself almost entirely to plants of the grass family, but this season some patches of lucerne were eaten to bare stems. The rains have been so frequent and heavy, however, that lucerne and veld speedily outgrew injury. The Magistrate at Aberdeen reported 3.45 inches in March and 3.40 inches in the first three weeks of April. For a generation an oft-told story in the Karroo has been that the locust does good by preventing steekgras from seeding. The locust has now rather spoilt its good reputation in this respect for, according to the Magistrate of Murraysburg, it has this season left the steekgras practically untouched.

Slight losses of stock through the careless use of the poison have been reported from the Aberdeen, Murraysburg, and Willowmore districts, but probably £100 would cover them.

The countries to the north of the Union continue to enjoy immunity from locust visitation. The records of the past suggest it is about time for another breeding-up of the red locust, but there is still no sign of growing trouble with this pest. A recent newspaper report that it had appeared in the Aberdeen district had no foundation.

A Ladybird Larva that Preys upon Ants.—A very interesting discovery has been made by Mr. R. H. Harris, of the Division of Entomology, Durban, in connection with the larval habit of the ladybird *Ortalia pallens* Muls. Mr. Harris has succeeded in demonstrating that these larvae inhabit ant nests and the environs thereof, where they seize upon and destroy the living ants. The ladybird larvae are covered with dense tufts of white secretion, so that they greatly resemble large mealy bugs. They do not pursue the ant, but appear to rely upon the natural inquisitiveness of these creatures to bring them within striking distance; then the ants are captured and destroyed.

The beetle *Ortalia pallens* is represented by specimens in the collection of the Division of Entomology from Kwambonambi, Zululand, and in the Transvaal Museum by material from Durban (Natal), Pietersburg, and Lydenburg (Transvaal). The Zululand specimens were determined by Dr. G. K. Marshall, of the Imperial Bureau of Entomology; those in the Transvaal Museum by Prof. Weise, of Germany.

In connection with the specimens mentioned as coming from Zululand, it is interesting to relate that these were taken from a fluffy white mass found in the centre of a red ant's nest. This was collected by Miss M. Wylde-Brown and forwarded to the Division by the Director of the Durban Museum. At the time no suspicion was aroused as to the real significance of the presence of these coccinellids in the ants' nest.

Mr. Harris' observations were in connection with the attack of the *Ortalia* larvae upon *Pheidole punctulata* Meyr. at Durban, Natal.

Beetle Mischief in Plantations.—A considerable amount of mischief is frequently accomplished in young plantations by curculios or weevils of the genera *Protostrophus* and *Strophosomus*. Early in this year a case was investigated at Delmas, Transvaal, where many transplants of eucalyptus were destroyed by one of these insects (*Protostrophus amplicollis*). This damage was restricted to certain blocks of trees and upon inquiry it was found that these blocks had been previously cultivated to maize. The beetle in question is one that injures maize in certain soils, noticeably the red soils of the Springbok Flats. In this case the weevils had bred in the maize lands last season, and upon coming to maturity this season found only the young eucalyptus transplants upon which to subsist. The damage was of a non-preventable nature, under the circumstances, and the trouble not are likely to persist.

Young trees, fruit and otherwise, are also often injured by wingless weevils of the genus *Strophosomus*, noticeably in the Transvaal. These are veld insects, and the attack, being confined to newly cultivated lands, follows on the fact that the insects are present, as larvae, in the soil when it is broken. Later, when they emerge, their natural host plants have disappeared, and, being unable to migrate any distance, they gather upon the young trees for food. This mischief is also of an unavoidable nature and transient, seldom recurring after the first season.

Our Eastern Province Entomologist, Mr. D. Gunn, has lately reported a considerable amount of damage accomplished by *Strophosomus* weevils in the Bathurst district among certain young gum and pine plantations. *Pinus insignis* trees about a year old were defoliated, and also the terminal growth of young *Eucalyptus saligna; Eucalyptus globulus* was found untouched. The main damage was done early in April, but fortunately the recent heavy rains in the district have enabled both gums and pines to make some recovery and put on new growth. An attempt was made to mitigate the nuisance by hand-collecting the weevils. This was not found successful, however, as the weevils proved too active for the native girls employed in their capture.

Woolly Bears.—Regarding the March outbreak of woolly bears or hairy grubs in the Free State, the following remarks upon the pest are quoted from a letter written by Mr. C. J. de Villiers, of Poundisford, Bloemfontein District: "These creatures congregate where there is any food they like, such as pumpkin leaves and stems and more especially potato leaves. They are not particularly fond of tall rank grass, and when amongst grass they seem to roam about singly in all directions. They are fairly good travellers and can put on a considerable pace. They are fond of lucerne, but have so wide a range of tastes as to include the foliage of peach trees. Where they congregated on plants in my son's vegetable garden, he reduced them considerably by beating them to death, in the early morning, with a wet bag. I am told that spraying with carbolic dips does not seem to kill them, and where one sprays with arsenate of lead the sprayed vegetation is avoided."

Fruit Moth.—In the latter part of April reports of injury by this sporadic pest, *Achaea leinardi*, were received by the Division of Entomology from the Transkei.

Pernicious Scale at Greylingstad.—During April pernicious scale was found at Greylingstad by Nursery Inspector Van der Vyver. This makes a new but not unexpected locality for this pest.

BOTANY.

A meeting of the committee of the Botanical Survey was held in Capetown during April, and was attended by all the officers in charge of the administrative areas, and by the chief Government officials connected with the survey. Sir Thomas Smartt and Mr. P. J. du Toit, Secretary for Agriculture, were also present and addressed the conference. The botanists in charge of the different areas summarized the work which had been done in their sections since the inauguration of the survey; Dr. Du Toit, Acting Director of Veterinary Education and Research, read an important paper on the present state of our knowledge of the poisonous plants of South Africa, and Dr. Phillips gave an account of his veld-burning experiments.

While in Capetown Dr. Pole-Evans discussed the whole question of fruit export with the Minister of Agriculture. He was instructed to continue the investigations in citrus fruit wastage by the Division, and to extend these operations to include a thorough investigation into the wastage which has been occurring in deciduous fruits.

In spite of the continued wet weather the citrus canker situation continues satisfactory, and no fresh outbreaks have occurred.

The officer in charge of the Groenkloof Experiment Station visited Natal, where he has been making a study of pasture grasses, especially Kikuyu, under Natal conditions. Miss Stent, who has gone to England on leave, intends to spend two months at Kew in the study of a collection of South African grasses from the National Herbarium.

During the month 167 fungi have been added to the cryptogamic herbarium: these include an exchange collection of Swiss fungi, principally rusts. Owing to the continued wet weather, it has been possible to continue a study of the mushrooms and other fleshy fungi. Numerous interesting and rare fungi have been received from correspondents during the month, including specimens of *Polyplocium inquinans*, *Morchella conica*, *Phellorina squamosa*, and *Terfexia claveryi*.

Advice has been sought from the Division on the following plant diseases: Die-back on apple trees (*Cytospora leucostonia*), apple mildew (*Podosphaera leucotricha*); various fruit spots on apples; a number of diseases of tobacco and cotton; early blight (*Macrosporium solani*), internal brown fleck, and *Fusarium* on potatoes; rose mildew, mildew on vegetable marrow, tomato leaf spot, bacterial disease of cabbage and beans, and a disease of the avocado pear.

TOBACCO AND COTTON.

The following are the winners of the British Cotton Growing Association's competition for the best fields of cotton of 50 acres and 10 acres respectively, grown during 1919-1920:—

50 Acres.

1st prize, £100: Gass Bros, Barberton. Total score, 82.87 per cent.
2nd prize, £50: H. L. Hall, Tomango, Nelspruit. Total score, 75.85 per cent.
3rd prize, £25: L. G. Trichard, Tussenkomst, District Rustenburg. Total score, 72.69 per cent.

10 Acres.

1st prize, £50: Mrs. P. Zeederberg, Barberton. Total score, 86.39 per cent.
2nd prize, £25: A. E. Wainwright, Barberton. Total score, 77.60 per cent.
3rd prize, £12. 10s.: A. N. Venter, Barberton. Total score, 76.16 per cent.

There were more than a hundred entries, but about half of them dropped out for various reasons, leaving 52 remaining in till the final results were obtained.

Our thanks are due to the British Cotton Growing Association for inaugurating this competition, which has been most interesting, and judging from the keen interest displayed by most of the competitors, it should be most valuable in improving cultural methods. It has also demonstrated clearly the importance of planting good seed of the longer staple varieties.

The Chief of the Division, accompanied by his Natal representative, has just completed a tour of Natal and the Transkei, inspecting cotton plantations, some of which are very promising in spite of the adverse weather conditions. Most cotton planters are busy harvesting. Mr. Scherffius also visited the Spelonken, where the Oceana Development Co. is beginning cotton planting in an experimental way; should their trial fields, this year 128 acres, prove suitable for cotton culture, it is proposed to develop on an extensive scale.

VETERINARY EDUCATION AND RESEARCH.

Australian Anthrax Vaccine.—Some months ago a quantity of anthrax vaccine, manufactured by the McGarvie Smith Institute, Sydney, New South Wales, was received at the Research Laboratory, Onderstepoort. Tests were carried out to determine whether the vaccine produced any ill-effects when inoculated into animals, and how strong the degree of immunity was in animals so inoculated. Our tests seemed to show that the inoculation was quite safe, in so far as no inoculated animal even developed any signs of anthrax, and no other ill-effects of the inoculation were noticeable. It must be pointed out, however, that the number of animals inoculated was far too small to make this point quite certain. Experiments carried

out at the same time with Spore vaccine prepared at this laboratory gave equally good results. And yet when this vaccine was used on hundreds of thousands of animals in the field, swellings appeared in many cases. We are not in a position to state whether the Australian vaccine also produces swellings under certain circumstances in the field.

The degree of immunity produced by the Australian vaccine is undoubtedly a good one. We have tested inoculated animals with various quantities of virulent anthrax germs, and have found, as in the case of our Spore vaccine, that, except where very large quantities were used, the animals resisted the infection.

It is impossible to say how long animals inoculated with the Australian vaccine remain immune. The only way to establish this is to wait for periods up to a year and longer and then to test the animals again.

One drawback of the Australian vaccine is the smallness of the dose. Cattle should receive two-fifths of a cubic centimetre, and horses, sheep, and goats one-fifth. This makes the operation rather difficult for the farmer. The price was quoted to us as working out at 2d. per head for sheep and 8d. per head for cattle and horses.

THE SCHOOLS OF AGRICULTURE AND EXPERIMENT STATIONS.

CEDARA, NATAL.

Hailstorm Effects.—The defoliation of the trees caused by the violent hailstorm on the 17th March, followed by a spell of warm weather in April, has resulted in many of the fruit trees breaking into blossom and starting new growth this month. As a measure for retarding this unfortunate activity, cultivation has been withheld, and the usual autumn ploughing is being delayed.

Value of Undecorticated Cotton-seed Cake and Meal as Feeds for Stock.—Farmers seem to be apprehensive of the effects on their stock of the lint that is always present in these materials. It may, however, be pointed out that these feeds have been in use in America and Europe for a large number of years, and no specially deleterious effects have been noticed through the presence of the cotton fibre. Of course, the comparatively large amounts of husk and lint in these materials lower their feeding value as compared with the decorticated varieties, but as long as the materials are up to the usual standards in composition, and are not mouldy or have not heated, and contain no excess of husk or lint, they should prove to be quite useful adjuncts to the ordinary foods grown on the farm.

It may be pointed out that all products of the cotton seed have been found to contain some principle which is often harmful when fed to calves and pigs more especially, so some caution has to be

exercised in this respect. The undecorticated products in particular have also certain astringent properties which would help to correct the aperient action of the young grass in the early spring.

Fourth Egg-laying Test.—This was commenced on the 1st April, 1920, and terminated on the 2nd March, 1921, a period of 48 weeks.

The accommodation available was the same as in the previous tests, viz., 120 single pens. A full description of the pens is given in Local Series Bulletin No. 70, published by the Department of Agriculture. Eighteen competitors made entries of twenty pens, each pen containing six birds. Of these pens, sixteen were from Natal breeders, two from the Transvaal, and one each from the Orange Free State and Cape Provinces.

Of the twenty entries, fifteen were Utility White Leghorns, two White Wyandottes, and one each of the following breeds: Ancona, Black Minorca, and Rhode Island Reds.

As in the previous test, only two-ounce eggs were counted from the commencement; as will be seen from the totals given, a big percentage of underweight eggs was collected, but nearly half of them were laid by two pens, one of which laid the largest number of eggs in the test, viz., 1184, or 174 eggs more than the pen which won the test.

The weather during the period under review was by no means ideal; as is usual in this locality, sudden changes were experienced, and cold misty days were frequent from October to April.

The three leading places were occupied by Utility White Leghorns, and the fourth by White Wyandottes. The silver and bronze medals presented by the South African Poultry Association for the pens laying the greatest number of standard-weight eggs during the test were won by Pen No. 7 (White Leghorns) (owner, Mr. A. B. Cheney, Pietermaritzbrug, Natal) and Pen No. 9 (White Leghorns) (owner, Mr. R. Porritt, Pietermaritzburg, Natal), respectively with 1003 full-weight eggs and 7 underweights and 932 full-weight eggs and 181 underweights.

The best individual record was made by Hen No. 84, Pen No. 14, the property of Mr. A. J. Hawkins, Pietermaritzburg, Natal, with 205 full-weight eggs, the second being Hen No. 49, Pen No. 9, the property of Mr. R. Porritt, Pietermaritzburg, Natal, with 204 full-weight eggs.

The total egg-yield for the 48 weeks was 19,091, giving an average per bird of 159 eggs. The total value of first-grade eggs produced was £166, 17s. 1½d.; the cost of feed during the test amounted to £85s. 10s. 3d.

Wet mash was fed in the morning, green food at noon, and grain in the afternoon. As in previous tests, the grain was fed in scratching litter in the houses, in order to give the birds as much exercise as possible. The average amount of mash consumed per bird during the test was 2.9 oz. per diem and of grain 2.5 oz. A supply of flint grit, oyster shell, and charcoal was always before the birds.

Only three deaths occurred, which may be considered very satisfactory.

ELSENBURG, MULDERS VLEI.

Codling-moth and Red Scale Control Investigations.—The following notes by Dr. Pettey, Lecturer in Entomology, are published as a preliminary report on the 1920-1921 season:—

1. Powder dusting with a mixture of 15 lb. lead arsenate powder in 85 lb. fine lime *versus* a liquid spray of 2½ lb. paste lead arsenate and 40 imperial gallons of water, in the control of codling-moth.

Detailed records show that six applications of dusted powder in comparison with six applications of liquid on Kieffers resulted in 70 per cent. clean fruit in the dusted area, and 92 per cent. clean fruit in the sprayed area. Dusted Beurre Hardy pears produced 60 per cent. non-infested fruit in comparison with 89.3 per cent. non-infested in the liquid-sprayed trees. As the lime used in the dusting operations was of South African manufacture of a poorer quality in respect to texture and weight than that used in North America, where dusting in many cases has been successful on apples, the writer will not be satisfied that dusting of pear trees has been given every opportunity to demonstrate its success until imported special dusting lime has been tried.

2. South African manufactured paste and powder lead arsenate *versus* two reliable imported brands.

The local manufactured paste and powder were both found to be fully as satisfactory in every respect as the imported lead arsenates. This should be of interest to fruit growers, as the former products may probably always be purchased more cheaply than the imported. Powder lead arsenate is quite as efficient as the paste, and has the special advantages over paste of not drying out, of being more quickly mixed with water, and more cheaply transported.

3. Calcium arsenate powder *versus* lead arsenate paste and powder in the control of codling-moth.

Duchesse and Kieffer trees sprayed with a mixture of ¾ lb. calcium arsenate powder, 3 lb. stone lime, and 40 gallons of water produced respectively 73 per cent. and 67 per cent. clean fruit in comparison with 93 per cent. and 91 per cent. non-infested for the lead arsenate sprayed trees. It appears that calcium arsenate, a comparatively new insecticide, which is considerably cheaper than lead arsenate, and is reported to be efficient in the control of codling-moth, especially in Canada, Nova Scotia, and Oregon, is a failure under South African conditions. It may, however, improve the efficiency by strengthening the solution, but much increase in strength would make the difference in cost between the two insecticides so little that its substitution for lead arsenate would certainly be inadvisable.

4. The influence of bordeaux on the efficiency of lead arsenate in the control of codling-moth.

Kieffer and Beurre Hardy trees sprayed in the two first codling applications with 2½ lb. lead arsenate paste in 40 gallons bordeaux mixture (4-4-40) produced 88.3 per cent. and 85.1 per cent. non-infested fruit respectively in comparison with 91.9 per cent. and 89.3 per cent. clean fruit for the trees where water was substituted for bordeaux mixture. This indicates that bordeaux destroys somewhat,

but not very seriously, the efficiency of lead arsenate. Until this is further investigated, fruit growers should not use less than 2½ lb. paste or 1¼ lb. powder lead arsenate in 40 imperial gallons of bordeaux. Probably the normal efficiency of lead arsenate in bordeaux will be maintained by increasing slightly the amount of lead arsenate in every 40 gallons of water.

5. Arsenite of soda *versus* lead arsenate in codling control.

Williams and Beurre Hardy trees sprayed with ¼ lb. sodium arsenite in 40 gallons of bordeaux or in 40 gallons of water, to which was added 3 lb. of stone lime, produced respectively 57 per cent. and 83 per cent. clean fruit in comparison with 84.1 per cent. and 91.5 per cent. non-infested fruit for the lead arsenate sprayed trees. The inefficiency of the killing capacity of the sodium arsenite, a much cheaper arsenical than lead arsenate, together with the severe burning of the foliage and fruit which resulted, discourages the use of this insecticide in orchard spraying.

6. The efficiency of concentrated lime sulphur in the control of red scale.

Kieffer pear trees sprayed with Capex (concentrated lime sulphur) diluted at the rate of 1-10, shortly before buds had opened in spring, and with no foliage spray of lime sulphur applied later, produced 45 per cent. of fruit infested with scale, in comparison with 5 per cent. infestation for trees sprayed at the same time with 1-10 lime sulphur and later with the foliage 1-40 dilution of lime sulphur during the first two codling applications of lead arsenate. Beurre Hardy and Duchesse pear trees sprayed with Capex, 1-20, in late winter before buds had burst, and with no foliage sprays, produced respectively 3.3 per cent. and 44 per cent. scale-infested fruits in comparison with nine-tenths of 1 per cent. and 9 per cent. for trees sprayed at the same time with 1-20 lime sulphur, and later twice with a foliage spray dilution of 1-40 during the first two applications of lead arsenate spray for codling control. Results indicate that red scale cannot be effectively controlled by one dormant spray of lime sulphur at a dilution of 1-10 (4.5 to 5 degrees Beaumè), but that in addition to the winter application two foliage sprays of a 1-40 (or 1 degree Beaumè) dilution will much more effectively control this pest. If this proves to be so in seasons of normally warm springs, fruit growers of the coastal regions of the Cape should consider the substitution of lime sulphur foliage sprays for bordeaux in the control of fusicladium, as the former would assist greatly in the control of young migrating scale insects, as well as prevent the fungus disease. Inland fruit growers, where the spring is dry and hot, should use concentrated lime sulphur as a foliage spray with caution, as it is likely to produce burning.

7. Ten unsprayed trees in the orchard produced an average of 68 per cent. wormy fruit.

(*Note.*—Most of the above experiments should be repeated and extended before the conclusions are put into practice by the fruit grower. The orchardist should depend on established methods of insect control, starting new ideas at first only on a small scale, if at all, until they are well established by experiment and demonstration by the expert.)

POTCHEFSTROOM, TRANSVAAL.

Maize Silage.—All the maize crops planted after the 1st January are being turned into silage without delay, as the crops are making no headway now as a result of the comparatively cold nights.

Red Amber Cane.—At the cattle post, Brakspruit, a crop of red amber cane (sweet sorghum), sown on the 30th November and subsequently beaten down to the ground on the 30th January by hail, yielded a phenomenally heavy crop of green fodder, which was turned into silage.

Teff.—Teff has proved a remarkable drought-resisting crop when once established. Stands of teff which were considered so poor that operations to replough the ground were commenced and only discontinued when the land became too wet, gave beautiful and heavy crops of hay as a result of the March rains.

Wheat Items.—Wheat growers in the western and north-western sections of the Province are advised to put their wheat crops in by the 15th June. Heavy yields cannot be expected from crops sown after that date. From experience here it would seem still better to sow wheat from the middle to the end of May, but for early varieties this procedure may lead to losses from late frosts in certain years or, under normal conditions, heavy losses through destruction by birds consequent on the crop providing food to grain-eating birds when they have comparatively little else to attract them. A limited amount of wheat seed is still available for sale to farmers, including the variety American No. 8, which is resistant to attack by birds.

Farmers' associations serving the interests of wheat growers are requested to undertake a campaign of destruction of grain-eating birds during the months of July and August. If funds are collected by each association (about 5s. per grower is suggested) and forwarded to the Principal of this Institution, manna and other suitable seed will be purchased, rendered poisonous and forwarded to the associations for distribution. The requirements of individual men cannot be dealt with in this way.

Maize Conference.—A conference of maize growers was held at this Institution on the 6th April, in order to allow farmers to view the experiment work carried on with maize here. In addition to the demonstrations, a series of lectures were delivered on subjects connected with maize growing. About sixty farmers from various parts of the Province and the Orange Free State attended the conference.

Ophthalmia.—This has been very prevalent in all stock here, as well as at Brakspruit. The Hereford breed seems to be especially susceptible to this eye disease more so than any of the other breeds. Cases of ophthalmia in Afrikander cattle are very rare, and the Sussex breed is a good deal more resistant to ophthalmia than the Hereford. On the other hand, the number of cases of infection in Friesland and Ayrshire cattle have also been very numerous during April.

Vermin.—This Institution now possesses a Clayton gassing machine, by means of which hot sulphur fumes can be blown into the burrows of rats, resulting in the destruction directly and indirectly of whole colonies of the vermin. It is thought that the machine could be effectively used against spring-hares, ground-squirrels, etc. This last has, however, not been tried.

GROOTFONTEIN, MIDDELBURG (CAPE).

Wheat Sowing.—June is considered the best month for sowing mid-season varieties of wheat, such as Federation, Main's Patent, Marquis, Early Spring, etc. The last named, a bearded variety, the origin of which is unknown, is not really an early wheat, and is often confused with Spring Early, which is beardless. Should the seed to be sown be infected with smut, or have been thrashed by a travelling machine, it is advisable to dip either in formalin or copper sulphate.

Formalin is recommended as follows: 20 ounces formalin to 45 gallons of water, or 4 ounces to 2¼ paraffin tins of water. If the seed contains unbroken smut balls, it is advisable to wash it first; these will then swim on the surface and can be skimmed off. This is necessary because the smut spores are enclosed in a tough skin and, unless broken, the dip mixture cannot penetrate. When unbroken smut balls have not been removed, they are likely to reinfect the seed during the subsequent seeding operations. After immersing the seed for 10 minutes in the solution, remove and cover with a bucksail or empty sacks for two hours, and then spread out thinly to dry and sow as soon as possible. If a seed drill is used it will be necessary to adjust the feed regulator to allow for the increased size of the grains due to swelling; this may be anything from 15 to 30 per cent., according to the period allowed for drying.

If copper sulphate is used, the following quantities are recommended: 1½ lb. to 10 gallons of water. Immerse seed for 3 minutes, stirring well, then drain for 10 to 20 minutes and reimmerse for a few minutes in a lime solution made of ½ lb. freshly burnt lime mixed in 10 gallons of water. The object of redipping in the lime solution is to neutralize the caustic effects of the copper sulphate on the wheat germ. Any type of vessel may be used for holding the formalin solution, but a wooden vessel is necessary when using bluestone.

As most forms of dipping to be successful in destroying the smut spores may also injure the germination of the seed, especially machine-cleaned seed, which may be slightly damaged during thrashing, growers are advised to procure their seed from a clean crop, and, if possible, to tramp it out, thus escaping the risk of smut from an infected crop. Tramping the seed is recommended in preference to thrashing with a machine, as the latter injures the grain to a certain extent and, if a travelling one that has thrashed smutty crops previously, it will infect a clean sample of seed.

All varieties may be sown slightly thicker than for May sowing.

Chinese Lucerne Seed.—Farmers are reminded that this Institution is the only grower of "Chinese" lucerne, and applications for seed should be made to the Principal direct in order to avoid unnecessary delay.

GLEN, ORANGE FREE STATE.

General.—There is an abundance of grass all over the country. Farmers are strongly advised to cut and stack as much of this as possible, even after the frost, as any kind of bulk feed is welcome during a severe drought.

