BULLETIN

OF THE

BOTANICAL DEPARTMENT, JAMAICA.

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.

Director of Public Gardens and Plantations.

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1902.

HOPE GARDENS, JAMAICA.

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ORANGE CONFERENCE.

The Orange Conference arranged by the Board of Agriculture took place at the Collegiate Hall on 4th December, His Excellency the Governor presiding.

In opening the meeting His Excellency said that the subjects for discussion were on the various phases of the growth of the orange, and he called on Mr. Fawcett to deal with the first subject, the Orange Plant, as an introduction to the Conference.

Introductory Remarks.

By W. Fawcett, Director of Public Gardens.

Roots.—Liebig, the father of agricultural chemistry, says "A proper knowledge of the root-system of plants is the ground-work of agriculture; all the operations which the planter applies to his land must be adapted to the nature and condition of the roots of the plants which he wishes to cultivate. To secure a favourable result to his labours, he should prepare the ground in a proper manner for the development and action of the roots. The root is not merely the organ through which the growing plant takes up the incombustible elements of food required for its increase, but it may, in another not less important function, be compared to the flywheel in an engine, which gives regularity and uniformity to the working. It is in the root that the material is stored up to supply the growing plant with the needful elements for conducting the processes of life, according to the requirements made upon it by the action of light and heat."

It is to the study of the plant itself that I wish to direct particular attention.

As Liebig points out, the function of the root is not merely to take up certain materials from the soil, but it has to act in some sense also as a storehouse. It is only that portion of the root close to the tip of the smallest rootlets that can absorb water and dissolved material from the soil. So that while everything must be done by tillage to encourage the production of the minute rootlets and root-hairs, we must also see that proper conditions exist to allow the larger roots to do their proper

work. Experience has taught us that these larger roots need to be close to the surface, and in fact the increase in thickness at length leads to the appearance of the roots above the surface, in this way they receive more heat and air than they could at lower depths The absolute necessity for such a position is shown by disease, such as 'foot rot' setting in as soon as they are planted too deep: and the recovery of the plant as soon as it is transplanted and placed at a higher level.

The fact of the orange tree having a long tap root indicates that the soil must be well drained to the depth to which the tap root descends.

Stem.— To come to the stem, the common division of a stem into heart-wood, sap-wood and bark, answers fairly well to a true physiological division The heart-wood is practically dead wood and serves the purpose of support to the plant This explains why trees are sometimes found to be living and producing fruit while their stems are mere shells, the heart-wood having been eaten away by insects. The sap-wood is the portion through which the water and dissolved material passes up into the leaves. Between it and the bark is the cambium layer, which is constantly reproducing wood on the inner side, and bark on the outside. The inner bark is the conducting tissue for food descending from the leaves to provide material for growth wherever it is taking place The outer bark of the older portion of the stem is dead, serving as a non-conducting protective covering to the cells lying just below full of food material. If the outer bark is injured, ants and other insects at once attack the inner layer. If they succeed in destroying it all round, the passage for food to the roots and to the reproductive cambium layer is cut off and death ensues.

The outer bark may be seriously injured by heaping up soil or weeds round the stem, or by lopping off the lower branches so that the sun burns it, or by allowing it to be covered with moss and other growths.

Leaves.—The leaves are the special parts of the plant which take in the carbonic acid of the air, and in which the plant food is elaborated under the influence of sunshine. The surface of the leaf is perforated with countless numbers of mixed pores through which the carbonic acid passes, the carbon of which is used to form the great bulk of the plant. The pores lead into air passages, and if these are closed, the plant is deprived of air, and cannot carry on the processes of life. These pores also exist on the green portions of the branches, and in a modified form even on the stems. It will be seen therefore how neeessary it is to the health of the the plant to keep it free from moss, wild pines, and other growths.

Flowers and Fruit.—Coming to the structure of the flowers, they are so adapted that the agency of insects is necessary for carrying the pollen, and it is well therefore for every grove to have its hive of bees.

If few flowers are formed, or few fruit produced, while the tree is in vigorous growth, it is because the vigour of the tree is thrown in excess into the vegetative side, that is, into production of new leaves and shoots. To alter this, and throw the balance on the reproductive side, it is necessary to give a check to the vegetative vigour, and this may be done by pruning the roots.

Seeds and Seedlings.—A correspondent writes as follows:—

"I have a few large grape fruit and orange trees – self planted, and

some of them have given from 40s. to 60s. net in one year—each. All of these trees are growing on and are surrounded by solid rock—orange trees grow on the dwarf walls of the house and I have one so placed that has been cut down many times and has at this moment thrown up a vigorous shoot 12 feet high.

How is this? plant and take care of them and they will not grow, but yet they appear to thrive in such unlikely spots as I have described."

To explain this, the following remarks are offered for consideration:

Trees that spring up naturally are an extremely small percentage of all the seeds that are scattered about.

Seeds vary greatly in constitution, and it is only the small number that are peculiarly strong that will grow at all in the hap-hazard way in which they are dropped about by birds, &c. Then out of these only a small percentage will find conditions of soil and situation suitable to their growth, and the very few seedlings that survive in their struggle for existence will be so strong in constitution that it is very difficult to kill them.

On the other hand there is nothing much to guide the cultivator about the constitution of seeds and seedlings. They are taken care of, and given every possible chance to make a good start in life. It may so happen that they are all of weakly constitution, and no amount of cultivation will make much of them. In such cases it is better to plant new seedlings and try again.

Again, the cultivated seedlings may be planted out under most unfavourable conditions for growth. The soil may be most unsuitable for many reasons, and experiments are necessary to find out what is wrong. It may be want of cultivation, or planting too deep, or the absence of lime or one of the essential elements in the soil.

When self-sown seedlings are found doing well growing on rock, but plants put out on cultivated soil close by are sickly, there is not much doubt that what they find in the rock, namely lime, is deficient in the soil, and also that their main roots are in an advantageous position, not buried too deeply.

Varieties.

By H. Q. Levy.

With reference to what I am about to say on the above subject, I want it to be clearly understood that I speak from the standpoint of one who has had only five years' experience of citrus culture, and while during that time I have used my intellect, such as it is, to the best advantage, yet I desire my remarks only to be used as a basis from which others who have not had even that period of experience can start and experiment for themselves, and in their turn give us the benefit of their individual experience.

I have always held that our wild Jamaica oranges as they are being shipped at present, without any classification of varieties, and in most cases without grading as to keeping qualities, colour or flavour, will never prove a success in any market except there be no oranges from other sources; for while such oranges as are shipped from Florida, California, and European groves meet bad markets as most products will at times, selling ordinary Jamaica oranges on such

a market, and at the same time, would, if persisted in, only lead the shipper to absolute ruin, as many know to their cost.

The man who ships a box of Jamaican wild oranges cannot tell even approximately whether half of the oranges are good keepers, whether they are sweet or acid, neither can he tell whether they have only a few seeds or are filled with them. How much less can the man abroad who buys them? He is simply gambling; he hopes for the best, but can never be certain. Not that I mean to say we have no oranges in Jamaica worth cultivating, on the contrary, I believe we have seedling oranges that are far superior to many that have been imported, but up to the present there has been no systematic classification or propagation, or even the study of them, therefore the man who desires to launch out in orange culture must for the present fall back on the varieties that have been imported from abroad, and which have been tested for years. It is to aid the young planter, that is, he who has absolutely no knowledge, that I desire to give my own hard-bought experience of five years' standing.

In laying out a grove, the planter must first settle in his own mind whether he will plant only early, medium or late ripening varieties, or whether he will have some of each so as to extend over a season commencing say September and finishing about the end of May. Having done this he can start selecting his varieties, taking into consideration the different qualities, commencing with suitability for shipping, for we have practically no home market; then their flavour, manner of growth, and general healthiness. For early ripening I should favour the following as from my experience I believe them to be best.

"Boone's Early" or "Parson Brown." The latter, although not quite so early, yet is sweeter. Boone's early, except when on the fair road to bright colouring, is insipid. Both are very good growers and the trees are of a healthy habit.

A medium season orange is not so easy to choose, for, besides a host of seedling oranges, we have the old and standard European and navel family to deal with. If you only want to cultivate one variety, your task becomes easy, for as an orange combining all the good qualities and possessing none of the bad, the navel as cultivated in Jamaica stands out alone.

In this island we have several varieties of navel orange. Whether they were imported in far away times or not, I have been unable to gather, and although I have been working on the subject for some months past, I have only been able to trace the history of two trees. Of these I shall speak further on. Most of the native varieties are not at present worth propagating until some one works on them and tones down their bad points. Some are extremely acid, others have seeds (which is a decided fault in a navel orange) and yet others have a very thin rind and the flesh is coarse.

One variety which I discovered about four years ago, and have been fertilizing for that time, trying to improve it, has a very thin skin, too thin I think for shipping, and except very ripe on the tree is distinctly acid. So far the experiments have failed to make any difference.

[The fruit was on exhibition and shown by Mr. Levy.]

Continuing, he said the two trees mentioned before were imported into Jamaica about 30 years ago, at the same time as California and Florida obtained their navel trees, and all came originally from Bahia in Brazil; and while Florida and California, especially the latter, have made these oranges famous the world over, the two trees imported into Jamaica were only re-discovered a few years ago. I have propagated largely from this variety, and expect great results from it. I shall refer to this variety as the Bahia navel

It is large to very large, full of juice, skin very thin for so large an orange, and I firmly believe will make a good shipper The tree is a quick and healthy grower and, instead of making long growths, puts on bearing wood very rapidly. It is free from insects, and a variety that I would conscientiously recommeud every one to plant.

[Exhibits of these were also shown by Mr. Levy.]

Then there is the "Washington" Navel, of which I spoke before, in connection with Florida and California. It scarcely differs from the "Bahia" except that it is not so large. The flesh is more "meaty", and has not such a quantity of juice, neither does it make as much growth in the same time, and, with me, is just as liable to scale insect as any other variety. It is the standard orange of America and I think would pay to grow.

Next is "Parson's" Navel. I can't say anything of this variety, not having much to do with it.

I imported from Mr. A. C. Thomson, of Duarte, California, a couple of years ago, some buds of his famous "Improved Navel," which is said to be a great improvement on the "Washington," but the trees have not yet fruited, so I can give no opinion on them.

Then we have the family of Maltese oranges of which "Jaffa," "Majorca," and "Joppa" are the chief, I am not in favour of these at all. My experience has been a continual fight with scale insects, and although the flavour and texture are excellent, yet as soon as the rains set in, they become soft and quite unsuitable for shipment.

This leads us on to an endless variety of seedlings of Floridan origin; "Homosassa," "Nonpareil," "Centennial," "Pineapple," "Ruby," &c. Of these I can only advise "Pineapple, which is a grand orange, its only drawback being the quantity of seeds that it contains. It has a nice rich flavour, deep coloured flesh, a thin, smooth, tough and bright orange coloured skin and altogether a most desirable sort. Its manner of growth is vigorous and healthy I have not had occasion to spray one of my trees.

We must now turn to the late varieties. These comprise "Hart's Tardif," "Bessie," and "Valencia," I can say nothing of the last mentioned, as my trees have not yet fruited, "Tardif" and "Bessie" I think the same orange, at least it would take a pretty keen judge to find any difference between the two.

I never thought an orange could possess so tough a skin as that I find in "Tardif." If packed and cured for a few days it is with difficulty one can tear it. The tree is a vigorous grower and very shapely. The fruit when ripe is excellent, resembling very much one of the better class of our own Jamaica oranges, and I had oranges of this variety that partly ripened last year October, and were still good in June this year, when I picked off the crop.

I think every grove ought to have some trees of the Tangierine or Mandarin variety, as I am certain there is a great future for it. You can have an early variety of Mandarin in "Satsuma," a tree of distinct growth, with fruit a bright yellow with the same colour flesh. In Florida it is said to be the earliest variety of oranges to ripen, but here I have never seen it colour before October. Perhaps when the trees get older the fruit may ripen earlier.

For a late Tangierine, I could give you no better choice than "King." Its outward appearance is not attractive, for it has a very tough skin, but once eaten it will never be forgotten. Its flesh can only be described as melting and luscious.

In closing I would like to say that if only two varieties are desired for a grove, stick to the "Navel" and "Pineapple" oranges and you won't go far wrong; and lastly, never mix up your varieties in planting; keep each in its own place. and have them properly labelled.

Mr. Sharp said he agreed with what Mr. Levy had said about the Pineapple orange. It was the variety he cultivated and he had from his own experience always advocated it.

Mr. Fawcett, in reference to what Mr. Levy had said about the history of the Bahia Navel orange, stated that it was first brought to this island by Captain Rivett, and was planted at Petersfield, now the property of Col. C. J. Ward. Buds had been taken from this tree, and plants were distributed at Hope from it all over the Island. Mr. Fawcett also called attention to the St. Michael's Tangierine which he had on show, and which were grown at Hope. He said they were a variety which he believed would make good shippers He had asked Mr. Withers to send a few to England, to see how they would stand the voyage.

Mr. Chas. Eugene Smith, contributed the following note on modification of varieties in Jamaica:—

Does the climate or soil of Jamaica have any effect in changing or modifying an established variety so that it loses its characteristics when imported here from Florida for example:—The Tardif (Hart's Late) is not fit for use in Florida before January, is at its best in March, and often hangs on the tree till May; yet oranges which are supposed to be Tardif, and resemble the variety,were shipped from this district early in September this year, and were well matured at that time. On the other hand, Tardifs in another grove are still hard green as they should be at this season.

Mr. Cradwick sends the following notes:—

So far as I have seen, the Navel and the Pine-apple are the only varieties of those imported recently that can be said to justify their importation.

The Pine-apple trees at Salt Ponds have grown magnificently, the trees having a spread of branches of from fifteen to twenty-one feet. They have been planted just over four years and have borne two good crops; the fruit is large, of good flavour, ripens early, and is a good shipper.

The Tardif has done well at Salt Ponds, as has Parson Brown, these two varieties ripening early and shipping well. At Hartlands the Pine-apple is the only variety which has suceeded. At Eltham Park it has thriven better than any other.

I do not think Navels have had a fair chance on the south side. The Bahia Navel grows faster, and is far more vigorous than the Washington Navel at Hope. The Navels in the young grove at Caswell Hill, Vere, have grown better than any other variety.

As far as Tangierines go, if they can only be shipped, southern Manchester can grow them to perfection, the trees there being a sight to see in the season.

The St. Michael's Tangierines at Hope are the only ones which I have seen fruit. The tree is hardy, grows rapidly, and fruits heavily. They are now on their trial as to their shipping qualities.

Lemons grow and fruit well wherever tried in Jamaica. Mr. Wigan of Hartlands complains that he cannot sell them. The earlier fruits sold well, but they are now practically unsaleable. An attempt will be made at forcing the fruit so as to have them ripe in the hot weather.

Grape fruit.—It is doubtful if all the money spent on imported varieties of this fruit has not been wasted. The so-called Walter's Royal Pomelo is as a rule a worthless variety, the tree growing badly and the fruit being poor. The trees at Hartlands are, however, a bright exception, having grown and fruited well, and the fruit has proved of excellent quality. Royal Pomelo equals the variety grown at Resource called Pernambuco. Triumph Grape fruit is a much more thrifty tree, more nearly resembling our native varieties, which is the highest praise I can accord it. It seems to be nearly identical with the Jamaica varieties which have lately been named "Wilton," "Ayton," "Silver Rind," &c., all three of which names may be looked upon as synonyms. This variety occurs in Vere, various parts of the Blue Mountains, Port Royal Mountains, and doubtless in many other parts of the island, and I think that if buds were carefully selected, that we should soon be in possession of a variety very hard to beat and if we could only eradicate the seeds it would be perfect.

The growth of the Grape fruits at Hartlands and at Hope Gardens indicates that this is a tree well suited to the plains of St. Catherine and St Andrew, with a very moderate amount of water.

Situation for Grove.

Mr. Fawcett read a short note as follows:—

Those who live in temperate climates do not care for fruit that is too sweet, and that is the fault that is found with many of our Oranges both in England and America. In Florida, it is said that the further north the Orange is produced the better it is; and, in Jamaica, Oranges with the best flavour and proportion of acidity are those which are grown at the highest elevations.

On the other hand, those who have groves in the places where they can be irrigated, can supply or withhold water at will; and withholding water is an important matter when it comes to the ripening of the fruit.

Mr. Cradwick sends the following notes:—

Any site in St. Andrew, St. Catherine, or Vere, where there is over a foot of good surface soil with good drainage and a moderate amount of water available, is an ideal situation for a grove of Grape-fruits, Navel, Pine-apple, Tardif or Mandarin oranges. If these varieties at any rate do not grow, it is the fault of the

grower, and not the plants or situation. As far as my observations go, an altitude of from 800 to 2 500 feet seems to be the ideal one for Oranges, with one drawback, and that is, that the higher the grove the later the fruit, and the early orange or grape fruit certainly seems to be the one that catches the quattie. The earlier we get our fruit without impairing the quality, the better, and it seems to me therefore, that what we have to do is to look for the orange best suited to low altitudes.

Propagation and Treatment in Grove.

By Hon. T. H. Sharp.

Having been asked to read a paper on Orange Culture, I do so basing it upon five years' experience not only in establishing orchards but in reading and learning from others. Prior to this date little or no attention had been paid here to orange culture; but the misfortunes in Florida have given us an opportunity which has been taken advantage of, namely the establishment of orange groves.

It would take too long for me to deal with the pros and cons of each item, and therefore, I shall simply state what may be useful in practice to suit Jamaica.

Seed.

The best seed for stock is from the thoroughly ripe Seville orange, grown in the Claremont district of St. Ann. There the seed matures to a large size and germinates readily. I have used from that district over 400 quarts supplied by Mr. Sutherland.

A simple method of obtaining good seed is to squeeze the oranges over a rough crocus bag; then by holding the bag at one end and shaking it, the large round seeds will be thrown forward, while the deformed ones and other matter will stick to the rough bag.

You should be careful to prevent the seed fermenting either by keeping it exposed in a cool place at night, and drying it during the day, or by immediately using it.

Nurseries.

Beds 5 feet wide should be made up and the Seville orange seed placed in drills 4 inches apart in the step and 18 inches wide in the row and 1 inch deep. Three rows should occupy one bed leaving a foot out at both ends. Then cover with banana trash for 10 days, afterwards removing it.

As soon as the seedlings are about 18 inches high, six months old and the thickness of an ordinary black lead pencil, they should be lifted carefully, half the tap root cut off, and planted out in rows 4 ft. x 18 inches, giving about 7,000 trees to the acre.

All weak seedlings should be thrown away.

Budding.

Three months after the seedlings have been planted out, they should be fit to take the bud, and six months later, when the plants are 15 months old they should be ready for planting out. Fifteen to eighteen months old trees are the best.

Angular wood is the best to bud from, although round wood is generally recommended. It should not be too young because it would then shrink. If it is too round and old it will not be sufficiently succulent. A happy medium is what you want.

Budding very low subjects your bud to be beaten by the sand thrown up by heavy rains. The bud should be inserted just above the third leaf from the bottom of the stock Ten days after, if the bud is firm, cut the stalk diagonally six inches above the bud, cutting about one third through the stock. Then bend the top part of the stock back until it tears, so as to prevent it rising again

By this method the circulation in the stock is kept up, and the portion turned down should remain attached to the stock until the bud is eighteen inches high Then you may remove the old stock which is lying on the ground.

Six inches are left above the bud in order to tie the new bud to it to keep it straight, and to prevent its being broken off or strained by the wind.

After the bud is put in the stock and the stock has been turned down, gormandizers will appear; unless these are removed they will starve the bud

When your bud is hard enough and fit for healing over which is ascertained by the bulge at the juncture between the bud and the stock, you should cut away the original stock low down and allow the bud to heal over.

Buds should be pinched back regularly in order to harden and straighten them.

Two shoots ought not to be allowed to remain growing from one eye.

No plant should be lifted for setting out until it has a strong second growth, so that the first growth is hard

Seven days before lifting for planting out, the plant should be cut back which will cause the eyes to swell.

In lifting, water should be freely used and the roots preserved, especially the small ones.

Before planting, all damaged roots should be cut off, and long roots cut reasonably short.

Packing for Exportation.

Young citrus trees should be packed in strong wooden cases with plenty of apertures for air. See that the roots are enveloped in moss in order to maintain their moist condition.

Planting.

Dig holes 2 feet wide by 1 ft deep, 20 feet apart each way, a week before planting. The earth out of the holes should be placed in two heaps on either side of the hole, and the land must be well drained. Expose the roots as little as possible, and cut off the injured and broken ones. Dip the roots in a bucket of thick wood ashes and water. Draw the surface soil round the hole into it, leaving the two heaps intact When the hole is full, add from the heaps and form a mound, on the top of which place your plant, allowing all the roots to be in their natural positions. See that the tap root is not bent, place the earth firmly round it. Raise the lateral roots with the back of your hand, and straighten them to their full natural lengths, and cover with fine surface earth about two inches deep. Crown roots should be 4 to 6 inches above the surrounding land. Press the earth firmly down after planting.

Catch Crops.

Tobacco, cassava, cocoes, yams, pines, corn, sweet potatoes, banana and plantains.

Tillage.

After the plants are established, deep tillage and the cutting of roots is highly injurious.

Drainage.

It is absolutely necessary to keep the land well drained, so that the sub-soil will be sweet.

Pruning.

Remove gormandizers, and pinch back long shoots. Beyond this very little should be done.

Irrigation.

Very little is required, and the water should not be allowed to lie on the ground

Forcing fruit so as to get it in the good season.

Pruning.

We want to have our oranges full during the months of July, August and September, so that we must resort to artificial means, as follows; — Pick every orange off the trees in November, then prune and stimulate so as to cause the trees to put forth young buds from which blossom will come By pruning I mean the removal of all fruit, absolutely; then with a small saw remove all thorns from the stems, and saw away all rotten branches, dead wood, gormandizers, &c., leaving space for light to play fully upon the tree. Remove all moss and fungus and weeds under the tree over an area the size of its diameter and fork round to allow light to penetrate the soil. Saw off exposed, rotten or bad roots, and both on branches and roots paint all sores with zinc paint.

Wash.

Extra light allowed by the removal of the superfluous wood will act as a stimulant; but in addition to that a wash should be applied to the bark and stem of the tree which will destroy all insects and fungoid growths. For this purpose the following recipe is recommended:

1 quart Soft Soap.
1 " Black Carbolic Acid.

rub together and then add 2 quarts slightly warm water. Stir until a thorough emulsion takes place; then add 8 quarts of warm water making a total quantity of 12 quarts. Agitate for a considerable time and apply with a white-wash brush beginning at the top of the tree on branches not less than *one inch* in diameter, immediately after pruning.

The tree will produce many more blossoms than it can bring to maturity, so that you must leave according to your judgment of the strength of the tree, as many, only, as it can support. The fewer you leave the quicker your fruit will come in.

The extra sun in July and August will brighten the colour of the fruit more quickly than October and November sun, the former being more sunny months.

As soon as you have discovered that you have forced an early spring in your trees, but still have doubts as to their likelihood of bearing fruit, you may girdle them. This may be done in three ways, namely :

(1) Cut the outer bark in a ring to meet round the trunk and large branches, avoiding the severance of the inner bark.

(2) By tightening a piece of wire round the stem of the tree, with a twist in order to check the circulation.

But what I think best in the tropics is this :—

(3) Drive several old nails or pieces of iron into the tree round the stem about 3 feet from the ground.

Every tree that has not blossomed by January should be girdled.

Destruction of Blossom.

To meet the destroying effects of the February and March droughts and winds upon the blossom, treat the trees with lime in December. This will cause the potash on the soil to become soluble and thus help the trees to a large extent to resist adverse conditions.

I estimate the cost of treating as I suggest, at 4½d. per tree.

Finally, it is necessary that all trees which shade your orange trees in such a way that the morning and evening light cannot fully act upon them should be removed ; otherwise those portions of your trees which are exposed to light, only, will bear.

Discussion.

Mr. Upton asked if it was absolutely necessary to pick the fruit in November to get early oranges ?

Mr Sharp explained that although early fruit could be obtained otherwise, picking off the whole crop by the end of November would give the tree time to store up food for an early crop next season.

Mr. Upton asked how they could get a middle year crop ?

Mr. Sharp said that they did not get a middle year crop as a rule. In Manchester they would see a few oranges ripe at the middle of the year and by studying the conditions under which those were produced they would get a larger number.

Mr. Levy disagreed with Mr. Sharp that Seville orange stocks were the best for budding on. He found rough lemon better. The trees grown from rough lemon stocks threw out more fibrous roots and altogether were more healthy. He disagreed with cutting back stocks as it was best that the plant should have as much sap as possible to support it. It was likely to die back if it was cut. In regard to early fruit, he could only get fruit in April and May.

Mr. Sharp was gratified to know that Mr Levy's experience showed that the season of ripening was amenable to change. If Mr Levy calculated the time oranges took to mature from flower to fruit he could regulate them. Supposing that fruit took seven months and he wanted oranges in August, he would have to see that the trees flowered in February. If they flowered earlier, knock off the flowers, and they would be sure to flower again six or seven weeks later.

Mr. Levy said he had tried them in several months, but the plan had not worked.

Mr. Cradwick asked if all the 200 or so trees that fruited early were of one variety.

Mr. Sharp said no. He could not get all of one variety at the time of planting; but they were mostly of the pineapple variety.

Mr. Cradwick asked if it would not be better to pay attention to getting varieties that were known to give early fruit.

Mr. Sharp said he had tried both the Pineapple and Boone's Early and the Pineapple gave 4 or 5 per cent. more fruit besides coming in earlier.

Mr. James Francis said seasons have wonderful effects on the time of the reaping of fruit, and it was his opinion that with close application it would be possible to get fruit in the early months.

Mr. Cradwick said it would be regretable to discard all the previous experience of growers abroad and turn on a new line here.

Mr. Sharp said the subject should be attacked from all sides.

Mr. Fawcett said it was well known that by checking the vegetative parts of the tree you induce it to develop and increase its reproductive parts. He did not, however, agree with Mr Sharp's method of checking the growth of the tree by driving in nails and girdling. He thought it would better to try pruning the roots.

Mr. Cradwick sends the following notes:—

Nursery Treatment.

With regard to nursery treatment, methods of propagation, and various stocks, I have seen no plants which have grown so well, as a lot supplied to Mr. Laurence Tate, Shafston, Bluefields, Westmoreland. These plants were especially propagated for him, and were budded on six months old rough lemons; as soon as the buds were well taken, from three to five weeks after budding, they were lifted and potted in clay flower-pots seven inches in diameter, and as soon as they were thoroughly rooted in them, sent to Mr. Tate. They were planted in an old vegetable garden, on a poor soil with a subsoil of clay and flat rock, not by any means an ideal place for citrus trees, and yet they are the cleanest, healthiest, and best grown lot of trees for their age that I have seen in Jamaica.

Treatment in Grove.

Distance for planting. With regard to distance of planting, the following measurements are instructive:—Grape fruits (Ayton) at Hope Gardens budded August 1896, planted out in April, 1899, have now a spread of branches of 12 feet 6 inches. The Grape fruits at Hartlands (Walter's Royal) planted same time, have the same spread of branches. Bahia Navels have a spread of eleven feet. St. Michael's Tangierine have a spread of twelve feet, all budded and planted out at the same time. The Pine-apple orange at Salt Ponds planted the same time has a spread of fifteen to eighteen feet, one very fine tree being twenty-one feet from tip to tip of the branches. These measurements lead me to believe that the usually accepted twenty-four feet is none too much. Budded trees of all kinds are always inclined to spread rather than go upwards, exactly opposite to seedlings, so the seedlings are no help in forming an opinion, however old they may be.

Method of planting.—If large areas of ploughable land are to be planted, the land should be ploughed, and subsoiled as many times as its physical condition renders necessary, finally ploughing it so that the land on which the plants are to be set, is at least a foot higher

than the centre of the interspaces. The plants should then be set so that the crown roots are at least a foot above the highest level of the land on which they are set. If planting is to be done by hand labour a circle three feet in diameter, should be forked and thoroughly pulverized; on this, the young plant should be set, and the roots covered with surface soil taken from outside the circle already forked. Great care must be taken to spread out the roots and to firmly surround them all with soil, and to thoroughly water the whole of the stirred soil after planting. The circle of soil on which the plant is set should never be hoed, but hand-weeded, throwing the weeds down on the soil to form a mulch, if necessary; the soil can be loosened with the fork, but keep away the hoe as you value your plant; I once saw a young tree with eighteen big notches in the bark which had been made with hoes. The owner wondered why the tree gummed and did not grow, I did not!

Drainage—Drainage simply depends on the physical condition of the soil of the grove. The three feet deep drains at Salt Ponds have simply worked marvels, the shallow drains at Hartlands have done a lot of good. But there is little doubt that it is almost impossible to drain too deeply on such flat lands with clay subsoils

Tillage—Supposing the plants have been set sufficiently high, the fork should be used to keep the land in tilth, and the plough or hoe may be, but it must be clearly understood that tearing the roots off the trees periodically with plough, hoe, or fork is not tillage.

Pruning—Unless it is done by a very skilful pruner, it must be strictly confined to removing undeveloped growths in the centre of the trees. I have still to see the improvement of young trees by pruning; there is no doubt that young, vigorous trees are often caused to gum by pruning.

Irrigation—It is extremely interesting to know that two years ago the lovely trees at Salt Ponds were being vigorously irrigated, and were practically undrained; at that date the drains were made, and since then they have not had a drop of artificially applied water. Young plants on the dry plains must have water to start with, and possibly water might be very useful in starting the trees into growth so as to secure early fruit, but apart from this, it appears that Citrus plants are able to subsist with a very small rainfall; providing that the preliminary cultivation has been such that the roots can go down without meeting sour soil. The great thing in watering by irrigation seems to be to run the water from the point of the roots to the base, and not vice versa. If the planting in ploughed land has been done in the way suggested, two lines for the water to run down should be made, say eighteen inches from the stems when first the trees are planted, these lines being gradually made further and further from the stems as the trees develop, always remembering that it is the points of the root that require most moisture. Where hand labour has been used for planting, and the plants are set on the circles just described, the water should be run round the outside of the circle, it will find its way to the base quickly enough if the tillage has been thorough.

Foot-rot—Orange trees are rendered liable to foot-rot by deep planting, and sour undrained subsoils. If orange trees are properly planted

and the soil in which they are planted is properly drained and aërated, I do not think either native or imported varieties will suffer from foot-rot. I have seen trees which were planted too deeply, suffering from so called foot-rot, until all the leaves had dropped off and 90 per cent. of the roots had died, recover their health and become vigorous healthy trees, simply from being lifted and planted high. Examples of this can be seen at Hope Gardens

Insect Pests--Whenever an orange tree becomes infested with scale insects, it is time to look at the roots; deep planting, insufficient drainage or damage to the roots in some way, is usually responsible for a Citrus tree being badly infested with insects No wash or so called insecticide in this world will rid a tree of insects and make it healthy if its roots are left in uncongenial soil. The only imported variety of Citrus that appears to be more liable to attacks of scale insects than are our native varieties, is the Walter's Royal Pomelo.

Manures.

Mr. Cousins said there was such a vast amount of plant food in the soil of Jamaica that there were only a few instances in which it was necessary to use manure It was known that nitrogenous manures assisted in increasing the vegetative part of the tree, while phosphoric manures aided the reproductive parts. In northern climates it was necessary to manure trees so as to build up wood to withstand the effects of frost, but in this climate it was better to devote all their energies to cultivation Plant the trees high and see that they had good drainage and proper care.

Mr. Sharp asked if he was right in saying that artificial manure was the reverse of beneficial to young trees.

Mr. Cousins said it was.

Mr. Levy asked if Mr. Cousins meant that farm-yard manure was injurious to the orange.

Mr. Cousins said it would be in the case of young trees, but thought it would be beneficial to fully grown ones.

Mr. Sharp said it was necessary to starve trees to get fruit early. They did not want to get more fruit from the trees. On the contrary they suffered from having too many. It was to regulate the size of the fruit and the time of fruiting that they were endeavouring.

Insects and other Pests of Citrus Trees.

By *E. Stuart Panton*, Assistant Curator of the Institute of Jamaica.

In commencing this paper on the pests of citrus trees, it will be well to allude to the great advantage that must result from the precautionary steps taken by the Government to safeguard the citrus and other horticultural and agricultural interests by making one port only responsible for the importation of plants and seeds, and providing for their fumigation, thereby lessening the danger of importing new pests which often prove more harmful than those already existing in and native to a given area.

In view of the great impetus recently given to citrus culture in Jamaica, and the important position that the industry is likely to assume in the future, it is of great moment that the grower should be able to combat effectively the pests that will assail his trees.

It appears to have been the general experience with those having to

do with imported select varieties of citrus plants that they are far more liable to insect pests than our own native kinds, and it behoves the grower to furnish himself with the necessary information and apparatus, that will keep down the pests as much as possible.

Very many districts in this Island are peculiarly suited to the growth of the orange and others of the citrus family, and it is advisable, when possible, to select one of these for the planting of a grove, as the closer we get to a natural soil for a plant, the greater chance has that plant of flourishing, and the less likely is it to suffer from the attacks of disease or pests.

But although the grower may be fortunate enough to have his trees favourably situated, he will still find that they will be subject, more or less, to the attacks of insects and other pests, and in this paper we shall consider the subject of employing, intelligently, methods that will effectively combat the injuries done by them. It will be well first to take into account the nature and method of such injury.

In considering the damage done by insects proper, it must be pointed out that the injury done to plants and trees is effected by two classes of insects, termed by entomologists *mandibulate* or biting, and *haustellate* or sucking insects, and each of these has to be dealt with by more or less different methods.

I The Mandibulate or Biting Insects.

Under this heading are found those insects that possess mandibles or jaws with which they masticate the foliage of plants and trees and bore into the bark and trunk tissues. This class comprises the beetles in both larval and perfect states, the caterpillars of both moths and butterflies, and such insects as locusts and ants.

(1) Beetles.

In the case of beetles the damage done may be two-fold, that is to say, the imago or perfect beetle may be destructive to the foliage of a tree, while its larva or grub will be boring tunnels into the bark or heart-wood. But it does not follow that an insect will be injurious to the same species of plant or tree in both larval and perfect states.

Hitherto investigations have proved that the larvae of two beetles are injurious to the orange tree in this country. One of them, *Oreodera glauca,* belongs to the tribe of Longicornes, a family famous for their wood-boring proclivities. The damage done by the larva of this beetle was investigated in 1895, when the trees in St. Ann and other parts of the Island were observed to be affected.

The larva was found to attack the trunk, making long shallow tunnels between the bark and the outer portion of the trunk, where oval depressions were made in the outer wood in some places.

The larva, which is about half an inch in length, is of a light cream colour, except the jaws and first segment, which are brown. The body is broadest anteriorly, narrowing gradually posteriorly, but thickens slightly again towards the end. The sides of the body are clothed with numerous fine hairs.

The larva undergoes its metamorphosis in the shallow tunnels it makes between the bark and the wood, when it finally emerges a perfect beetle. More investigations are necessary to ascertain facts concerning a fuller life history of the species, and more observations as to the time of year that it generally makes its appearance.

In relation to wood-boring beetles, it must be observed that orange trees are very often found to be more or less hollow, and this is especially so among old trees, some of them being supported by little more than the bark.

The cause of this hollowness among orange trees is not fully understood, but facts seem to point to the boring larva above referred to, and possibly to the second, mentioned further on, as the primary agents in an evil, that, later is carried on by the white, or duck ants, or more correctly speaking, *Termites*. These latter take advantage of the entrance made by the beetle larva, and the consequent decay set up in the wood, to gain admittance, when it becomes only a question of time to bring the trees to their shell-like state.

That orange trees do not suffer more from these severe attacks, can only be accounted for by their wonderful vitality and hardihood, and their adaptability to our soil and climate But it is most unlikely that trees so hollowed out can live as long, or be as prolific as those in a sound condition.

It is therefore important to see that the "borer" does not gain an entrance to the tree, and when it does, to stop its ravages at once.

Remedies.

To do this, it is of course necessary to destroy any of the beetles whenever possible, and in cases where the tree is seen to be attacked by the larvae, the loose bark and wood in such places should be removed, and the holes or channels searched by a wire, or some sharp pointed instrument, and the larvae killed. After this, a thick lime wash, composed of one part of arsenic to a hundred parts of lime, should be applied to the trunk and larger branches.

A simple wash of lime and water will often preserve trees against the attacks of boring insects, but the wash must be renewed once in three weeks.

Special wash preparations for preventing borers attacking trees are sold, such as rosin and castor oil, whale oil soap and washing soda, soft soap and carbolic acid; but these must not be allowed to remain on the trees longer than two or three months at most.

(2) The Orange Weevil.

The other beetle destructive to our citrus trees is the well known, and common "orange weevil,"—*Praepodes vittatus*. This beetle is a representative of a West Indian group that is included in a larger group or family termed *Curculionidae*. The species of this family are exceedingly numerous, and many are very brilliantly coloured. They are entirely herbivorous, some feeding upon leaves, others on seeds, and some on stems of various plants and trees, while others do great damage to grain, as in the case of the corn weevil In movement they are slow, their cushioned feet indicating strong adhesive rather than walking powers. When alarmed, they fall to the ground, or suddenly take wing; many species however, are destitute of the organs of flight, as in them the elytra or wing-sheaths are soldered together.

The larvae of this family are voracious, fleshy, footless grubs, though possessing a double row of retractile fleshy tubercles in the place of legs.

The orange weevils measure from half an inch to an inch and a quarter long, and they constitute a variety of local forms, most of which

are brightly coloured. It is probable that all the varieties feed on Citrus, but those generally met with on orange trees are black, with red and white, and sometimes yellow and white stripes down the back.

But it is in the larval state that these beetles are injurious to orange trees, though the beetles themselves nibble the leaves, and hence the chief reason for their being often found hanging to the leaves and branches. This nibbling of the leaves however, does no real damage to the trees, but may rather be looked upon as an advantage than otherwise, as the beetles then come within reach of the grower, and may be picked off and destroyed, which should be done on all occasions.

On shaking the trees they will often fall to the ground, and can then be picked up. But when possible they should be picked off the trees, as they sometimes take flight before reaching the ground, when shaken from the branches.

The larvae of these beetles are soft, white, fleshy grubs, and are found boring into the roots of the tree. The female beetle probably lays her eggs just beneath the surface of the soil adjacent to a root, and the eggs hatching, the little grubs bore into the roots.

It is therefore advisable to keep the surroundings of the trees as free as possible of weeds or rubbish of any kind that may harbour the beetles, so as to prevent the eggs being deposited.

When a tree is seen to be affected by these under-ground grubs, the following remedies will be found useful for treating them.

Remedies.

Lime Dressing.

(1.) After clearing the tree free of weeds, stir the soil with a fork all round where the roots extend, and give a dressing of lime.