Maize Experiments.—In the experimental trials with maize this year, it was again shown that a crop raised from seed introduced from the low veld takes a longer time to come to maturity than a crop of similar seed secured from the high veld. This phenomenon can be explained in this way: if a variety has been grown in a certain locality with a long growing season for a number of years, it naturally adapts itself to the soil and climatic condition of that area, and if seed of this variety is taken to an area with a shorter growing period than that to which it has been accustomed it would necessarily, for the first year at least, take the same period of time to complete its growth, and would continue to do so until it adapts itself once more (or becomes acclimatized) to the new conditions. The mealie plant will, of course, adapt itself to new conditions within limits; thus, a variety taking five months to mature could not be expected to adapt itself to mature in three months.

Another noticeable feature was that the cross-bred varieties, such as German Yellow, Potchefstroom Pearl, etc., stood the drought far better than the pure-bred varieties, such as Hickory King, Iowa Silver Mine, Chester County, etc. This again proves that when maize has been inbred too much, it loses its vigour, and an infusion of "new blood" of the same variety, in preference to that of another variety, is necessary to restore constitution.

Cowpeas and Kaffir Beans.—In comparative trials with cowpeas and kaffir beans to prove their similarity or otherwise, it was found that the latter crop, although much later in maturing, stood the dry condition infinitely better than the former, and yielded more than twice the tonnage of green stuff per acre. In view of this it is unnecessary for farmers to buy cowpeas at 1s. per lb. when they could secure mixed kaffir beans at from 15s. per bag of 200 lb.

Witchweed.—Requests are often received from farmers for advice on the eradication of witchweed (*isona*). One fairly effective way is to grow either teff grass or Sudan grass on the infected field. Both these grasses, as do maize, kaffir corn, etc., act as hosts to the weed, which generally does not show above the ground until the latter part of January or during February. By that time the first crop of teff or Sudan grass can generally be cut for hay, and when the weed shows "red" over the land and before it starts seeding, it should be ploughed under with what grass there is at that time. The next year some witchweed may put in an appearance as a result of seed that did not germinate the first time, but danger from this pest will have been avoided.

Plant Nurseries in Quarantine.

There is no change in the list of nurseries placed in quarantine as published in the May, 1921, *Journal*.

THE IMPROVEMENT OF COTTON BY SEED SELECTION.

By J. DU P. OOSTHUIZEN, M.Sc. (Agr.), Manager, Tobacco and Cotton Experiment Station, Rustenburg, Transvaal.

SOUTH AFRICA is now making her second effort to become a real cotton-producing country. Her first attempt was made just after the American Civil War, when, as a consequence, very little cotton was

A good type of cotton plant.

produced in the States, and prices were naturally very high. These high prices attracted the South African farmer, and within nine years after the industry was commenced, a quantity of almost a quarter of a million pounds of lint was produced in the country. Unfortunately prices declined before the industry was well established, which, together with such disadvantages as lack of proper ginning facilities, distance from European markets, etc., soon caused the failure of the industry. The second attempt has thus far been more successful, but

even now the industry is faced with a number of serious problems, which are certainly not incapable of being solved if sufficient thought and the necessary attention are given them. But if they remain unsolved, the country will lose a very promising industry.

The table given below shows how the industry developed year by year during these two periods. It will be seen that in 1863 the price of cotton was abnormally high and that the industry came to nothing as soon as the high prices gave way. In 1909 we find a different state of affairs. Prices were practically at their lowest when the industry was commenced, and, notwithstanding the fact that prices remained almost constant for the next few years, the industry made good headway. Production increased gradually each year, making rather big jumps in 1915 and 1919. The large increase in 1915 cannot be attributed to high prices, although prices may have had a considerable effect on the big increase in 1919. From the year 1909 to 1916 prices advanced gradually from about 5d. to 7½d. per lb., whereas the annual production increased from approximately 15,000 lb. in 1909 to 227,562 lb. in 1916. These figures indicate that the industry has this time been built on a sounder foundation, and with proper attention there is no reason why it should not become one of the leading industries of South Africa.

Year.	Annual Production. Pounds. (Lint.)	Average Price per Pound.	Year.	Annual Production. Pounds. (Lint.)	Average Price per Pound.
1863	3,414	4s. 10½d.	1909-10 ..	31,169	5¾d.
1864	35,730	1s. 5¾d.	1911	13,623	5d.
1865	62,231	1s. 3¼d.	1912	32,025	5d.
1866	91,122	1s. 0¼d.	1913	32,471	5d.
1867	110,090	10½d.	1914	71,654	7.26d.
1868	55,913	9½d.	1915	215,990	6.65d.
1869	67,880	8d.	1916	227,562	7.47d.
1870 ...	84,749	9¾d.	1917	243,885	1s. 3d.
1871	234,241	5¾d.	1918	283,128	1s. 6d.
1872	189,841	6¾d.	1919	800,000	2s. 5d.
1873	156,886	6½d.	1920	1,000,000	
1874	40,962	6½d.			
1875	6,603	7¼d.			
1876	3,206	6½d.			
1882	400	6d.			

Criticism of South African Cotton.—Most of the reports received from European manufacturers on the quality of our cotton have been very satisfactory, in practically all cases being reported on as above middling in grade, strong fibre, good colour, and from 1 to 1¼ inch in length. Recently, however, some of our cotton received somewhat severe criticism from these manufacturers. The chief points of criticism were: (1) The staple is too short; (2) the staple is mixed; (3) the cotton is not properly graded.

These accusations seem strong, but we know that they are only too well founded, and unless we try to discover the reasons for them and the remedies to overcome them, our second attempt to make South Africa a cotton-growing country will also fail.

* Bulk of crop unsold at date of writing.

The following may be given as some of the chief causes responsible for the above criticism:—

(*a*) A good many varieties of cotton were introduced into the country in order to find out which would give the best results in the

A poor type of cotton plant.

different parts suitable for cotton growing. Some of these varied a great deal as regards the length and strength of the staple, uniformity, and quality. The seeds were distributed amongst

farmers, but these different varieties were not always picked separately, and even when picked separately were sometimes mixed at the gins. The result was that a quantity of mixed seed was issued to farmers.

(*b*) As long as the lint from the best of these varieties was kept separately, our cotton was spoken of very highly, but as soon as the different varieties were mixed this was no longer the case.

(*c*) The industry developed so rapidly during the past few seasons that the supply of good seed was altogether inadequate. Farmers were crying out for proper seed, but there was none to be had. As a result they had to take anything that was offered them.

(*d*) Cotton was a new crop to most of the farmers, and as they did not know their varieties and what qualities to look for, very little seed selection was done, and consequently the seed degenerated.

(*e*) Some ginneries are not yet grading their cotton, and middling cotton is still being baled with fully good middling, and so on. Practically no distinction is made between the longer and shorter staples, and very often lint of $\frac{3}{4}$ inch is baled with lint of $1\frac{1}{4}$ inch.

Remedies.—The points raised above must be solved before we can reasonably expect the industry to make any further headway. The remedies necessary are obvious. They are: (1) Better seed and (2) proper grading of our cotton.

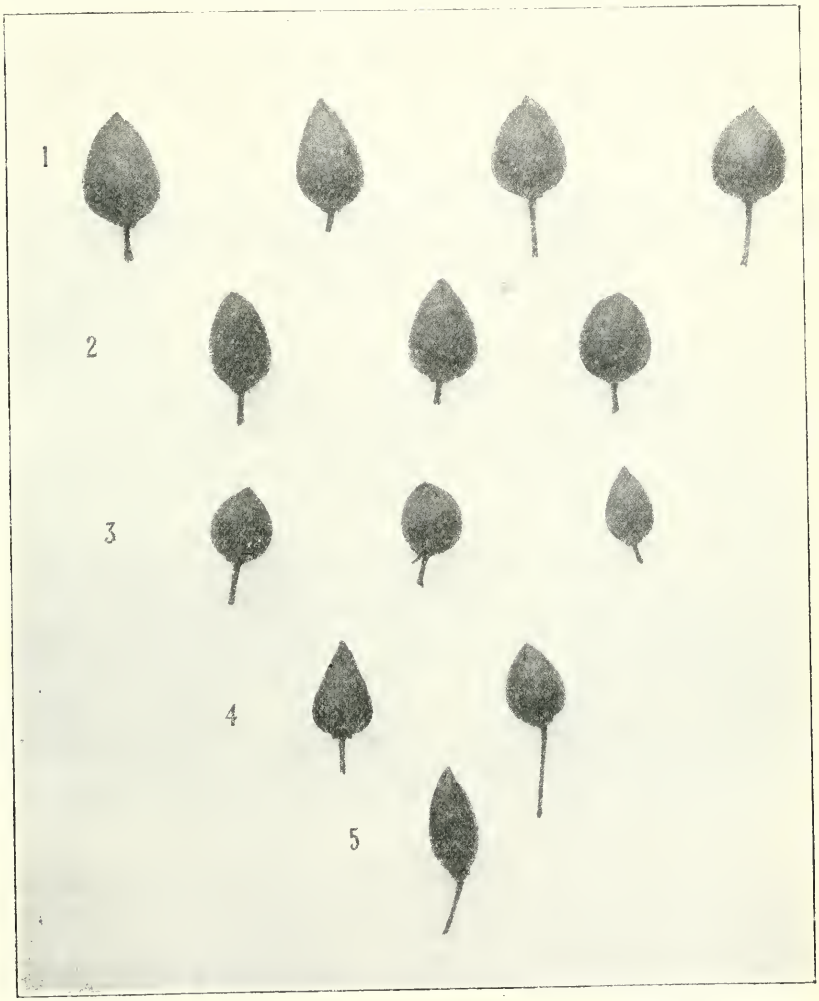
It is not the intention of the writer to go into detail in regard to the second remedy, beyond pointing out the tremendous harm being done, not only to a young and very promising industry, but to South Africa as a whole, by those people who are not properly grading the lint after it has been entrusted to their care. The Department of Agriculture has recently secured the services of a cotton grader, and as he will be at the disposal of the ginneries, the difficulty of grading the cotton should now easily be overcome. Not a single bale of cotton should leave the country unless properly graded by an official grader, otherwise South African cotton will not find a ready market, and will be looked upon with some suspicion. Nobody can blame the manufacturer, for under the present system he is not sure what he is going to get.

As to the first question, that of better seed, we can attain our purpose by either of the following two methods, viz.: (1) Importation of pure seed; (2) selection from the best varieties already grown in the country.

Importation of Pure Seed.—The British markets require a staple of about one and three-sixteenth inch in length. If any seed is to be imported, it would seem advisable to import varieties which will produce a staple of at least this length, as it commands a higher price.

The most likely countries from which such varieties can be obtained are Uganda, Egypt, or America. There would be no difficulty in obtaining enough of this seed for our requirements, but unfortunately there are such tremendous dangers (in the form of insect pests) attached to the importation of cotton seed, especially to a young industry, that the risk run in importing seed is too great. In Egypt they have the pink bollworm, and there are strong suspicions that it has already worked its way down as far as Nyasaland. In

America both boll-weevil and pink bollworm are only too well known. Judging by the experience of America and Egypt of these two pests, we must make every effort to keep them out of this country. In bad years the loss caused by the pink bollworm in Egypt has been estimated at from 7,500,000 to 10,000,000 dollars.



Cotton Bolls—showing differences in shape and size.

1st and 2nd rows : bolls from Improved and Green-seeded Bancroft ; 3rd row : bolls from King ; 4th row : bolls from Uganda ; 5th row : boll from Egyptian.

Pink bollworm reached Mexico in 1911, undoubtedly through small importations of seed from Egypt, and seven years later it was estimated that from 50 to 75 per cent. of the Mexican crop was destroyed by it. It has already made its appearance in the United States, and is looked upon there as a far more serious pest than the

boll-weevil. The damage done by pink bollworm to the Brazilian cotton crop in 1917-1918 was estimated at 27,500,000 dollars.

If it is found absolutely necessary to import seed, it should be done only by the Department and grown under the supervision of the Department, so that every precaution may be taken against introducing cotton pests, the seed from the resulting crop being issued to farmers.

Selection on the Farm. It seems necessary therefore to adopt some other way of improving our cotton crop, and the soundest method appears to be selection on the farm.

A farmer may buy pure seed from his neighbour, but this seed will degenerate in a few generations if no selection is done. In the first season a few plants only may show different characters such as small bolls, short lint, or unproductiveness, but if they are not discarded we may expect a very considerably increased number the following year. And even if the seed of such discarded plants is rejected, there can be no assurance that some of these degenerate characters will not appear the following season.

The work of the grower is, therefore, never complete, and he must continue to select year by year. To the beginner the selection work may seem very difficult, but a little practice will soon enable him to distinguish differences between different varieties, and later on even between different plants of the same variety.

There is always a great deal of variation in a cotton field. Differences can be noticed between the individual plants of an unselected field, and even in the most carefully selected varieties of cotton, where no crossing with other varieties has taken place, individual variations away from the type will appear. These variations may occur from a crossing of varieties or from a spontaneous mutative variation. If a uniform variety of cotton is introduced into a different area and grown under new conditions, a certain amount of individual variation may also occur.

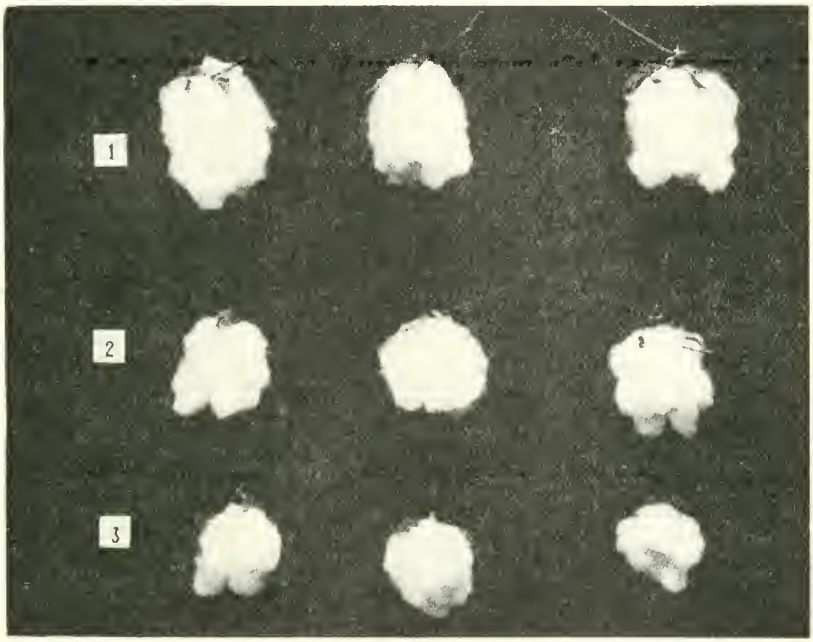
Characters to look for.—When the grower goes in for selection, his aim must be not to change the characters of the selected plants, but by selection to preserve the desired characters and discard any undesirable ones which may appear. By continually doing this, he will gradually establish a uniform variety giving the highest expression of those characters aimed at. Selection, therefore, is simply a means of discarding or "rogueing" out all those plants which show an expression of undesirable or degenerate characters.

Some plants which show very superior characters will also be found in the field and may or may not be different to the type selected. If these show some exceptional superior character or combination of characters, the seed from them may be used in the progeny row tests.

Before deciding upon the type of cotton to be grown, it becomes necessary to study the factors which constitute a desirable type. The following are probably the most important of these: (1) Length and strength of staple; (2) productiveness; (3) high percentage of lint; (4) large bolls; (5) storm resistance; (6) early maturity; (7) uniformity; and (8) disease-resisting qualities.

It is perhaps just as well to say something about these factors, in order to show more clearly why they are desirable. The length

and strength of the staple are certainly two of the most important factors. The length of the staple varies a great deal with the different kinds of cotton, and so do prices, the higher price being paid for the longer staple. At the present time we are growing varieties which will barely average ⅞ inch in length and some which produce a lint of fully 1¼ inch in length. We must endeavour to grow a variety which will produce a uniform staple of 1¼ inch in length. If we succeed in producing a staple of this length, we can be certain of a ready market for our cotton, and so ensure the success of the industry in South Africa. Samples of our cotton have been forwarded to the British Cotton Growing Association, and the following is an extract from one of the reports received from them: "Length, one to one and



Opened Cotton Bolls—exhibiting relative sizes.
1st row: large bolls: 2nd row: medium bolls: 3rd row: small bolls.

one-sixteenth inch. Value of cotton compared with the price of current month's American futures at 25½d., or say ½d. on the price of futures. The quality is scarcely suitable for Lancashire trade, as the staple is rather too short, and an extra one-sixteenth to one-eighth of an inch in length would greatly improve the value of the cotton, and would also make it more readily saleable."

In another report written at the same time the following appeared: "The staple of Uganda cotton is about one and three-sixteenths and the quality is suitable for the Lancashire cotton trade: at the present time it is worth from 18d. to 22d. above the price of American futures."

We see that at that time an eighth of an inch added to one and one-sixteenth inch staple made a difference of from 18d. to 22d. per

pound. It is thus clear that length of staple is a very important factor. These prices were for abnormal times. In normal times the differences will not be so great, but a bigger premium will always be paid for the longer staple. The staple must also be strong, or else it is of very little use to the spinner.

(2) *Productiveness.*—In order to get a good yield, seed must be selected from only well-formed plants, with plenty of fruit limbs and producing a large number of well-developed bolls. Plants which are sterile or partially sterile should not be selected, because if they are selected a decreased yield will result.

(3) *High Percentage of Lint.*—If the seeds are well covered with lint, we can expect to find a high percentage of lint to seed. Partially naked and naked seed will give a smaller percentage of lint to seed.

(4) *Large Bolls.*—Varieties with big bolls have a great advantage in reducing the cost of picking. They are usually storm-resistant. In a big boll variety we would not expect to find plants maturing small bolls, and should such plants appear they must be taken out.

(5) *Storm Resistance.*—Storm resistance is indicated by the drooping position of the bolls and also by a heavy involucre, which will assist in protecting the bolls from wind and the beating of rain.

(6) *Early Maturity.*—Early maturity is again indicated by the position of the fruit limbs on the plants. Such plants are usually small, with the lower limbs very close to the ground.

(7) *Uniformity.*—It is very essential to have a uniform field of cotton. This can be obtained by selection. Uniformity must be maintained, for degenerate plants will always appear. A uniform field of cotton will give a larger yield, and lint from such a field will be of better quality and fetch higher prices than from a field not so uniform.

(8) *Disease-resisting Qualities.*—Very often a number of healthy plants can be seen in a diseased cotton field. By selecting seed from such plants a strain can be developed which will be able to resist that particular disease. An example of this is the wilt-resisting strain of cotton developed in the Southern States.

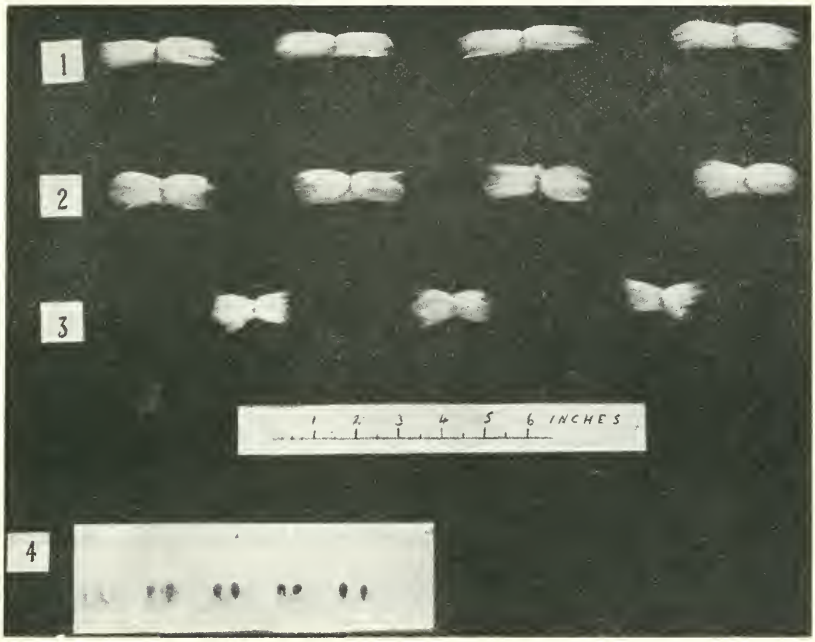
In selecting for the above we must not sacrifice the desirable characters of the variety, but must select for these characters only as far as is consistent with the variety.

To what extent the grower will be successful in his selection work will depend entirely on his skill to detect minute differences, enabling him to grow a variety which will show the most uniform expression of desired characters. The following sub-divisions will assist the grower in making his selections: (1) Shape and structure of bushes and leaves; (2) shape and size of bolls; (3) shape and colour of seed; length, strength, and silkiness of fibre; (4) colour and shape of flowers.

The first step of the cotton grower must be to decide upon his variety, and then to procure his seed from some reliable source. As soon as the plants are from 2 to 3 feet in height selection must begin. In making his selections he must examine and study the best plants in the field. In order to get the best impression of the true type it is desirable to look about until several of the most likely plants are found together. In comparing the different plants in the same field

it will soon be discovered that differences can be seen in the leaves, stems, and branches. In a well-selected and uniform variety grown under the same conditions, the plants will be very similar in habit of growth, shape and size of leaves, and hairiness. The length of stalk, joints, and branches will be more or less similar, and about the same height above the ground. When one plant is seen in the field with a marked difference in any of the above characters, it should be closely examined, and, if undesirable, discarded.

Selection by leaf and stalk characters is much more effective than by boll, seed, and lint characters, because most of the inferior plants can be pulled out early in the season and before they have had an opportunity to spread their pollen.



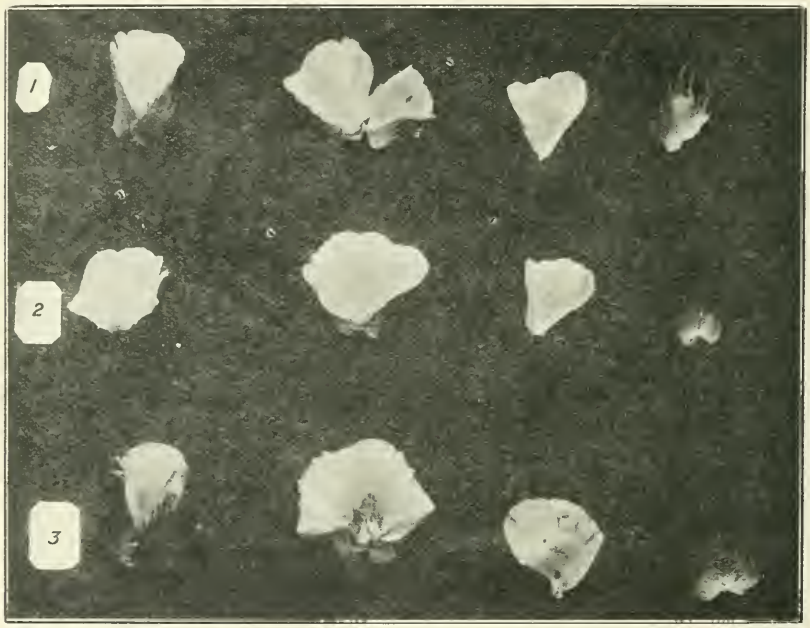
Seed Cotton—showing length of fibre: (1) from Uganda; (2) from Improved Bancroft; (3) from King.

No. 4 shows: (1) seeds covered with white fuzz; (2) seeds covered with green fuzz; (3) seeds partly covered with white fuzz: (4) seeds almost naked, only tips covered with fuzz: (5) small black naked seeds.

When all the undesirable plants have been discarded, and as soon as the earlier bolls have reached full size, the second stage of the selection work is begun. This time the selection is done by boll characters. By examining the bolls it will be seen that not only will small and large ones be found on different plants, but they will also have different shapes, such as round, narrow, and long bolls. Their colour will vary from a dull green to a deep green. There will be differences in the surface of the bolls, some being smooth and others having a rough appearance. The quality of the lint can also to a certain extent be judged in advance by the shape of the boll. The

small round ones usually give a short lint, while the long narrow ones usually have a longer lint. Again, the large short bolls will give more abundant lint than the narrow pointed ones.

The third stage of selection is done by means of the seed and lint characters. As length and strength and abundance of lint are all very important factors, a good deal of time and study must be devoted to this phase of the work. The seed cotton is taken from a portion of the boll, and examined and compared with that of the neighbouring plants. In order to make a good comparison of the length, the lint is straightened out from the sides of the seed with a small comb or by means of the thumb and forefinger. The lint thus combed out is then taken between the thumbs and first fingers of the two hands



Flowers.