It is worthy of note in connection with lime dressing for insect pests, that a soil rich in lime is considered necessary for the production of superior fruit The lime tends to produce a smooth-skinned and well flavoured orange, and abundance of lime has the effect of hastening to some extent the ripening of the fruit.

Sulphate of Potash Dressing.

(2.) Prepare the ground in the same way as for the lime dressing, and give a dressing of sulphate of potash by sprinkling about two quarts on the surface around each tree. This will penetrate to the roots, and have a caustic action on all grubs, &c, even destroying insect eggs deposited in the ground, or in the roots of the tree. At the same time the sulphate of potash will, of course, act as a valuable fertilising agent, so that while destroying the pests, the tree will be stimulated into vigorous growth.

I would here call attention to that part of Dr Johnstone's paper on "Orange Culture, picking and packing," *where dealing with the cultivation of orange trees in Spain, he observes that as a preventive to insect borers, a circular hole is dug round the roots of each orange tree, forming a basin-shaped hollow which exposes the roots some 18 to 20 inches from the trunk. The paper goes on to say that by so doing, less shelter is afforded the borers who prefer to attack the roots near the trunk of the tree It is also stated that this system of exposing the roots proved of great value in getting rid of a gum disease that caused the death of 60 per cent. of the young orange trees of that country.

* Journal of Jamaica Agricultural Society, December, 1901.

Leaving the beetles we now come to the family of insects called

(3) Formicidae, or Ants.

Ants occur abundantly in tropical countries Almost without exception they are social in their habits living in companies. The study of the internal economy of their societies has always been a popular one, and the facts brought to light might almost cause one to assign to them some measure of reasoning power.

The association of ants with aphidae or plant lice, is well known, and it has been a matter of long observation that ants use the aphidae as milch cows. A species of ant in a temperate climate is known to take the eggs of the aphis into their nests in winter, and when spring comes, put them out on trees for future use as farm stock.

The reason of this attraction to plant lice, is that the latter secrete a saccharine substance that exudes from two tubercles situated on the hinder part of their bodies, and is dropped on the leaves of the plant, and of this the ants are very fond. Sometimes they are also attracted to exudations of plant juices caused by the puncture made by the proboscis of the aphis.

Ants are probably attracted to scale insects for the same reason, for the latter also secrete a similar sweet substance, called in both instances honeydew. This is probably why, in many cases where ants occur on plants, that scale insects are to be found associated with them. For this reason ants sometimes get blamed for injury done to plants, that has really been caused by other insects. However, ants are not to be counted as friends to the orange grower, for apart from other disadvantages from their presence, it is very probable that they may play some part in the distribution of scale insects, by carrying the eggs and young that may adhere to their feet, from tree to tree; but this has not yet been satisfactorily proved by entomologists.

Two instances will now be given where ants become a pest to citrus growers in this country.

(1.) By making nests on the trees.

Black ants nests' are very often to be seen on orange trees, and are generally located on one of the higher branches. The limb on which the nest is, is often dead, or appears unhealthy When these nests occur on trees, the ants are to be seen crawling all over the tree, and become a great source of trouble and annoyance to pickers and pruners.

Remedies.

These nests should be removed by rubbing them off and smearing the place with a little crude carbolic acid, when it will be found that the ants will not return to the spot. Should they attempt to build a nest on another branch, it should be rubbed off in the same way, and the carbolic applied

(2) Black stinging ants a different species to the above, are often found to be very troublesome to a nursery of young budded trees, by making nests of earth round the roots, sometimes piling the earth to some little distance up the stems.

In cases where trees are thus infested, they generally present a more or less dwarfed appearance, and do not look as healthy or vigorous as those not so attacked.

Associated with these ants may often be observed the white "mealy bug," a species of scale insect. The cause of the presence of scale

insects among ants has been alluded to above, but in this case the ants are the greatest offenders, and the following remedy should be applied to them.

Remedies

Spray the nest with a weak solution of carbolic acid and water, and rub off any mealy bugs that may be attached to the plant.

(4) Termites

In connection with ants may be mentioned the Termites, insects that generally go by the name of "White Ants," or "Duck Ants." These are not true ants, but belong to a family called *Termitidæ*. As previously mentioned, their attacks are to be feared in cases where the borer has been at work, or from some other cause, a part of the woody tissue of the tree has become injured, and in consequence, decay set up. In such cases they will often gain an entrance to the trunk, and in time eat away the whole of the inner tissues, leaving hardly more than the outer bark to support the tree.

Remedies.

A common and successful remedy against these pests is the use of a little calomel or arsenic applied to the nest, when it will be well to crush a few of the ants in the poison, allowing them to remain in the nest, or anywhere where the others can get at them, when they will start eating them, and then eating up one another, till the entire colony will be destroyed. Jeyes' disinfectant has also been used with success against duck ants.

As a preventive against borers and duck ants, it is very necessary that a coating of tar or diluted carbolic acid be applied to any part of a tree where the wood has become exposed by pruning, or any other cause. The tar not only keeps away borers and duck ants, but tends to prevent moisture from penetrating the woody tissues, which would accelerate decay.

(5) Caterpillars.

Of the larvae of Lepidopterous insects, or the caterpillars of moths and butterflies that feed on the leaves of the orange and lemon trees, may be mentioned the larvae of a brown or chocolate coloured butterfly, called *Achylodes philemon*, Fabr belonging to the family *Hesperidae* or "skippers" But no special account will be taken of this insect here, as, hitherto, the presence of the larva on Citrus trees has not proved of any economic importance. It is not a voracious feeder, and its occurence is rather rare. A full account of its life, history and habits have been given by the writer in a paper on some Jamaica *Hesperidae*, which will be found in the Journal of the Institute of Jamaica, Vol. II, No. 5, page 435.

(6) The Bag Worm.

Larvae of a species of bag worm, probably *Oiketicus abbottii*, Grote, have lately been sent to the Botanical Department, the correspondent stating that they were found attacking a young sweet orange tree, and had eaten nearly all the leaves off the tree.

The real food plant of this insect is the Almond tree, on which they are found commonly about Kingston Their presence on orange trees has not been recorded before, and is probably only occasional, and of no general importance.

Remedies.

If found necessary, hand-picking would be the best method for dealing with these insects.

II. Haustellate or Sucking Insects.

We now come to the second, and in the case of Citrus trees, the most important class of insect pests. In this class are those insects that exhaust the vitality of plants and trees by absorbing their juices with a beak-like proboscis.

(1) Scale Insects and Mealy Bugs.

Scale insects and mealy bugs belong to the family *Coccidae*, which is included in the order *Hemiptera*, or true bugs, and they may here be taken to represent the haustellate or sucking insects.

Most of the injury done to plants in tropical and sub-tropical countries is due to scale insects, some 1,200 species of which are known to occur the world over, and about one-tenth of these are to be found in the West Indies. These pests have been the bane of citrus growers in the United States, where all the science of economic entomology has been brought to bear on them, resulting in the greatest success in keeping them under control.

Upwards of sixty species of scale insects are recorded from Jamaica, a few of which infest the orange and other Citrus trees. Among those occurring on Citrus trees may be mentioned the orange mussel scale, *Mytilaspis citricola*; the red spotted Aspidiotus, *Aspidiotus ficus*; and the orange snow scale, *Chionaspis citri*. This latter scale has lately been sent to the Museum, and reported to be infecting hundreds of orange trees in a grove in Clarendon. The pest was identified at the Museum as *Chionaspis citri*, but as this species has hitherto not been recorded as occurring in Jamaica, specimens were sent to Dr. Morris of the Imperial Department of Agriculture for further determination, and Mr. Lefroy. the Entomologist for the Department, confirmed the determination as *Chionaspis citri*. This species occurs in great numbers on the leaves and twigs. The females are brown and much larger than the males, which latter are pure white. This scale is said to occur in the orange groves of the Eastern United States, and to be specially troublesome in Louisiana. It is also reported to be very prevalent from New Orleans to the Gulf, and that its presence on the trees causes a bursting of the bark and very ugly wounds. As a result of this, it is said that the trunks of many of the older trees become rotten, and all this is said to be due to the attacks of this scale insect, which is a most pernicious scale of orange and lime trees. Every effort therefore ought to be taken to prevent it spreading.

In Jamaica scale insects in general, appear to be most dangerous to Citrus trees in the lower and drier parts, and while they may occur on trees at higher elevations, they do not seem to affect them as injuriously.

Hitherto the growth of Citrus fruits under anything like proper cultivation, has not reached much more than an experimental stage in this country, and therefore to what extent the trees will suffer from insect and other pests when a more artificial state of cultivation is entered upon, and systematic groves established, and foreign and select varieties more cultivated, can only be a matter for the future to settle; but in the

mean time it will be well that as much local knowledge regarding insect and other pests should be accumulated as possible.

Before passing on to the more practical matters of how best to cope with the attacks of scale insects, it will be well here to give a short sketch of their life and development on Citrus trees.

We are indepted to American entomologists for much of what is known of the life history of scale insects, and the general account given below will give some idea of how carefully they have studied this group.

It must be understood that there is great variation exhibited in the life histories within the group. but the following account will give a general idea of their life and development

With very few exceptions, scale insects are derived from eggs, the exceptions being in a few cases where the young appear to have been produced alive, that is to say they emerge from their shells or envelopes at the moment of birth, and so seem to have been born alive. The eggs are minute oval bodies, of various colours When just hatched the insect is very small, oval in outline, with a flattened body, and furnished with three pairs of legs, a pair of antennae, and a delicate sucking appartus, consisting of three or four long fine threads by which to extract the juices of plants.

Although the larvae of scale insects are very minute, it is possible to make them out with the naked eye as they run over the leaves, twigs and fruit. At this stage of their existence they are usually of a light lemon colour, and present the more typical insect form, by possesing an articulated head, thorax and abdomen. Very soon after hatching, generally within two hours, they seek suitable places on the leaves or stems, in which to bury their sucking threads, and having done this, they soon increase in size. As soon as they have started to feed they begin to secrete and throw out waxy thread like secretions or filaments from the upper surface of their bodies, which go to form, along with the cast or moulten skin, the beginnings of a scale covering, which is gradually enlarged by further supplies of waxy filaments, as the increasing size of the insect requires.

After the first month they present a remarkable change, losing their antennae, legs and eyes, they are degraded to not much more than a mere sucking apparatus, appearing something like a sack possessed of a beak-like process by which they adhere to the leaf or stem of the tree, and through which they draw up its juices.

The females cast their skins twice, and soon after the second skin is cast they arrive at maturity. At the second moult the males reach the pupal or chrysalis state, and unlike the females, they undergo a complete metamorphosis, emerging from the pupa as minute two-winged flies, possessed of eyes, antennae, and three pairs of legs, but without mouth-parts. Their only function in life is to effect the fertilisation of the females, which being done, the latter become distended with eggs, which are laid beneath the scale, and the body of the female gradually shrivels up to make room for the eggs.

General Observations.

In tropical and sub-tropical countries where citrus trees are cultivated, scale insects are more or less active all the year round. In the United States it has been observed that they produce three or four

broods in a year, and each brood may be said to extend over three or four months. Therefore these insects are generally to be found in all stages of development on the trees, which is due to the fact that the separation into distinct broods is often more or less confused, as one generation overlaps the next.

Means of Dispersal.

Several agencies effect the spread of scale insects from tree to tree. Among these may be mentioned the wind, insects, and birds.

Preventive Measures.

The best means to insure a tree from the attacks of scale insects, is to endeavour by all possible methods to promote its vigour. Scale insects attack weak trees first, and any lack of food or water will lay a plant open to their attacks.

As a preventive against scale insects, judicious pruning is also very necessary, for they thrive best where they are protected from the direct sunlight and a free circulation of air. It is therefore necessary that the trees be kept from a dense matted growth of clustered branches and twigs, for such parts are more likely to be affected by scale; for the same reason trees should not be planted too close together.

In Jamaica our heavy seasonal rains act as a considerable check to scale insects, at which period they will be found to be less active.

Natural Remedies.

In the United States, natural remedies are encouraged, and artificial means used to keep a check on the attacks of scale insects. The natural remedies are the encouragement of other insects that prey on them. Foremost among these are the larvae of the ladybird beetles. Where not already existing, these beetles are sometimes introduced into districts to prey on the scale insects, and in some cases with the greatest success. So much so that sometimes artificial remedies are found to be unnecessary.

Another important class of natural enemies found to be very destructive to these pests, and to keep them well in check, are some hymenopterous parasites These are four winged parasitic flies, the larvae of which feed within the bodies of the scale insects.. Less important among the insect enemies to scale insect may be mentioned the Lace-winged flies, a few parasitic dipterous flies, and the larvae of several species of Lepidoptera.

Very little is known of what natural enemies to scale insects there are in Jamaica, but that some are present is certain, for some larvae of a ladybird beetle were seen crawling over scale insects that were lately brought to the Museum, which were infesting orange trees. And a former Curator has observed the same species of scale, *Mytilaspis citricola* to be parasitised by some Hymenopterous insect. But from the abundance of scale insects in Jamaica, it appears likely that they do not suffer much from natural enemies. In the future it might therefore be found advisable to import from the United States or elsewhere, some of their natural insect enemies. Such that would prove useful for this purpose would be some of the ladybird beetles, and the parasitic *Chalcididae* and *Mymaridae* flies, and as the habits of these predaceous and parasitic insects are well known, there would be no reasonable objection to their introduction here.

There is no doubt that great importance must be attached to natural enemies, but in cases where scale insects increase to any great extent, it is necessary to resort to artificial means to keep them under control.

Artificial Remedies.

The most readily applied artificial remedies for scale insects, and those that are best calculated to check their increase, are the various poisonous washes that are applied to plants and trees by means of some spraying apparatus. Other remedies consist of fumigating the trees with carbon bi-sulphide, hydrocyanic acid, &c., but these latter remedies are not so easily applied, and therefore are less adapted for use in the West Indies

The remedies then that will be found most useful are the different kind of washes, the application of which must be thorough, so that by a uniform spray every insect comes in contact with the wash, which in some cases suffocates the insects by forming, when dry, a coating or case over them, and in other instances not only suffocates, but poisons, by coming in contact with their bodies.

In applying these washes to trees it may be found best to do so after the fruiting has taken place, and before the trees take on young foliage in the spring; but this principle might be open to modification, depending on the condition and the species of scale insect.

The following are six different recipes of washes, issued by the Imperial Department of Agriculture for the West Indies, which will be found to be very effective for use on scale insects, and are readily obtained, and easy of preparation.

(1) *Kerosine Emulsion* (hard soap.)

Dissolve ½lb. hard soap in one gallon of boiling water. Add two gallons of kerosine to the hot liquid and immediately churn, with a syringe or force pump, till the mixture becomes creamy. This is the stock solution. Make up to 33 gallons. Use only rain water, or soft water (that is, without lime)

(2) *Kerosine Emulsion* (soft soap).

Dissolve one quart soft soap in two quarts hot water; add one pint of kerosine to the hot mixture and immediately churn, with a syringe or force pump, till the whole is creamy. Add an equal amount of water, and it is ready for use. Any water may be used.

(3) *Rosin Wash.*

Mix 20lbs. rosin, 3½lbs. of 98 per cent. caustic soda, and three pints of fish oil. The rosin and the caustic soda must be pounded before mixing. Cover this with about 2 inches of water and boil. When the liquid is clear, slowly add water, still boiling the mixture, till the whole is made up to 15 gallons. This is the stock solution and can be made up to 100 gallons when cold, using only rain water or soft water.

(4) *Rosin compound.*

Mix 4lbs. powdered rosin, 3lbs. powdered washing soda, and one gallon of water. Boil, and when all is dissolved, slowly make up to five gallons. Boil the mixture till it becomes of a clear brown colour. This is the stock solution. Make this up to 30 gallons.

(5) *Whale Oil Soap.*

Dissolve 1lb of soft soap in one or two gallons of warm water.

(6) *Rosin and Whale Oil Soap Compound.*

Mix 1 gallon of water with 3lbs. of powdered washing soda an

four pounds of powdered rosin. Boil till dissolved and, while boiling, make up *slowly* to 5 gallons.

In a separate vessel boil 10lbs. of whale oil soap with 5 gallons of water. These may be mixed while hot to make the stock solution or, when cold, mix these two with 35 gallons of cold water, pouring both into the water together while actively stirring the mixture. However mixed, the final amount must be 45 gallons.

In the case of kerosine emulsion made with hard soap, rain water must be used, as water containing lime will cause the oil to separate out on the surface after making the emulsion. Rain water is to be preferred for all washes.

Rosin wash is cheaper than that made from the kerosine emulsion, but the latter is found to be the most convenient for use. The former sometimes clogs the spraying nozzle, but this can be overcome by first straining the solution through a piece of thin tarlatan cloth.

Application of Washes.

The wash preparations are best applied with a spraying machine though where small plants are concerned, a brush or syringe may be used. To spray an orange tree, it will be necessary to obtain a good spraying machine, capable of giving a spray of various fineness. Many kinds of machines are now obtainable from the makers, and those made of brass or copper are the best, as they are not affected by the washes used. Two forms of machines are generally employed, that which is carried strapped to the shoulders, and called "knapsack," which holds about 4 gallons of wash, and larger ones that are fitted into a barrel which is carried on a light iron truck with two wheels, which can be pushed from place to place in the orange grove. Good machines can be bought of the Deeming Company, Salem, Ohio, and from the Gould's Manufacturing Company, 16 Murray St., New York. The 'Bordeaux' or 'Seneca' nozzles are highly recommended, and appear to be found the best.

Sometimes one thorough application of a wash will be found sufficient, but two are generally needed: the first destroys the living insects, but might not kill the eggs. Therefore a week after the trees should get another spray, which will destroy any young insects that may have hatched.

(2) Aphidae or "Plant Lice."

The Aphidae are so well known that they hardly need description. They comprise a numerous and obnoxious tribe of insects, allied to the coccidae or scale insects. Few plants escape being attacked more or less by them. They are possessed of a rostrum or sucking beak, by which they puncture and extract the juices from the young shoots and leaves of plants, on which they reside in societies, and are generally associated, as previously mentioned, with ants.

As affecting citrus trees, these insects perhaps do most damage to young nursery trees, congregating on the young shoots and leaves, producing in many instances vesicles or gall-like excrescences, which not only weaken the vitality of the plants, but very much disfigure them by contortion.

Remedies.

Spraying with the kerosine emulsion and other washes recommended to be used against scale insects, will be found effective in the case of aphidae.

III. Slugs and Snails.

Included among the pests that citrus growers have to contend with are the slugs and snails. Their attacks are easily detected by the line of slime and excrement they leave on the plants they have been attacking. The slugs are perhaps especially injurious to young orange trees. They are seldom seen doing their work of destruction, as they chiefly feed at night. During the day they are in some cool retreat, probably hiding in the grass roots near the tree, or under stones or logs of wood, or some other available shelter. But after sunset they crawl out, and often do great damage to nursery and other young citrus trees that may have been set out to grow.

They appear generally to eat the young shoots and leaves first, and do much damage by eating the bark off the stems, sometimes killing a tree entirely.

Less destructive than these, but also responsible for injury, is the very common large white-shelled snail, *Helix aspera.*

Remedies.

When slugs and snails are doing much damage to Citrus plants, it is a good plan, when possible, to run a few pigs through the grove. Pigs will devour every slug and snail that they can get at, but care must be exercised to see that the pigs do not plough up the land too much, and so injure the trees. For this reason China pigs would be the best to employ for the purpose.

White lime has been found of use against these pests. The earth should be stirred some two or three feet round the tree, and good lime spread on the surface, and the stems of the plants white-washed.

The potash manure known as "Kainit," destroys grubs and caterpillars, and has been found to be useful against snails. As an experiment, some of it might be sprinkled round the trees instead of lime.

In the case of snails that are possessed of shells, much can be done by hand-picking, as they are easier found than slugs.

It will be well in conclusion to remark, that growers throughout the Island would do good service to Citrus culture if they studied the question of the attacks of scale insects and other pests on their trees, and the effects of the different remedies used against them, and communicate the results to the Curator of the Museum from time to time; for, while much of the knowledge and experience brought to bear on these pests in other countries will be of great value and assistance here, it must be remembered that our soil and climate are different, and therefore in some cases modifications in treatment may be found beneficial. Therefore the accumulation and report of such matters to the Museum, would help to bring about a system of treatment best adapted to our needs, and benefit all concerned in the development of the growth and culture of Citrus fruits in Jamaica.

THE JAPANESE PERSIMMON.*

The term Kaki, is used by both Japanese and Americans for this species, Diospyros Kaki. It is a native of Japan, but is found in Corea, China, Cochin-China, and some parts of the East Indies, probably having been introduced into these countries from Japan. There is considerable doubt, however, about this point, as the varieties found in China and Corea are said to be more hardy than those of Japan. Japanese persimmon trees are conspicuous in the landscape of the Island Empire. The trees are plentiful in the native flora and they have been largely planted in cultivated grounds. The people of Japan regard the persimmon as their most valuable fruit. No tree in their gardens is more admired than the persimmon with its large, broad, glossy leaves and handsome crimson or golden fruit. The Japanese have not made a mistake by giving this fruit such high rank simply as an article of food, since chemical analysis show that it has a high nutritive value.

The Kaki has been improved by the Japanese until it is much superior to the wild fruit. A large number of seedlings have been grown and the best ones retained for general cultivation. The seed of the Japanese persimmon, like that of the American persimmon, does not fully reproduce the characteristics of the specimen from which it is taken; hence, many varieties have arisen, the fruits of which vary more or less in every particular. It is these same varieties of Japanese origin, excepting a few of American production, that are cultivated in the United States.

Botanical Characters.

The trees of the Japanese persimmon are of medium size when grown on their own roots and in their native habitat. The leaves vary considerably in shape and size in the cultivated varieties, but are generally ovate, elliptic, acuminated, elliptic-oblong, or obovate, cordate at the base, paler underneath, downy on both sides, entire, varying in length from three to eight inches. The flowers are inconspicuous, whitish green; the peduncles are usually three flowered. The flowers are complete but all varieties are not equally self fertile.

The wild fruit is "yellow when ripe, globose, 8-celled, size of an orange, abounding in yellow, fleshy, edible pulp" which is considered fairly pleasant. The Kaki has been improved by the Japanese until it is much superior to the wild fruit. The average specimen weighs about six ounces. Some specimens examined of the Hachiya from Florida, weighed over ten ounces. By extra care single specimens have been made to weigh a pound or more, which weight is rarely surpassed by the apple.

Fruits of the Japanese persimmon vary greatly in shape, being globular, oblate, oblong, or a combination of these forms.

* Extracts from Bulletin on Persimmons by R. L. Watts, Agricultural Experiment Station of Tennessee.

The surface is generally smooth, although some have small slightly raised specks, and the fruits of several varieties are marked by a network of dark lines at the blossom end caused by the breaking of the skin.

The colour ranges from light yellow through the various shades of red and yellow to a dark red. Perhaps the most common colours are bright orange, red, and vermilion yellow.

The flesh varies almost if not quite as much in colour as the skin, the shades frequently resembling that of the skin. A general classification is made into light and dark fleshed varieties. The fruits of some varieties have both dark and light flesh, but the two shades are always more or less distinct. The astringency of the fruit may be known to some extent by the colour of the flesh. Dark fleshed specimens are rarely puckery and may be eaten and relished before they become soft, while the light fleshed types are always astringent and must soften before this peculiar quality disappears. Dark fleshed fruits are more solid and resemble somewhat the consistency of an apple. Although they may be eaten before reaching maturity, some of the dark fleshed fruits are better after softening, while others should be eaten when still hard and crisp.

The astringency of the light fleshed class is lost in some varieties as the fruit begins to soften. Others must be fairly soft and some must become almost jelly-like before the astringency disappears. Dark fleshed varieties have seeds; those with light flesh are frequently seedless. The seeds are large and exceedingly hard, and vary in number in different specimens from the same tree. There are never more than eight seeds in a single fruit and usually less than this number, these being solitary in the cells. A number of specimens examined contained only one seed.

The flavour of the Kaki varies considerably in different varieties. Some fruits are sweeter than others. All, when properly ripened, contain sufficient sugar to make them highly palatable but they vary widely in juiciness. The Tsuru when sufficiently ripe to eat is so soft and juicy that a spoon is required to eat it, while the Zenji contains much less juice and is more compact when at the proper stage for consumption. The Hyakume is different in consistency from either of the two varieties just named. When slightly overipe it approaches a mealy condition, but if eaten at the proper time the fruit is crisp and sufficiently juicy to be relished.

USES OF THE FRUIT.

The Japanese persimmon is generally consumed in the fresh state. It is said that the fruit of some varieties is very delicious when dried. It is also claimed that they are palatable when preserved. There is, however, not an agreement among growers on this latter point, for one very practical fruit culturist informed the writer that the attempt of his wife to preserve thoroughly ripe specimens was entirely unsuccessful. It is necessary to be familiar with the fruits of the different varieties in order to know when they should be consumed. As previously stated, some are edible when still hard, while others must be fairly soft, and some almost mushy before they are free from astrin-

gency. When served on the table they are delicious with cream. The more solid varieties may be sliced like tomatoes before serving.

CULTIVATION.

The majority of growers in the Southern States recommend thorough cultivation during the summer season, contending that the persimmon responds to this kind of treatment as well as any other fruit. Two or three persons, however, discourage cultivation, claiming that it causes premature dropping of the fruit. As summer tillage is without doubt necessary for the best results with all other fruits, and as the majority of the most successful growers practise frequent cultivation, it is proper to conclude that this operation is desirable on most, if not all persimmon plantations. The dropping of the fruit referred to was probably due to other causes.

TRANSPLANTING.

Persimmon trees are more difficult to transplant than other orchard fruits on account of the long tap roots In digging young trees care must be exercised not to cut off too much of the tap roots, for this is quite certain to result in the death of the trees. It is best to transplant the trees before the tap root has attained any considerable size. It is safest to use trees not more than one or two years old.

Soil intended for persimmons should be ploughed deeply, using a subsoiler if possible. The holes for the reception of the trees should be deep enough to allow a foot or more of loose soil below the lower end of the tap root. If the trees have been grown in this climate and are well hardened, fall planting will give the best results If the trees are received from a more southern nursery it will be safer to get them in the spring and plant as soon as possible after their arrival. As we do not know what size the trees will attain in this climate it is impossible to make safe recommendations concerning the proper distance between the trees in the orchard. It is likely that twenty-five or thirty feet between the trees would give them plenty of room during their entire existence.

PRUNING AND THINNING.

Trees of the Japanese persimmon do not require much pruning. It is simply necessary to remove dead limbs and those which interfere with the growth of others and to cut back the leading branches so that a symmetrical head is formed. Mr. W. A. Yates, of Texas, who has two thousand trees, recommends cutting back the previous season's growth one-half, and the training of low pyramidal heads.

Thinning is an essential operation when a considerable quantity of the fruit dees not drop prematurely. The Japanese persimmon is exceedingly productive, and thinning is important for the following reasons: *First* to secure larger and finer fruits. It would be unreasonable to expect each one of the numerous fruits found on some trees to attain a large size. *Second*, to promote longevity. A prominent grower of Florida believes that overbearing kills sixty per cent. of all the trees in the South that die from various causes. *Third*, to secure annual crops of uniform proportion. A tree which overbears one year is not in condition to yield even a fair crop the following year. Thinning should be deferred until the fruit is at least one inch in diameter.

Removing the surplus specimens at this time will not result in over-thinning as premature dropping generally occurs before the fruit has attained the size mentioned. Thinning is especially important for very young trees.

VARIETIES.

[The following varieties have been received from the United States Department of Agriculture: Costata, Hachiya, Hiyakume, Tsuru, Tane-nashi, Yemon, Zenji, Okame, Yedo-ichi]

ADDITIONS AND CONTRIBUTIONS TO THE DEPARTMENT.

LIBRARY (Serials).

EUROPE.

British Isles.

Botanical Magazine, Nov. [Purchased.]
Bulletin Kew Gardens, App. I. 1902. [Director.]
Chemist and Druggist, Nov. 2, 9, 16, 23. [Editor.]
Colonial, Diplomatic and Consular Reports, Aug., Sept., Oct. [Col. Sec.]
Garden, Nov. 2, 9, 16, 23. [Purchased..]
Gardeners' Chronicle, Nov. 2, 9, 16, 23. [Purchased.]
International Sugar Journal, Nov. [Editor.]
Journal of Botany, Nov. [Purchased.]
Nature, Oct. 31. Nov. 7, 14. 21. [Purchased.]
Our Western Empire, Nov. [Publishers.]
Pharmaceutical Journal, Nov. 2, 9, 16, 23.
The Anatomy of the Bark of Robinia Pseudo-Acacia, Linne
The Chemistry " " " " " " " } Director of Wellcome Chemical Research Laboratories.]

France.

Sucrerie indigène et coloniale, Oct., 29. Oct, 5, 12, 19, 26. [Editor.]

Denmark.

Familien Podostemaceae. By Eug. Warming. [Author.]

Belgium.

Bulletin, Société d'Etudes Coloniales, Mar,-Nov. 1901. [Editor..]

Germany.

Notizblatt, Berlin. Oct. [Director.]
Beihefte zum Tropenpflanzer. Nov. [Editor.]
Tropenpflanzer, Nov. [Editor.]

Switzerland.

Bulletin de l'Herbier Boissier Vol. 1, No. 11. [Conservateur.]

Italy.

Chronological Tables for Tobacco in America, Europe, Africa, Asia, and Oceania. [Dr. Prof. O. Comes.]

ASIA.

India.

Agricultural Ledger (Calcutta) No. 8. [Lt. Gov. Bengal.]
Planting Opinion, Aug. 24, 31. Oct. 5, 12, 19, 26. Nov. 2. [Editor.]
Proc. Agri. & Hortl. Soc. of India, April-June. [Secretary.]

Straits & Federated Malay States.

Agricultural Bulletin, Vol. 1, No. 1. [Editor.]

Ceylon

Times of Ceylon Aug. 29. Oct. 10, 16, 24, 31. Nov. 7. [Editor.]

Java.

Proefstation East Java, No. 29, 32. [Director.]

Australia.

N. S. Wales.

Agri. Gazette, Sept., 1901. [Dept. of Agri.]

Queensland.

Queensland Sugar Journal, Oct. 1901. [Editor.]

Western Australia.

Journal of the Dept. of Agri., Oct. 1900. [Dept. of Agri.]

Africa.

Cape of Good Hope.

Agri. Journal, Sept. 26. Oct. 10. [Dept. of Agri.]

Natal.

Agri. Journal and Mining Record, Oct. [Dept. of Agri.]

Central Africa.

C. African Times, Sept. 7, 14. [Editor.]

Gold Coast

Report upon the Botanical Dept., 1900. [Curator.]

West Indies.

Barbados.

Agricultural Gazette, Nov., Dec. [Editor.]

General Treatment of Insect Pests, 2nd Edition.
Hints for School Gardens.
Annual Report on the Botanic Station, Antigua, for year ended March 31, 1901

} [Commr. Imp. Dept. of Agri. for the West Indies.]

Jamaica

Journal, Jamaica Agri. Soc. Sept., Nov. [Secretary.]

Weather Report for Oct., 1901.

Trinidad.

Proc. of Agri. Society, Aug. 20, Oct. 8, 1901. [Secretary.]

British Guiana.

Journal Roy. Agri. Commercial Soc. of B. Guiana. [Secretary.]

British North America.

Ottawa.

Farm Pests,—Fodder Grasses. Evidence of Dr. Jas. Fletcher, Entomologis & Botanist, before the Select Standing Committee of Agriculture & Colonization, 1901. [Author.]

Bull. No. 38. Soft Pork, an investigation into its character and causes. B. Jas. Fletcher. Author's Edition from Annual Report on Experimenta Farms for the year 1900. [Author.]

Montreal.

Pharmaceutical Journal, Nov. [Editor.]

Nova Scotia.

Provincial Government Crop Report, Nov. 1901. [Sec.]

United States of America.

Publications of the U. S. Dept. of Agriculture. [*Directors.*]

Scientific Bureaus and Divisions.

Division of Botany: Contr. from the U. S. National Herbarium, Vol. V. No. 6. Report on a Botanical Survey of the Dismal Swamp Region. By Thos. H. Kearney.

Division of Entomology: The Life History of Two Species of Plant lice inhabiting both the Witch-hazel and Birch.

Division of Forestry: 31 Notes on the Red Cedar.

Division of Vegetable Physiology and Pathology: 20 Peach Leaf Curl: its Nature and Treatment. By Newton B. Pierce. [Author]

Experiment Stations.

Arizona. (Twelfth Annual Report for year ending June 30, 1901)

Farmers' Bulletin. 134 (Tree planting on rural School Grounds.)

Kansas. 105. (Vet. Dept.: Blackleg in Kansas.) Press Bulletin 103. (Grain Weevils.)

Maryland. 77. (The Comparative Digestibility of Raw, Pasteurized and Cooked Milk)

Virginia. 115, 116 & 117. (The Teeth of the Horse as affected by age Parts I, II, & III.) 118 (The Teeth of Cattle & Sheep as affected by age.)

A Laboratory Camera Stand.
Farmers' Bull. No. 140—Pine-apple growing } By P. H. Rolfs. [Author.]

American Journal of Pharmacy, Nov., Dec. [Editor.]

Annual Report of the Director to the Board of Trustees, 1899-1900, Vol. I, No. 6. [Field Columbian Museum.]

Botanical Society of America. Publication 18 (Problems and Possibilities of Systematic Botany.) [Sec. N. Y. Bot. Garden.]

Bulletin No. 2 of the Lloyd Library of Botany, Pharmacy and Materia Medica. Reproduction Series No. 2. The Indian Doctor's Dispensatory, being Father Smith's Advice respecting Diseases and their Cure. By Peter Smith of the Miami Country. [Lloyd Library, Cin. Ohio.]

Extract from Fourth Annual Report of Commrs. of Fisheries, Game, and Forests, N. Y. Forestry on Sandy Soils. By Prof. Jno. Gifford. [Author.]

Journ. Cincinati Soc. of Nat. Hist. Vol. XIX, Nos. 7 and 8. (With Index to Vol. XIX.)

Missouri Botanical Garden. Twelfth Report, 1901. [Director.]

Practical Forestry in the Southern Appalachians. By Overton W. Price. Reprint from Yearbook of Dept. of Agri. 1900.

The Forester, Nov. [Editor.]

The Plant World, Oct. [Publishers.]

Torrey Club Bulletin, Nov. [Editor.]

Central America.

Boletin del Instituto Fisico-Geografico de Costa Rica, [Director.]

Polynesia.

Planter's Monthly, Hawaii, Nov. [Editor.

Library (Books).

Riddell (R.) A Manual of Gardening for Western & Southern India. Edited and Revised by Lieut.-Col. Beddome, Madras. 1884. 8vo. [Purchased.]
Hill (T. G.) Index to Annals of Botany, Vols. I-X. (1887-1896). Prepared by T. G. Hill, under the direction of the Editors, London. 1901. 8vo. [Purchased.]

SEEDS.

From Messrs. Reasoner Bros., Oneco, Florida—

Canna-Louis Colomb: Cinnamomum Cassia; Hamamelis sphærocarpa; Ilex Dahoon.

From Botanic Gardens, British Guiana—
Arrows from Seedlings Canes of the following varieties:—
95, 102, 109, 115, 116, 145.

PLANTS.

From A. Robert Gray, Esq., Trinidad——

Lycaste cristata.

From Messrs. Reasoner Bros., Oneco, Florida—
Sweet Bough, Early Harvest, Lawrence, and Bartlett Pears.
Hard Shell Almond, Soft Shell Almond, Spanish Chestnut.
From Dr. John M. Macfarlane, Dir. Bot. Garden, Pennsylvania—
Tubers of Nymphæa cœrulea, and N. gracilis.

[Issued 29th Jan. 1902.]

Vol. IX. MARCH, 1902. Part 3.

BULLETIN

OF THE

BOTANICAL DEPARTMENT, JAMAICA.

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.

Director of Public Gardens and Plantations.

CONTENTS:

PRICE—Threepence.

A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Kingston P.O.

KINGSTON, JAMAICA:
HOPE GARDENS.

1902.

JAMAICA

BULLETIN

OF THE

BOTANICAL DEPARTMENT.

Vol. IX. MARCH, 1902. Part 3.

REPORT TO THE BOARD OF AGRICULTURE BY THE CHEMIST.

Government Laboratory,
Kingston, Jamaica, 13th January, 1902.

Manurial Experiments during Quarter ending Dec. 31st.

The beginning of October last saw the following Experiments actually started, manures applied and samples of soil taken for analysis.

Pines— Barbican, Billy Dun, } C. E. Smith, Esqr.
Rowington, Vere, L. Isaacs, Esqr.
Huntley, H. Q. Levy, Esqr.
Gregory Park, United Fruit Co.

Coffee— Brokenhurst, W. W. Wynne, Esqr.
Chesterfield. C. E. DeMercado, Esqr.
Chester Vale, R. Sidgwick, Esqr.

Bananas—Llanrumney, Messrs. Kerr & Co.
Burlington, Hon. H. Cork.
Koningsberg, Hon. Dr. Pringle.
Rodens, R. Hay, Esqr.
Lawrencefield, A. Clodd, Esqr.
Quebec, Hon R P. Simmonds.
Brown's Town, H. Q. Levy, Esqr.

The Burlington Experiments were spoilt by floods and are to be repeated on a fresh plantation.

Mr. Hay reports marked results at Rodens.

The Pines at Billy Dun also show decided results.

Tobacco.—The Montpelier Experiments are postponed for a year. Our analysis of the soil and three stages of subsoil, sampled with extreme care by the Montpelier authorities showed that the land was badly drained and deficient in available phosphates. I advised not planting Tobacco until this had been remedied. It is most regrettable that so many thousands of pounds should have been wasted owing to a primary agricultural necessity which was ignored, viz., *drainage*.

Canes—Mr. M. H. M. Farquharson is carefully managing the canes at Holland that were manured at the end of October. Our arrangements for Cane Experiments stand as follows :—

1. Holland, St. Elizabeth, M. H. M. Farquharson, Esqr.
2. Mount Eagle, Westmoreland, E. R. Burgess, Esqr.
3. Money Musk, Vere, Hon. Col. Ward.
4. Amity Hall, Vere, G. W. Muirhead, Esqr.
5. Hillside, Vere, P M. Ellis, Esqr.
6. Catherine Hall, St. James, F. A. Dougall, Esqr.
7. Cinnamon Hill, St. James, Joseph Shore, Esqr.
8. Vale Royal, Trelawny, H. S. Hoskins, Esqr.
9. Llandovery, St. Ann, A. J. Webb, Esqr.
10. Caymanas, St Catherine, J. Scudamore, Esqr.
11. Albion, St. Thomas, J. Grinan, Esqr.

Manures applied, No. 1.
Manures sent Nos. 2, 3, 4, 5, 6.
Manures now being prepared Nos. 7, 8, 10, 11.
Experiments still to be decided No. 9.

All these are Manurial Experiments.