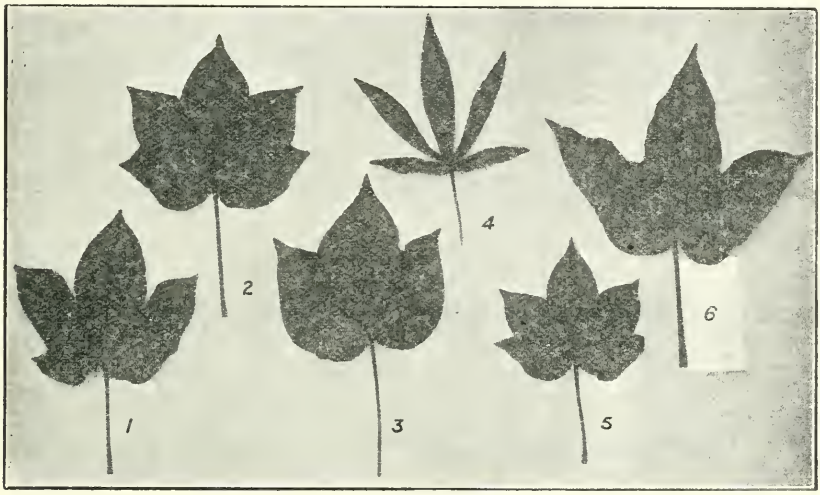
(1) Upland Flower, white with purple spot at base of petal; (2) Creamy White Flower (King), with slight spot at base of petal; (3) Yellow Flower, with purple spot at base of petal (Egyptian).

and broken in order to determine the strength. The seeds must be well covered with lint in order to give a high percentage of lint to seed.

It is not uncommon to find small black seeds with scarcely any lint on them in the Upland varieties. This lint is usually very short and weak. Such plants give practically no seed cotton, and must be destroyed. Plants of the above description have been found in Improved Bancroft, Green-seeded Bancroft, King, and Nyasaland Upland. Partly naked seeds are also found in the Improved Bancroft variety, but these are as large as the white seed and produce a fairly long lint of good quality, although the percentage of lint to seed is smaller than in the case of the white seed.

The characters of flowers are also sometimes useful in assisting the farmer to detect undesirable plants or impure strains. Pure strains of cotton have definite flower colours. The Egyptian flower ranges from a lemon to a yellow colour, with rich crimson spots at the base of the petals. The Upland flowers are white or creamy with no spots at the base of the petals. If the colour and spots are not as described above, then the strain is not considered pure.

In some of the small-bolled types, like King, we sometimes find the yellow flower with purple or pink spots at the base of the petal, but these should not appear in the big-bolled Upland type. And yet we very often find these characters in our big-bolled Upland types, which shows that through the distribution of a great many varieties of seed a good deal of crossing has taken place. It will be an easy matter to discover such plants and discard them.



Cotton Leaves taken from different varieties.

(1) Egyptian ; (2) Improved Bancroft ; (3) Green-seeded Bancroft ; (4) Union ; (5) King ; (6) Pima. Observe relative sizes and shapes.

How to Pick Selected Seed Cotton.—When about 25 to 30 per cent. of the bolls are open, and just before picking commences, the grower must go through his field, marking all the selected plants with labels or tying a piece of white cloth, easily seen, to the tops of such plants. These plants are then picked separately, and the seed saved for the main crop.

If any plants of outstanding merit are found, they are labelled and numbered. The seed cotton from each plant is picked and kept in a separate paper bag. The seeds from such plants are used for the individual row tests. Only about half of the seed from each plant is planted out in a separate row in order to compare it with the other specially selected plants. By having these plants alongside of one another a good comparison can be made as to the merits of each individual plant. The seeds from these plants are not used again, but should any row prove to be outstanding, the grower can fall back

on the other half of the seed kept in reserve from the parent of that row. This seed is planted in a separate plot the following year, and he has a foundation of a good strain from a single superior plant, and in a few seasons he will have sufficient seed for his main crop from this one plant.

It will pay every cotton grower to select his seed. If he succeeds in producing a uniform field of cotton from a superior strain, he will produce a more uniform staple of a better quality cotton, and he is also bound to obtain an increased yield, as all the inferior plants are discarded from such a field. There is an excellent future for the cotton grower who is going to make it his business to breed good cotton seed. Such breeders will not only be a real asset to the industry, but they will soon establish a reputation for themselves as breeders of good cotton seed, and in a short time will be more than repaid for their extra trouble in selecting their seed. Such breeders must be careful to maintain uniformity by selection, and must not think that when they have produced a uniform strain their work is completed.

Acknowledgments.—W. H. Scherffius, for statistics *re* cotton production in South Africa; W. B. Wilson, for statistics *re* cotton production in South Africa, "Cotton Growing in South Africa"; O. F. Cook, "Cotton Selection on the Farm by the Character of the Stalks, Leaves, and Bolls"; M. and B. Stern, for information on pink bollworm in Brazil and U.S.A., "Cotton Facts."

Outbreaks of Animal Diseases: April, 1921.

Month.	East Coast Fever.	Mange.	Anthrax.	Dourine.	Glanders.	Epizootic Lymphangitis.	Tuberculosis.	Lung-sickness.
March, 1921...	34	8	231	4	—	—	—	—
April, 1921 ...	18	9	131	6	—	—	1	—

DISTRIBUTED AS FOLLOWS:

Disease.	Transvaal.	Natal.	Cape.	Orange Free State.	Transkei.	Totals.
East Coast Fever	7	10	—	—	1	18
Mange	4	—	4	1	—	9
Anthrax	47	9	18	31	26	131
Dourine	—	—	6	—	—	6
Glanders	—	—	—	—	—	—
Epizootic Lymphangitis ...	—	—	—	—	—	—
Tuberculosis	—	—	1	—	—	1
Lung-sickness...	—	—	—	—	—	—

CATARRHAL FEVER OF SHEEP—BLUE-TONGUE OR BEKZIEKTE.

By R. W. DIXON, M.R.C.V.S., Senior Veterinary Officer, Cape.

THIS is a specific disease which affects sheep over a large area of South Africa. It is characterized by high fever, a catarrhal inflammatory condition of the mucous membranes of the mouth, lips, tongue, upper air passage, and intestines, very often accompanied with inflammation of the laminæ of the feet and coronary band, followed in some cases by suppuration and shedding of the hoof and also shedding of the fleece. The lips, cheeks, and tongue become greatly swollen, the latter assuming a purple colour from discoloration of the lining membrane, hence the term applied to this disease: "*blue-tongue.*"

ORIGINATING CAUSE.

Blue-tongue is not a contagious disease (affected sheep have been kept in intimate contact with healthy susceptible sheep with no ill effects), but is readily communicable by inoculation with a small dose of blood taken from an affected animal, either subcutaneously or intravenously, and is due to a micro-organism. So far, all attempts to find the organism, both by microscopical and bacteriological means, have failed. It has been found that the blood of a sick sheep when passed through a Berkefeld filter retains its virulence. All visible micro-organisms would be unable to pass through such a filter, consequently the conclusion is formed that the organism of this disease must be so small as to be non-visible under the highest power of our microscopes.

The disease is very much more prevalent in some years than in others. In very dry seasons it is much less prevalent and is mainly confined to the low-lying districts, whereas in seasons in which there has been an abundance of rain it prevails over a large area of the country. Under warm and moist conditions, the disease may appear as early as December or even November, but February to April are the months in which we find it most general. It is very rarely met with in mountain veld, being usually confined to the valleys and plains, but it is the local elevation which gives the protection, not as elevation above sea-level, but as compared with the surrounding country. If sheep are kraaled before sunset on the top of high, elevated portions of the farm, or placed in proper sheds during the night, this malady can be prevented. Further, if a flock of sheep, in which the disease is prevalent, is dipped in some sheep dips, especially the carbolic or tar derivative dips, the spread of this disease can be arrested.

It has long been suspected that the disease is contracted and spread under natural conditions by the agency of flying insects, probably mosquitoes. We have no positive proof of this yet, but the negative evidence produced is so strong as to justify these suspicions.

The principal facts brought forward to prove the agency of flying insects in the production of this disease are:—

(1) Blue-tongue can be produced artificially only by inoculation. All attempts to produce the disease by drenching with virulent material have failed.

(2) By shedding and dipping, the disease can be prevented by protecting the sheep from the attack of insects; on the other hand, shearing sheep when the disease is prevalent is apt to increase the chances of infection.

(3) The disease is not contracted during the day, but at night time.

(4) The disease is more prevalent in low-lying marshy districts, where night insects, such as mosquitoes, are most numerous, and during the season of the year when such insects are most active.

SYMPTOMS.

The period of incubation varies from two to four days from inoculation; under natural conditions it is not yet determined, but is probably about the same time as when produced by inoculation. The temperature is high at the onset of the disease, reaching from 104° F. to 107° F., the fever period extending from five to seven days, there being a marked drop when the eruption about the mouth appears.

One of the first symptoms noticed is a frothing from the mouth and licking of the lips. If the animal is caught and examined, it will be found that the mucous membrane of the mouth is inflamed, showing a purplish-blue discoloration with swelling of the gums and lips.

In very severe cases the tongue becomes badly swollen, of a dark blue colour and sore from shedding of the epithelium.

There is sometimes an œdematous swelling of the lower part of the face, and of the space between the lower jaw-bones. The affected animal is noticed to walk lame and tenderly, and examination of the feet shows great heat and tenderness. During the febrile stage, when the mouth is sore, there is great thirst, and if the affected sheep are then allowed to drink large quantities of water, this sometimes produces vomiting.

The fatal cases usually occur amongst young animals that develop symptoms of diarrhœa and severe emaciation.

In cases of recovery the whole course of the disease is about twenty-one days.

POST-MORTEM APPEARANCES.

As a rule, death supervenes from debility and extreme emaciation, the lesions in the mouth in most cases have already healed, but the flesh and organs are found pale and nearly bloodless. In acute cases the tongue is more or less stripped of its epithelium lining, and may be found gangrenous at its tip. The dental pad and inner surfaces of the lips are raw and sore. The rumen often shows inflamed patches. The contents of the third stomach are usually found liquid, but the fourth stomach is very frequently much inflamed, in severe

cases the membrane being swollen, of a purple colour, with small ulcers or erosions near the exit.

The small intestines may also be found inflamed, more especially when the disease is complicated by diarrhœa, in which case the large intestines are found more or less affected. The spleen is enlarged and the pulpa slightly softened.

The liver is usually congested and the gall bladder full of dark green bile.

The kidneys are also congested and œdematous, the covering membrane being easily stripped off. The lungs are usually normal, except in cases where there is œdema and frothy mucus found in the trachea and bronchial tubes. The blood is unaltered in appearance and well coagulated. A little yellow fluid is found in the pericardial sac, and there is also to be found petechia (blood markings) on the endocardium of the left ventricle of the heart.

CURATIVE TREATMENT.

Many remedies have been tried and recommended, but many recover as well without medicinal treatment, for it is found inadvisable to disturb or distress the sick sheep by continual dosing.

The mouth lesions may be washed with some weak antiseptic and astringent solution, such as alum or chlorate of potash, one teaspoonful to a bottleful of water, or a few grains of permanganate of potash to a pint of rain water. One dose of a mixture containing one teaspoonful of a carbolic sheep dip, such as Little's dip, and one wineglassful of raw linseed oil is recommended.

The patient should be placed under cover or in a cool shaded place and disturbed as little as possible. If there are no sheds, the sick sheep should be picked out of the flock as soon as they are noticed sick, and placed in paddocks or sheltered spots near the homestead, where they will not be disturbed. Allow them a free access to a lick of common salt, which they appear to like and take readily.

SUSCEPTIBILITY.

This varies greatly. The pure Merino is most susceptible, especially when young. Africander and Persian sheep seem to have a considerable degree of immunity. Both old and young are liable to attack, but it is found that sheep one to two years old contract the disease most severely. It is noticed that unweaned young lambs escape. The blood and also the serum of the blood of an affected sheep is virulent during the whole course of the fever, and for a considerable number of days after recovery. Blood obtained from a severe case fifty days after the fall of fever on intravenous injection, produced a typical sickness (Spreull).

PREVENTIVE INOCULATION.

The only method of preventive inoculation, for which a vaccine is prepared, is Theiler's method. This vaccine is prepared by passing the virus through several generations of sheep and using the blood of such animals. It is, in fact, an attenuated virulent blood preserved by the addition of carbolic acid and glycerine. The inoculation sets up a fever, which lasts for about a fortnight, producing mild symptoms of the disease and some loss of condition. The mortality

from the result of the inoculation is small, usually below 1 per cent. Immunity is not fully established until eighteen days after inoculation.

The most suitable months for vaccination are from October to February, more preferably January and February, as experience has shown that, the more recent the inoculation, the stronger the immunity.

Rams and breeding ewes should be vaccinated some time before the breeding season in order to allow them to recover their condition and procreative powers. Ewes in lamb, especially those advanced in pregnancy, must not be inoculated.

The vaccine, with full directions for use, can be obtained on application through any Government Veterinary Officer, Resident Magistrate, or from the Veterinary Research Laboratory, P.O. Box 593, Pretoria (telegraphic address, "Microbe").

Export of Agricultural Produce.

Proclamation No. 79 of the 20th April, 1921, provides that the following articles shall be agricultural produce for the purposes of the Agricultural Produce Act (No. 35 of 1917), which prohibits the exportation by sea of agricultural produce unless such has passed inspection, viz., maize, maize products, oats, bran, rye, beans, peas, lucerne seed, kaffir corn, millet, and barley.

Meat Statistics.

EXPORTS.

	April, 1921.	Total for Period 1st Jan., 1921, to 30th April, 1921.
Beef (quarters)	2,004	3,160
Bacon and Ham (lb.)	65,490	116,981

CATTLE IMPORTED FROM ADJOINING TERRITORIES.

For Slaughter	2,916	12,379
For Breeding...	675	2,355

SUMMARY.

Calendar Year.	Beef Exported.	Cattle Imported from Adjoining Territories for Slaughter and Breeding.
	Quarters.	No.
1916	115,992	26,580*
1917	309,214	53,410
1918	123,354	50,053
1919	285,367	57,267
1920	69,885	89,135

* 1st July to 31st December only.

BARLEY PRODUCTION FOR BREWING.

Hints to Farmers on Growing and Harvesting Malting Barley.

AMONG the industrial activities of the Union, the brewing of beer occupies an important place, the total value of the output of our breweries, including native beer breweries, according to the Industrial Census of 1919, amounting to £1,173,000. Farmers are aware that for many years past efforts have been made to ensure that the breweries shall obtain a sufficiency of malting barley from local production to meet their requirements, and the principal breweries have figured prominently in this direction in encouraging the growing of the desired type of barley through the distribution of seed to farmers in the south-western Cape Province and also in the Transvaal. It has recently been estimated that the requirements of the breweries in respect of malt are equal approximately to 170,000 bags of barley per annum. In addition to the large quantities of barley cut green, the Union's production of barley (grain) is returned as follows:—

Season 1917: 657,149 bags (150 lb.).
*Season 1918: 329,290 bags (150 lb.).
*Season 1919: 230,390 bags (150 lb.).
Season 1920: 364,000 bags (150 lb.) (crop estimate).

In actual quantity it will be seen that the Union produces far in excess of the requirements of the breweries, but a great deal of the production is not suitable for malting. In this connection it is interesting to examine the trend of the importations of barley and malt from oversea. In respect of barley there has been generally a steady falling off. The average annual importation during the five years 1910-14 was 571 bags and of the succeeding five years 1915-19, 345 bags. Indeed in 1909 only 50 lb. of barley were imported. But the following year, on account apparently of the serious shortfall in the Union's barley crop of 1919, heavy importations were made, principally from Australia, to the extent of 48,718 bags. The same tendency is observed in the case of malt. On the basis of 112 lb. malt being equivalent to 150 lb. barley, it is seen that the average annual importation of barley (in the form of malt) was 111,121 bags during the five years 1910-14, diminishing to 45,753 bags during 1915-19; during 1920 the importations amounted to 57,634 bags, also mostly from Australia. Apart from the abnormal year of 1920, the importations of barley have fallen to negligible quantities in recent years, and those of malt have also shrunk to small proportions compared with earlier years. In the meantime the brewing industry has been developing, which points to the fact that the efforts to induce the production of suitable malting barley in the Union have resulted in a very satisfactory forward movement.

* Not including native locations, returned at 9298 bags in 1917.

It has been found necessary, however, to restrict the importation of barley (not malt), for the purpose of preventing the introduction of diseases, to small quantities for seed purposes, which can be thoroughly disinfected on arrival. As the supply of barley for brewing is thus confined to the Union, it is necessary that every endeavour should be made to continue to improve the standard of barley grown, bearing in mind the requirements of the breweries as to the quality of malting barley needed by them. To assist in this direction, we publish the following hints to farmers on the growing and harvesting of malting barley. This information, prepared originally by the Board of Agriculture and Fisheries, London, has already been published in pamphlet form by one of the principal breweries in South Africa, and the Department wishes to endorse the advice contained therein and to impress upon farmers the need of carefully following out the directions:—

GROWING AND HARVESTING.

1. Till the ground as early as the condition of the soil will allow.

2. Use the best, pure seed, free from smut.

3. If the seed is bought or comes from a field that shows signs of smut, it should be treated with a half per cent. solution of copper sulphate.

4. The drills should not be too far apart (6 to 8 inches).

5. Avoid sowing clover with barley.

6. The Chevalier barleys are the best, but they require very careful cultivation and good soil, and are especially sensitive to strong nitrogenous manuring.

7. Imperial barleys, therefore, should be preferred where the soil is highly nitrogenous, or where, owing to unfavourable weather, the Chevalier and other sorts may be expected to suffer from "lodging" and damage to quality.

8. For dry soils, the Hanna barleys are most suitable. These barleys also deserve consideration for better soils on account of their prolific yields.

9. Brewing barleys require rich and easily assimilated stores of plant food.

10. This is supplied by heavy manuring with potash salts and superphosphate. For light soils, potash is especially important. Barley should be grown after hoed crops, not after leguminous plants.

11. Great care is necessary in applying nitrogen, because nitrogen makes the barley rich in albumen, and therefore of less value for brewing purposes. The manuring and the production of the preceding crop must be taken into consideration. The application of farmyard manure should be avoided.

12. The disadvantageous effect of nitrogen on the quality may be largely controlled, to the advantage of the total yield, by heavy manuring at the right time with potash and phosphoric acid, as well as by careful cultivation. The potash should be put on early.

13. The soil should be so prepared that the spreading of the delicate roots of the barley may meet with little mechanical hindrance.

14. On all light soils the provision of moisture during growth must be secured by deep cultivation, working the soil in the summer, by taking barley after hoed crops, by early seeding, harrowing, and destruction of weeds.

15. In clay soils an excess of water must be avoided by careful tillage, which keeps the soil in a favourable mechanical condition; a crust must not be allowed to form on the surface.

16. The barley must be fully ripe before being harvested.

17. If the barley is quite dry, it should be carried immediately it is cut.

18. If for any reason this cannot be done, the barley must be immediately tied into sheaves, and put into stooks.

19. Care should be taken not to set the thrashing machine so close as to damage the barley by breaking the skin or chipping the ends of the corn. The finer the sample of barley, the more readily is it skinned by careless thrashing.

20. The greatest care should be taken in the preparation of the barley for sale, as the dressings, etc., are valueless to the brewer, but can be usefully used for fodder.

21. Barley of uniform quality should be offered for sale in as large lots as possible.

22. Damp barley must be protected from injury by drying, as, if the grain germinates, it becomes useless for brewing.

THRASHING.

Complaints are frequently made by brewers and maltsters of the injury done to barley in the process of thrashing owing to the fact that the drum of the thrashing machine is set so close that many of the grains are cracked or broken. The presence of such injured grains greatly reduces the value of the barley for malting purposes, as the broken, bruised, or skinned grains fail to germinate, and soon show signs of mould, thus leading to unsoundness in the malt and bad results in the brewery. The injury caused by overdressing is not limited to grains which are actually broken; grains closely nipped at one or both ends, or such as have been bruised and peeled, are equally objectionable. In fact, if by too vigorous thrashing the husk of the barley is damaged, although the damage may not be apparent, irregulaties in the malting, accompanied by the production of mould, are likely to result. Therefore to prevent injury the following advice is given:—

1. When farmers commence a day's thrashing they should at the outset, and repeatedly during the day, carefully examine the grain. If any signs of injury are observed, the concave of the drum of the machine should be slightly opened. It is better that part of the beard should be left adhering to the grain than that any risk should be run of injuring the reputation and value of home-grown barley on account of broken and chipped grains.

2. A new machine will break the grain more than a machine which has been used for a time and in which the roughness of the beaters has been worn off. On the other hand, when a machine has

been much worn, the centre of the drum and concave having had the most work, in consequence of the feeding being necessarily more in the centre than at the ends of the drum, the space between them is greater in the centre than at the two ends, and if they are set to thrash clean in the centre they will be too close at each end, and consequently damage will occur. This fault can only be remedied by putting on new drum-beaters and concave ribs.

3. Great attention should also be paid to regularity of feeding. The mill should be driven at an even speed, and proper care should be taken over the adjustment of the several parts of the machine.

4. It is not only in the drum of the thrashing machine that unnecessary damage to the kernel takes place through imperfect setting of the several parts, but also in the barley-awner or hummeler, through which the grain subsequently passes. Here, if the beaters are set too closely, and the barley is roughly handled, "nibbing" will take place.

Different varieties of barley require different treatment, so that those in charge of the thrashing should make a point of constantly examining the sample, and if this is injured in any way, of ascertaining in what part of the machine the injury occurs, altering the setting until it is remedied.

5. As a further guide in thrashing it may be added that on no account should the barley be rushed through the machine, as it is better to be content with a moderate output and a more perfectly thrashed sample.

6. It is important that the machine should be thoroughly clean in all parts before commencing the day's thrashing.

Fruit Export.

The following are the shipments of fruit for overseas for the month of April, 1921:—*Ex* Capetown (boxes): Grapes, 38,259; pears, 56,142; peaches, 46; persimmons, 85; apples, 42; melons, 284; medlars, 4; avocado pears, 8; oranges, 1548. *Ex* Port Elizabeth (boxes): Pines, 254. *Ex* Durban (boxes): Pines, 1665; mandarines, 96; oranges, 47; naartjes, 37. Total boxes exported during the month: 98,517.

Total shipments from all ports during the 1920-1921 deciduous fruit season: November, 1920, 42 boxes; December, 1920, 27,422 boxes; January, 1921, 76,286 boxes; February, 1921, 141,424 boxes; March, 1921, 104,561 boxes; April, 98,517 boxes. Total, 448,252 boxes.

The exports for the 1919-1920 deciduous fruit season amounted to 265,300 boxes

PLANT DISEASES IN THE WESTERN PROVINCE.

Notes by V. A. PUTTERILL, M.A., Division of Botany.

CHLOROSIS IN KELSEY PLUMS.

DURING the month of October, 1920, Mr. Rowland Taylor, of Wellington, Cape Province, drew my attention to a fairly large block of twelve-year-old Kelsey plum trees badly affected with *chlorosis*.

For those to whom this term is unfamiliar, I might mention that chlorosis is an abnormal condition of plants whose foliage is normally green and healthy looking, but in affected plants assumes a yellow colour owing to the non-formation of chlorophyll, the green colouring matter which gives that familiar colour to vegetation. Chlorophyll is of paramount importance to the life of plants. It captures energy from the sun's rays, enabling the tissues in which it is present, by means of this imprisoned energy, to make use of the carbon dioxide (carbonic acid) in the air, and build it up into plant foods. It will be readily understood, therefore, how vitally important it is for plants to be grown under conditions favourable for the chlorophyll. Various conditions have been shown to be essential for its production: light (this factor is certainly not lacking at Wellington), iron in the soil, and generally satisfactory conditions of nutrition.

The block of trees in question is on a good slope, and is very well drained. As too great acidity in the soil is very common in the Western Province, I made a qualitative test for acidity in soil taken from around the feeding roots of a badly attacked tree. The tests showed that the soil was slightly acid. The root system of a badly affected tree was examined, the whole tree being dug out. There was no indication of parasitic attack, and this was confirmed by microscopical examination of the roots.

Apricot trees in the same block were slightly affected though not nearly as badly as the plum trees.

I am much indebted to Dr. Juritz, Agricultural Research Chemist, Capetown, for making a complete analysis of two samples of soil taken at levels of 6 inches and 12 inches below the surface respectively, and close to a diseased tree. As his remarks on the results of his analysis will be of interest to Western Province fruit growers, I will give them here in full:—

"It is noticed that, according to your remarks which accompanied the samples, the orchard is on a good slope and well drained; the surface soil, to a depth of 18 inches, consists of coarse sand wherein the feeding roots are located, the sub-soil below the above depth being clay.