Messrs. Grinan, W. Farquharson, H S. Hoskins, E. R. Burgess, J. Shore and M. H. M. Farquharson are growing seedlings for chemical analysis.

Our seedling trials from the central plots at Hope should start in 1903.

A critical study of the Barbados and Leeward Island Experiments has convinced me that analyses of canes from manurial plots are simply wasted efforts. Manures do not affect the composition of the juice which is a characteristic of the variety. An estate sample of juice from each acre of plots will be taken for analysis from the Manurial Experiments.

Soil analysis.

	Soils.	Subsoils.	Total.
Soils analysed	26	13	39
" being analysed	9	9	18
" for analysis	18	16	34
Total	53	38	91

By the end of this month, 57 soils will have been analysed, leaving 34 still to be done—This includes samples from all the experimental plots besides several of general agricultural interest—When complete, they should form a basis for a generalisation on Jamaica soils for agricultural purposes.

Supervision—The arrangement with Mr. Cradwick is now in force, viz., that he is to visit any station in his line of travel and report from time to time. He is also to supervise the harvesting of the canes at crop time.

Storage of Manure—I propose to continue the use of the lower room at the present used for the storage of the manures, as a more convenient centre for distribution than Hope.

Finances—The sum of £140 voted for manures should just cover the expenses for the current year, but the margin will be very small—

From 20 to 25 o/o of the manures are still in hand and will serve for use early next year before the new lot arrives.

(Sgd.) H. H. Cousins,
Island & Agricultural Chemist.

IMPORTATION OF SEEDS AND PLANTS.

Colonial Secretary's Office,
10th September, 1901.

It is hereby notified for general information, that the Jamaica Agricultural Society having called the Governor's attention to the need for protecting this Colony against the importation of diseased plants, His Excellency on the recommendation of the Board of Agriculture, has deemed it advisable to issue the following proclamation, prohibiting the importation from the countries named, except at the Port of Kingston, of plants, etc., and their coverings, and providing for their being fumigated immediately on importation.

By Command,

Sydney Olivier,
Acting Colonial Secretary.

A. W. L. Hemming.

By His Excellency Sir Augustus William Lawson Hemming, Knight Grand Cross of the Most Distinguished Order of St. Michael and St. George, Captain-General and Governor-in-Chief, in and over the Island of Jamaica and its Dependencies.

A PROCLAMATION.

By virtue of the power in me vested in that behalf by the first Section of Law 4 of 1884, "The Seeds and Plants Importation Law, 1884," and by the first and second Sections of Law 25 of 1891, "A Law in aid of the Seeds and Plants Importation Law, 1884."

I do hereby prohibit, until further Proclamation, the importation into this Island, at any Port except Kingston, of any plants, cuttings, buds or grafts or any goods, packages, articles, coverings or things in which the said plants, cuttings, buds or grafts may be packed or otherwise contained from any of the Countries hereinafter named, viz.:—

The British Islands, Sweden, Norway, Denmark, Germany, Austria, Holland, Belgium, France, Spain, Portugal, Italy, Russia, Greece, Bulgaria, Servia., Roumania, Montenegro, Turkey, China, Japan, India and Burma, Ceylon, Straits Settlements and Malay Peninsula, Sumatra, Java, Borneo, Philippine Islands, Persia, Arabia, Africa (any part),

Madagascar, Mauritius, Reunion, Canada, United States, West Indies, Mexico, British Honduras, Honduras, Guatemala, Nicaragua, San Salvador, Costa Rica, Colombia, Venezuela, Guiana, Ecuador, Peru, Brazil, Paraguay, Uruguay, Argentine Republic, Chili, Bolivia, Fiji, Sandwich Islands and other Polynesian Islands, Australia, (any part), Tasmania and New Zealand.

And I do hereby accordingly revoke the Proclamation issued by Sir Henry Arthur Blake and dated the sixth day of September, 1895, under which Orange plants, cuttings, buds or grafts, might be imported at other Ports besides Kingston.

And I do hereby under the Sections of Law quoted above further proclaim that immediately on the importation into this Island of any plants, cuttings, buds or grafts, or of any goods, packages, coverings or things in which such plants, cuttings, buds or grafts may be packed or contained, they shall be subjected to a thorough process of fumigation, to be hereafter decided and approved by me in Privy Council for the purpose of completely destroying all animal or vegetable parasites which may have been imported on or along with the said plants, cuttings, buds or grafts.

And I do hereby order that this my Proclamation shall come into force on the First day of October, now next ensuing.

Given under my hand and the Broad Seal of this Island, at King's House this Seventh day of September, in the first year of His Majesty's Reign, Annoque Domini, 1901.

By Command,

SYDNEY OLIVIER,
Acting Colonial Secretary.

18th September, 1901.

With reference to the Governor's Proclamation of the 7th instant, prohibiting, as from the 1st October, 1901, the importation from certain Countries, except at the Port of Kingston, of Plants, &c., and providing for their being fumigated immediately on importation, it is hereby notified that large consignments of Plants will be fumigated in a room on the Government Wharf, East Street, Kingston, which will be fitted for the purpose.

Until January, 1902, small consignments will be fumigated at the Government Laboratory, East Street, Kingston, after that date the plants will be placed in a special box placed inside the fumigatorium.

The Island Chemist will be responsible for the work of fumigation and for the provision of the necessary labour, chemicals and appliances.

By His Excellency Sir Augustus William Lawson Hemming, Knight Grand Cross of the most Distinguished Order of Saint Michael and Saint George, Captain-General and Governor-in-Chief in and over the Island of Jamaica and its Dependencies.

A PROCLAMATION.

WHEREAS by a Proclamation dated the seventh day of September, and made under the authority of Section 1 of Law 4 of 1884, (The Seeds and Plants Importation Law 1884,) it was among other thing proclaimed and ordered that immediately on the importation into this island of any plants, cuttings, buds or grafts, and of any goods, packages, coverings or things in which such plants, cuttings, buds or grafts, hereinafter referred to under the general term of "proclaimed articles" might be packed they should be subjected to a thorough process of fumigation to be hereafter decided upon.

And whereas the Governor in Privy Council has since decided upon adopting the process of fumigation hereinafter set forth for the purpose of completely destroying all animal or vegetable parasites which may have been imported on or along with the said proclaimed articles :

Now, therefore, I do hereby proclaim and order that the importation into this Island of all "proclaimed articles" shall be subject to the following conditions :—

All proclaimed articles shall be fumigated, and the work of fumigation shall be carried out by the staff of the Government Laboratory —a fumigatory box shall be employed for small operations, and a fumigatory chamber at the wharf for large. For ordinary purposes the dose of cyanide to be vaporised shall be one ounce for every 300 feet of cubic space and the exposure shall be one hour. For the more delicate plants half the above dose of cyanide shall be used and the exposure shall be half an hour only. Plants in Wardian cases shall be fumigated while still in the case. The Island and Agricultural Chemist shall be the authority to decide in any question connected with the fumigation of proclaimed articles which involves the exercise of any discretion.

Given under my hand and the Broad Seal of this Island, at King's House, this fifteenth day of October, in the First year of His Majesty's Reign, Annoque Domini, 1901.

By Command,

Sydney Olivier, Colonial Secretary.

7th January, 1902

THE GOVERNOR directs the publication, for general information, of the Instructions issued for the guidance of Officers of the Government Laboratory and the Kingston Customs in regard to the manner in which imported plants, seeds, etc., shall be dealt with.

By Command,

SYDNEY OLIVIER,

Colonial Secretary.

Instructions for the Guidance of Officers of the Government Laboratory and Kingston Customs in regard to the manner in which imported Plants, Cuttings, etc , and their coverings, shall be dealt with.

Immediately on the landing of any plants, cuttings or other articles specified in the Governor's Proclamation of the 7th September, 1901, published in the Government Notice No. 278, of the 10th of that month in the Jamaica Gazette, they shall be taken charge of by the Customs Officer who will give the Wharfinger or other party concerned a receipt therefor, shewing the time and date of delivery.

The Customs Officer shall at once notify the Government Chemist, in wrtiing, of the articles to be fumigated, stating the approximate dimensions thereof and obtain his instructions as to the time at, and place to, which they are to be forwarded for fumigation.

The Customs Officer will then forward the articles accordingly in charge of a Customs Escort who will remain in attendance during the process of fumigation and afford, or provide such assistance and labour as the Government Chemist or his Officer in charge may require.

Immediately on receipt of the Articles the Government Chemist (or his Assistant) shall cause them to be fumigated in the manner and under the conditions prescribed by the Governor in Privy Council.

So soon as this has been done, and a memorandum shewing the time of receipt and delivery furnished to the Customs Escort, the Articles shall be taken charge of by the Escort and conveyed to the King's Warehouse or other place, as arranged by the Landing Waiter.

The greatest care must be taken by the Officer in charge of the King's Warehouse to keep plants, cuttings, &c., alive and in good condition.

All expenses of removing the articles to the Government Laboratory, and thence to the King's Warehouse, with any expenses necessarily incurred in keeping the articles in good condition, shall be met by the Importer, all such amounts being brought to account as King's Warehouse Fees as provided by the Customs Regulations on the subject.

Plants, cuttings, &c., should not be forwarded to the King's Warehouse in cases where Importers defray expenses of removal, labour, &c. (if any) at once, and at the same time arrange with the Customs Officer to take delivery of the articles immediately after fumigation. This provision will refer more particularly to the plants, &c., brought by passengers and imported through the parcel post, &c.

Officers of Customs and of the Laboratory are required to exercise strict economy in arranging for the transport of the plants &c., and other expenses, so that the charge to the Importers may be as small as possible.

JAMAICA ORANGES IN ENGLISH MARKETS.

From Thomas Kemp, Esq., to Hon. Chairman of the Board of Agriculture.

Kingston, Jamaica, February 22nd, 1902

SIR,

I left Jamaica on the 30th November on a short visit to England to see the Christmas Fruit Market in Covent Garden, and also to follow the fruit sent from this side to the other and watch the changes it undergoes As the Orange business looms large before us just now, I took special care to watch this fruit daily, and the conclusions I have come to, I now beg to offer.

It is a fact to be faced, that a very large per centage of Jamaican Oranges arrive in the Mother Country in a more or less rotten condition, and that this is so, is certainly not creditable to those who have been engaged so long in the business. As Oranges arrive from other countries in a sound state, surely the cause for our failure can be found. I inspected a certain number of boxes of Oranges each day on board for 10 days, and found boxes with bad fruit from the first; Oranges however that I repacked on the eleventh day, I opened on the 3rd January, and found that no more waste had taken place A good deal has been said from time to time that the fault lay in the packing, but after seeing Jamaica packages opened up side by side with those from other countries, I have no hesitation in saying that in only a few cases can this be attributed, as the majority of the Jamaican Oranges I saw were just as carefully packed as any in the Market.

I further saw Jamaica Oranges in Stirling that had been in the Fruiterer's shop six weeks, and found them in sound order, and good to eat. This fruiterer told me a story that I heard very frequently in London, Edinburgh and Glasgow, namely, that the Jamaica Orange was a splendid fruit, but owing to the waste in the boxes, the business was too risky, and they did not care to handle them.

Enquiring as to the effect the colour had on the Market, I found in some instances that people had to be persuaded to try them, after which there was no difficulty, and in fact I think the colour is, and will be in future, quite a decided advantage, as it will be a distinguishing mark for the Jamaica Orange, and better than any brand mark.

My conviction therefore is, that if an Orange will keep three weeks it will keep three months, and that they should be kept in the packing house here until all that will not keep, go wrong. An Orange here costs very little but by the time it is put in England it costs a great deal, therefore the shippers should face the loss here. At present I am not quite decided as to what length of time oranges should be kept before being packed, but that the ordinary four days, which I find is the usual time now in vogue to keep them before packing, is *too short*, I am quite convinced.

It must also be remembered that the climatic conditions must be carefully considered and noted as Oranges picked after wet weather will assuredly require more time as a test than those picked in dry weather.

Whether the weather has anything to do with their keeping qualities after they are in the packing shed, I have not sufficiently studied to express an opinion. One Packer in St. Ann told me he had found it so, whilst another in Manchester did not think it could have, but if so, it would not be expensive to have drying sheds heated artificially.

I believe the first cause of our failure is that we are not careful enough in picking off the tree, as most of us have seen fruit carefully picked and kept for months, eventually drying up, but not going rotten. As it will take us time to overcome this difficulty I have to fall back on advising that the Oranges be kept a longer time before being packed.

As to what has been said and written about inspection, this can only be effectually done in the packing houses, as it would be impossible to inspect on the Wharf during the Season.

I may say that Messrs. Elders & Fyffe's are experimenting now, as to the length of time to keep before packing, and as it is somewhat late in the Season these experiments will be continued next crop.

In regard to the English Market it gave me the idea that it was only necessary for us to put our Oranges there in good order, *at any time of the year*, to realize very good prices, and I look forward with the greatest confidence to the growth of this trade; but each one interested must recognize that just now the Jamaica Oranges has not a good name in the Market, owing to the condition in which it arrives, and we must therefore work for the success of the trade generally.

Good brands will tell eventually, just now it is the *Jamaica Orange* that has to be considered.

I have the honour to be,

Yours obediently,

THOMAS KEMP.

Extract from Messrs. Elders & Fyffe's letter 18th Jan., 1902, to Shipper.

"We are very pleased to tell you that your fruit arrived in very good condition—in fact the 24 cases marked . . . . could not very well have been better, and the . . . mark was only slightly inferior, but it showed a little sign of waste, so we had to reduce the price.

"We took particular notice to examine the packing of your fruit and it was most satisfactory, which no doubt accounted for the fruit arriving in such splendid condition. We notice that the fault of most of the oranges shipped from Jamaica is that they are not packed tight enough in the cases. We are sure that if you can only manage to always ship sound fruit they would realize very good prices.

Extract from Mr. Stockley's letter of 17th Jan., 1902, to Shipper.

"I am very glad indeed to see how splendidly your oranges by the 'Morant' arrived. I was down at Avonmouth when they came out of

the ship and they were in perfect condition. This proves that Jamaica oranges can be sent over here all right, but it more especially proves that my arguments at the Conference were right when I said, that however glutted the market at this end might be with inferior oranges, should Jamaica Oranges arrive here in sound condition they would always have a market to themselves—as although "714" cases of Spanish Oranges are a drug here at 7s., we have been able to realize . . . for yours. I only wish that people out in Jamaica could realize the amount of money that has been wilfully thrown away this year through their own stupidity in insisting on bringing forward a lot of worthless immature fruit which simply damned the market for Jamaica Oranges. I suppose next year the same thing will happen again."

PACKING FRUIT IN FLORIDA.

From Professor H. Harold Hume, Department of Botany and Horticulture, to Director Public Gardens, Jamaica.

Florida Agricultural College and Experiment Station.
Lake City, Fla.,
Dec. 27th, 1901.

Dear Sir,

Yours of recent date reached the Station while I was absent in South Florida, hence the delay in answering the question which you have asked.

There is no law in force in our State governing the packing and inspection of fruit, and the only thing I can do toward answering your questions is to give the rules used by our best shippers. The orange box used in the State usually known as the "Standard" orange box is 12 x 12 x 27 with a cross partition in the middle. The ends and the partitions are each one inch thick, so you see the box is divided into two compartments each of exactly one cubic foot capacity.

Two classes of fruit are made; bright and russet. There is practically no difference in the quality of these two grades but the latter grade has a russet colored rind, a condition brought about by the attacks of the rust mite. In each of these classes two or three grades are generally made which are usually designated as fancy bright, choice bright, russet bright and russet choice respectively. Those classed as fancy bright and russet bright should both be perfect fruit in every respect. Bright and russet oranges should never be packed together in the same box. The package should be uniformly neat and the fruit should be well packed and graded. The usual sizes of oranges in this State are the following: 96, 112, 126, 150, 176, 200, 216, 226 and 252. The diameters of these different sizes of fruit are as follows: 112 equals $3\frac{3}{16}$, 126=$3\frac{1}{8}$, 150=$3\frac{1}{16}$, 176=$2\frac{15}{16}$, 200 – $2\frac{13}{16}$, 226 – $2\frac{9}{16}$ approximately. 150 oranges to a box, for instance, means that the oranges are of 150 sizes and that there are exactly 150 oranges in a package. In packing fruit in the early part of the season it is usually cured in the packing houses for two or

three days before being placed in the boxes. This prevents the skin from cracking and materially improves the shipping quality of the fruit. When the boxes are packed the fruit should stand about one-fourth or three-eighths of an inch above the top. Each fruit is wrapped in a piece of thin paper before being placed in the package.

Pineapples are the only other fruit crop of importance grown in the State. Three varieties are grown extensively; the Red Spanish, Smooth Cayenne and the Abbachi The first named variety is usually designated as Common Pine Apple while the latter two are designated as fancy. The common, the Red Spanish Pine Apples, are packed in crates 12 x 11 x 36 with a partition in the middle. The sizes are as follows: 18, 24, 36, and 48. Each pineapple is wrapped in a piece of thick glaced paper before being placed in the crate. The fruit is placed in with the crown of one toward the base of the next, alternately. The fancy varieties are usually packed in a different crate, the inside measurements of this being 20 x 12 x 22 without any cross partition. These are wrapped as the others and securely packed in excelsior. Sizes 8, 10, 12, etc.

The pineapples are picked just when the basal eyes have commenced to turn slightly. For shorter distance shipping they may be allowed to become riper and for long distance shipping probably not quite so ripe.

If there are any other points which I have not made clear in relation to the matter I shall be pleased to hear from you and will answer your questions to the best of my ability.

REPORT ON "BLACK-ROT" DISEASE OF GINGER IN JAMAICA.*

By A. Howard, B.A., Mycologist, Imperial Department of Agriculture for W. Indies.

The material sent by Mr. Harris consisted of rhizomes of ginger placed in spirit. An examination of these specimens shows that the disease is due to a fungus which is able to travel underground by means of black root-like bodies (rhizomorphs.) The affected rhizomes are filled with the mycelium of the fungus which collects into dark strands which run to the surface These strands are seen as dark lines when the pieces of ginger are cut through. They are continuous with the dark root-like bodies seen on the outside of the diseased rhizomes which enable the fungus to spread underground and rapidly destroy the patch of ginger.

Remedies: There is little to add to the suggestions in my memorandum of October 28th, last, on this disease besides drawing attention to the necessity of isolating the diseased patches by trenches taking care to throw the soil on to the affected areas, and destroying the diseased plants by burning. Care should be taken to select healthy rhizomes from the best fields for planting and to soak these for a few hours in Bordeaux mixture.

A. H.
17.2.02.

* See previous correspondence in *Bulletin of the Botanical Department, Jamaica, Nov. & Dec., 1901.*

ADDITIONS AND CONTRIBUTIONS TO THE DEPARTMENT.

Library (Serials).

Europe.

British Isles.

Annals of Botany, Vol. XV, No. LX. Dec. 1901. [Purchased.]
Botanical Magazine, Dec., Jan. Feb. [Purchased.]
Chemist and Druggist, Nov. 30, Dec. 7, 14, 21, 28, Jan. 4, 11, 18, Winter Issue. Jan. 25, Feb. 1. [Editor.]
Colonial, and Diplomatic and Consular Reports, Oct. Nov. Dec., and Jan. 1902. [Col. Sec,]
Statistical Abstract. From 1886 to 1900.
Garden, Nov. 30. Dec. 7, 14, 21, 28, Jan. 4, 11, 18, 25, Feb. 1. [Purchased.]
Gardeners' Chronicle, Nov. 30, Dec. 7, 14, 21, 28, Jan. 4, 11, 18, 25, Feb. 1. [Purchased.]
International Sugar Journal, Dec , Jan., Feb. [Editor.]
Journal of Botany, Dec., Jan., Feb. [Purchased,]
Journal, Royal Colonial Institute, Jan., Feb.
Journal, Board of Agri. England, Dec. [Sec Board of Agri.]
Journal, Royal Horti. Society, Vol. XXVI, Parts 2 and 3, Dec. 1901.
Nature, Nov. 28, Dec. 5, 12, 19, 26, Jan. 2, 9, 16, 23, 30. [Purchased.]
Our Western Empire, Dec. Jan. [Editor.]
Pharmaceutical Journal, Nov. 30, Dec. 7, 14, 21, 28, Jan. 4, 11, 18, 25, Feb. 1.

France.

Sucrerie indigène et coloniale, Dec., 3, 10, 27, Jan. 7, 14, 21, Feb. 4, 11. [Editor.]

Holland.

Bulletin, Koloniaal Museum, No. 25. [Editor.]

Belgium.

Société d'Etudes Coloniales, No. 1, Jan.

Germany.

Beihefte zum Tropenpflanzer. Jan. [Editor.]
Tropenpflanzer, Dec., Jan. [Editor.]
Symbolae Antillanae seu Fundamenta Florae Indiae Occidentalis, Vol. II, Fasc. III. [Purchased.]

Switzerland.

Bulletin de l'Herbier Boissier Vol. I, No. 12, Vol. II, No. 1., No 2. [Conservateur.]

Asia.

India.

Agricultural Ledger (Calcutta) 1901, Nos. 9, 10, 11, 12. [Lt. Gov. Bengal.]
Annual Report on the Gardens of H. H. The Maharana of Udaipur. 1898-99, to 1900-01. [Supt.]
Annual Report on Govt. Gardens & Parks in Mysore for the year 1900-1901. With the Government Review thereon. [Supt.]
Northwestern Provinces & Oudh, Bull. 15 (The Cultivation of longer-stapled Cottons at the Cawnpore Exp. Station.) 16 (The Cultivation of Maize at the Cawnpore Exp. Station.) 17 (A Note on Agricultural Improvements suitable to the N. W. Provinces & Oudh.) 18 (Use of Town Drainage as Manure.)
Planting Opinion, Nov. 9, 16, 23, 30, Dec. 7, 14, 21, Jan. 4, 11. [Editor.]

Straits & Federated Malay States.

Agricultural Bulletin, Vol. 1, Nos. 2 & 3, Nov. & Dec. [Editor.]

Ceylon

Observations on Dracæna reflexa. By Herbert Wright. Extract from *Annals of the R. Botanic Gardens, Peradeniya, Part 2 Vol. 1.* [Author.]
Tropical Timbers and their Rings of Growth. By Herbert Wright. Reprint from "*Indian Gardening & Planting*" *Calcutta, dated 22nd Aug. 1901.* [Author.]
Times of Ceylon Nov. 14, 21, 29, Dec. 5, 12, 19, 26, Jan. 2, 9, 16. [Editor.]

Java.

Proefstation East Java, Nos. 33, 34. [Director.]

AUSTRALIA.

N. S. Wales.

Agri. Gazette, Oct., Nov. [Dept. of Agri.]
Report on Botanic Gardens & Domains for 1900. [Director.]

Queensland.

Queensland Agri. Journal Nov., Dec. [Sec. of Agri.]
Queensland Sugar Journal, Nov., Dec. [Editor]
Annual Report of Dept. of Agri. 1900-1901. [Dept. of Agri.]
Botany: Plants reputed poisonous to Stock, & Contr. to the Flora of New Guinea, Oct. 1900. Contr. to the Flora of Queensland, Nov. 1900. Contr. to the Flora of New Guinea, Aug. & Oct. 1901. Extracts from the Queensland Agri. Journal. By F. Manson Bailey, Colonial Botanist. [Dept. of Agri.]

Western Australia.

Journal of the Dept. of Agri., Nov., Dec. [Dept. of Agri.]

Victoria.

Annual Report, 1899.
Handbook of the Destructive Insects of Victoria. Part III. } [Sec. for Agri.]

AFRICA.

Cape of Good Hope.

Agri. Journal, Oct. 24, Nov. 7, (with Index for Vol. XVIII,) 21, Dec. 5, 19, Jan. 2. [Dept. of Agri.]

Natal.

Agri. Journal and Mining Record, Nov. 13, 22, Dec. 6, 20, Jan. 3, 17. [Dept. of Agri.]

Central Africa.

C. African Times, Sept. 21, 28, Oct., Nov., Dec. 7, 14, 21. [Editor.]

Mauritius.

Station Agronomique; Composition et rendement des Cannes de Graines. Bull. 4.—Richesse Saccharine et rendement de Cannes de Graines.

Zanzibar.

The Shamba, Journal of Agri. (Supplement to the Gazette) Nov. 6. [Editor.]

West Indies.

Barbados.

Agricultural Gazette, Jan., Feb. [Editor.]

West Indian Bulletin, Extra No.—Report of Proceedings at the W. I. Agri. Conference, 1902, & Vol. II No. 4 [Commr. Imp. Dept. of Agri. for the West Indies.]

On Diplodia cacaoicola, P. Henn.; a parasitic Fungus on Sugar-Cane and Cacao in the West Indies. By Albert Howard. Extract from "*Annals of Botany, Vol. XV. No. LX. Dec. 1901.* [Author.]

Jamaica.

Journal, Jamaica Agri. Soc., Dec., Jan. & Feb. [Secretary.]

Report on the Cultivation of Pine-apples & other products of Florida. By Robt. Thomson. [Chairman, Board of Agriculture, Jamaica.]

Cornwall Herald. [Editor.]

Trinidad.

Bulletin, Botanical Dept., Jan. [Superintendent.]

Proc. of Agri. Soc., Nov. 12, 1901. Index from Jan. 1, 1900, to Dec. 31, 1901. [Secretary.]

Report of the Executive Committee on Agri. Show 1901.

Grenada.

Annual Report on Botanic Station, 1900. [Curator.]

British North America.

Ontario.

Crop Bulletins 77 and 78, Bull. 116 The Hessian Fly in Ontario. 117, Pasteurisation of Milk for Buttermaking. 118, Yeast and its Household Use. [Dep. of Agri.]

Report of the Supt. of Farmers' Institutes 1900, Part I. [Dept. of Agri.]

Ottawa.

Bull. 39, Results obtained in 1901 from Trial Plots of Grain, Fodder Corn Field Roots and Potatoes. [Dept. of Agri.]

Montreal.

Pharmaceutical Journal, Aug., Dec., Jan. 1902, [Editor.]

United States of America.

Publications of the U. S. Dept. of Agriculture. [*Directors.*]

Scientific Bureaus and Divisions.

Bureau of Plant Industry.—Bull. No. 2, Spermatogensis and Fecundation of Zamia. By Herbert J. Webber.

Experiment Stations.

Experiment Station Record, Vol. XIII, Nos. 3 and 4.

Alabama. 116 (Texas or Acclimation Fever.)

Arkansas. 67 (Investigations of Swine Diseases in Arkansas.) 68 (Soil improvement and Forage Experiments.)

California. 131 (The Phylloxera of the Vine) 132 (Feeding of Farm Animals) 133 (Tolerance of Alkali by various Cultures.) 134 (Report on Condition of Vineyards in portions of Santa Clara Valley.) 135 (The Potato Worm in California.) 136 (Erinose of the Vine. 137 (Pickling Ripe and Green Olives.)

Illinois. 66 (Individual differences in the value of Dairy Cows.) 67 (Apple Scab.) 68 (Important details of Spraying.)

Kansas. Fourteenth Annual Report for Fiscal Year 1900-1901. With Index to Bulls, 89 to 103.

Press Bulletins: 106 (Profit in maintaining the Milk Flow.) 107 (Cerebritis or "Staggers" in Horses. 108 (Destroying Prarie-Dogs.—A Preliminary Report.) 109 (Destroying Pocket-Gophers.)

Maryland. 77 (The Comparative Digestibility of Raw, Pasteurized, and Cooked Milk.)

Michigan. 193 (Some experiments with Beet pulp as a Stock Food.)

New York. Geneva. 197 (The food source of Milk Fat; with studies on the nutrition of Milch Cows.) 198 (Inspection of Feeding stuffs.) 199 (An Epidemic of Currant Anthracnose.) 200 (Notes from the Botanical Dept).

Rhode Island. Report of Agri. Experiment Station, 1901. 80 (A Modern Dairy Barn, Individuality of Cows.) 81 (Commercial Fertilizers.)

Tennessee. Vol. XIV, No. 2, (Winter Wheat.) No. 3 (Winter Cereals and Legumes.)

Virginia. 1 (The most common irregularities of the teeth of the Horse.) Part II.) 13 (Comparative skimming qualities of Holstein and Jersey Milk.)

Wyoming. 48 (Experiments in Wheat Culture.) 49 (Alkali Series VI, —Alkali Lakes and Deposits.)

American Journal of Pharmacy, Jan. Feb. [Editor]

A Study of San Luis Obispo County, California. By Chas. H. Shinn. [Author.]

Botanical Gazette, Chicago, Dec., Jan. [Editor.]

Briefer Articles. Clues to Relationship among Heteroecious Plant Rusts. Reprinted from the Botanical Gazette, Vol. XXXIII, No. 1. Jan. 1902. By J. C. Arthur.

An Edible Fungus.
Two Weeds: Horse Nettle and Buffalo Bur.
} By J. C. Arthur. Extracted from the Fourteenth Annual Report of the Indiana Agri. Exp. Sta.

} [Author.]

Bulletin of The University of Wisconsin, No. 49, with Index to Vol. 2.

California Floriculturist, Jan. 1902. [Editor.]

California's Horticultural Statutes, with Court Decisions and Legal Opinions relating thereto. Compiled by the State Board of Horticulture.

Fern Bulletin, Jan. [Editor.]

Florida Bulletins, No. 53. Some Citrous Troubles, No. 58, Pomelos. By H. Harold Hume. [Author and Reasoner Bros.]

Forest extension in the middle West. By Wm. L. Hall. (Reprint from *Yearbook of Dep. of Agri. for 1900.*)

Forestry and Irrigation, Vol. VIII. No. 1.

John Hopkins University Circulars, Jan. 1902.

Proc. American Academy of Arts and Sciences, No. 9—The Algae of Jamaica. By Frank S. Collins. [Author.]

Report of the Forester for 1901. By Gifford Pinchot. [Dept. of Agri.]

Transactions of the Kansas Academy of Science, Vol. XVII, 1899-1900. [Librarian.]

The Forester, Dec. [Publishers.]

The Plant World, Nov., Dec. [Editor]

Torrey Club Bulletin, Dec., Jan. [Editor.]

The Genera of Gastromycetes. By C. G. Lloyd. [Author.]

Central America.

Boletin del Instituto Fisico-Geografico de Costa Rica, No. 11. [Director.]

South America.

Boletim da Agricultura, Sao Paulo, Brazil, Nos. 8, 9. [Director.]

Polynesia.

Planter's Monthly, Hawaii, Dec. 1901, Jan. 1902. [Editor.]

Library (Books).

Dörfler (I.) Botaniker-Adressbuch. Vienna, 1902. 8vo. [Purchased.]
Engler (A.) Das Pflanzenreich, IV 75 Rafflesiaceae and IV, 76 Hydnoraceae by H. Graf zu Solms-Laubach; IV. 242 Symplocaceae by A. Brand, Leipzig, 1901. 8vo. [Purchased.]

The following have been presented by the "Lawes Agricultural Trust Committee" on behalf of the late Sir John Bennet Lawes, Bart:—

Lawes (Sir John Bennet, and Sir Joseph Henry Gilbert) Rothamsted Memoirs on Agricultural Chemistry and Physiology. (From the Philosopical Transactions.) Reprinted in 3 Vols. London, 1893. 4 to.—Vol. I. Researches on Vegetation. Published 1861 and 1889; Vol. II. Researches on the Mixed Herbage of Permanent Grass-Land. Published 1880–1900; Vol. III. Researches on Animal Composition. Published 1859 & 1883.

Lawes (Sir John Bennet, and Sir Joseph Henry Gilbert) Rothamsted Memoirs on Agricultural Chemistry and Physiology. Reprinted in 7 Vols. London; Vols. I–VI 1893; Vol. VII, 1899. 8vo. Vol. I. Field Experiments, Experiments on Vegetation, &c., &c. Published 1847–1863 inclusive; Vol. II. Experiments on the Feeding of Animals, Sewage Utilization, &c., &c. Published 1849–1863 inclusive; Vol. III. Field Experiments, Experiments on Vegetation, &c., &c. Published 1863–1874 inclusive; Vol. IV. Experiments on the Feeding of Animals, Sewage Utilization, Ensilage, &c., &c. Published 1864–1885 inclusive; Vol. V. Field Experiments, Experiments on Vegetation, &c., &c. Published 1875-1883 inclusive; Vol. VI. Field Experiments, Experiments on Vegetation, &c., &c. Published 1884–1890 inclusive; Vol. VII (Supplementary) Field Experiments, Experiments on Vegetation. On the Feeding of Animals, &c &c. Published 1890-1898 inclusive.

Lawes (Sir John Bennet, and Sir J. Henry Gilfiert) The Rothamsted Experiments; being an account of some of the Results of the Agricultural Investigations conducted at Rothamsted in the Field, the Feeding Shed, and the Laboratory, over a period of Fifty Years. (From the 'Transactions of the Highland and Agricultural Society of Scotland,' Fifth Series, Vol. VII, 1895.) Edinburgh. London. 1895. 8vo.

Gilbert (Prof. J. H.) History and Present Position of the Rothamsted Investigations. For Private Circulation. London. 1891. 8vo.

Gilbert (Sir Joseph Henry) Agricultural Investigations at Rothamsted, England, during a period of Fifty Years. Six Lectures delivered under the Provisions of the Lawes Agricultural Trust. Under the auspices of the Ass. of American Agricultural Colleges and Experiment Stations, in Nov. 1893. Bulletin No. 22. U. S. Dept. of Agri. Washington. 1895. 8vo.

Gilbert (Sir J. Henry) Memoranda of the Origin, Plan, and Results of the Field and Other Experiments conducted on the Farm and in the Laboratory of the late Sir John Bennet Lawes at Rothamsted, Herts. London. 1901. 8vo.

Two Abstracts of the Rothamsted Experiments with Plans and Summary Tables arranged for Reference in the Fields. London. 1901.

SEEDS.

From Dr. Preuss, Dir. Bot. Gard. German Cameroons, W. Africa.
Spondias dulcis (large and good variety.)

From Messrs. Reasoner Bros., Oneco, Florida.
Quercus coccinea, Ulmus Americana.

From Mr. A. Robertson-Proschowsky, Nice, France.
Carica quercifolia.

From Mr. B. O. Roberts, Seychelles.
Adenanthera pavonina; Albizzia Lebbek; Artocarpus integrifolia; Bois Marie, (rotten); Capuchin (?Sideroxylon); Heritiera littoralis; Manihot Glaziovii; Nephrosperma van Houtteanum; Pomme Jacque (Sapotaceae); Raphia Ruffia; Roscherie melanochætis; Verschaffeltia splendida.

From Mr. R. Derry, Govt. Gardens, Perak.
Arenga sp.

From Miss H. A. Wood, Halfway Tree.
Gomphrena globosa.

From Messrs. E. Sander & Co., St. Albans, Herts, England.
Carnation.

From Supt. Govt. Hort. Gardens, Lucknow, India.
110 Sylchet orange.

From Mr. Banes, University of Pennsylvania, U.S.A.
Gingko biloba.

PLANTS.

From Messrs. Jas. Veitch & Sons, Ltd., Chelsea, London.
36 Gloxinias, and 24 Caladiums.

From Miss H. A. Wood, Halfway Tree.
Evolvulus villosus; Euphorbia splendens.

From Dr. John M. Macfarlane, Dir. Bot. Garden, Pennsylvania—
Tubers of Nymphæas; N. alba candidissima; N. amazonium; N. Gladstoniana; N. odorata minor; N. tuberosa.

[Issued on 17th March, 1902.]

Vol. IX. APRIL, 1902. Part 4.

BULLETIN

OF THE

BOTANICAL DEPARTMENT, JAMAICA.

EDITED BY

WILLIAM FAWCETT. B.Sc., F.L.S.

Director of Public Gardens and Plantations.

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KINGSTON, JAMAICA:
HOPE GARDENS.

1902.

JAMAICA.

BULLETIN

OF THE

BOTANICAL DEPARTMENT.

Vol. IX. APRIL, 1902. Part 4.

TOBACCO: CULTIVATION AND CURING.

By T. J. HARRIS, Superintendent of the Experiment Station, Hope.

NURSERY.

Selection of site.—Select an open space quite devoid of shade of any description, and with a south or south eastern aspect if possible; bill off the bush and spread same out to dry; when dry, rake up and put on one side.

Preparation of beds.—Hoe off and clear away the grass roots, &c., from the space thus cleared and then proceed to lightly fork up the land, taking care not to turn up the subsoil; when this is done peg out and line off the beds, allowing three feet for the bed and four feet for the path; now with a spade or shovel lift the loose soil from the two feet of the middle of the path, to the depth of four or five inches, and place it upon the bed and level down with a rake: the paths will then be two feet wide and the three feet beds will have a long slope on either side.

Burning—If the soil be light (sandy or loamy) and not likely to cake down after rain it will be necessary only to burn say five or six inches of rubbish over the bed, just sufficient burning to destroy caterpillars &c., but if the soil is of a heavy clayey nature the beds must be burned twice; each time spreading about two feet of rubbish on the beds; the ashes to be mixed with the surface soil after the first burning, and in either case before the seeds are sown. A seed bed ten yards long will yield ample "suckers" for one acre of land.

Time of sowing.—The best time to sow is about the middle of August; the suckers would then be ready for planting out during October. After this main sowing it is, however, very necessary to sow a few beds every fortnight, for the purpose of keeping up a supply of plants in the event of continued heavy rains interfering with the planting out of those that are just the size for planting; in which case they over-grow and become useless.

Sowing.—Mix the seeds with twice their bulk of fine sand or wood ashes and scatter evenly over the bed (including the long sloping sides) when the air is still; water with a fine rose watering can, and keep the bed moist until the "suckers" are ready for hardening off before planting out.

Shading.—Immediately after sowing, cut some forked sticks and rig up a skeleton arbour about four or five feet high and lay some long Guinea grass or coco-nut leaves over it, with the stalks pointing to the north; this will secure the points of the grass or coconut leaves trailing over on the southern or sunny side.

This covering serves two purposes—it protects the germinating seeds from the sun, and breaks the force of the rain during a heavy shower.

As soon as sufficient seedlings have made their appearance, remove most of the shade from the arbour; this stops the germination of seeds that can very well wait for a time; the visible seedlings should now be an inch or so apart.

When these have begun to develope their third leaf, remove the whole of the shade.

Weeding.—Pick out all weeds as they appear, as, if allowed to get big before they are pulled out, the tobacco seedlings come out with them.

Hardening off.—Four weeks after germination the seedlings will begin to pack up together, covering the soil, they should now be gradually hardened off by keeping them on the dry side, watering them only when there is danger of the leaves drooping. In seven weeks from sowing they will be ready for planting out.

Damping.—Sometimes a shower of rain will bruise the young plants; inducing "damping" in some places; to prevent the spread of the "damp" fungus, apply a dusting of slaked lime to the affected parts of the bed.

Summary.—Select a southern aspect for nursery.

Secure the destruction of caterpillars and a loose uncakable soil by burning. Sow the seeds thinly and evenly.

Keep them moist and protected from sharp sunlight and heavy rain during germination.