"Two samples of soil were received, one (No. 1) taken at a depth of 6 inches, the level of the feeding roots, and the other (No. 2) at a depth of 12 to 15 inches, both of them, therefore, above the level at which the clay begins.

"These samples were of a light drab colour and seemed to have been derived from granite largely denuded of its clay-forming materials, namely felspar and mica, leaving only the quartz.

"The samples, as received in the laboratory, were found to be composed as follows, allowance being made for the moisture present:—

	Stones.	Coarse Gravel.	Soil.
No. 1	16.86	13.58	69.56
No. 2	21.75	13.45	64.80

Twig and Fruit of Kelsey Plum Tree, showing Chlorosis.

"More detailed mechanical analyses were made after sifting off the stones and coarse gravel, with the following results:—

	Fine Gravel.	Coarse Sand.	Medium Sand.	Fine Sand.	Very Fine Sand.	Silt.	Fine Silt.	Clay.
No. 1	28.47	17.32	25.44	9.87	11.36	5.68	1.95	Trace
No. 2	28.74	17.02	24.99	8.82	10.56	5.13	4.78	Trace

"These soils are virtually identical in mechanical composition, and may both be classed as coarse gravelly sands.

"Even without proceeding to chemical examination, the above mechanical analysis is quite sufficient in itself to indicate the chemical

poorness of the soils, and their need of continuous all-round manuring. The actual chemical analyses resulted as follows:—

	No. 1.	No. 2.
Moisture	.30	.58
Organic matter	1.01	1.03
Nitrogen	.014	.014
Potash	.033	.031
Lime	.034	.040
Magnesium	.016	.027
Phosphoric oxide—		
Soluble in cold hydrochloric acid	.029	.025
Soluble in strong boiling acids	.060	.059

"These figures abundantly confirm the inferences already drawn from the results of the mechanical analyses, namely, that the soils are very deficient alike in plant food and in humus-forming organic substances, and low in water-retaining power. The proportion of iron, too, is small, and, as in all soils composed almost exclusively of silica, the inherent tendency of the soil is towards acidity, although it seemed neutral to litmus. It is unlikely, however, that such low acidity could produce the chlorotic symptoms mentioned.

"The possibility of brak in the soil was also considered, and analyses in that direction, resulting as below, were undertaken:—

	No. 1.	No. 2.
Calcium carbonate	.048	.014
Calcium sulphate	.022	Nil.
Magnesium carbonate	Nil.	.004
Magnesium sulphate	Trace.	Trace.
Sodium sulphate	.014	.034
Sodium chloride	.054	.053
Total soluble salts (by analysis)	.138	.105
Total soluble salts (by weighing)—		
Before heating	.192	.168
After heating	.120	.088

"The alkali salts may therefore be said to amount to from .06 to .09 per cent. of sodium sulphate and chloride in the surface 18-inch sandy layer, with the possibility of larger quantities being brought up from greater depths by capillary attraction after irrigation, assuming any brak salts to be concentrated in layers at lower levels in the clay. Such an assumption would, however, scarcely seem to be warranted in view of the natural slope of the ground and the statement that it is well drained.

"Taking the weight of an acre foot of soil at 4,000,000 lb., the amount of alkali salts in a surface foot of the Wellington orchard would be between 2400 and 3600 lb. per acre. This would correspond, supposing the proportion of brak to be uniform all the way down, to from 9600 to 14,400 lb. in the whole 4-foot layer, in which the amount of sodium sulphate is from 560 to 1360 lb. and of sodium chloride about 1650 lb. According to Hilgard, prunes were not affected by 9240 lb. of sodium sulphates, or by 1200 lb. of sodium chloride, or by 11,800 lb. of total alkali.

"Prunes and apricots are much more sensitive to brak than almonds and oranges, and it would be interesting to learn whether any of these are differentially affected in Mr. Taylor's orchard. The grape vine is far more resistant to alkali than even the prune and the apricot, but lemons and mulberries are affected by one-tenth the quantity that the grape can endure uninjured."

The foregoing would seem to show that in the present case the trouble is due to a general lack in plant foods and in humus-forming organic substances; possibly also to a lack of iron, which is well known to be essential to the production of chlorophyll. It will be interesting to learn, amongst other things, whether the application of an iron containing fertilizer to the soil has any effect on the general health of the trees.

Of the two accompanying photographs, one was taken in the orchard showing the affected trees, while the other is a view of a branch with young fruit showing the same condition.

Kelsey Plum Trees, showing Chlorosis.

LITHIASIS IN PEARS.

Our attention was drawn in May last year to a trouble which had been affecting the fruit of a block of some 200 twenty-year-old Bon Chretien pear trees at Somerset West, Cape Province, for the past two or three seasons; the 1919-1920 season was a particularly bad one, as far as this trouble was concerned, as it was estimated that about 15 per cent. of the fruit from these trees was affected. As no specimens were available at the time, it was impossible to tell what the disease was.

At the beginning of December last I went out to Somerset West to see the trees for myself, and it was only after continued search that I was able to get a couple of young fruits showing typical symptoms.

At various spots on the surface of the affected fruit, the underlying tissue bursts through the epidermis, giving rise to a very disfiguring wart-like excrescence on the fruit up to about one-sixteenth of an inch in diameter, and the same in height. The tissues in the immediate vicinity of the wart become hard.

This disease, known as *Lithiasis*, is not caused by any parasitic organism, but is of a physiological nature, and occurs in pears of certain varieties more particularly in dry years, when the trees are in soil which is not rich in plant foods, or which suffers from certain disabilities such as, perhaps, lack of drainage. I am told that the block of trees in question was not given adequate drainage until last winter. It will be recalled that last season was a particularly dry one, and this doubtless accounts for the prevalence of the disease then.

BLACK MOULD, A STORAGE ROT OF SOFT FRUITS CAUSED BY *Rhizopus nigricans* Ehr.

ONE of the common causes of storage rot in soft fruits in the Western Province is the mould *Rhizopus nigricans* Ehr. This mould is considered to be a strict wound parasite, that is, it can only gain access to a fruit and cause its rot through an injury of some sort in the skin; a few tentative inoculation experiments carried out with the spores of this fungus in the laboratory here, indicate that the injury need only be very minute.

The fungus, to the naked eye, appears as a thick mould on the surface of the fruit. The growth of the fungus in the interior of the fruit precedes the formation of superficial mould, with the result that surrounding the black area one finds a brown zone about half an inch wide without a growth of mould on the surface. The spore-bearing organs, or sporangia as they are called, are produced on comparatively long stalks, the sporangiophores, and are visible as minute spherical black bodies; each sporangium might be likened to a hollow sphere on a stalk with a cap fitting over the top half of it. The sphere is known as the *Columella*, and the spores are formed in the space between its wall and the cap. The spores are liberated by the breaking up of the cap, while the columella is left intact. This is shown in figure 1, *a*, which shows a group of three sporangiophores, the one on the left has not yet liberated its spores; the one in the centre has just done so; that on the right shows the columella only (magnified 47 diameters). The figure marked *b* is a single sporangium magnified 167 diameters, and shows the columella *y*, *x* the line of union between the columella and the sporangium wall proper, and *z* the contained spores; figure 1, *c*, shows three spores magnified about 1060 diameters.

As far as actual size is concerned, a sporangium which is only about one two-hundred-and-fiftieth part of an inch in diameter, probably produces anything from 1000 to 1500 spores, each spore being only about one two-thousand-five-hundredth part of an inch long.

This mould was first brought to my notice in a consignment at Stellenbosch of magnificent peaches of the Sea Eagle variety, packed for export. The consignment showed such a high percentage of waste due to this mould, however, that it had to be disposed of locally.

Figure 2 is a photograph of one of these peaches; the brown zone surrounding the black area of superficial mould is clearly distinguish-

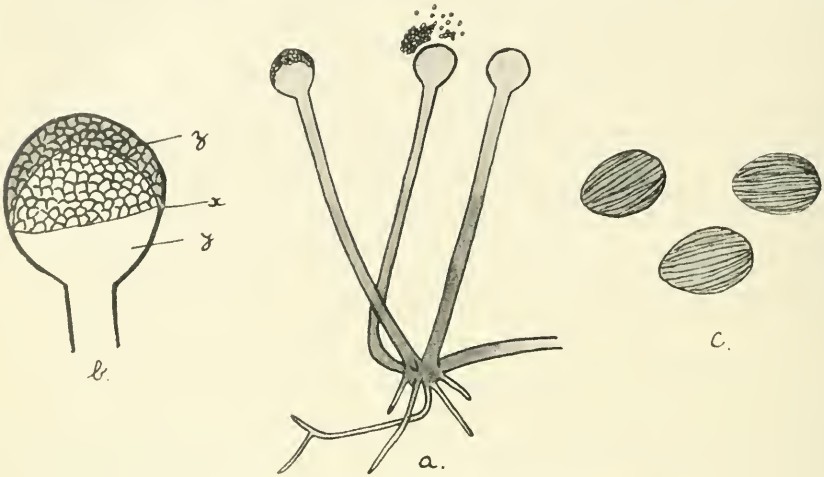


FIG. 1.

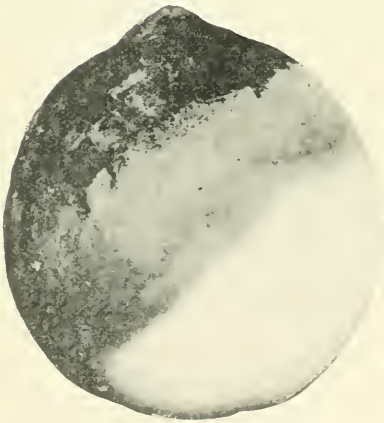


FIG. 2.

FIG. 3.

able. The insidious nature of the fungus and its rapid development are well instanced in this case, as there was nothing to make one

imagine that so many of the fruits would go to waste in the short time which elapsed between packing and inspection at the Docks, Capetown.

Rhizopus nigricans was also found together with blue mould, *Penicillium italicum*, one of the common moulds affecting oranges, in some of the plums and peaches which had been in store for some time, for exhibition at the Rosebank Show.

With regard to precautionary measures, great care should be exercised in the handling of the fruits; particular care should be taken to prevent injury to the fruit at the stalk end in picking. Fallen fruit should not be allowed to rot under the trees in the orchard, but if not utilizable should be collected and burned, as otherwise it becomes a serious source of infection. It is possible, too, that insects play an important rôle in the dissemination of the disease.

A nearly related species, *Rhizopus schizans*, Mas., has been recorded as being the cause of a split-stone in peaches in Australia, but this fungus has, up to the present, not been found here.

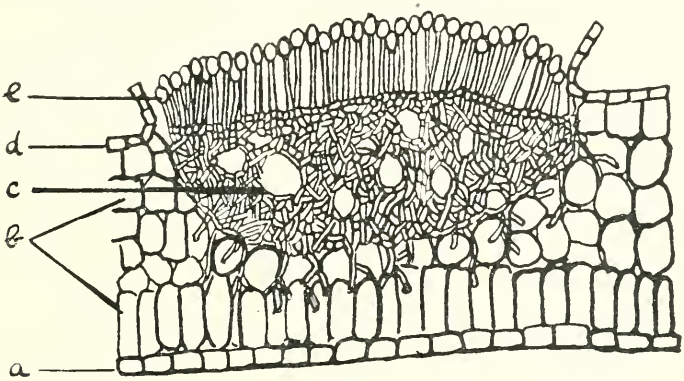


FIG. 4.

CHRYSANTHEMUM RUST.

This disease, which is caused by the parasitic fungus *Puccinia chrysanthemi* Roze, has been fairly common on chrysanthemums at Sea Point this season.

As I find many people either altogether fail to notice diseases in their plants, except when such diseases are so noticeable as to make non-detection impossible, or else are apt to ascribe well-known fungus diseases to the depredations of insects or to unsuitable soil conditions, I am including a photograph here (figure 3) of a chrysanthemum leaf attacked by this fungus. The disease makes itself evident in numerous small brown pustules on the leaves, chiefly on the under surface. On careful examination it will be seen that a brown powder is formed in these pustules; this consists of numerous minute spores which spread the disease. Figure 4 is a somewhat diagrammatic drawing of a section of a piece of chrysanthemum leaf passing through one of the pustules; in this figure, *a* is the upper epidermis of the leaf, *b* are the cells of the leaf tissue, *c* is a fairly compact mass of

parasitic fungus threads, some of which can be seen penetrating the leaf-cell walls, *d* is the lower epidermis which has been ruptured by the growth of the parasite, and *e* are the spores, each of which is borne on a fairly long stalk. (Magnification about 80 diameters.)

The disease can be checked in slightly affected plants by gathering and burning diseased leaves. Very badly attacked plants should be burned. Spraying healthy plants with bordeaux mixture would probably be of aid in preventing infection.

True Co-operation at Kopjes.

In the course of the very interesting and instructive 1920 report* of the Land Bank, the following instance of success following true co-operation among the settlers at Kopjes is given:—

"The dairy live stock society established amongst the settlers at Kopjes has proved probably the most interesting of any of the co-operative ventures financed by this bank.

"It was established during January, 1917, but did not commence active business until July of that year. Only fifteen selected settlers were admitted to membership, each of whom was supplied with five cows, whilst, in addition, two bulls were purchased; the cost to each member being £80.

"It must be borne in mind that the members were not strong financially (the security necessary to warrant an advance being made was forthcoming by Mr. J. W. Moor, M.L.A., and two or three others joining the society), so that it was necessary to arrange terms of repayment in such a way that the earnings of the cows themselves would be more than sufficient to cover the instalments. With this object in view, it was agreed that only 10 per cent. of the capital would be repayable during the first year, 15 per cent. during the second year, 20 per cent. during the third year, 25 per cent. during the fourth year, and 30 per cent. during the fifth year. Practice has shown that the members are able more easily to meet the heavier instalments with the advance of time than the comparatively small amount which was payable during the first year. The original 75 cows have increased to about 230.

"The Board desires to guard against the danger of creating the impression that the lot of the average poor settler will be materially improved by the simple method of putting him in possession of dairy live stock. That is not so, for the experience gained at Kopjes goes to show that it was the factor of true co-operation, the feeling of a real community of interest, and the rigid supervision exercised by members over their co-members that made the Kopjes society, which was regarded as a doubtful experiment, an unqualified success."

* "Report of the Land and Agricultural Bank of South Africa, for the year ended 31st December, 1920." (U.G. 9—'21.) Government Printer. Price 4s. 6d.

MAIZE IN ROTATION.

Notes on Co-operative Experiments in Natal supplied by W. H. HALL, Assistant Experimentalist, Cedara School of Agriculture.

DURING 1915 and 1916 co-operative experiments with maize in rotation were commenced on three farms in Natal, the experiments being designed and closely supervised by the School of Agriculture, Cedara. These experiments have not been concluded, and will be continued, it is hoped, for some time. It is thought, however, that the publication of a progress report, giving results to date, even though these results are not conclusive, would be both of interest and of value, inasmuch as they are distinctly suggestive of the value in the rotation of cowpeas in improving the yield of maize, compared with maize grown continuously, even though fertilized every year.

The series of experiments was started in 1915, on the farm of W. G. Stead, New Leeds, Thornville Junction, and in 1916 on the farms of D. Bester, Besters, and J. Mackillican, Matiwane. The following is the rotation—5 years: First year, maize; second year, maize; third year, teff; fourth year, silage (maize); fifth year, cowpeas for hay. In addition, the following four-year rotation is carried out on Mr. Stead's farm: First year, maize; second year, maize; third year, maize; fourth year, cowpeas—ploughed in.

Arrangement of the Experiment.—The plots are arranged side by side and each consists of an area of 1½ acres. At each end of the range is an area of 1½ acres used as a control plot, and planted with maize every year. A dressing of 250 lb. bone meal per acre is applied to all maize plots every year. The cowpea sections and teff sections are not fertilized.

The farmers are supplied with fertilizer, cowpea seed, and teff seed free, but supply their own maize for seed. They maintain the experimental area, and in return take the produce of all the plots. They prepare the land, plant, cultivate, and harvest under the supervision of the experimentalist from Cedara. The maize (grain) sections are harvested when ready. The maize silage section, teff section, and cowpea section are cut and weighed when deemed advisable in April. The silage and cowpea sections are taken at fresh weight and the teff (after curing) as hay. The roots of the cowpeas remain in the land and are ploughed in during the following season. In the case of the four-year rotation at New Leeds, the cowpeas are all ploughed in during the flowering stage (or early podding).

Particulars of the Farms.—W. S. Stead, New Leeds, Thornville Junction; soil, grey sandy loam; altitude, 3000 feet. D. R. Bester, Besters; soil, red loam with ironstone; altitude, 4000 feet. J. Mackillican, Matiwane; soil, heavy dark grey loam; altitude, 3591 feet.

Summary of Results: Five-year Rotation.—The following table shows the average yields of maize and also average increases over the average of the control plots for first and second years respectively after cowpeas on the three farms, with the five-year rotation:—

	Average of two Control Plots in each Experiment.	First Year after Cowpeas.		Second Year after Cowpeas.	
		Average of Plots.	Percentage Increase over Average Control Plots.	Average of Plots.	Percentage Increase over Average Control Plots.
	lb. per acre	lb. per acre	per cent.	lb. per acre	per cent.
New Leeds	(5) 1312·5	1978·2	50·7	1489·0	13.4
Besters	(4) 1362·5	1663·0	22·0	1307·5	4·0*
Matiwane	(4) 1328·1	1883·6	41·8	2021·0	52·2
Average of three farms	13 9·0	1876·0	41·15	1589·0	19·56

Figures in brackets indicate the number of years over which the average is taken.

Since these experiments have only been in progress some four or five years, no conclusions can yet be drawn. The results to date, however, are fairly consistent in indicating the value of cowpeas in increasing the yield of maize over maize grown continuously. In not one plot on the three farms in the five-year rotation is the yield of maize for the first or second year after cowpeas less than that in either of the control plots where the maize was grown continuously and manured every year. To those who are familiar with the deviations to which the yields of plots in agricultural experiment are subject, this result is striking. The averages of the plots of maize for first and second years after cowpeas, compared with the averages of the control plots in each experiment, as shown in the above table, are remarkably good, and indicate very forcibly the value of the cowpea in the rotation. For the first year after the cowpeas, the increase due to this crop on the three farms amounts to 41 per cent. over the yield of 1329 lb. per acre on the plots where the maize is grown continuously and manured every year. Now, 41 per cent. of 1329 lb. is 545 lb. or $2\frac{3}{4}$ bags per acre. At 12s. per bag this is worth 33s. per acre. For the second year after cowpeas, the average increase due to the cowpeas on the three farms amounts to 20 per cent. over the yield of 1329 lb. per acre on the control plots; 20 per cent. of 1329 lb. is 266 lb., and this at 12s. per bag is worth 16s. Thus the cowpeas have been worth 49s. per acre to the maize. The question now to be determined is whether the total cost of the cowpea crop was less or more than 49s. per acre, plus the value of the cowpea hay. The average yield of cowpea hay, calculating in the "green" weights, appears to have been from $2\frac{1}{2}$ to 3 tons per acre, and this should amply have repaid its cost of cultivation. It is therefore obvious that the introduction of cowpeas into a maize rotation is good, sound practice.

Summary of Results—Four-year Rotation.—The following table shows the average yields of maize and also average increases over

* Decrease.

the average of the control plots for first, second, and third years after cowpeas ploughed in on the four-year rotation—one farm only:—

Average of two Control Plots 5 years.	First Year after Cowpeas.		Second Year after Cowpeas.		Third Year after Cowpeas.	
	Average of Plots.	Percentage Increase over Average of Control Plots.	Average of Plots.	Percentage Increase over Average of Control Plots.	Average of Plots.	Percentage Increase over Average of Control Plots.
lb. per acre 1430	lb. per acre 1901	per cent. 32·9	lb. per acre 1546	per cent. 8·1	lb. per acre 1430	per cent. Nil.

In this rotation, which is being tried on one farm only, three crops of maize are grown successively, and are then followed by one crop of cowpeas ploughed in, the object being to test whether the beneficial effect of the cowpeas, when treated in this manner, would extend over three crops of maize. In the five-year rotation, the effect of the cowpeas grown for hay was very marked in the two succeeding crops of maize. In the four-year rotation, as shown above, the beneficial effect of the cowpeas ploughed in in the first two crops of maize succeeding it were distinct, though not quite so marked as in the five-year rotation, and in the third year after the cowpeas the yields were no better than in the plots on which the maize was grown continuously. The experiment, however, has only been in progress for five years, and only on one farm, and the results therefore are in no way conclusive. It may well be that the results in later years will show more markedly the beneficial effect of cowpeas ploughed in in augmenting the yield of maize.

Export of Grain, etc.

The exports of grain, etc. (in bags) for the month of April, 1921, were as follows: Maize, 610,359; maize meal, 56,903; hominy chop, 3625; oats, 14,607; rye, 5419; lucerne seed, 416; total, 691,329.

Total exports, in bags, for the period 1st July, 1920, to 30th April, 1921, were: Maize, 1,562,566; maize meal, 419,451; maize flour, 1199; maize grit (rice), 3111; hominy chop, 60,936; kaffir corn, 1715; oats, 31,085; beans, 1213; lucerne seed, 897; rye, 10,255; millet, 11; bran, 1500; total, 2,093,939 bags.

Stocks in hand at all ports at 30th April, 1921 (in bags): Maize, 286,725; maize meal, 12,120; oats, 870; hominy chop, 2; rye, 1162; kaffir corn, 166; total, 301,045.

Marking Sheep with Tar.

The Department is advised, through the Trade Commissioner in London, that the British Wool Federation complains of the great inconvenience and loss to certain sections of the wool trade caused by the marking of sheep with tar. This practice, it is stated by the Federation, has increased of late years, and as the matter is viewed seriously by the Department, farmers are urged not to mark their sheep with tar, a practice which depreciates the value of wool reaching the London market.

EXPORT OF SOUTH AFRICAN DRIED FRUIT.

The Regulations controlling the Trade.

REFERENCE was made in the April, 1921, number of the *Journal* to the conference held at Capetown early in March last (the result of a train of circumstances arising out of the Union's export trade in dried fruit, and more particularly in raisins), which lead to the unanimous verdict of all concerned in the welfare of the trade that the time had arrived when the export of dried fruit from the Union should be subject to control similar to that exercised in respect of fresh fruit. This decision was acted upon, and regulations, which we publish in full below, have been issued (Government Notice No. 715 of 1921), providing that no dried fruit shall be exported overseas unless it conforms with certain requirements as to quality, grading, packages, marks, etc., and operating from the 1st May, 1921.

Perusal of these regulations will show that they are clear and explicit, and explanation of the various clauses does not seem necessary. Much time and effort were expended in framing them, so that they should not be too cumbersome or hamper in any way the existing trade in dried fruit. They were drawn up originally by the Chief, Division of Horticulture, then fully discussed clause by clause at a conference representative of farmers and merchants directly concerned in the trade, and finally passed after careful deliberation by the following committee, viz., Messrs. Robt. Law, Wellington; C. L. Maltby, Wellington; P. B. van der Westhuizen, Worcester; A. L. Franceys, Manager, Rhodes Fruit Farms; H. Hamilton Barry, Robertson; and I. Tribolet, Chief, Division of Horticulture.

There are in this country, happily, many farmers and merchants whose methods are thorough and conducive to the fair fame of the Union's products; the goods they export are of a high standard and equal to the products of any country. For such the regulations will be welcome, for they are designed to protect and foster legitimate trade. That the regulations will prove irksome to others is certain, and to none more than the unscrupulous exporter who was wont to send parcels of inferior merchandise to the oversea market, hoping to benefit by the name established for the high-grade article sent forward by the conscientious shipper. These speculative shipments were fast undermining the reputation of South African dried fruit carefully built up by certain of our farmers and exporters. This was most noticeable in the case of raisins, at present constituting the bulk of our exported dried fruit; there were occasions when consignments of inferior quality raisins, stuffed in sacks piled one on top of the other in the ship's hold, were exported from the Union. The condition of such goods when opened on arrival in London for sale to perhaps the most critical buyers in the world can well be imagined. That they were sold at all was due solely to the stress of war and the shortage in food supply; to-day they would most probably be consigned to the incinerator as unfit for human consumption. But the mischief has been done, the memory of those consignments lingers,

and it is now the duty of the South African producer to provide a high standard article, and so establish for all time the reputation of the country's dried fruit. This has already been done in the case of fresh fruit and maize, commodities subject to control similar to that which has now been put in force for dried fruit. And it is confidently expected that the same gratifying results will follow.

Regulations are, of course, open to amendment, and those now published are subject to such change as experience may dictate. Therefore, in urging the farming community strictly to adhere to them, it may be stated that the Department is always open to suggestions for the improvement of the regulations and willing to give them full consideration with this end in view.

For the administration of the regulations, the services of a thoroughly competent dried fruit expert, acquainted with all the phases of fruit drying, have been secured. He will be stationed in some central place, to be decided upon, and during the lull in the export season will be available to give expert advice to all who produce or handle dried fruit in this country. In this connection the attention of fruit growers is directed to the bulletin* written by Mr. Tribolet, which gives practical advice on the correct methods of fruit drying and should be in the hands of all engaged in the industry or who contemplate doing so.

REGULATIONS FOR EXPORT OF DRIED FRUIT, UNDER THE AGRICULTURAL PRODUCE ACT, 1917 (ACT NO. 35 OF 1917).

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(1) Every person who intends to export dried fruit from the Union to a place outside the limits of the Union, by sea, shall give not less than seven days' notice to the Government Fruit Inspector at Capetown, and at such other place as the Minister of Agriculture may prescribe.

The notice shall be in the following form:—

Address.....

Date.....

I/We hereby give notice that I/we intend to export dried fruit through the port of....., commencing on or about the.....next. My/Our boxes or bags of dried fruit will bear the following distinctive mark, namely .....

Signature.....

(2) The name, address, and distinctive brand of the applicant shall be registered by the inspector, by whom the applicant shall be informed of such registration.

(3) For each consignment of fruit examined by the inspector the exporter shall pay at the rate of 5s. per 40 cubic feet (one ton measurement of shipping space) or part thereof.

(4) (*a*) The following fruits shall be packed in boxes: Dried pears, peaches, nectarines, apricots, mebos, prunes, apples (rings, pippins, squares, etc.), raisins, currants, figs, and any other fruits that may be successfully dried.

* "Fruit Drying" (L.S. No. 83), obtainable from this office: price 1d. prepaid.

(*b*) Nuts such as walnuts, almonds, etc., may be packed for shipping in double linen bags.

(5) The size of the boxes for dried fruit such as mentioned in section (4) shall be as follows:—

Net Weight of Fruit.	Size of Box.
(*a*) 56 lb. ...	... 20 inches × 11 inches, depth optional.
50 „ ...	... 20 „ × 11 „ „ „

Wood required:—

Tops and bottoms, 20 inches × 11 inches × $\frac{3}{8}$ inch.
Sides, 20 inches × depth optional × $\frac{3}{8}$ inch.
Ends, $10\frac{1}{4}$ „ × „ „ × $\frac{3}{4}$ „

(*b*) 28 lb. ...	... $15\frac{1}{2}$ inches × $9\frac{1}{2}$ inches, depth optional.
25 „ ...	... $15\frac{1}{2}$ „ × $9\frac{1}{2}$ „ „ „

Wood required:—

Tops and bottoms, $15\frac{1}{2}$ inches × $9\frac{1}{2}$ inches × $\frac{5}{16}$ inch.
Sides, $15\frac{1}{2}$ inches × depth optional × $\frac{5}{16}$ inch.
Ends, $8\frac{7}{8}$ „ × „ „ × $\frac{5}{8}$ „

(*c*) 10 lb.

Wood required:—

Tops and bottoms, $11\frac{1}{2}$ inches × $6\frac{3}{4}$ inches × $\frac{1}{4}$ inch.
Sides, $11\frac{1}{2}$ inches × $4\frac{1}{2}$ inches × $\frac{1}{4}$ inch.
Ends, $6\frac{1}{4}$ „ × $4\frac{1}{2}$ „ × $\frac{5}{8}$ „

(Depths can be optional for fruits other than raisins or currants.)

(*d*) 14 lb. For raisins and currants only.

Wood required:—

Tops and bottoms, $15\frac{1}{2}$ inches × $7\frac{1}{2}$ inches × $\frac{5}{16}$ inch.
Sides, $15\frac{1}{2}$ inches × $4\frac{3}{16}$ inches × $\frac{5}{16}$ inch.
Ends, $6\frac{7}{8}$ „ × $4\frac{3}{16}$ „ × $\frac{5}{8}$ „

(*e*) Tray for 12 lb. of stalk raisins packed in 1-lb. cartons.

Tops and bottoms, $20\frac{5}{8}$ inches × $9\frac{7}{8}$ inches × $\frac{5}{16}$ inch.
Sides, $20\frac{5}{8}$ inches × $2\frac{9}{10}$ inches × $\frac{5}{16}$ inch.
Ends, $9\frac{1}{4}$ „ × $2\frac{9}{10}$ „ × $\frac{5}{8}$ „

(This tray, with depth optional, may be adapted for packages of cartons of dried fruit other than loose raisins or currants.)

(6) Every box of dried fruit submitted for inspection shall be clearly branded on one end thereof, with

(*a*) the registered brand of the exporter (or his name or other means of identification);

(*b*) and of one side thereof the variety and the kind of dried fruit and the net weight, together with the words "S.A. Dried Fruit."

(7) Every box of fruit submitted for inspection must be consigned direct to the Dock Goods Superintendent, Capetown, or other officer appointed by the Minister of Agriculture by notice in the *Gazette* or to him through an agent, and bear on the other end of the box the shipping mark of the agent appointed by the exporter to dispose of his fruit overseas.

The shipping mark to be at least one inch in depth.

(8) The dried fruit in each box or tray of cartons shall be in sound condition, of uniform size and colour, and of one variety, and the receptacle shall be lined with tissue packing or some such suitable paper. First-grade fruit shall be faced at least on the top or lid of the box. The existing sizes of boxes in stock will be allowed for export during the season 1921-22.

(9) All dried fruit shall be delivered for inspection not less than 24 hours prior to loading on the vessel by which the exporter intends such fruit to be shipped.

(10) The following shall be the grades for the dried fruits mentioned:—

Varieties.		Grades (Sizes).
(*a*) Raisins (Loose)	1st Grade.	Any raisins not passing through a sieve of $\frac{5}{8}$-inch mesh.
"	2nd Grade.	Any raisins not passing through a sieve of $\frac{17}{32}$-inch mesh.
"	3rd Grade.	Any raisins not passing through a sieve of $\frac{7}{16}$-inch mesh.
"	4th Grade.	Any raisins passing through a sieve of $\frac{7}{16}$-inch mesh.
(*b*) Sultanas ...	1st Grade.	Any sultanas not passing through a sieve of $\frac{17}{32}$-inch mesh.
" ...	2nd Grade.	Any sultanas not passing through a sieve of $\frac{7}{16}$-inch mesh.
" ...	3rd Grade.	Any sultanas passing through a sieve of $\frac{7}{16}$-inch mesh.
(*c*) Prunes ...	1st Grade.	Any prunes not passing through a sieve of $1\frac{1}{16}$-inch mesh (about 40–60 to the lb.).
" ...	2nd Grade.	Any prunes not passing through a sieve of $\frac{7}{8}$ inch mesh (about 60–80 to the lb.).
" ...	3rd Grade.	Any prunes not passing through a sieve of $\frac{5}{8}$-inch mesh (about 80–120 to the lb.).
" ...	Low Grade.	Any which go more than 120 to the lb.
(*d*) Peaches ...	1st Grade.	Any peaches not passing through a sieve of $1\frac{5}{16}$-inch mesh.
" ...	2nd Grade.	Any peaches not passing through a sieve of $1\frac{3}{16}$-inch mesh.
" ...	3rd Grade.	Any peaches not passing through a sieve of $1\frac{1}{16}$-inch mesh.
" ...	4th Grade.	Any peaches not passing through a sieve of $\frac{15}{16}$-inch mesh.
" ...	Low Grade.	Smaller sizes than the above.
(*e*) Apricots ...	1st Grade.	Any apricots not passing through a sieve of $1\frac{1}{2}$-inch mesh.
"	2nd Grade.	Any apricots not passing through a sieve of $1\frac{1}{8}$-inch mesh.
"	3rd Grade.	Any apricots not passing through a sieve of 1-inch mesh.
"	Low Grade.	Smaller sizes than the above.

Varieties.		Grades (Sizes.)
(*f*) Pears ...	1st Grade.	Any pears 2 inches across.
,,	2nd Grade.	Any pears $1\frac{1}{2}$ inch across.
,,	3rd Grade.	Any pears $1\frac{3}{4}$,, ,,
,,	4th Grade.	Any pears $1\frac{1}{8}$,, ,,
,,	Low Grade.	Smaller sizes than the above.

(*g*) Walnuts, almonds, pecan nuts, or any other nuts which may be either soft shell or hard shell shall be divided into the two classes, (*a*) "soft shell" and (*b*) "hard shell," and the class shall be indicated on the exterior of the box or bag in which the fruit is shipped. The fruit shall be sorted to sizes.

It is recommended that these fruits be shipped in double-linen clean bags, and that the packages be not less than 56 lb.

(11) (*a*) Stalk or Cluster Raisins.—The fruit must be of uniform colour and size according to grade, and for a high-class pack must be free from blemishes, and must not contain any foreign matter.

(*b*) A first-class sample of the above shall have the skin supple but fairly tough, the flesh firm and slightly crisp, and the surface of the berries dry and without the slightest sign of stickiness.

(*c*) Raisins shall be made from the following varieties of grapes: Hanepoot, Waltham Cross, Rozaki, Sultana, Thompson's Seedless, and any other grape that may from time to time be added by the Minister of Agriculture to this list.

(12) Currants shall be made from the Zante currant and the ordinary Cape currant.

(13) The consignor shall, within *seven* days of the date of the inspector's notice (which notice shall be given forthwith) remove from the place of inspection any fruit which the inspector has refused to brand or which, having been referred to the Board of Reference, has been decided upon by the Board in favour of the inspector.

(14) Boxes of fruit branded so as to represent a grade higher than the correct grade shall be rebranded by the inspector, and, if otherwise complying with these regulations, branded or stamped by the inspector as provided in these regulations.

(15) In case any variety of fruit not specified in Regulation No. (4) be offered for inspection, it shall, if otherwise complying with the regulations, be branded by the inspector, at his discretion, and thereafter the inspector shall forthwith report the fact to the Secretary for Agriculture.

(16) Not less than two boxes of each consignment, but in no case less than 1 per cent. of the total consignment, shall be opened by the inspector for examination, and all boxes opened shall be stamped by the inspector to that effect.

(17) Only new and clean boxes or packages shall be used by exporters.

(18) The Board of Reference appointed by the Minister of Agriculture, to which an exporter may appeal if he is aggrieved by any decision of, or action taken by, the inspector, are:—In Capetown: Messrs. Maynard Nash, A. A. Persse, and E. F. Bird.

[*Note.*—The charge of 5s. stated in paragraph (3) above is to be raised to 10s.—*Editor.*]

WEEDS OF SOUTH AFRICA.

By K. A. LANSDELL, Botanical Assistant, Division of Botany, Pretoria.

[Like other countries, South Africa is awaking to the importance of suppressing its noxious weeds which, owing to the alarming rapidity of their spread in recent years, are becoming increasingly dangerous to our pasturage and wool and other agricultural pursuits. While much has been done in the past to place the farmer in a position to recognize and cope with the danger, the problem grows in seriousness, and the time has arrived when all information regarding the noxious weeds found in the Union should be gathered into one publication for the use of the farmer, the student, and the general public. This work has now been undertaken by the Division of Botany, the opening contribution, continued hereunder, appearing in our April, 1921, number. This publication, which will include an illustrated glossary on the morphology of weeds, is the first of its kind in South Africa, and will appear in serial form in the *Journal*.—EDITOR.]

II.

LEAVES.

THE *leaves* are borne on the stems at the nodes. They are organs of respiration, transpiration, and assimilation, i.e. it is through the leaves that the plants breathes, gives off water-vapour, and in which the carbon dioxide of the atmosphere is elaborated into complex compounds.

A *typical leaf* is composed of a flattened *blade* or *lamina*, and a *petiole* or *leaf stalk*, which attaches the leaf to the stem. In many leaves *stipules* are present which are appendages on each side of the leaf insertion. (See fig. 12.)

The leaves may be arranged on the stem in the following manner:—

Opposite, when two leaves arise at the same node on opposite sides of the stem, e.g. the Upright Star-bur (*Acanthospermum hispidum*), etc. (See fig. 13.)

Alternate, when the leaves are scattered on the stem, e.g. the Malta Thistle (*Centaurea melitensis*), etc. (See fig. 14.)

Sessile, when the leaves have no leaf-stalk as young leaves of the Upright Starbur (*Acanthospermum hispidum*). (See fig. 13.)

Petiolate, when the leaves are attached to the stem by a leaf-stalk called the petiole, e.g. the Pig Weed (*Amaranthus paniculatus*), the Burweed (*Xanthium spinosum*), etc. (See fig. 15.)

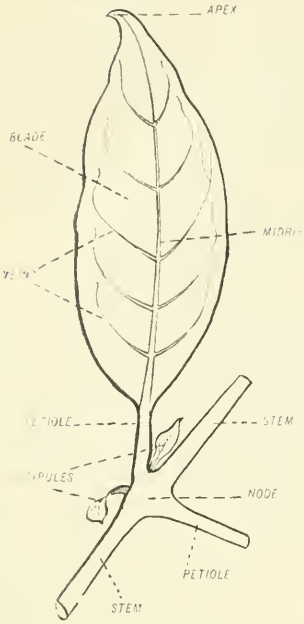


FIG. 12.—Typical leaf.

FIG. 13.—Opposite.
The Upright Star-bur (*Acanthospermum hispidum*).

FIG. 14.—Alternate.
The Malta Thistle (*Centaurea melitensis*).

FIG. 15.—Petiolate.
The Pig Weed (*Amaranthus paniculatus*).

FIG. 16.—Simple Leaf.
The "White Epecachuana"
(*Richardsonia scabra*).

FIG. 17.—Compound Leaf.
The Mexican Marigold
(*Tagetes minuta*).

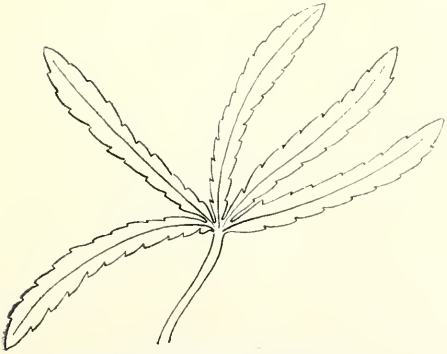


FIG. 18.—Palmately compound.
"Dagga" (*Cannabis sativa*).

FIG. 19.—Trifoliate.
Melilot (*Melilotus parviflora*).

FIG. 20.—Linear.
"The False Horse-Weed" (*Erigeron bonariensis*).

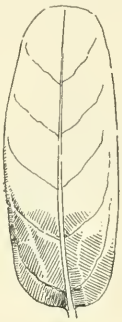


FIG. 21.—Oblong.

FIG. 22.—Lanceolate.
Rib Grass (*Plantago lanceolata*).

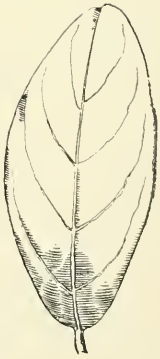


FIG. 23.—Elliptic.

Leaves are divided into *simple* and *compound* leaves.

The *simple* leaf is one whose margins are entire or in which the incisions do not reach down to the mid-rib, e.g. the White Epecacuanna (*Richardsonia scabra*), etc. (See fig. 16.)

In a *compound* leaf the leaf-blade is cut down to the mid-rib to form leaflets, e.g. the Black Jack (*Bidens pilosa*), the Mexican Marigold (*Tagetes minuta*), etc. (See fig. 17.)

The various types of *compound leaves* are as follows:—

Pinnate, when the lobes are arranged in a single row on either side of the rachis, e.g. the Mexican Marigold (*Tagetes minuta*). (See fig. 17.)

Palmately compound leaf is one in which the leaflets arise at one point at the apex of the petiole, and spread out in a fan-like manner, e.g. Dagga (*Cannabis sativa*). (See fig. 18.)

Trifoliate, when the leaf has three leaflets, e.g. Melilot (*Melilotus parviflora*), etc. (See fig. 19.)

Simple leaves or the leaflets of compound leaves may be of various shapes:—

Linear, when the leaf is about six times longer than broad, e.g. the upper leaves of the False Horse Weed (*Erigeron bonariensis*), etc. (See fig. 20.)

Oblong, when the leaf is two-three times longer than broad. (See fig. 21.)

Lanceolate, when the leaves are narrow and taper at each end, e.g. the Ribgrass (*Plantago lanceolata*). (See fig. 22.)

Elliptic, when the leaves are shaped like an ellipse. (See fig. 23.)

Ovate, when the leaf is broader at the base than at apex, e.g. the Common Chick Weed (*Stellaria media*). (See fig. 24.)

Obovate is opposite to ovate, when the apex is broader than the base. (See fig. 25.)

Spathulate, when the leaf is shaped like a spoon; the apex is rounded. (See fig. 26.)

Palmate, when the leaf is lobed or divided so that the sinuses point to the apex of the petiole, e.g. the Mallow (*Malva rotundifolia*), the Castor Oil (*Ricinus communis*), etc. (See fig. 27.)

Leaves are differently shaped at the apex, the base, and the margins are often lobed as follows:—

Acute, when the leaf ends in a sharp point. (See fig. 28.)

Obtuse, when the apex is blunt, e.g. Hare's Ear Mustard (*Coringia orientale*, L.). (See fig. 29.)

Truncate, when the apex of the leaf is square. (See fig. 30.)

Acuminate, the apex of the leaf is prolonged into a tapering point. (See fig. 31.)

Aristate, when the apex is tipped with a bristle-like point. (See fig. 32.)

Mucronate, when the apex of the leaf is tipped with a small or short point. (See fig. 33.)

Cordate, when the leaf is heart-shaped. (See fig. 34.)

Cuneate, when the leaf is wedge-shaped at the base, e.g. Purslane (*Portulaca oleracea*). (See fig. 35.)

FIG. 24.—Ovate.
The Common Chick-Weed (*Stellaria media*).

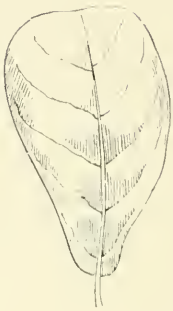


FIG. 25.—Obovate.

FIG. 26.—Spathulate.
Seedling of False Flax
(*Camelina sativa*).

FIG. 27.—Palmate.
The Mallow
(*Malva rotundifolia*).

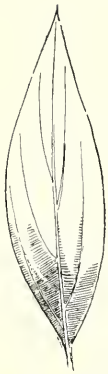


FIG. 28.—Acute.

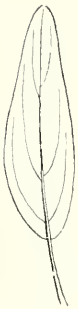


FIG. 29.—Obtuse.

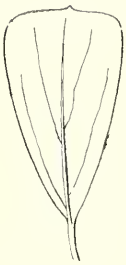


FIG. 30.—Truncate.

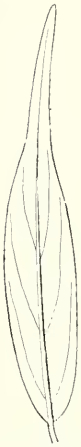


FIG. 31.—Acuminate.

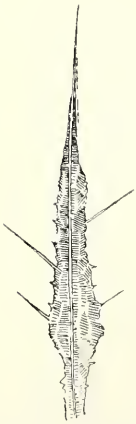


FIG. 32.—Aristate.

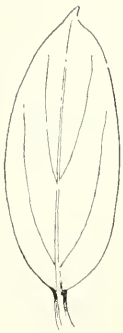


FIG. 33.—Mucronate.

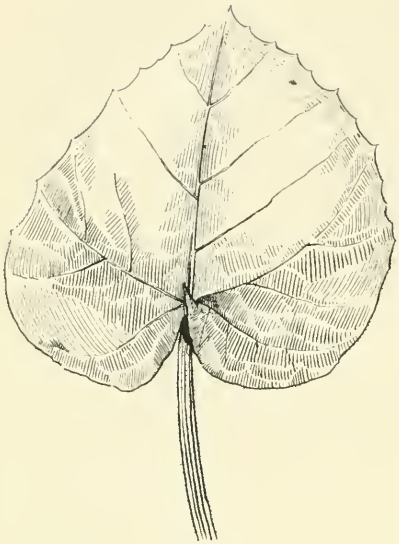


FIG. 34. Cordate.
The Devil's Claw (*Martynia lutea*).

FIG. 35.—Cuneate.
Purslane (*Portulaca oleracea*).

FIG. 36.—Retuse.

FIG. 37.—Auriculate.
Hare's Ear Mustard (*Coringia orientalis*).

FIG. 38.—Hastate.
Sheep's Sorrel (*Rumex acetosella*).

FIG. 39.—Sagittate.
Wild Lettuce (*Lactuca capensis*).

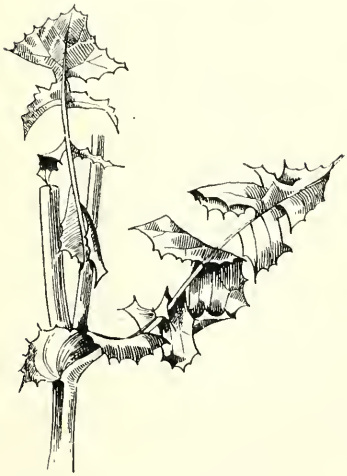


FIG. 40.—Amplexicaul.
Sow Thistle (*Sonchus oleraceus*).

FIG. 41.—Entire Leaf.
The Khaki Leaf (*Alternanthera achyrantha*).

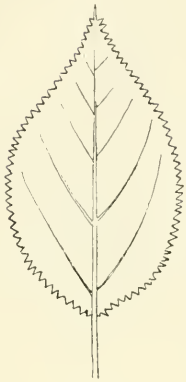


FIG. 42.—Dentate.

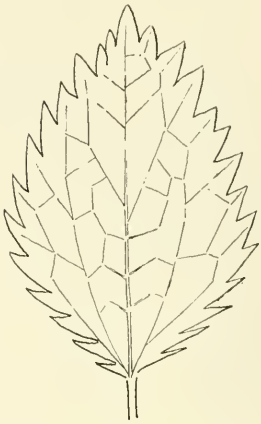


FIG. 43.—Serrate.

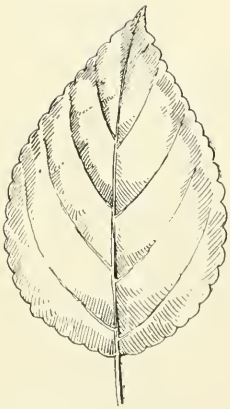


FIG. 44.—Crenate.

FIG. 45.—Repand.

Retuse, when the apex of the leaf is notched. (See fig. 36.)

Auriculate, when the leaf has a pair of small blunt projections at the base, e.g. Hare's Ear Mustard (*Coringia orientale*). (See fig. 37.)

Hastate, similar to auriculate, but the lobes pointing outwards, e.g. Sheep's Sorrel (*Rumex acetosela*). (See fig. 38.)

Sagittate, prolonged at the base into two acute straight lobes, e.g. Wild Lettuce (*Lactuca capensis*). (See fig. 39.)

Amplexicaul, when the leaf-base partially clasps the stem. (See fig. 40.)

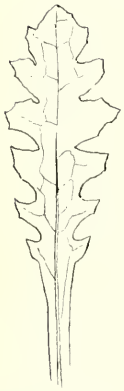


FIG. 46.—Pinnatisect.

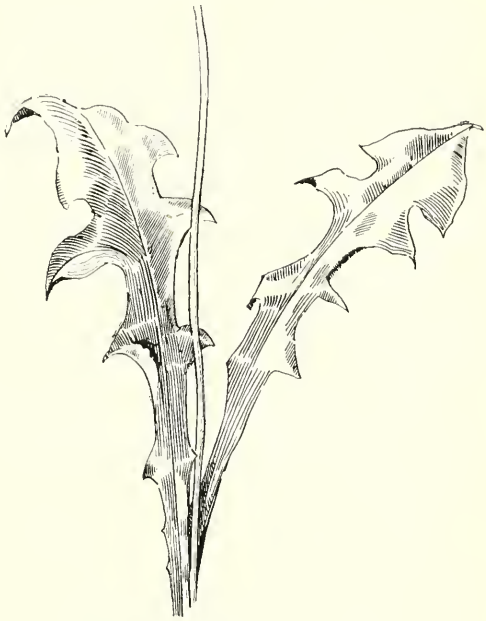


FIG. 47.—Lyrate.

THE LEAF MARGIN.

Entire leaf, is one without any incisions on the margin, e.g. the Khaki Weed (*Alternanthera achyrantha*). (See fig. 41.)