Remove the shade gradually as soon as sufficient seeds have germinated, e.g., an inch apart.

Keep down weeds and continue the watering until the plants pack up together. Gradually withhold the water to ensure the "suckers" being hard when planted out.

Look out for damp after a shower of rain.

Planting.

Time for planting.—There is a certain short period towards the end of the year at which tobacco plants, whether in the beds or in the field, grow and develope at an exceedingly rapid rate; namely, from the last week in October to the middle of December; the success of a crop depends very largely on whether the main lot of plants are set out before this period or not; if not, then the plants will not be fully developed by the time the dry ripening weather comes on. The main point is to make the best possible use of the latter half of the October "Seasons" with a view to growing large plants and leaves that will be ready for the dry weather when it arrives.

Soil.—The best soil for tobacco is a rich vegetable mould containing just sufficient clay to enable it to hold moisture for a good length of time; it can be taken as a maxim that the richer the soil is and

the quicker the tobacco grows the better will be the quality of the cured product. Tobacco grown in a poor gravelly soil at a hot dry time of the year is so rank and heavy with narcotic gum that it is almost unsmokable; it makes however, a first class insecticide.

Situation of Plantation.—Tobacco should not be planted in districts where there are no well defined wet and dry seasons; it matters not how well the plants are grown, how carefully they are tended, if the two or three weeks continuous sunshine and dry atmosphere be not forthcoming when the plants reach the ripening stage.

Preparation of Land.—The land on which it is intended to grow tobacco should be cleared of all trees and other objects that are likely to shade the plants; it is not necessary to grub the stumps out except for convenience in ploughing; the rubbish should be burned in heaps and the ashes scattered over the soil to be ploughed in. Where tobacco is grown every year on the same land the growth of cow-peas or other leguminous plant between the crops is highly beneficial; the "Velvet Bean" seems to be the best for this purpose, for besides storing nitrogen in the soil, it climbs over and kills out any weeds that attempt to grow, and goes down itself quite easily before the disc harrow at ploughing time, reducing the cost of preparation very considerably. The seeds may be sown at any time doring June and July, two or three in shallow holes three feet apart more or less. Tobacco land should be broken up and cultivated as thoroughly as possible; the least that can be done is to plough, cross-plough, harrow, and cross-harrow; as the rows have to run north and south it is as well to plough in this direction first, finishing up with the cross-harrowing from east to west; this small matter makes it more convenient to arrange the lines when planting out.

Planting.—Two days before planting is to be commenced the nursery beds should receive a thorough soaking with water; the plants can then be got out without damaging the roots. Planting boxes, each capable of holding about 1,000 plants, should be prepared beforehand: these may be made out of any light wood, the most convenient shape being that of a square coal-scuttle or sugar scoop: 15 inches by 2ft. 3in. on the longest side; the "suckers" are stacked into the boxes just as they come from the bed and are not disturbed until they are planted in the field; each planter should have a box, and there should be several spare ones so that the planters may be kept supplied with newly filled boxes from the nursery as the others get empty; the idea is to prevent the roots being exposed or damaged in any way.

The "suckers" are ready for planting out when they have three or four leaves about four inches long and a hard stem from two to three inches long; care should be taken when lifting them from the beds not to break off the tap root as such a sucker often results in a curly leaved plant. The best time of the day for planting is from three o'clock in the afternoon until dark; but this is because the plants are enabled to lay hold of the soil before they have to face the strong sunlight; so that advantage should be taken of cloudy days to push ahead with the planting as rapidly as possible. If the plants lose their first leaves by exposure to bright sun, they usually take some time to recover, and make fresh ones before they can start into

rapid growth; whereas if these leaves get safely through the transplanting, the plant starts into vigorous growth immediately.

In the actual planting out great care should be exercised in organising the work in such a way as to prevent a hitch occurring causing loss of time; after repeated trials of various methods I have found the following to be the best and quickest—procure eight stout pegs and two rough mallets; put four pegs into the ground on each side of the field at a distance of three feet apart and stretch lines between the first two pairs; start one man with a six pointed dibbler from each end to make the holes, with one man following each to fill the holes with water as they are made, whether the soil be moist or dry; three planters may follow each waterer.

Care should be taken to see that the roots are put into the mud formed by throwing in the water, to secure this thrust two fingers into the centre of the small puddle and draw half on one side; insert the roots, then press the moved half back again to the plant and smooth down the surrounding soil; no water will be required after this.

As soon as one line is holed and planted it can be moved to the next pair of pegs over the one on which the planters are working; the pegs may be moved in the odd moments whilst the planters are changing over from the finished line to the one newly holed and watered.

This is a brief outline of a plan that may be modified to suit varying conditions; for instance the water may be some distance off, necessitating more hands in this part of the work; and again, women can apply the water just as well as men. A dibbler capable of making six holes at once can be very easily made out of 2 in. x 3 in. pitch pine scantling:—six 3 ft. lengths planted smooth and pointed with iron, held 15 inches apart by a hand bar at the top and a foot bar 1 ft from the points; the lengths should be 15 in. from centre to centre, that is, from point to point. An acre of tobacco planted three feet by fifteen inches should contain 11,600 plants; these in a fair season will yield about 10 quintals of cured tobacco = 1,000 lbs.

COFFEE FERMENTATION.

By B. S. Gosset.

Coffee is made or marred during the first three days. The practice in the Blue Mountains is to pulp the coffee as soon after it is picked as possible, drain the water off, and leave it in a heap either in tank under the pulper or one adjacent, to ferment for about 48 hours; if the weather is cold it may take longer to ferment, but that is a matter of judgment on the curer's part. If the syrup does not come away freely when it is washed, the coffee will not be first class.

When the pickings are small it is often pulped into a cistern day by day, into running water to prevent fermentation, till the end of the week when the water is drained off and the coffee left in a heap to ferment, this can only be done where there is plenty of water from cold streams, such as we have in the Blue Mountains.

If the weather is wet and there are no available barbacues, coffee after washing is often left with water running over it in the washing tank, till a favourable opportunity arises to put it on the barbacues; it can be kept like this from a week to ten days or more.

Plenty of running water, large washing tanks, and receiving cisterns, are very essential to producing fine quality coffee.

It is sometimes considered better that the cisterns should be relined with wood; fermentation is more easily set up in a wooden receiver than a stone or cement tank, though the latter is good for washing out.

I have noticed that those plantations who are best supplied with cisterns and washing tanks realise the best prices for their coffee.

CHEER PINE.

PINUS LONGIFOLIA.

This species according to "Gordon's Pinetum" attains to a height of from 60 to 100 feet, and is confined in a great measure to the outer or lower ranges of the mountains of N. India, commencing as low as 1,000 feet above the level of the sea, and rarely, if ever, attains a greater elevation than 7,000 feet, but appears to have a very great power of enduring variations of climate: for it seems equally at home in the hot, damp valleys of Sikkim, as on the dry, stony hills of the Punjaub, where rain hardly ever falls, and it is at all seasons exposed to a powerful and scorching sun.

A large quantity of tar and turpentine is extracted from the wood, and the chips are used for candles in India, and called "Chamsing" (night-lights); and, according to Sir J. D. Hooker, ink is made in Sikkim from the charcoal of the burnt leaves mixed with rice-water.

It is called "Cheer" by the hill people in India; a word according to some meaning "Bark" or "Rind", so conspicuous on old trees; but, according to others,, from its milk or turpentine, which it produces in great abundance. It is called "Sulla" by the mountain people from Nepal to Buseher, a term denoting "to spread fragrance," which this tree does to a remarkable extent.

Timber excellent, and full of turpentine. The seeds are large with rather long narrow wings, one inch and a half long; they are eaten by the hill people in India.

Veitch states that its most marked characteristic is seen in the leaves, which are of a vivid green, disposed in spiral rows round the young wood, varying in length from 12 to 18 inches, very slender and pendulous.

A few plants are available for distribution from Hope Gardens.

BANANAS, COFFEE, COCOA IN COSTA RICA.

EXTRACT FROM CONSULAR REPORT FOR 1900.

By MR. CONSUL HARRISON.

Bananas.

The banana industry continues to develop, the quantity of fruit exported in 1900 being larger by 457,395 bunches than in 1899. The following returns of the number of bunches exported show the rapid growth of this trade since its commencement in 1881 :—

Year.	Quantity.
	Bunches.
1881	3,500
1891	1,133,717
1899	2,962,771
1900	3,420,166

All of which were exported to the United States. The export trade is in the hands of the United Fruit Company, a large American corporation, organised in the spring of 1899 and incorporated under the laws of the State of New Jersey, with headquarters in Boston, United States of America. The prime movers in this organisation were the Boston Fruit Company, which, together with other important fruit companies, was absorbed by the new corporation. A controlling interest was also obtained in the Tropical Trading and Transport Company, a British joint-stock Company which formerly had large interests in Costa Rica and controlled the export trade in bananas from that country, and which went into liquidation in 1900, the United Fruit Company taking over all its interests. The company contracts with the farmers for the latter to deliver their fruit alongside the railway track at certain fixed places. When the fruit has been passed by the company's receivers, the growers receive checks stating the number of bunches and specifying the proportion of "firsts" (bunches with 9 "hands" and upwards) and "seconds" (bunches with fewer than 9 "hands"). These checks are afterwards changed by the company for sight drafts on New York, or, if preferred, for the equivalent in Costa Rican currency, the rate of exchange being fixed by the company at the commencement of each month. The contracts are made for a term of years, the present price being 26 c. American gold (13d.) for "first" and 13 c. (6½d.) "seconds." Many of these contracts expire shortly, but the company has already entered into an agreement to renew them on slightly better terms. In addition to their export business, the company owns large tracts of banana lands already in production, or being brought into production. A large proportion of the profits derived from this industry does not remain in the country, but there can be no doubt as to its importance and the Government so fully recognises this that, in September last, Congress enacted that no export duties should be imposed on bananas for a term of 10 years from that date.

Coffee.

Coffee is still the staple product and the most important article of export. The year 1900 was a good one for exporters, the average price paid by them to the growers for the berry in fruit being £1 10s. per Fanega (400 litres) as against £1 11s. 2d., per Fanega in 1899, while the prices realised abroad were higher by 1¼d per lb., the actual figures being: 1899, net average value, 4½d per lb.; 1900, net average value 5¾d. per lb. It is true that owing to the fall in exchange the colon was worth more in 1900 than the peso in 1899, but the principal decline did not take place until April, by which time most of the coffee drafts had been negotiated. Growers complain, however, that at these prices coffee barely pays expenses, and it is possible that, if there be no improvement in the near future, many older farms and also those

in inferior soil will be abandoned. This is even more probable now as so far from any prospect of an advance in price, appearances all point the other way. The improvement in the Coffee markets abroad mentioned above, was only temporary, and the prices so far obtained for this year's (1901) crop, are, in many instances, as much as £1 per cwt., less than those of the preceding year.

Cocoa

Some progress has been made in the cultivation of cocoa. In order to encourage the industry, a law was passed in 1894, offering a preminm of 25 c a tree for plantations containing upwards of 500 trees, of at least three years' growth, provided that they were in good condition. In virtue of this law, applications for the premium have been made to the Minister of Public Works representing 400,000 trees, but the report of the Commision appointed to inspect the plantations and count the trees has not yet been published. In order to protect this industry, the import duties were raised in April to 30 c. per kilo for cocoa in bean and 50 c. per kilo on ground cocoa. Those who have embarked in this industry are well satisfied with the results so far obtained; the production is already almost sufficient to supply the home consumption, and when the existing plantations come into full bearing it is probable that cocoa will figure conspicuously among the exports.

Woods.

Although there was a large falling-off in the quantity of dyewoods exported, this has been more than compensated for by the larger shipments of mahogany, cedar and rosewood. This industry being dependent on the exploitation of the forests, it is destined of necessity, to decline as the forests, or at least, those near the coast, or the navigable rivers, become depleted.

VARIATION IN COLOUR OF GRAPES.

A correspondent writes as follows:—

"A plant of so called Madresfield Court which I obtained from Hope in 1899, fruited two small tasteless, or better say flavourless bunches of *purple coloured* grapes in 1900, without being pruned; and after being pruned in February, 1901, the vine fruited four bunches of round *white* grapes with full muscat flavour"

Another correspondent contributes the following:—

"I have cultivated grapes for some years past, and this year I have had a strange experience which perhaps may interest you. About four years ago Mr. Griffith gave me some slips of a black grape which he called Royal Ascot and which I grew at my residence Cavaliers Pen and two years it bore a few small bunches of black grapes. I then had to change my residence and have gone to live on the Brentford Road and took several grape plants with me (layers from my old vines) among them a plant of the Royal Ascot, which I layered in a kerosine tin. Last year it bore a few bunches and this year it has borne again only the grapes this year are white and the flavour seems very much improved but in every other respect the vine is like the old one. At Cavaliers the ground was hard and clayey, while at my present residence it is virgin soil, a beautiful loam."

CHINESE OR DWARF BANANA.

Mr. G. H. Withers of Messrs. Elder, Dempster & Co., sends the following note with reference to the question whether the Dwarf Banana of Jamaica is the same as the fruit exported from the Canary Islands :—

"I have also always been under the impression that the Canary Banana is the "Chinese," it is certainly the same, as I have seen growing here in the hills They say they were brought there originally by a Priest from one of the W. I. Islands It may be true that there are different kinds, but we must remember the different climates they grow in ; also soils ; lack and (in rare cases) superfluity of water, and manure, also varieties in manures from stable manure up to ammonia pure and simple. All this must tell in the matter of flavour and to a certain extent appearance.

"The climate certainly is better, it allows the fruit to mature slower, and is never liable to excess or lack of water.

"There are plants there still bearing known to be over 30 years old."

In Bengal which is so much hotter than the W. Indies, the Chinese banana is said to be difficut to get in perfection, "as it is uneatable till quite ripe, and on its becoming ripe commences almost immediately to decay."

COST OF SUGAR CANE CULTIVATION.

Cost of Cultivation on an Estate in Vere, Jamaica, of 400 acres of cane land divided into 3 crops, i.e., plants, 1st & 2nd ratoons, according to Messrs. J. W. Mitchell & Muirhead.

Plants 100 Acres.

		per acre
Preparing land for plough	...	2/6
Close ploughing	...	6/
Single mould do.	...	5/
Double do	...	3/
Digging row ends	...	2/
Planting and procuring tops	...	9/
Covering land in plants	...	2/6
5 cleanings, 4s. each	...	20/
Banking up canes with plough	...	4/
Booting ...	...	5/
Removing dead leaves, trashing	...	5/
		64/ per acre

Ratoons.

Turning, reversing and spreading trash		4/
Rough Moulding	...	2/
Spreading trash and cleaning canes	...	3/
Booting canes	...	5/
Trashing do.	...	5/
		19/ per acre.

100 acres plants	£320		
200 " ratoons	190		
	£510		
Cane cultivation ...		£510	
Manuring canes, plants 5 cwt., ratoons 2½ cwt., 50 tons at £10 ...		500*	
Foddering pens—growing cow peas ...		100	
Fences and pastures ...		60	
Cattle Men ...		25	
Annual depreciation of live stock ...		80	
Do. dead do. ...		50	
Immigration (coolies) ...		120	
Salaries ...		400	
Headmen, Watchmen ...		75	
Taxes ...		80?	
Interest on working Capital ...		50	
Premium on silver 1 p.c. ...		20	
		£2,070	£2,070
If the canes are to be cut and carried to factory depot:—			
Cane cutting 8/ per acre ...		£120	
Carting to depot 11/ ...		15	
		£135	£135
			£2,205

The cost per acre is thus, £7 7s.

The return may be estimated—

Plants	28 tons per acre
1st ratoons	20 " "
2nd do.	18 " "
	66 or 22 tons average per acre.

Cost per ton of canes 6/8 nearly.

No allowance has been made for casualities, such as unusual dry weather reducing the crops, heavy winds causing the canes to fall down and rot, heavy rain coming when the canes are well grown and approaching ripeness; perhaps 1/ per ton might be added for insurance against these evils—making the total 7/8 per ton. With regard to

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*The item of £500 for manuring canes, is not in my opinion justified. That it is not a prevalent agricultural practice is proved by the fact that it represents ¼ of the total value of fertilisers imported into Jamaica. That it is unnecessary, is brought home to my conviction by recent analyses of Vere soils showing an extraordinary standard of fertility. At present crops are solely limited by the water-supply. If fertilisers were used, the yield per acre should be increased to such an extent as still further to reduce the cost of cane per ton. Eliminating this factor the cost of cane comes out at 5/2 per ton instead of 6/8, a figure in accord with other data given this district which have been submitted to me.

15.4.02. H. H. Cousins.

cost of cattle and cattle-men,—the cattle are supposed to be used for cultivation only, and not for manufacture, otherwise the charge would be about doubled. Out of the 400 acres 100 are supposed to be occupied in preparing the land for ploughing, &c.,—the plants to be put in as what are called "fall plants." With spring plant you can gain a cutting but are unable to cultivate the land properly, also the spring plant is much less certain and often requires constant supplying. We have not included irrigation expenses, as they would be about covered by the 1/ a ton allowed for casualities, the chief casualty in Vere being dry weather.

Cost of Cane Cultivation on a Ratooning Estate in Northern St. James, having 200 acres in Cane—Average Rainfall, 40 Inches according to Mr. J. Shore.

Cultivation of Canefield	—Cleaning canes twice, per acre,		4/.
	Trashing once "		5/.
	Supplying with dung		6/.
	Making and applying manure		20/.
			35/.
General expenses—	Headmen and Watchmen		5/.
	Pasture cleaning and fences		8/.
	Attending stock		4/.
	Tradesmen, repairs, &c.		3/.
	Estates' roads and sundries, including trenches, &c.		5/.
	Cutting and carting canes		15/.
	Total for Labour		75/.
Yearly purchase of Stock	...	15/.	
Lumber and supplies	...	4/.	
Taxes and rates	...	4/.	
Salaries	...	20/.	
Sundries, including fertilizers	...	5/.	48/.
Total cost per acre	...		123/.

The above statement is based on actual figures from estates' books, taking into account the fact that no manufacture is done on the property on which the canes are grown, and that the distance to depot is reasonable. Interest on money is not allowed for, as that is chargeable to the proceeds. No immigration is needed here. Plenty of grass land is kept up from which nearly all the manure is made, only a small proportion being done with fertilizers. One third of the acreage is manured yearly, part being "fly-penned on the stock," part done by forking in manure, and part supplied with dung, or done with artificial manures working stock say 150 head, with perhaps a few young stock penning.

Average return per acre, 18 tons canes; taking into account good and bad years. The cost per ton of cane will thus work out at 6/10. Including all expenses except rent.

Of course every district has to work differently: here we cannot do "planting" to any extent owing to the deficient rainfall, but the manuring is kept up all along.

It seems that the cost of cultivation according to Mr. Mitchell's figures is very reasonable, but his allowance for stock is far too low. That is met by the increased cost of manures, which we make on the spot—good farmyard manure. We have plenty of labour and require no coolies, as cane is about the only dependence of the people here. The cost per ton of cane is very near in both cases. It may be said that my estimate of salaries is too low, but it must be taken into account that the present salaries are paid for manufacturing and shipping as well as for cultivation. A proportion of the salary item will have to go to the Factory account. Otherwise the details in my statement are actual figures as at present.

This memo refers to one estate of 200 acres which makes nearly all its own manure, (and of course to estates of similar size and position.) The figures given to the Conference were rather higher, being 7/3 per ton of cane instead of 6/10 here, owing to thest atistics being collected from 5 estates not altogether and of different sizes, averaging 180 acres of canes each, some of which allowed for more artificial manure. It is of course a fact that the larger the area of caneland under one management, the cheaper the cost of production, so that 5 estates averaging 200 acres each would total 1,000 acres instead of 900 in the Conference figures, and make a difference in the results.