Dentate, when the margin is sharply toothed, and with the teeth at right angles to the blade. (See fig. 42.)

Serrate, when the margin is sharply toothed, but the teeth projects upwards. (See fig. 43.)

Crenate, when the margin has rounded teeth. (See fig. 44.)

Repand, when the margin of the leaf forms a wavy line. (See fig. 45.)

Pinnatisect, when the leaf is cut almost, but not quite to the mid-rib. (See fig. 46.)

Lyrate leaf is cut into lobes, but with the terminal lobe, large and rounded. (See fig. 47.)

LOSS OF WATER-SOLUBLE PHOSPHATE IN CERTAIN FERTILIZER MIXTURES.

Note from the Chemical Laboratory, Elsenburg School of Agriculture, Mulders Vlei, Cape.

It is commonly held that superphosphate should not be mixed with any fertilizer containing lime, e.g. basic slag, bone-dust, etc., because on keeping the mixture for some time an appreciable decrease in the percentage of water-soluble phosphate occurs. This decrease is what is technically termed "reversion of the soluble phosphate," and it implies that a chemical change has taken place resulting in the conversion of the soluble monocalcium phosphate ($CaH_4P_2O_8$) into the less soluble dicalcium phosphate ($Ca_2H_2P_2O_8$).

As a mixture of superphosphate and bone-meal is of great value on many grain farms, a series of analyses was undertaken with a view to determining the rate and amount of deterioration that takes place in the water-soluble phosphate in certain fertilizer mixtures.

The following fertilizers were used in the preparation of the mixtures: (1) High-grade superphosphate; (2) bone-meal; (3) Government guano.

The percentage of citric-soluble and water-soluble phosphate was determined in each of the above before the mixtures were made. Throughout the experiment the mixtures were kept under dry storage conditions in the laboratory; periodic moisture determinations were made in each of them, and the moisture content was found never to exceed 5 per cent.

Farmers who prepare such mixtures should not lose sight of the importance of keeping them under normal storage conditions, as the access of too much moisture would undoubtedly hasten the rate and amount of loss of water-soluble phosphate.

Three mixtures of bone-meal and superphosphate were prepared in the proportions of 1:2, 1:1, and 2:1 respectively, and two mixtures of superphosphate, bone-meal, and Government guano in the proportions of 1:1:1 and 1:1:½. An analysis of the citric and water-soluble phosphate was made in each mixture immediately after its preparation, and these analyses were continued at intervals of seven days for a period of six weeks.

From the results given on the following table it would seem that the loss of water solubility in the phosphate is not very serious, more especially if one takes into account the comparative availability of the resulting precipitated phosphate and the advantage here of the application of a mixture with lime to soils over the application of a purely acid manure,

TABULATION OF RESULTS.

	Citric Sol. P_2O_5.	Water Sol. P_2O_5.
Superphosphate	17·06 per cent.	16·62 per cent.
Bone-meal	15·7 "	—
Government Guano	10·01 "	4·35 "

	Fertilizer.	Proportions in which Ingredients were mixed.	Analyses made immediately after Preparing Mixtures.	Change in Water Soluble Phosphate.					
				At end of 1st Week.	At end of 2nd Week.	At end of 3rd Week.	At end of 4th Week.	At end of 6th Week.	Total Change.
			Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Mixture No. 1 ...	Bone-meal Superphosphate	1 : 2	11·256 W.S. 16·83 C.S.	11·18	10·9	10·85	10·89	10·84	0·42
Mixture No. 2 ...	Bone-meal Superphosphate	1 : 1	8·63 W.S. 16·78 C.S.	7·72	7·66	7·60	7·59	7·54	1·09
Mixture No. 3 ...	Bone-meal Superphosphate	2 : 1	5·83 W.S. 16·32 C.S.	5·59	5·25	5·23	5·24	5·13	0·7
Mixture No. 4 ...	Bone-meal Superphosphate Government Guano	1 : 1 : 1	6·72 W.S. 14·30 C.S.	5·91	5·80	5·76	5·75	5·75	0·97
Mixture No. 5 ...	Bone-meal Superphosphate Government Guano	1 : 1 : ½	6·86 W.S. 12·75 C.S.	6·33	6·12	6·10	5·85	5·84	1·02

THE "FIJI DISEASE" OF SUGAR-CANE.

Advance Report on One of the Most Serious Cane Diseases.

THE name "Fiji disease" has been applied to this serious malady because it was first reported from the island of Fiji. Further study of the disease will doubtless lead to a better and more appropriate name.

The disease has been known in Fiji since 1905 at least. Although observed by many people, it has not been thoroughly investigated, and the only published accounts that we have thus far been able to find, by men who have studied the disease first-hand, are those of H. L. Lyon and F. Muir, both of the Hawaiian Sugar Planters' Experiment Station. Their articles are published in the *Hawaiian Planters' Record*, a journal that is not widely distributed. An account has also been given recently by Otto A. Reinking (Diseases of Sugar-cane in the Philippines—Fiji Disease, *Sugar News*, 1, 17th-19th November, 1920), who used the published matter of Lyon as a basis for his note.

This disease occurs in the Fiji Islands, New Guinea, New South Wales, and has just been discovered in the island of Mindoro, of the Philippine Islands. It was found in Fiji by F. Muir in the early part of 1910, and reported on by him (*Ha. Pl. Rec.*, 3, 197, 1910). It was also reported on from Fiji by H. L. Lyon (*Ha. Pl. Rec.*, 4, 230-232, 1911), who made a special study of the disease as it occurred in that locality. The disease was reported on from New Guinea by Mr. S. S. North, of the Colonial Sugar Refinery Co., of Australia, who wrote to Lyon that one of the sugar company's men had found the disease to be very prevalent in parts of New Guinea (Lyon, H. L., Fiji Disease in New Guinea, *Ha. Pl. Rec.*, 12, 200, 1915) on native cane. In view of this discovery, Lyon expressed the opinion that the original home of the disease was very likely New Guinea, from which place it had spread to Fiji and Australia.

The occurrence of the disease in Australia is indicated by Lyon (*Ha. Pl. Rec.*, 2, 200, 1915) and has been reported by D. S. North as appearing on experimental plots of New Guinea cane, and by H. A. Haywood (*Agr. Gaz.*, N.S.W., Nov., 1920, pp. 773-780), who states that it is now a problem with which growers will have to contend.

The presence of the Fiji disease in Mindoro, Philippine Islands, has been suspected for the last three years. W. H. Weston, of the United States Department of Agriculture, in 1919-20 learned of this suspicion from C. W. Hines, of the Bureau of Agriculture at Manila, and a published note of the possible occurrence of the Fiji disease in Mindoro has appeared in the report of the Pest Control Section of the Bureau of Agriculture (*Phil. Agr. Rev.*, 12, 93, 1919). During the Christmas vacation (1920-21) Prof. Otto A. Reinking, of the College of Agriculture at Los Banos, went to Mindoro and found the Fiji disease there doing great damage. According to one of the

planters, it was present on the island as early as 1916. Prof. H. A. Lee, of the Bureau of Agriculture at Manila, reports that Mr. Medalla, his assistant, also visited the island and returned with specimens of the Fiji disease. Letters from both Reinking and Lee, telling of the discovery, reached Washington at the same time. These are the first authentic reports by pathologists of the presence of the Fiji disease in the Philippines. Just how widely the disease occurs in the Philippines will have to be determined, but it probably does not occur in Negros, the most important cane-producing island.

IMPORTANCE OF THE DISEASE.

Regarding the seriousness of this trouble, F. Muir (*Ha. Pl. Rec.*, 3, 197, 1910) writes as follows: "The worst disease in the Fijian cane fields is one known as Fiji disease. . . . This disease has spread over the whole island, but is worst on the northern side, especially on rich soils. This disease is strongly hereditary; when the stool looks perfectly healthy and the galls are seen only on one stalk and in very small numbers, every stalk from the root will produce diseased cane if used as 'seed'." Again H. L. Lyon (A New Cane Disease now Epidemic in Fiji, *Ha. Pl. Rec.*, 3, 205, 1910) writes: "It is certain that the Fiji disease is one of the most serious diseases yet recorded on sugar-cane."

The report of the Experiment Station Committee of the Hawaiian Sugar Planters' Association, 14th October, 1911 (*Ha. Pl. Rec.*, 5, 323, 1911), says: "Dr. Lyon's researches say that the so-called Fiji disease is the most to be dreaded of all known maladies of the sugar-cane." In Mr. Reinking's letter he says: "The disease is one of the most destructive plant diseases that I have ever observed in the Philippine Islands." In view of the above quotations and also from other reports on the importance of this disease, it seems that this is one of the most serious of sugar-cane diseases and one to be feared in sugar areas where the disease does not now occur.

SYMPTOMS.

Mr. F. Muir (*l.c.*) states that the most constant symptom of the disease as pointed out to him by Mr. North, of the Sugar Refinery Co., is the presence of small galls on the undersides of the leaves and in the softer tissues of the cane tops, sometimes extending a long way down the stalk. A more noticeable character is the dying of the tops and the growth of lateral branches, the tops of which also sometimes die, and in turn give off lateral growths.

H. L. Lyon (*Ha. Pl. Rec.*, 4, 300, 1911) describes the disease as follows: "The most conspicuous symptom of Fiji disease to be noted in the fields is the shortening and crumpling of the last leaves to unfold from the spindle. This peculiarity will attract the attention when one is still a considerable distance from the affected cane. The shoot may have attained considerable length and be clothed with many healthy-looking leaves of the usual length and colour, but all of a sudden it loses the power to produce normal leaves, throws out a few bent and twisted stems and then ceases to grow altogether. Some of the eyes may start, but the resulting 'lalas' soon repeat the antics of the main stem. The stalk may also remain alive for months or it may die soon." He also mentioned the characteristic galls usually

to be found on most of the healthy-looking leaves and on all of the deformed and blighted ones. The appearance of these galls is the first outward symptoms by which the disease may be detected, but the cane may be infected for months before any gall appears. In other words, the galls mark a well-advanced stage of the disease. According to Lyon's photographs affected plants are very much stunted and dwarfed and die early.

CAUSE.

The Fiji disease is apparently caused by a myxomycete, somewhat similar to *Plasmodiophora brassicae*, the cause of the club-root of cabbage. A study of the etiology of the disease was made by H. L. Lyon and a preliminary report given out by him (*Ha. Pl. Rec.*, 3, 200-205, 1910). Lyon found what appeared to be the plasmodium of an organism in the cells of the leaf galls, but apparently has not proved the pathogenicity of such organism.

He thinks that the swarm spores may gain entrance to the cane tissue by penetrating the roots and then following up the vascular bundles to the leaves. He also thinks that the organism can live over in the soil for a considerable length of time, as does the organism of the club-root of cabbage. Plants grown from cuttings taken from diseased cane are sure to be infected. The organism is also readily carried from field to field by the transfer of bits of trash.

VARIETAL SUSCEPTIBILITY.

According to Lyon and Muir, the disease shows marked differences in varietal susceptibility in Fiji and New Guinea. On account of this fact and because of the danger of the appearance of the disease in Hawaii, the Hawaiian Sugar Planters' Experiment Station sent a large number of cuttings of various Hawaiian varieties to Fiji to be propagated there and to ascertain their relative resistance to the Fiji disease. (R. J. Haskell, Plant Disease Survey, Washington, D.C., 1st March, 1921).

Bon Chretien Pears: Breakdown in Export.

The later shipments of Bon Chretien pears during the past season have arrived in London in a very wasty condition, and the Chief, Division of Horticulture, is of opinion that there are probably three main factors operating in causing the consistent breakdown of these pears, viz., (*a*) too high a temperature, (*b*) moisture-content through abnormal rains, and (*c*) over-ripeness.

It is intended to carry out some definite temperature experiments next season both at the Capetown docks and on board ship, with a view to verifying the precise cause of the trouble, and if possible preventing its recurrence.

ARSENICAL POISONING OF STOCK.

By JAS. L. WEBB, F.R.C.V.S., Government Veterinary Officer, Ixopo, Natal.

THE dipping of stock in arsenical solutions for the eradication of ticks has brought in its train a danger which, from my experience, has proved very real, namely, the occasional loss of farm stock from arsenical poison. This loss in many cases could be avoided, and it is principally for the purpose of drawing the attention of farmers to the risks they run through insufficient attention to small details when handling arsenical mixtures that this article has been prepared.

The most common accidents which lead to fatal results from arsenical poisoning are often to a great extent due to carelessness; they may be classified as follows:—

(1) Dipping solution made too strong.—By the aid of the isometer this need never occur, and the standard strength can always be correctly maintained; but fatal results sometimes happen with the standard strength mixture for a five or seven days' dip, in this way: A fresh batch of cattle, not previously dipped, is brought on to a farm, and it will be found after the first or second dipping that some are scalded. If this is not noted and the cattle are again put through the tank, the arsenic is very likely to become absorbed through the broken skin and the animals so become poisoned. It is necessary to use some discretion when dealing with cattle which have not been accustomed to the dip. For the first half a dozen times dip in three-quarter strength, or, if the tank is already filled with standard strength solution, dip once every ten to fourteen days during the first month to six weeks. If the farm on which dipping operations are to be commenced is infected with East Coast fever it is probably better for a time to use the three-day dip, as this strength dip can be used continuously without injurious effect. The teats and udders of cows just before and for some time after calving appear to be particularly susceptible to scalding with dip, especially the sides of the udders where they rub against the legs when walking; this can be avoided by smearing the teats and udders with lard or vaseline before dipping.

(2) Dipping on misty or wet days, or through such weather coming on after animals have been dipped.—Here, again, some discretion is necessary. Do not put animals through the tank if the weather is damp just because it happens to be your regular dipping day; and always dip early in the day so that the stock may get thoroughly dry before the storms come on. Arsenical poisoning from absorption cannot always be avoided, for instance, when the weather turns misty or wet and remains so for several days after dipping. Such weather is a source of anxiety to farmers in the mist belt who dip regularly. Fatalities often result under these conditions, and it is quite common for cattle thus exposed to show distress, high

temperature, stiff gait, and, after a few days, a rough scurfy condition of the skin along the back and over the loins, showing that the continuous action of the dip has scalded the skin. Cattle with these lesions should not be dipped again until the skin has healed. There are two factors which help to produce this action of arsenic during damp weather: one is dirty dip and the other long coats, and when both are combined the action is still more severe. The time of year when this usually happens is early spring, before the winter coats are shed. It is a common sight to see cattle, when dry again after passing through a dirty tank, plastered with filth, and when the hair is long much more is retained. Tanks should be kept as clean as possible, and hair and other floating material skimmed off the dip; it is a good plan to use a tank dredger. With valuable cattle it is advisable to brush off with a dandy-brush any dirt which has settled on the back.

(3) Working during the heat of the day oxen which are being regularly dipped in full strength solution every five or seven days, and continuing to work them after they show signs of distress.—The only remedy for this, if it is essential that the working oxen should be dipped as regularly as other cattle on the farm, is to work them as much as possible during the cooler parts of the day and to outspan as soon as they become distressed. Unfortunately, native drivers are often not sufficiently careful in this respect, with the result that it has become no uncommon thing to hear of an ox dropping dead in the yoke, probably from heat apoplexy, undoubtedly aggravated by the action of arsenic on the skin, which appears to interfere with the normal cutaneous respiration.

Other cattle, especially fat cows, also become distressed during very hot weather, and are anxious to obtain shelter from the sun, and such shelter should, where possible, be provided.

(4) Leaving dipping solutions exposed to the access of stock.—This is by far the most frequent source whereby stock become poisoned with arsenic. I have in numerous instances been called to investigate what have been looked upon as mysterious deaths amongst stock, particularly cattle, and almost invariably the owner, when told the post-mortem appearances were those of arsenical poisoning, assured me it was quite impossible for the animals to have got at any arsenic; but when I have visited the tank the source from which the arsenic has been obtained is obvious. Probably the concrete sump outside the draining-pen is full of dip, or rain-water which has washed the floor of the draining-pen and mixed with the dip. This could not very well be completely removed from the sump, and, being left open, was of free access to stock. Some stockowners, too, are very careless in the disposal of the dip and refuse when cleaning out their tanks. I have found it thrown just alongside the tank, where cattle could lick it, and where rain-water could wash over it and form pools on the lower side, which would be full of arsenic, whilst nothing is done to prevent stock getting to this material. Sometimes the draining-pens are not properly drained, with the result that they have pools of rain-water, saturated with arsenic, which cattle are quite likely to drink. Some tanks have no sides to them, consequently the splash, during dipping operations, saturates the ground outside the tank. I have also known cattle actually to walk down the race and drink the dip.

To prevent such accidents as indicated, concrete sumps should be fitted with heavy lids; suitable draining arrangements from the drying-kraals should be made; and, when the tank is emptied, the dip and refuse should be thrown into a deep hole prepared alongside the tank. It is advisable to surround the whole tank and kraals with a fence.

(5) Drinking dip during the process of dipping.—This occasionally happens, especially when large and small cattle are run together through the tank. A large beast will sometimes jump on to a smaller animal when entering the tank and keep it immersed longer than it otherwise would be, with the result that the fluid may enter the mouth or nostrils, and be swallowed; but if not actually swallowed the dip is likely to irritate the delicate membrane lining the nostrils and induce a stinking discharge and necrosis of the membrane. I saw a case of the latter in a horse which had turned a somersault in the tank, and also in a yearling heifer which had remained too long under the dip. Occasionally a beast will, probably through being thirsty, take a drink from the tank before entering same. I have known this to happen with two valuable imported animals, a bull and a cow, and the former died.

It is advisable not to dip large and small cattle together, and also not to allow the animals to follow each other too quickly through the tank. Never allow stock to go to the tank thirsty.

(6) Too frequent dipping or spraying.—Cattle are sometimes poisoned by standard strength dips applied at too frequent intervals. This is usually brought about by over-anxiousness on the part of the owner. Two instances have come under my notice. In the one a farmer had moved some cattle on to his farm for restocking purposes; one died, but not from East Coast fever. The manager became alarmed and put the remainder through what was supposed to be a seven-day strength dip, five times in nineteen days. Fortunately, the dip was considerably below the proper strength, otherwise the losses would have been heavier. In the other case a native removed seven cattle from an infected to a clean paddock, sprayed them four times within seven days; two died, and the remainder were badly scalded.

Heavy losses occasionally occur either through ignorance of the severe corrosive action of arsenic in concentrated form or as the result of a pure accident. I remember one farmer who lost a number of cattle through applying one of the proprietary arsenical paste dips neat, under the tail and to ears, as a hand-dressing mixture; and at a tank on a public commonage, the hand-dressing mixture having run out, a native was sent to obtain some more, and instead of bringing tick grease brought a tin of arsenical paste dip; this was applied with disastrous results.

(7) Malicious poisoning of cattle with arsenic.—Malicious poisoning can hardly be brought under the heading of an accident, but since arsenic has been brought into common use, cases of malicious poisoning have increased to an alarming extent, and not only have cattle been the victims, but human beings as well. Indian or native servants are usually the culprits. I can recall three instances which have come to my knowledge. An Indian servant poisoned three horses by administering arsenite of soda in crushed mealies, and sixteen oxen by mixing the poison with salt and placing this on the ground for them to lick. A native placed some arsenite of soda in a horn

and stuffed the end with grass; this he threw into a spring of water near a kaffir kraal, possibly to try its effect on the inmates, but some cattle came along and had a drink and died very soon afterwards. The natives cleaned out the spring and found the horn. The mud removed from the sides and bottom of the spring was thrown on the side, and more cattle licked it with fatal results. A native mixed arsenite of soda with lobola-cake mash which he knew was to be fed to a herd of seventeen valuable pedigree Frieslands, and fourteen died; these cattle were worth probably £8000.

Farmers cannot be too careful in seeing that their arsenic is kept under lock and key, but unfortunately under existing conditions this is not sufficient to prevent natives obtaining arsenic; they have no difficulty in obtaining same from stores for dipping purposes. Something should be done to stop this, and I think the best suggestion is to prohibit the sale of arsenite of soda in powder form; if it were liquefied and given a decided odour and unpleasant taste, malicious poisoning would become a much more difficult proposition.

Farmers who use an arsenite of soda solution as a dip might with advantage add some soluble tar dip in the proportion of 1 to 1000. This is beneficial for several reasons: it would prevent the dip being used for malicious purposes; it keeps the dip from becoming foul; the odour would possibly keep ticks off longer; it will kill lice, which arsenite of soda will not; and it increases the wetting power of the solution.

SYMPTOMS OF ARSENICAL POISONING.

These will depend somewhat on the method by which the arsenic gains access to the system. The usual way is either through the mouth or by absorption through the skin.

When arsenic is swallowed the severity of the symptoms will depend on the amount taken and the susceptibility of the animal. Very often death occurs with alarming suddenness, no preliminary symptoms having been noticed. The animal is found dead, usually with evidence that scouring had occurred before death; in other cases death may not take place for three or four days, or even longer, and, of course, some animals will recover. The symptoms are those associated with abdominal pain, viz., in the horse, colic; in cattle, disinclination to move, lying down most of the time, often with the head turned back towards the shoulder; when made to rise the animal is uneasy, kicks towards the belly with the hind legs, and soon lies down again. There is loss of appetite and suspension of rumination; the membrane lining the mouth, nostrils, and eyelids is bright red in colour; scouring is a marked feature, and the scour has a particularly strong, disagreeable odour. In my experience the temperature remains normal, or very little above, when the poison is taken through the mouth, but there is a considerable rise of temperature when the arsenic is absorbed through the skin.

POST-MORTEM APPEARANCES.

The post-mortem appearances are: Evidence that the animal has been scouring, acute inflammation of the membrane lining the stomachs and intestines—this is particularly noticeable in the fourth stomach, small intestines, and in the coecum (blind gut)—the lining membrane will be found to be of a deep red or port wine colour, and

almost invariably ulcerated. Farmers often look upon the separation of the mucous lining of the rumen as evidence of poisoning, but such is not the case, unless the tissues underneath are inflamed. The contents of the stomachs exhale an odour resembling garlic.

If the animal has been sick for several days before death the liver has a macerated appearance.

To ascertain for certain whether an animal has died from the effects of arsenic, fluid from the fourth stomach and small intestines, with a piece of liver, should be forwarded to an analyst with instructions to test for arsenic.

TREATMENT.

The best chemical antidote is ferric hydrate. This may be prepared by diluting three ounces of tincture of perchloride of iron with four ounces of water; dissolve one ounce of carbonate of soda (washing soda) in half a pint of water; mix the two solutions and administer. These quantities will render insoluble ten grains of arsenic. Three doses at least should be given, repeated at intervals of a quarter of an hour. The above doses are for horses and cattle.

In animals the diagnosis can rarely be made soon enough to give the chemical antidote a chance. To be of any use it must be administered within a very short time after the poison has been taken.

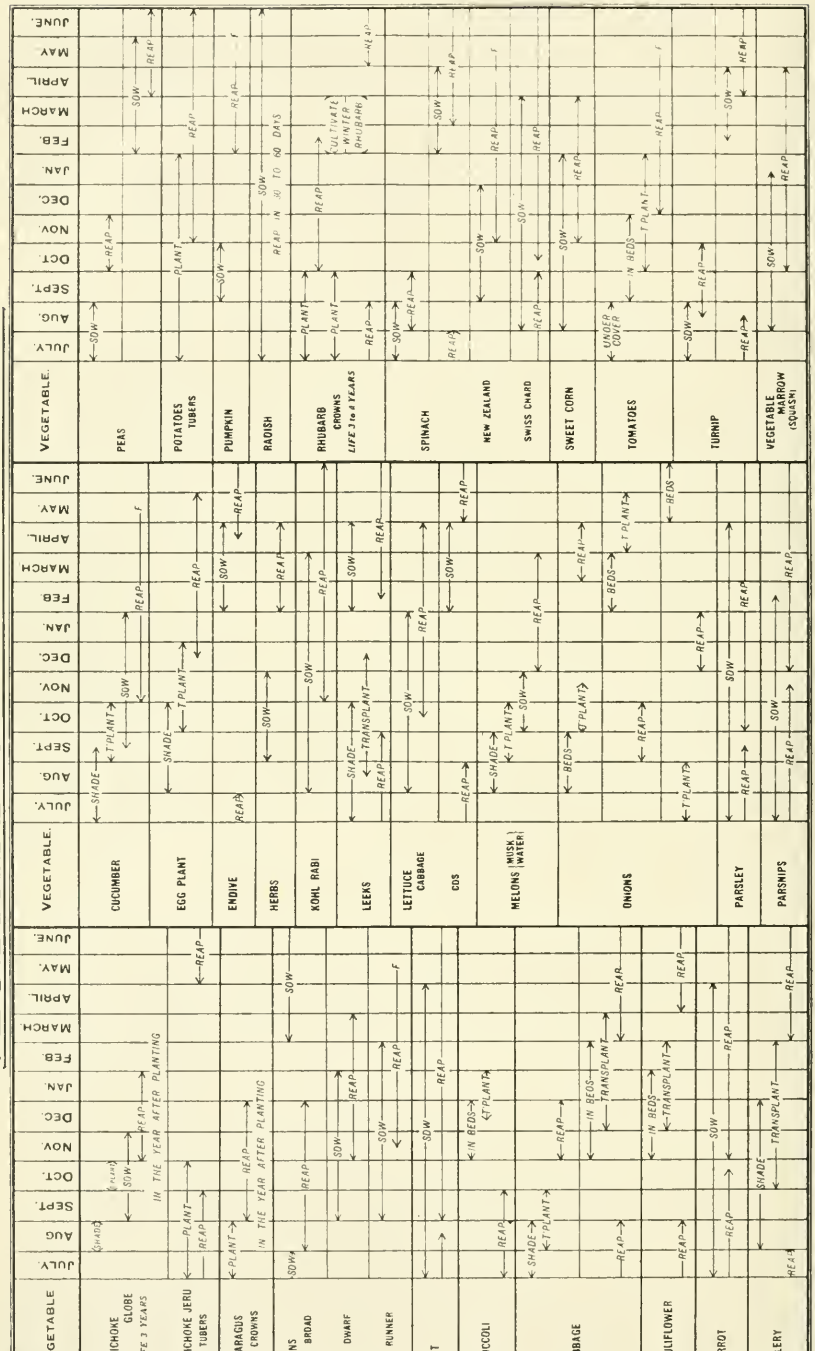
If the chemical antidote is not at hand, or if the poisoning has not been discovered until several hours have elapsed, the best line to adopt is to try and allay the corrosive action of the drug by administering demulcent drinks, such as well-boiled flour or oatmeal gruel thinned with plenty of fresh milk, together with sedative medicine, such as tincture of opium or chlorodyne. The dose of these drugs for full-aged horses and cattle is from one to two ounces according to size, and this dose may be repeated every six hours whilst the pain and diarrhoea continue. The subcutaneous injection of four-grain doses of morphia in the first stages retards absorption of the arsenic, and in later stages relieves the pain and inflammation. Purgative medicines are contra-indicated.

As external dressings to the skin when it has been scalded by dip, soothing applications should be applied, and one of the best is carron oil, made by shaking together equal parts of lime-water and linseed-oil. Lime-water is made by adding a piece of quicklime about the size of a walnut to a gallon of water; shake it thoroughly, then allow the undissolved lime to sink and pour off the clear liquid.

Restriction of Introduction of Cotton Seeds, etc., from Southern Rhodesia.

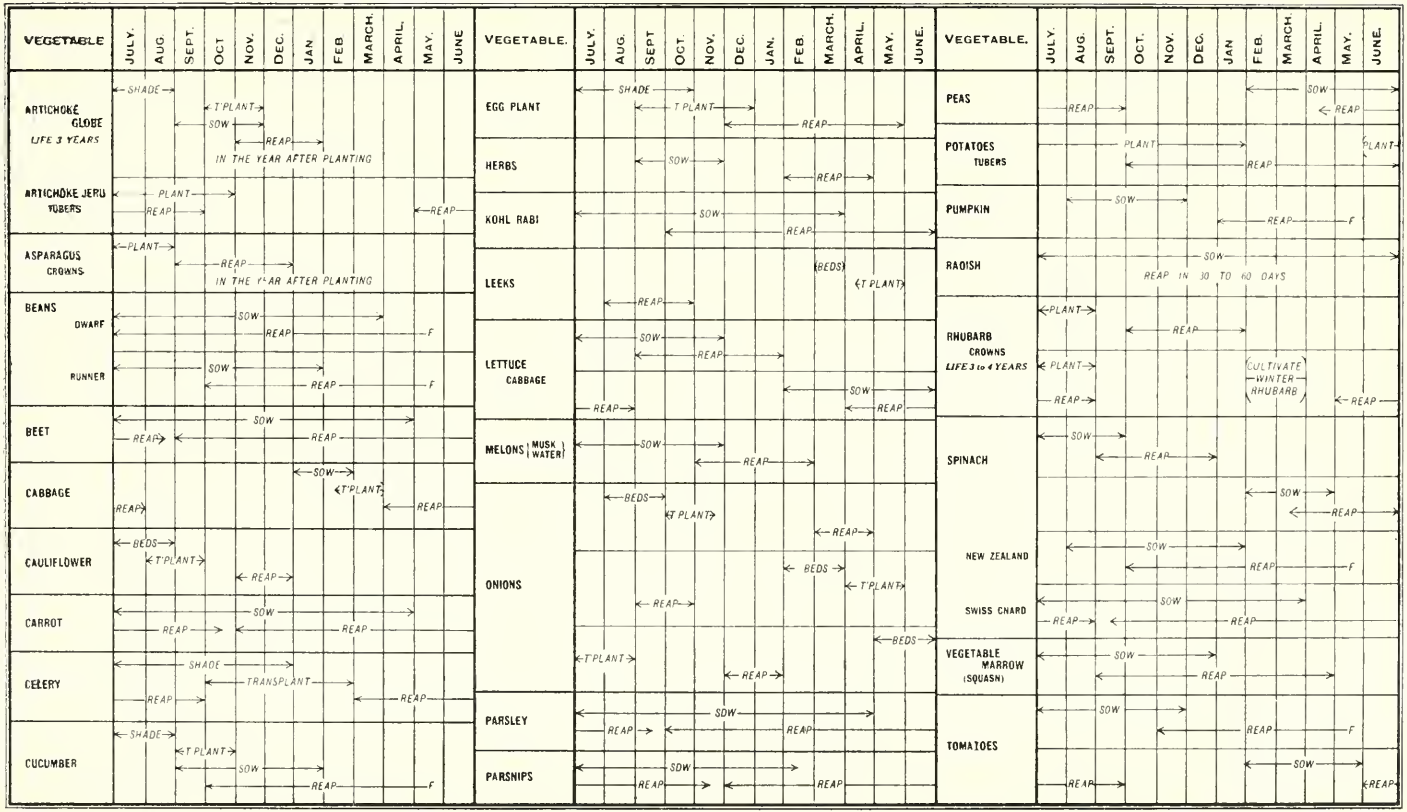
Attention is directed to Proclamation No. 67 of the 30th March, 1921, which prohibits the introduction into the Union from Southern Rhodesia of any cotton seeds or cotton seeds with lint attached, except under permit issued by the Department of Agriculture, which may attach conditions thereto. For any further information and for permits application should be made to the Chief, Division of Entomology, Pretoria.

CHART SHOWING SEASONS FOR GROWING VEGETABLES ON HIGH VELD.



Shade.—Means the sowing of seeds in tins or pots, protected from frost, for planting out with soil around the root when the danger is past; also the sowing of seed under protection, to be transplanted when favourable conditions occur. This gives the advantage of one or two months start over direct sowing into open ground. *See.*—Denotes direct sowing into open ground. *F.*—Indicates frost.

CHART SHOWING SEASONS FOR GROWING VEGETABLES ON LOW VELD.



Shade.—Means the sowing of seed in tins or pots, protected from frost, for planting out with soil around the root when the danger is past; also the sowing of seed under protection, to be transplanted when favourable conditions occur. This gives the advantage of one or two months start over direct sowing into open ground. *Sow.*—Denotes direct sowing into open ground. *F.*—Indicates frost.

THE VEGETABLE GARDEN.

June.

By H. B. Terry, Cert. R.H.S., Lecturer in Horticulture, School of Agriculture, Potchefstroom.

The opportunity should be taken to clean up the vegetable section, destroying by fire or burying any remnants of previous crops that may afford shelter for insect pests. While this is being carried on, and before the soil is turned over, apply liberally any stable or kraal manure obtainable, then, after resting until August or September, the soil will be in a condition to receive any crop.

Turnips may still be sown for succession; thin out the young plants to about 6 inches apart; use the thinnings as spinach.

Carrots should be kept well watered and cultivated; they will make very little growth otherwise.

Cabbage and Cauliflower require a similar culture, and both crops must be watched to see that they do not suffer from drought. The earliest heads should now be ready to cut. As cauliflowers come on it is as well to break down a few leaves over the heads to protect them from frost.

Kohl Rabi is a much neglected vegetable, and only needs to be better known as an excellent substitute for turnips to cause it to be more extensively cultivated. It will grow where turnips have repeatedly failed, is easy to germinate, and quick to mature.

Peas may still be sown for spring use if the position is not subjected to heavy frosts. All existing crops should be kept well watered, as there is a great strain upon the plants when the pods are filling.

Radish may continue to be sown. A good plan is to sow in the same rows as lettuce; the radish matures early and leaves the lettuce to utilize the ground as a follow-on crop.

Onions.—Autumn seedlings should be planted out now and not delayed any longer. Set them out in straight rows, 15 to 18 inches apart. The soil should be well firmed after planting, and take care not to plant deeper than 1 inch.

Celery should now be fully developed and available for use. A little dry grass spread over the plants will protect the leaves from frost bite; keep the plants earthed up and watered to make the stalks crisp.

Leeks are advancing well and only require a few waterings to maintain growth. Further planting may be made; treat like onions and give rich soil.

Broad Beans should be sown to pod during October and November. Progress above the ground may be slow, but the good root action below will be made good use of when the weather becomes warmer.

Asparagus.—Clean off any old top growths and spread a covering of well-decayed stable manure over the beds. New crowns should be planted as soon as possible; the beds should not be raised, but sunk slightly for preference to facilitate irrigation during dry weather in spring. Set the crowns 4 inches deep and spread the roots well out; 2 feet 6 inches to 3 feet between the rows is required for cultivation.

Rhubarb of ordinary type will also require to be well manured after the rubbish has been cleaned away from the recent crop. Old crowns may be lifted, divided, and replanted if more plants are needed. Winter rhubarb (Topp's Crimson), if well watered and the soil kept loose around the plants, will supply unlimited quantities of this delightful pie-vegetable throughout the entire winter season.

SHALLOTS and GARLIC.—This is the best month for planting; most people bury the small bulbs too deeply; this is a mistake, the tops of the bulbs should be just under the surface. Shallots are always needed in the kitchen, and garlic as well when sauces and other condiments are being made.

POTATOES are best allowed to remain in the ground until required for use. If lifted for storing let the tubers be placed in a pit and cover them with fine soil or sand; if exposed to too much light they turn green and are not fit for human consumption.

JERUSALEM ARTICHOKES are produced under ground similar to potatoes. They may be dug out now when required, and make a delightful change to the usual vegetable.

SWISS CHARD, as a substitute for spinach, will continue to make plenty of leaves if given liberal waterings and kept well hoed.

It is hoped that where provision has not been made for the growing of vegetables on the farm, if only to supply the homestead with a change of vegetables several times a week, a start will now be made, as the most important sowing months are rapidly approaching, and if one is prepared the rest is simple.

THE POULTRY YARD MONTH BY MONTH.

By J. J. JORDAAN, Lecturer and Instructor in Poultry, Glen School of Agriculture, Orange Free State

June.

Feeding.—Good circulation is essential to good health; therefore provide exercise by digging all grain food into the ground 8 to 12 inches deep. Throwing it into chaff, leaves, etc., is not severe enough. A good plan is to have a place dug, say, 6 feet square for the purpose. The feeding of the breeding birds should be of the best and closely studied. Avoid warm mashes and all forcing foods. Good, sound, hard grain is best. Green food, grit, and oyster shell or lime should be provided *ad lib.* If green food is scarce or unobtainable oats, barley, mealies, kaffir corn, or any other available grain should be sprouted; the feeding values are excellent, and green food is essential to fertility; Cabbage, lettuce, barley, mangel wurzel, or dry lucerne hay soaked overnight in warm water, are all good. To sprout grain, take as much as is required for a day, put it into a grain bag, tie fast, and place in a bucket of water (warm is best) until saturated, and then place in a dark corner and keep moist and covered with old bags, etc. In a week or ten days, according to the weather, it will be fit for use. In feeding, just throw the tangled mass of growth to the birds; they will soon shred it.

Egg Production.—Laying birds for table-egg production must have stimulating food. (See last month's notes and formula.)

Breeding Pens.—In the breeding pen do not be tempted into giving the male bird more hens than will ensure strong fertility.

Showing.—The show season is now at its height; be sure to attend at least one of the leading shows—the information to be gathered there is invaluable. If you are not clear upon any point look up the judge and ask him; especially get him to explain that class in which you are interested or of which you are a breeder. It is also wise to exhibit some birds of your own breeding to compare your stock with those of other breeders. In sending your birds to the show see that the coop is well made, warm, and roomy. Such a coop lasts longer, and as the bird is comfortable whilst travelling, its chances of winning are improved. Two or three hours before sending the bird away give it a pill the size of, say, a walnut, consisting of equal parts of ground chalk and ginger; it will then be

less likely to get sick or catch cold. In replacing birds in the pens on their return from shows, do so at night; they are not so likely to fight. A little Douglas mixture in the drinking water for a day or two after arrival will assist greatly in getting them over the effects of the travelling and showing.

Douglas mixture is made as follows:—To 1 gallon water add ½ oz. sulphuric acid; pour this on ½ lb. sulphate of iron. When the iron is dissolved and water is cool, bottle and store for use. The usual dose is one tablespoonful to each quart of drinking water. Douglas mixture must always be given in enamel or earthenware vessels.

General.—In the coastal districts (excepting Natal) rain and cold weather may be expected. Scratching sheds must be provided in these parts. In inland districts the birds must be kept warm at night, but not at the expense of ventilation. A few wheelbarrows full of ground or stable manure on the roof of the sleeping quarters will go a long way towards adding warmth to them. All water vessels should be emptied at night and fresh water given the birds in the morning. Drinking water that has been frozen is liable to set up bowel trouble.

NOTES FROM THE "GAZETTE."

Attention is drawn to the following matters of interest which appeared in the *Union Gazette*:—

(Abbreviations: "Proc."—Proclamation; "G.N."—Government Notice.)

Gazette. No.	Date.	ITEMS.
1139	8/4/21	For purposes of the Stock Diseases Act, No. 14 of 1911, the farm Stammere, Estcourt District, has been declared to be in the Lions River District, Natal. (G.N. No. 552.)
1139	8/4/21	The regulations governing the terms and conditions under which Government water drills may be hired from the Director of Irrigation are published in G.N. No. 554.
1139	8/4/21	The Districts of Molteno and Maraisburg, and a portion of Albert District adjoining Steynsburg and Molteno Districts, have, owing to the absence of scab therein, been declared protected areas in terms of the Scab Regulations framed under the Stock Diseases Act. (G.N. No. 556.)
1139 1140 1144 1146	8/4/21 15/4/21 22/4/21 29/4/21	Compulsory dipping of cattle as required under the Stock Diseases Act has been prescribed as follows:—(*a*) Every three days in the three-day dip for portions of Zoutpansberg; (*b*) every five days in the five-day dip for portions of Pretoria, Umtata, Umvoti, Alfred, Camperdown, Pietermaritzburg, Pinetown (including certain native and mission locations), Estcourt, Durban, Port Shepstone, Emtonjaneni, Babanango, Nkandhla, Weenen, and Umvoti; (*c*) every seven days in the seven-day dip for portions of Lydenburg. (G.N. Nos. 557, 602, 637, and 683.)
1139	8/4/21	The compulsory removal of cattle from portions of the Lydenburg District, as prescribed by Government Notice No. 1934 of 1920, has now been cancelled and the said Government Notice withdrawn. (G.N. No. 558.)
1139	8/4/21	An amendment, affecting the valuation of wool for purchase by the Imperial Government, under the scheme outlined in G.N. No. 533 of 1st April, 1921, is published in G.N. No. 569.
1140	15/4/21	The introduction of cotton seed in various forms from Southern Rhodesia has been restricted, under certain conditions published in Proclamation No. 67.

Gazette. No.	Date.	ITEMS.
1140	15/4/21	The period for the compulsory dipping of cattle as prescribed for the District of Umtata, Transkei, by G.N. No. 517 of 30th March, 1921, has been extended and will terminate on the 30th June, 1921. (G.N. No. 581.).
1140	15/4/21	Crown lands in the Paarl District are to be sold by public auction at 10 a.m., Thursday, 16th June, 1921, in front of the Magistrate's Office, Paarl, and in Calvinia (Loeriesfontein), at 11 a.m., on Tuesday, 14th June, 1921, in front of the Court-room, Loeriesfontein. (G.N. No. 362.)
1140	15/4/21	Certain species of birds have, under the Game Preservation Ordinance, 1905, of the Transvaal (applicable to Swaziland by Swaziland Proclamation No. 2 of 1906), been declared protected throughout the year for the period ending 31st March, 1921. (*Official Gazette*, Proclamation No. 1, 1921.)
1144	22/4/21	Owing to the partial prevalence of scab therein, (*a*) additional portions of Hoopstad, certain portions of Boshof District, the District of Prince Albert, and certain adjoining farms in the Beaufort West District have been declared semi-protected areas in terms of the Scab Regulations; and (*b*) owing to the absence of scab therein, portions of Rouxville, Hoopstad, and Boshof Districts have been declared protected areas. (G.N. Nos. 635, 636, 686.)
1144	22/4/21	For the purpose of allowing slaughter stock to reach Cullinan for rail direct to approved abattoirs for immediate slaughter, a road has been prescribed along which such cattle may be driven, in terms of the Stock Diseases Act. (G.N. No. 638.)
1146	29/4/21	Any agricultural produce intended for export under the Agritural Export Act, No. 35 of 1917, and which has been so treated as to give it the appearance of an article of different commercial value, is prohibited. Contravention of this provision is punishable by heavy penalties. (Proc. No. 78.)
1146	29/4/21	Certain grains, cereals, seed, etc., have, in terms of the Agricultural Export Act, been proclaimed agricultural produce. (Proc. No. 79.)
1146	29/4/21	Dried fruit of all descriptions has similarly been included in the term "agricultural produce" for export purposes. (Proc. No. 80.)
1146	29/4/21	The conditions governing the award of Government scholarships for study abroad are published, and cover the following subjects:—Field husbandry, horticulture, dairying, entomology, agricultural chemistry, poultry, and viticulture. (G.N. No. 682.)
1146	29/4/21	Brands registered under the Cape of Good Hope Brands Registration Act for horses, cattle, ostriches, and small stock are published in G.N. No. 696, and brands registered under the Orange River Colony Brands Ordinance in G.N. No. 697.
1146	29/4/21	Up to 7th June, 1921, the Lands Branch, Windhuk, will receive applications for the disposal, on conditional purchase, of certain farms in Bethanie, Rehoboth, Windhoek, and Okahandja Districts, South-West Protectorate. (G.N. No. 670.) The Secretary for Lands will receive applications up to 10th June, 1921, for the disposal of certain farms in the Pietersburg, Potchefstroom, Rustenburg, Waterberg, and Zoutpansberg Districts, and Stellenbosch Division. (G.N. Nos. 699 and 700.)
1148	6/5/21	In terms of the Forest Act, No. 16 of 1913, it is the intention to declare Reserve No. IV, in the Lower Umzimkulu District, called Imbezana, a demarcated forest. (G.N. No. 701.)
1148	6/5/21	Regulations for the export of all dried fruit (including nuts) and governing the methods of packing, grading, etc., are published in G.N. No. 710.

THE WEATHER.

Extracts from the Monthly Weather Report of the Chief Meteorologist for the Union.

April, 1921.

MEAN pressure about normal, except in the west, where it was lower than usual; days one to four degrees cooler and nights half a degree to one degree warmer than the average; precipitation greater than usual over practically the whole of the Cape Province, Swaziland, and central Transvaal, but deficient elsewhere; some killing local frosts and destructive hailstorms were the most noteworthy features of the weather of April, 1921.

Precipitation during the month was above the average in the Cape Province, particularly over the northern Karroo, the north-east and south-east of the Province, and south of the Orange Free State, where it was commonly from two to three inches in excess. Over the central, west-central portions, and the extreme north of the Transvaal there were small surplus amounts varying from about 0.2 to 1.7 inches. In the Cape Province the excess decreased to about half an inch along the South Coast and to 1¼ to 2 inches in the south-east. Over the greater portion of the west central area, however, as well as in the south-west, the surplus over the interior decreased to deficits of about half an inch. A shortage was also common to Natal, by far the major portion of the Orange Free State, Bechuanaland, and the west, south, east, and north of the Transvaal, forming an almost complete circle round the central area having a small excess. Over Natal the deficits varied between half an inch and two inches; in the Orange Free State the shortage was small except in the north and east central areas, where it amounted to about one to one and a half inches; over the major portion of the Transvaal and the south of Bechuanaland the deficits were generally under an inch, but rising to about one and a half inches in the more easterly and north-westerly and south-westerly parts, as also in the northerly portion of Bechuanaland. Precipitation occurred on every day of the month in one part or another of the Union. Over the Transvaal the rains occurred at intervals of practically a week, being noted on 1st, 6th to 9th, 14th to 16th, 22nd and 23rd, and 29th to 30th; the distribution as to time intervals was similar over the Orange Free State, Natal, and the Cape, although not on the same dates. The cumulative seasonal rainfall since 1st July, 1920, is generally above the average over the Cape by 2 to 4 inches, but rising to 6 to 8 inches in the central Karroo and south-west portion of the northern Karroo. Along the South Coast there was a deficit, however, varying from 0.24 inches at Mossel Bay to 4.96 inches at East London. Another broad belt of deficient rainfall partially encircled Basutoland and the Orange Free State from Kokstad, in the Transkei, to Vryburg, in Bechuanaland. Here the shortage varied from 0.14 inch at Hopetown to 3.70 inches at Philipstown, being generally between one and two inches. Over the centre and south of the Orange Free State there is an excess ranging from a few hundredths of an inch to almost two inches, with a deficiency in the north and east of a third of an inch to 1.30 inches. An excess of precipitation of 1 to 9 inches has been experienced in the centre and south of Natal, but large deficits of 6 to 10 inches in the north and west, with a small shortage of about an inch in Zululand. Over the Transvaal there has been a surplus rainfall of 3 to 5 inches, except in the east, where relatively small deficits have been recorded, amounting to about 2½ inches at Barberton. The cumulative rainfall since the beginning of the calendar year is above the average, commonly by 2 to 4 inches or more over the Cape Province, except in the Cape Peninsula, where there is a deficit of about one-quarter to two inches; a similar shortage is exhibited by the neighbourhood of Philipstown. Over the north, south, and west of Natal, the centre and east of the Transvaal, as well

as the east of the Orange Free State, there is also a deficiency in the precipitation, ranging in amount from a few tenths in the south of Natal, through 1 to 2 inches in the Transvaal and Orange Free State to 7¾ inches at Vryheid. Elsewhere there is an excess usually of 1 to 2 inches, but rising to 5 to 6 inches in the west, north, and south-east Transvaal, and at Durban (Natal). These late rains have kept the veld green and made pasture plentiful, whilst frost, which was of fairly common occurrence from the 23rd to the end of the month, caused some damage, principally to young mealies, pumpkins, and potatoes, and the tips of cotton plants (the last in the Waterberg District). Stock generally are reported in good condition. The continued wet weather proved unfavourable to harvesting operations in some districts and checked the growth of teff and other pasture grasses. The veld for winter grazing is reported as short on most farms in the Wepener District (Orange Free State). A good deal of damage has been caused by insects to the cotton crop in the Rustenburg District. Ploughing operations are being carried out in a number of districts. Light hailstorms were frequent in the Orange Free State, with occasional heavy storms, causing damage to tobacco, etc., in the Transvaal and north of the Cape.

STAFF: APPOINTMENTS, TRANSFERS, ETC.

(1) Agriculture.

1/4/21 *J. B. Rabie*, Private Secretary to the Minister of Agriculture, transferred to the Department of Mines and Industries as Private Secretary to the Minister of Mines.

21/3/21 *C. A. Celliers*, transferred from Lands Department and appointed as Private Secretary to the Minister of Agriculture.

31/3/21 *G. F. Joubert*, Inquiry Clerk, Department of Agriculture, Bloemfontein, retired on pension.

1/5/21 *J. G. Bush*, Government Veterinary Officer, Middelburg, Transvaal, seconded to Department of Defence.

1/5/21 *J. J. G. Keppel*, Government Veterinary Officer, Dundee, Natal, transferred to Middelburg, Transvaal, *vice* J. G. Bush.

(2) Agricultural Education.

1/4/21 *R. A. Whitelaw*, First Grade Clerk, Audit Office, Pretoria, transferred to the Grootfontein School of Agriculture, Middelburg, Cape.

Movements of Officers.

Mr. B. G. L. Enslin, Chief, Division of Sheep, has been appointed as Director of the Government Wool Purchase Scheme as from the 1st April, 1921. For this purpose his headquarters will be at Port Elizabeth, and during his absence from Pretoria Mr. J. F. Jordaan will act in his stead.

Mr. W. G. Mason, until recently Director of Training Farms, left at the end of April for Capetown, where he is now stationed for the purpose of giving advice to immigrants who desire to settle in South Africa and take up farming pursuits.

Mr. H. K. Munro, of the Division of Entomology, Pretoria, left on the 9th May to take charge of the plant inspection work at East London and to give attention to entomological investigations that may be most advantageously conducted with headquarters at that port. His office is in the Customs Building at the waterside, and his postal address Box 16, East London. This transfer has been made in response to oft repeated requests for the Division of Entomology to station one of its scientific staff at East London.

THE OVERSEA MARKET.

MARKET PRICES OF SOUTH AFRICAN AND OTHER PRODUCE CABLED BY THE TRADE COMMISSIONER, LONDON, ON THE 11TH MAY, 1921.

Mohair.—No change in the market.

Ostrich Feathers.—No change in the market.

Maize.—The market is dull. For maize on the spot, La Plata is quoted at 53s. (22s. 1d. per 200 lb.) and round yellow No. 6 at 52s. (21s. 8d. per 200 lb.). For round yellow No. 6, April shipment, 45s. (18s. 9d. per 200 lb.) has been paid. For flat white No. 2, 38s. (15s. 10d.) has been paid on the Continent for May shipments.

[NOTE.—Referring to the marked difference in "spot" and "forward" prices, seen in earlier advices, the Trade Commissioner explains that the difference was due to the big premium on spot maize (including, of course, landing charges) and that the discount of forward maize was due to the imminence of the Argentine crop.—EDITOR.]

Maize Meal.—£9. 5s. per ton quoted.

Cotton.—Closing prices for American futures: May, 8.08d.; June, 8.19d.; July, 8.33d.

Butter.—The market is falling. Present prices, Danish £9. 5s. to £9. 15s.; Australian, £9 to £9. 10s.; New Zealand, £9. 10s. to £9. 15s. (per cwt.).

Cheese.—There is a steady demand and little alteration in price.

Bacon.—The market is falling owing to the coal situation.

Skins.—At the auctions on the 5th May, 315,229 Cape goat skins were offered; 15,688 were sold, but mostly privately at 10 per cent. to 12 per cent. decline. The following quotations are given: Capetown and Mossel Bay, light 10¼d. to 10½d., extra 10¾d.; Algoa Bay, extra light 9¼d. to 10d., sun-dried light 8½d.; Natal, light 8d., extra 10d., kids 6d.; Bastard, light, 7¼d. to 7½d.; Cape Angora skins were offered, but there were no sales.

Natal Wattle Bark.—A little business was done in chopped at £7. 10s. to £7. 12s. 6d. per ton, c.i.f.; ground, £8. 10s. to £8. 15s., *ex* store.

CROP REPORT.

April, 1921.

Maize.—Reports on the progress of the season's crop show that during April weather conditions were favourable generally, but that frost in some localities has reduced the originally anticipated yield, and for the whole Union the crop condition, which was 11 per cent. at the end of March last, has fallen still further, being 13 per cent. below normal at the end of April. As far as prospects at present can be gauged, therefore, the Union's crop is estimated to yield 12,130,000 bags this season.

Kaffir Corn.—There is little difference in the condition of the crop as estimated at the end of March, the condition now being placed at 15 per cent. below normal.

Tobacco.—During April the tobacco crop suffered slightly from rust in some parts, and on the whole the condition shows a decline of 4 per cent. compared with last month, so that at the end of April the Union's crop was estimated to be 14 per cent. below normal in condition.

LOCAL MARKET PRICES.

RATES OF AGRICULTURAL PRODUCE AND STOCK RULING AT THE 14TH MAY, 1921.

CENTRE.	Wheat. Per 200 lb.		Wheat Flour. Per 100 lb.		Boer Meal. Per 200 lb.		Mealies. Per 200 lb.		Mealie Meal. Per 180 lb.		Barley. Per 150 lb.		Oats. Per 150 lb.		Oat-hay. Per 100 lb.		Lucerne Hay. Per 100 lb.		Potatoes. Per 150 lb.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Cape Province—																				
Aliwal North....	—	—	52 6	52 6	—	—	—	—	—	—	—	—	—	—	—	—	5 0	5 0	12 0	16 0
Beaufort West...	35 0	37 6	28 0	28 0	38 0	40 0	17 0	18 0	18 0	18 6	22 6	24 0	15 0	17 0	6 0	6 3	5 0	5 0	17 6	18 6
Capetown	28 0	29 0	—	—	—	—	14 0	16 0	—	—	17 0	17 6	10 0	10 6	5 0	5 6	7 0	7 3	8 0	15 0
East London....	—	—	—	—	—	—	12 0	15 0	—	—	—	—	—	—	—	—	—	—	10 6	21 0
Grahamstown....	—	—	—	—	—	—	13 0	18 0	—	—	—	—	—	—	7 0	8 0	3 0	3 6	12 0	21 6
Kimberley.....	27 0	30 0	26 6	28 6	39 6	40 6	11 6	13 6	11 6	13 6	19 6	21 6	12 3	13 3	6 0	6 9	5 0	6 0	5 0	20 0
Kingwilliamstown	—	—	—	—	—	—	12 0	15 2	—	—	—	—	—	—	7 0	9 0	—	—	9 6	21 0
Port Elizabeth...	—	—	—	—	—	—	11 0	15 0	—	—	—	—	—	—	4 0	5 6	4 6	5 3	4 6	15 9
Queenstown	30 0	31 0	39 0	40 0	37 6	39 6	12 6	14 0	19 0	20 0	15 0	18 6	12 6	15 0	5 0	7 0	4 6	5 6	10 0	18 0
Natal—																				
Durban.....	—	—	—	—	—	—	10 0	13 6	9 0	13 0	—	—	—	—	4 6	5 1	3 0	4 6	10 0	26 0
Pietermaritzburg.	—	—	—	—	—	—	11 0	11 6	—	—	—	—	—	—	7 0	7 6	6 9	7 0	—	—
Orange Free State—																				
Bloemfontein....	27 0	29 0	33 6	37 0	45 0	50 0	9 6	12 0	12 6	16 0	17 6	22 6	10 0	15 0	6 6	8 6	5 6	7 0	8 6	15 0
Harrismith.....	27 6	27 6	26 0	26 0	50 0	50 0	8 0	8 6	11 6	11 6	15 0	16 0	8 0	10 0	3 6	6 0	—	—	10 0	12 6
Transvaal—																				
Pretoria.....	35 0	40 0	—	—	—	—	9 9	13 4	—	—	—	—	11 0	11 0	6 10	7 6	—	—	3 0	12 6
Johannesburg....	25 9	26 9	—	—	—	—	9 0	12 0	—	—	10 0	10 0	13 9	13 9	2 0	7 0	2 6	6 0	3 0	16 9

CENTRE.	Onions Per 120 lb.		Tobacco (Boer Roll). Per lb.		Beans. Per 200 lb.		Beef. Per lb.		Mutton. Per lb.		Fresh Butter. Per lb.		Eggs. Per dozen.		Cattle (Slaughter). Each.		Sheep. Each.		Pigs. Each.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	£ s. d.	£ s. d.	s. d.	s. d.	s. d.	s. d.
Cape Province—																				
Aliwal North....	25 0	25 0	—	—	—	—	0 6	0 9	0 5	0 9	1 4	1 10	3 0	4 6	—	—	—	—	—	—
Beaufort West...	15 0	15 0	1 3	1 6	45 0	70 0	0 10	1 4	0 8	0 10	2 0	2 6	3 6	3 6	6 15 0	13 0 0	16 0	25 0	25 0	200 0
Capetown	8 0	12 6	0 7	1 3	30 0	50 0	0 5	1 3	0 8	1 0	1 6	1 9	2 6	3 0	10 0 0	14 0 0	18 0	25 0	30 6	90 0
East London....	—	—	—	—	20 0	25 0	0 6	0 8	0 4½	0 10½	1 3½	1 9	2 6	5 1	—	—	—	—	—	—
Grahamstown....	—	—	—	—	30 0	45 0	0 4	0 10	0 7	0 11	1 4	1 7	2 7	4 1	—	—	—	—	—	—
Kimberley.....	7 6	20 0	0 [illegible]	1 0	18 0	40 0	0 6	1 0	0 7	0 9	1 3	1 7	2 0	3 9	10 0 0	4 10 0	14 0	25 0	*0 5½	0 9
Kingwilliamstown	—	—	—	—	12 0	24 0	0 7	0 9	0 6½	0 9	1 2	1 7	1 7	3 1	—	—	—	—	—	—
Port Elizabeth...	12 0	19 3	—	—	32 0	46 0	0 8	1 0	0 8	1 0	1 4	1 9	2 3	4 7	—	—	—	—	35 0	85 0
Queenstown.....	17 0	17 6	0 9	1 0	28 0	42 0	0 5	0 6	0 5	0 7	1 4	1 6	2 6	4 0	12 0 0	15 0 0	14 0	20 0	*0 4	0 5
Natal—																				
Durban.....	11 0	19 0	—	—	18 0	54 0	0 3	0 6	0 4	0 8	1 6	2 9	2 9	5 6	—	—	—	—	—	—
Pietermaritzburg.	—	—	—	—	—	—	0 5	0 9	0 6	0 10	1 11	2 8	3 6	4 6	—	—	—	—	—	—
Orange Free State—																				
Bloemfontein....	7 6	16 0	1 0	2 0	25 0	35 0	0 6	0 11	0 6	0 11	1 0	1 0	3 0	4 6	13 0 0	15 5 0	18 6	27 0	*0 6	0 8½
Harrismith.....	15 0	15 0	—	—	—	—	0 6	0 9	0 4	0 8	1 6	2 3	2 3	3 6	6 0 0	14 0 0	5 6	12 6	10 0	50 0
Transvaal—																				
Pretoria.....	17 6	20 6	0 4	0 4	16 6	27 6	0 2	0 5	0 5½	0 6	1 9	2 0	2 3	3 9	2 17 6	17 0 0	9 6	26 0	*0 4	0 8
Johannesburg....	7 6	17 0	—	—	14 0	40 0	†25 0	40 0	0 5	0 6	1 2	2 0	2 6	3 6	5 10 0	15 10 0	6 0	27 0	*0 3	0 8

* Live weight per lb. † Dressed weight, including hides, offal, etc., per 100 lb.

NOTE.—The rates quoted for produce sold in bags include, as a general rule an additional 3 lb. for weight of bag.

THE LOCAL MARKET.

Position at Mid-May, 1921.

(NOTE.—The local market prices of certain other agricultural produce and stock are published elsewhere in this issue.)

WOOL.

THE market has had a slightly firmer tendency during the past month and the recent keener demand has been maintained, especially in regard to good combing wools of 12 months growth. Prices are slightly higher than those prevailing last month. The latest reports from London also show a firmer market with an advance of prices from 5 to 10 per cent.

The following are present quotations :—

	per lb.		per lb.
Extra super combing, 12 months', skirted	10½d.	Superior medium, 8 to 10 months', skirted	5½d.
Superior combing, 12 months', skirted	9d.	Average medium, 8 to 10 months' skirted	5d.
Good average combing, 12 months' growth	7d.	Superfine shorts, 8 months' and less, skirted	6d.
Superior combing, 10 to 12 months'	7d.	Good average shorts, 8 months' and less, skirted	5½d.
Average combing, 10 to 12 months' ...	5½d.	Average shorts, 8 months' and less ...	4½d.
Extra super medium, 8 to 10 months', well skirted	6½d.		

MOHAIR.

There is a more general inquiry for summer kids and summer firsts, but buyers continue to exercise great discrimination in their selections and only the very best lines command top rates. Winter hair is more or less neglected. The following prices are quoted :—

	per lb.		per lb.
Super summer kids	26d.	Super summer firsts	8½d.
Average summer kids	24d.	Winter hair	5½d.

SKINS AND HIDES.

At the skin sales held since the beginning of May, there has been keener competition on the part of buyers, and the market has a decidedly firmer tone all round. There is a slight improvement in the prices for all sound skins, but damaged skins are still neglected. The following are the prices obtained at recent sales :—

SHEEPSKINS.

	per lb.		per lb.
Sheep skins, sound	3d.	Capes—Salted, each	38d.
Pelts, sound	1⅜d.	Capes—Sundried, each	22d.
Coarse and coloured skins, sound ...	3d.		

GOATSKINS

	per lb.		per lb.
Angora—Light...	3¼d.	Bastards—Sound	5⅝d.
Angora—Heavy and sun-dried ...	2⅜d.	Goatskins—Light	8⅝d.
Angora—Shorn	1¾d.	Goatskins—Sun-dried...	7⅛d.

HIDES.

	per lb.		per lb.
Sound—Sun-dried, ...	5½d.	Sound—Salted...	5⅛d.

OSTRICH FEATHERS.

Messrs. Dunell, Ebden & Co., furnish the following information :—Sales were held on 4th, 11th, 18th, and 26th April. Weight of feathers sold was 19,280 lb., of a total value of £32,713, while 6864 lb., valued at £8583, were withdrawn. Prices gradually declined : in the first instance owing to anxiety over London sales, and afterwards on account of the coal strike in England, and uncertainty in regard to the settlement of German liabilities. It is improbable that there will be any improvement whilst unsettled conditions prevail in Europe. London sales showed a decline of 30 per cent. in the best lines and from 10 to 15 per cent. in inferior lines. Feathers are still very fashionable but exchange and industrial problems are depressing the whole market.

WORLD CROPS.

Wheat and Rye Supply.

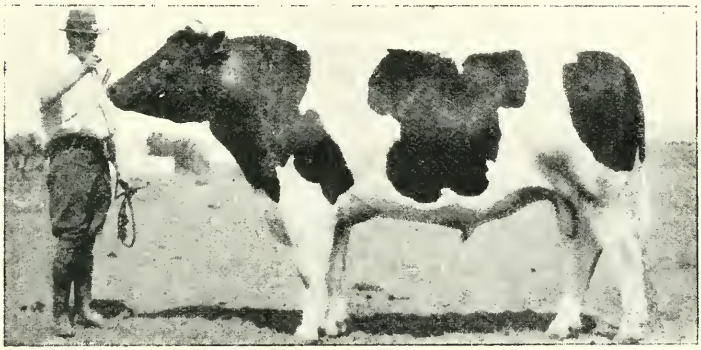
According to advice cabled on the 9th May to the Department by the International Institute of Agriculture, Rome, it is estimated that the available world supplies of wheat and rye will be sufficient to cover requirements in these commodities until the world's new harvest will be available at the beginning of August, 1921.

The Agricultural Position.

As supplementary to earlier advices, it is observed that the March, 1921, report of the Institute announces a moderate increase in the area sown with winter wheat, as compared with last year, in Belgium, Bulgaria, Spain, France, Finland, Great Britain, Norway, Roumania, and North Africa, while in Poland and the United States a slight decrease is indicated. Rye was sown on a full area, excepting in Spain and the United States. The prospects of both cereals may be considered as favourable in all the countries already mentioned, while the outlook in Hungary is very good and in Italy it is an average.

The most recent advices from India report the area under wheat as 85 per cent. of that of last season, and prospects below average.

The data now to hand as regards sugar yields comprise the approximate totals from countries representing about 70 per cent. of the world's crops, and indicate an aggregate of about 4.1 million metric tons of unrefined beet sugar, being 44 per cent. more than the corresponding returns of last season.



Stud Friesland Bull, Glen School of Agriculture.

New Tariff for Export Grain, etc.

Attention is directed to the subjoined revised tariff of fees for the inspection and grading of grain, etc., at the ports prior to shipment. The tariff, which came into force on the 1st April, 1921, is designed to ensure greater uniformity in the charges, and the resultant revenue is expected to be higher than in the case of the prior tariff. In respect of maize graded inland it will be observed that the fee is 1d. per bag:—

Maize (for export only), millet, kaffir corn, wheat, rye, barley, beans, peas, oats, bran, maize meal, hominy chop, and other mill feeds, ½d. per bag; oat-hay, lucerne, compressed fodder, and other hay, 6d. per ton; lucerne seed, 3d. per bag; maize (graded inland), 1d. per bag.

RECENT AGRICULTURAL LITERATURE.

SELECTED LIST OF BOOKS ADDED TO THE DEPARTMENT'S LIBRARY.

[NOTE.—The first number is that of the class to which the book belongs; the last number is that of the book itself.]

GENERAL.

120 Tonteldoos. In een Dag Volleerd. Pretoria, 1920. Noordelike Drukpers. No. 7493.

350,42 Cunningham, J. C. Products of the Empire. Oxford, 1921. University Press. No. 7490.

351.13 Ward, Sir W., Consul-General. Report on the German Paper Industry and Export Trade. (Diplomatic and Consular Reports. No. 642. Miscellaneous Series.) London, 1905. Harrison & Sons. No. 7501.

351.52 White, Oswald. (Student Interpreter in British Consular Service in Japan.) Japanese Paper-making. (Diplomatic and Consular Reports. No. 635. Miscellaneous Series.) London, 1905. Harrison & Sons. No. 7502.

AGRICULTURE, LIVE STOCK, AND ALLIED SUBJECTS.

100,68 Dowsley, W. G. Boerdery, vir Suidafrikaanse Skole. Boek II. Kaapstad, 1921. Nasionale Pers, Bepkt. No. 7512.

100,54 India, Agricultural Adviser. Review of Agricultural Operations in India. 1919-1920. Calcutta, 1921. Superintendent, Government Printing. No. 7495.

130 Matheson, Darley. Cattle and Sheep. A Practical Manual about Breeds and Breeding, Foods and Feeding, and General Management. London, 1921. Pearson, Ltd. No. 7491.

130.1,11 Cameron, James. Shorthorns in Central and Southern Scotland. Edinburgh, 1921. Blackwood & Sons. No. 7489.

130.5,43 Hutschenreiter, Dr. Carl. Uber Vollblutzucht und Rennwesen in Österreich (Wiener Tierärztlichen Monatsschrift, 1920, Leipzig.) 1920. Gesellschaft der Tierärzte in Wien. No. 7494.

130.7 Smart, Oscar. The Inheritance of Fecundity in Fowls. Sunbury-on-Thames, 1917. Oscar Smart. No. 7488.

131 Guthrie, Edward. The Book of Butter. New York, 1920. Macmillan Co. No. 7492.

163 Hand, T. E., and Cockerham, H. L. The Sweet Potato. A Handbook for the Practical Grower. New York, 1921. Macmillan Co. No. 7498.

169,51 China: Imperial Maritime Customs. The Soya Bean of Manchuria. (II.—Special Series. No. 31.) Shanghai, 1911. Kelly & Walsh, Ltd. No. 7515.

170 Field Force Pump Co. The Why and How of Orchard Success. Elmira, N.Y.N.D. Howell & Co. No. 7487.

183 The Stoney Sluice. Water Storage and Control. 4th Ed., London, N.D. Ransomes & Rapier, Ltd. No. 7513.

DIVISION OF VETERINARY EDUCATION AND RESEARCH.

Supply of Vaccines, etc.

THE following particulars relating to the supply of Laboratory products are published for general information:—

Horse-Sickness in Mules.—All applications for the inoculation of mules against horse-sickness should be made to the nearest Government Veterinary Officer.

Horse-Sickness in Horses.—The experimental inoculation of a limited number of horses against horse-sickness will be undertaken, and applicants should communicate with the Director of Veterinary Education and Research, P.O. Box 593, Pretoria.

Black Quarter (Quarter-Evil or Sponsziekte) Vaccine.—This vaccine, which is in the form of a powder, is supplied in 10-dose tubes, and in two forms, one (double) where two inoculations are necessary, another (single) where only one injection is required. Full directions are enclosed with the vaccine. Black quarter principally attacks cattle up to two years of age, and farmers in a district where the disease is prevalent should inoculate their young stock when about four months old as a regular routine. Price, 2s. 6d. for 10 doses (single or double forms). Double vaccine is supplied unless otherwise instructed. The vaccine must b used within three months of issue.

Blue-Tongue Vaccine.—This vaccine is put up only in bottles containing twelve doses and multiples of twelve. The disease affects sheep, and in some districts at certain seasons of the year assumes the character of an epidemic. Certain restrictions detailed in the directions issued with the vaccine are necessary when dealing with imported sheep. Price, 2s. for 12 doses. The vaccine must be used within three months of issue.

Anthrax Spore Vaccine.—The vaccine consists of one injection only, and is put up in four sizes of bottles containing respectively sufficient vaccine for the inoculation of 10, 25, 50, and 100 head of cattle, horses, mules, and donkeys, or 20, 50, 100, and 200 head of sheep and goats. The price is 5s. for 10 doses. The vaccine must be used within three months of date of dispatch from the Laboratory.

Redwater and Gall-Sickness Vaccine.—The double vaccine for inoculating cattle against redwater and gall-sickness can be supplied at 1s. per dose. Details as to the symptoms to be watched for and the method of treatment of animals undergoing these inoculations are dealt with in the leaflet of directions obtainable on application. Applicants are recommended to communicate with the nearest Laboratory before placing a definite order. The vaccine must be used within four days of issue.

Wire-Worm Remedy.—This is put up in powder for dosing sheep and goats affected with wire and tape worms. The dose for various ages of animals is regulated by dosing spoons specially manufactured for the purpose. The remedy can also be used for worms in cattle, for ophthalmia in cattle, and for galziekte in sheep. Full instructions accompany all supplies. Price, 2s. per tin, containing sufficient powder for dosing 100 adult sheep. Dosing bowls, 1s. 6d. each; dosing spoons (set of five), 7s. 6d.

A supply of these vaccines will be kept at the Veterinary Research Laboratory, P.O. Box 593, Pretoria (telegraphic address, "Microbe"); the Veterinary Research Laboratory, P.O. Box 41, Grahamstown (telegraphic address, "Institute"); the Veterinary Research Laboratory, P.O. Box 405, Pietermaritzburg (telegraphic address, "Bacteria").

Vaccines can also be obtained on application through the Government Veterinary Officers of the Union or any Magistrate, who will obtain the vaccine required and remit the money in payment to Pretoria, and will telegraph urgent orders, if required to do so, when payment is made for the telegram.

Vaccines are issued for cash only, and no orders will be accepted unless full payment is made in advance.

Vaccines can be sent by rail on the C.O.D. system, and should any order be unaccompanied by a remittance, the Government reserves the right of using its discretion, and of either dispatching the consignment C.O.D. to the nearest railway station or of holding the order until a remittance in payment is received.

Payment may be made by cash, postal order, or cheque.

Parcels cannot be sent C.O.D. by post.

All vaccines are sent railage or postage free to any address in the Union.

Syringes and other instruments cannot be supplied by the Department, but must be obtained through the ordinary channels. A list of firms supplying syringes can be obtained on application to the Director, Veterinary Education and Research, P.O. Box 593, Pretoria.

The Government cannot undertake to exchange any Laboratory product once it has been issued. All consignments are carefully packed before dispatch, and liability cannot be accepted for any breakages that may occur in transit.

All Laboratory preparations are carefully tested before being sent out, but they are issued solely at the purchaser's risk. The Government cannot accept any responsibility for any losses or accidents which may occur from the use of these vaccines.

Mushrooms and Allied Fungi: Determination of.

Regarding the collection and determination of Agarics and allied fungi by the cryptogamic section of the National Herbarium, it is pointed out that numerous specimens of these fleshy fungi have recently been received by the Division of Botany from correspondents for identification, very often with the inquiry as to whether they are edible or not. Unfortunately these specimens have usually arrived in such a state of decomposition that determination has been impossible. For the sake of those interested in the subject, it is suggested that in order to ensure fleshy specimens, especially of the mushroom type, arriving in the best possible condition, they should be picked when quite young, packed in newspaper, and dispatched in a cardboard box. Mushrooms packed in tins or other airtight receptacles rot almost immediately. Much wastage of specimens has also occurred through their arriving at a week-end or before a public holiday. This point should be taken into consideration when sending specimens for determination.

Experiment Stations in Brazil.

The Legislature of the State of Bahia, Brazil, has authorized (according to a paragraph in a recent number of the United States Department of Agriculture *Experiment Station Record*) the Department of Agriculture there to institute a series of agricultural experiment stations throughout the State. A unique feature of the legislation is that the service is to be made self-supporting by the collection of a 1 per cent. export duty on all agricultural products.