AN INCH OF RAIN.

An error has crept into the note on page 125 of the August Bulletin. The number of cubic inches to the gallon is approximately 277.274. Therefore an inch of rain means 22,622½ gallons to the acre, which weighs 226,225 lbs., or about 101 tons; every square yard receives about 4⅔ gallons.

How is this to be stored up for the use of plants, so that they may not be affected by drought? How shall we prevent it first from running off the surface into the streams? By deep cultivation,—by ploughing over a large area, by digging or forking over a small patch before the rain falls. On well-tilled land the rain sinks in, and the object then is to keep as much as possible of it there for the growing plants. If no care or trouble is taken, it will gradually all evaporate from the ground just as water does out of a vessel standing in the sun. To prevent evaporation as much as possible, and so to retain the water where the roots can get it, it is necessary when the rain is over, to keep the surface of the soil well tilled. On sloping hill-sides where there is danger of the loose soil being washed away, a layer of grass answers the same purpose, and in fact is in every case better, if it does not harbour insects, as then the topmost layer of soil is available for the roots.

THE LATE MR. G. S. JENMAN, Government Botanist, of British Guiana.

It is with much regret that we have to record the death of Mr. George S. Jenman, Government Botanist, which occurred at his residence, Botanic Gardens, on 28th February. Mr. Jenman had been

in failing health for some time, but a fatal termination to the illness, which recently confined him to his room, was not generally anticipated. He was taken seriously ill about a month ago with a complication of heart and lung tronbles,. It was only within the last week or so, that the Government decided to grant long leave of absence to Mr. Jenman, in order that he might proceed to England to recruit, as it was fondly hoped, his shattered health, it being recognized that his breakdown was due to long and arduous labours in this tropical clime.

Mr. Jenman was a native of the south of England, but early in life he went with his family to the south of Ireland, where his boyhood days were spent. He selected horticulture as the profession he was to pursue, and entered the world-famous botanic gardens at Kew. There he remained for several years prosecuting his studies both in theory and practice, with such success that when a botanist was wanted in 1873 to take charge of the Castleton Gardens, Jamaica, the choice of the authorities fell on the young gardener from Ireland. After spending six years in that colony, Mr. Jenman was appointed Government Botanist and Superintendent of the Botanic Gardens of British Guiana, when these were instituted under Government supervision in 1879. Under his care, the Gardens have been laid out and cultivated, what was once to all intents and purposes waste land being converted into one of the finest and most valuable botanic gardens in the West Indies. His experiments in tropical culture extended over a large variety of plants and growths, but what his name has been most closely associated with are seedling cane experiments. At first, on his own initiative, and later, on the arrival of Professor Harrison in the colony, in close association with the Government Chemist, Mr. Jenman carried out a long series of experiments which have made the names of Harrison and Jenman almost household words wherever the sugar cane is cultivated. In other branches he was equally distinguished, and many plants indigenous to the tropics have been discovered by and named after him Nor did he confine his attention to botany, in zoology and natural history he was equally at home, devoting much time to original research He contributed largely to literature on the subjects which he had made a life study; and his articles in "The Argosy," in British and American scientific journals, and to learned societies, attracted widespread attention, and were fully appreciated as he had many tokens to show, by scientific men throughout the world. He was in his fifty-seventh year.—(*The Argosy, Demerara, 1 March, 1902,*)

[Mr. Jenman made the ferns of Jamaica a special object of study, and he contributed to this Bulletin a long series of articles on his favourite subject. Jamaica is one of the richest spots on the globe for variety of ferns, nearly 500 species being found here. Mr. Jenman's descriptions in the Bulletin have induced many fern-collectors from the British Isles and from America to visit our shores. From a botanical point of view his articles are of great value, and constant applications are received for copies of the Bulletin containing them. It is much to be desired that they could be reprinted in one publication for the convenience of visitors and others who study our native ferns. *Editor, Bulletin of the Botanical Department of Jamaica*].

ADDITIONS AND CONTRIBUTIONS TO THE DEPARTMENT.

Library (Serials).

Europe.

British Isles.

Botanical Magazine, March. [Purchased.]
Bulletin, Kew Gardens, App. II. 1902. [Director.]
Chemist and Druggist, Feb. 8, 15, 22, Mar. 1, 8, 15. [Editor.]
Colonial Import Duties, 1901. [Col. Sec.]
Garden, Feb. 8, 15, 22, Mar. 1, 8, 15. [Purchased.]
Gardeners' Chronicle, Feb. 8, 15 22. Mar. 1, 8, 15. [Purchased.]
International Sugar Journal, March. [Editor.]
Journal of Botany, March. [Purchased.]
Journal, R. Horti. Society. Report for the year 1901.
Journal, R. Colonial Institute, March.
Nature, Feb. 13, 20, 27, Mar. 6, 13. [Purchased.]
Pharmaceutical Journal, Feb. 8, 15, 22, Mar. 1, 15.
Rubber Cultivation in West Africa. By J. H. Holland, Curator of Bot. Gard., Old Calabar, Southern Nigeria, 7 Mar., 1901. [Author.]

France.

Sucrerie indigène et coloniale, Feb 18, 25, Mar. 4, 11, 18. [Editor.]

Germany.

Beihefte zum Tropenpflanzer. Mar. [Editor.]
Notizblatt, Berlin, Feb. [Director.]
Tropenpflanzer, Feb., Mar. [Editor.]

Switzerland.

Bulletin de l'Herbier Boissier Vol. II, No. 3. [Conservateur.]

Belgium.

Bulletin Société d'Etudes Coloniales. (Library Catalogue) Feb. [Editor.]

Italy.

Bullettino del Laboratorio ed Orto Botanico, Siena. 1901. [Director.]

Asia.

India.

Planting Opinion, Jan. 11, 18, Feb. 1, 8, 15, 22. [Editor.]
Proc. & Journal, Agri. & Horti. Soc., July-Sept. 1901. [Sec.]
Proc. United Planters' Association of Southern India, 1901. With Appendices.

Straits & Federated Malay States.

Agricultural Bulletin, Vol. 1. Nos. 4 & 5. [Editor.]

Ceylon

Circulars, R. Botanic Gardens. Series I., 21 (Helopeltis, "What we know & what we want to know about it.") 22 (School, Bungalow, & Rest-house Gardens, and some hints on how to plant them.) 23 (Cacao Canker in Ceylon.) 24 (Camphor.) 25 (Mosquitoes & Malaria.)
Times of Ceylon Jan. 30, Feb. 5, 13, 21, 27. [Editor.]

Java.

Proefstation East Java, Nos. 35, 36. [Director.]
Do. West Java, Nos. 53, 54, 55. (With Index for No. 1-50, 1886-1900.) [Director.]

Australia.

N. S. Wales.
Agri. Gazette, Dec., Jan. [Dept. of Agri.]

Queensland.
Queensland Agri. Journal Jan., Feb. [Sec. of Agri.]
Queensland Sugar Journal, Jan. [Editor]

Western Australia.
Journal of the Dept. of Agri., Jan. [Dept. of Agri.]

Africa.

Cape of Good Hope.
Agri. Journal, Jan. 16, 30, Feb. 13. [Dept. of Agri.]

Natal.
Agri. Journal and Mining Record, Jan. 31, Feb. 14. [Dept. of Agri.]

Central Africa.
C. African Times, Dec. 28, Jan. 4, 11, 18. [Editor.]

West Indies.

Barbados.
Agricultural Gazette, March. [Editor.]
Cane Farming. Issued by the Agricultural Committee, British Guiana. [Commr. Imp. Dept. of Agri.]
Report of the Agricultural Work for 1900 carried on under the direction of the Imperial Dept. of Agri. for the W. Indies. [Supt. Botanic Station.]

Jamaica.
Cornwall Herald. [Editor.]
Journal, Jamaica Agri. Soc., March. [Secretary.]

British Guiana.
R. Agri. and Comm. Soc. British Guiana. [Secretary.]

British North America.

Ottawa.
The value of Nature Study in Education. By Jas. Fletcher. From the *Transactions of the Roy. Soc. of Canada, Second Series—1901-1902. Vol. VII. Section IV.*

Montreal.
Pharmaceutical Journal, Feb. [Editor.]

United States of America.

Publications of the U. S. Dept. of Agri. [*Directors.*]

Scientific Bureaus and Divisions.
Bureau of Plant Industry.—Bull. No. 5. Inventory of Seeds and Plants No. 9, Numbers 4351-5500.
Division of Chemistry: Bull. No. 58. The Manufacture of Starch from Potatoes and Cassava. By Harvey W. Wiley.
Division of Entomology: Bull. No. 31, New Series. Proceedings of the Thirteenth Annual Meeting of the Association of Economic Entomologists.

Experiment Stations.

Experiment Station Record, Vol. XIII, 5 and 6.

Alabama. 117 (Orchard Notes.)
Arkansas. 69 (Some Muskmelon Experiments.) 70 (Cowpea Experiments.)
Florida. 9 (Entomological Notes.) 14 (Annual Report— Horticulture, Cereals, Stock, &c.) 19 (Miscellaneous.) 38 (Tobacco in Florida. A Revision of Bull. No. 30, with Additions.) 43 (A Chemical Study of some Typical Soils of the Florida Peninsula.) 44 (Cane, Syrup, Sugar.) 49 (Oassava as a Money Crop.) 59 (Cauliflower.) 60 (Velvet Bean.)
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Virginia. Vol. IX No. 12 (The most common irregularities of the teeth of the Horse Part I.) Vol. X. No. 2 (Steer Feeding.)
Wisconsin. Annual Report for year ending June 30, 1901.
79 (Principles of Construction and Maintenance of Country Roads.) 91 (Oat Smut in Wisconsin.)

American Journal of Pharmacy, March. [Editor.]
Botanical Gazette, Chicago, Feb., Mar. [Editor.]
Forestry and Irrigation, Vol. VIII. Nos. 2 & 3. Feb. & Mar.
New or little known North American Trees, IV. By Chas. S. Sargent. Reprinted from the *Botanical Gazette, Vol. XXXIII., Feb., 1902.* [Author.]
Plant World, Jan. Feb. [Editor.]
Proc. Am. Acd. of Arts & Sciences, Vol. XXXVII. No. 17. } [Gray Herbarium Harvard University Cambridge Mass.]
The Instability of the Rochester Nomenclature, Reprinted from the *Botanical Gazette, Vol. XXXII, No. 5 Nov. 1901.* } [Gray Herbarium Harvard University Cambridge Mass.]
The Cow Pea. [Supt. Exp. Farm, Southern Pines, N. C.]
Torrey Club Bulletin, Feb. Mar. [Editor.]

Central America.

Boletin del Instituto Fisico-Geografico de Costa Rica, No. 12. [Director.]

South America.

Boletin da Agricultura, Sao Paulo, Brazil. 2nd Series, Nos. 10, 11, & 12 3rd Series, No. 1. [Sec. of Agri.]

Polynesia.

Planters' Monthly, Hawaii, Feb. [Editor.]

Library. (Books.)

Natural History of New York. New York, Boston, Albany, 4to. 1842-1861.
General Introduction by William H. Seward; and
Part I, Zoology, by James E. deKay, in 5 Vols., 1842-1844.
Part II, Botany, by John Torrey, in 2 Vols. 1843.
Part III, Mineralogy, by Lewis C. Beck, 1 Vol. 1842
Part IV, Geology, by Wm. W. Mather, Ebenezer Emmons, Lardner Vanuxem, and James Hall, in 4 Vols. 1842, 1843.
Part V, Agriculture, by Ebenezer Emmons, in 5 Vols., 1846-1854.
Part VI, Palaeontology, by James Hall, in 4 Vols., 1847-1861.
[Presented by Dr. Britton, Director of the New York Botanic Garden.]

SEEDS.

From Imperial Dept. of Agri. for the W. Indies—
Sabal Palmetto.
From Mr. H. P. Peans, Priestman's River—
Andira inermis; Pachira aquatica.

PLANTS.

From Rev. W. Griffith, Kingston—
Grape Vine Cuttings.
From Dr. Morris—
3 plants Antigonon insigne,
From Mrs. Raper, Trafalgar Park—
12 Tuberous Begonias; 6 Gloxinias.
From Senora de Zeledon, San Jose, Costa Rica—
Orchids: Cattleya Skinneri, var. alba; Epidendrum sp.; Gongora sp.; Odontoglossom Warscewiczii; Oncidium phymatochilum; Stanhopea sp.; Trichopilia suavis.
From Mr. H. Jekyll, Robertsfield—
Marica sp.; Crossandra undulæfolia; Linaria Cymbalaria.
From Supt. Botanic Station, Barbados—
Sugar Cane Seedlings—3 barrels of Nos. B.156, B,306, B.347.
From Messrs. Jas. Backhouse & Son, Ltd., York—
Trichomanes anceps.

[Issued on 2nd May, 1902.]

Vol. IX. MAY, 1902. Part 5.

BULLETIN

OF THE

BOTANICAL DEPARTMENT, JAMAICA.

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.

Director of Public Gardens and Plantations.

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PRICE—Threepence.

A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Kingston P.O.

KINGSTON, JAMAICA:
HOPE GARDENS.

1902

JAMAICA.

BULLETIN

OF THE

BOTANICAL DEPARTMENT.

Vol. IX. MAY, 1902. Part 5.

TOBACCO: CULTIVATION AND CURING. II.*

By T. J. HARRIS, Superintendent of the Experiment Station, Hope.

AFTER CULTIVATION.

About two or three weeks after planting, according to the state of the weather, the young plants will have put out some fresh leaves; and it will be noticed that each new leaf will be larger, when developed, than the one immediately below.

If the weather has been dry, "suckers" will very quickly make their appearance at the junction of the stem with the leaves. These should be removed at once. If, on the other hand, nice moist growing weather has prevailed, suckers will not become troublesome until the plant reaches a height of 2 feet to 3 feet; until in fact it is topped. Care should be taken from the first to keep down weeds, but avoid, if possible, trampling on the soil when it is wet; it is better by far to allow the weeds to remain until the surface of the soil is dry than to trample it into mud. During dry weather the surface of the soil should be kept loose by the use of the hoe, or a small cultivator drawn by a steer, to prevent the escape of the soil moisture.

Moulding.—When the plants are about a foot high, there is some danger of their falling over; advantage should be taken of the first spell of dry weather to give them a light moulding; this will also cover up the roots that come out during wet weather on the surface near the base of the plant, and protect them from the sun and dry wind. The easiest and best way to mould is to hoe a little soil out from the centre of the three foot space between the rows and scatter it evenly over the distance from there up to the plants; the workman walking in the three foot space and using the hoe left and right handed alternately. This method should be insisted upon as by moulding each row of plants separately there is danger of breaking the leaves and of cutting the roots that are extending towards the middle of the three foot space.

Avoid, when moulding, making a high sharp ridge; for it is a veritable death trap to the plants. For they will grow well only as long as there is a large amount of moisture in the atmosphere, but

* Continued from Bulletin, April, page 52.

will stop suddenly as soon as the air gets dry. The fact is that the plant has been encouraged to put out roots high up the stem and on that account has discarded the deeply-laid roots. In such a case, a few days dry wind is sufficient to absorb all the moisture out of the ridge that is so much above the surrounding level, with the result that the roots contained therein, on which the plant has been depending for its sustenance, very quickly become useless through lack of moisture. The ridge should be low and broad, extending from the centre of one interval to the centre of the next. To enable the workman to place the mould right up to the stem of the plant the small leaves at the base are removed. A No. 1 hoe is the best size for moulding tobacco.

Topping.—Each successive leaf is larger than the one just below, up to the eighth or ninth; the next four or five are about the same size, and those developed afterwards get gradually less until those near the infloresence are nothing more than small scales. One object in topping is to ensure all the leaves ripening at the same time so that the whole plant may be cut; this only happens when the plants are topped down to the last developed large leaf; *e.g.*, the top one of the four or five that are the same size as each other.

Some practice is required to be able to judge just where to top the plant as these leaves have not yet developed, the best way at first is to top down to the twelfth leaf from the bottom those plants in which the flower bud is just discernible, not counting those leaves that were removed in the moulding.

In poor sandy soil, planted late, only eight or nine good leaves per plant will be obtained, but in rich soil under the best conditions as many as fifteen good leaves have been secured per plant.

Suckering.—The topping is the signal for a sudden burst of suckers from the axils of the leaves; those at the top being the quickest to develop. These suckers must be removed as soon as it is possible to lay hold of them conveniently, care being taken not to leave a single one on any part of the plant; remove every vestige of a sucker right down to the ground. If one is left it will be benefited by the removal of the others and grow at a prodigous rate.

If the weather is moist the suckering can be done at any time of the day, but if dry hot days obtain, the suckering is best done in the morning, as the suckers are brittle and snap off easily; whereas in the afternoon they become leathery and difficult to remove without injuring the good leaves.

About ten or fourteen days after the first suckering another lot of suckers will appear; these must be removed in the same way *leaving two only that are growing out of the stem below the surface of the soil;* these are called the first "ratoons", to distinguish them from the plant which is called the "principal."

Ripening.—Seven or eight days after the second suckering the leaves will begin to ripen; the first to do so will be, of course, the bottom or oldest leaves and the last the top one. The first sign of ripening will be a crimped appearance in the leaf, somewhat like a savoy cabbage but not so pronounced; the next is the leaves turn a light green; which, on closer examination, will be found to be caused by a yellow shading at the summit of each little bump or crimp. The

leaves then become thick and leathery, and the minute hairs lose their glistening appearance, and in some cases the edges turn down.

If the plant was topped properly, it will be ready to cut when the lower middle of the top leaf is ripe; this being the last spot on the whole plant to ripen. It will thus be seen that it is possible to judge to a day when the plant is fit to cut.

Ratoons.—It is a saying among the Cubans that the price obtained for the "principals" covers the cost of the cultivation and curing of the whole crop; the "ratoons" representing net profit. The former are sold as Capa (wrapper) but are used for "capoti" (binder) in the best cigars, for which Sumatra wrappers are used, and as wrappers for cheap cigars; the ratoons are used for "tripa" (filler).

By good management it is, however, possible to obtain excellent capa leaves from the first ratoons; more especially when the principal ripens up quickly and is cut in time to allow the ratoon leaves to develop in the full light. The ratoons require the same attention as the principals with regard to weeding, moulding, topping and suckering, again leaving two or one ratoon, according to the strength of the plant, to take the place of the ripe ratoons when cut.

The cutting may go on in this way until the leaves produced are so small as not to be worth the expense of cutting and hanging.

VARIETIES OF BANANA.

On several occasions during the last 10 or 12 years we have received varieties of bananas from the famous collection of economic plants at Kew Gardens, got together with so much trouble, and expense by the former Directors, Sir W. J. Hooker, and Sir J. D. Hooker, and by the present Director, Sir W. T. Thiselton-Dyer.

In 1898 several different kinds of bananas were sent from Kew by Sir W. Dyer to the Botanic Garden in Dominica, which, in the wonderful climate of that beautiful island, and under the skilful treatment of the Curator, Mr. J. Jones, is said to be one of the prettiest gardens in the West Indies. In the following year Dr. Morris, Commissioner of the Imperial Department of Agriculture, very kindly sent to this Department suckers of 17 varieties from the collection in Dominica, and 12 of these have survived.

A note on bananas by Mr. Watson, Curator of Kew Gardens, was inserted from the 'Gardeners' Chronicle in the Bulletin for March, 1901, and notes by a correspondent appeared in the Bulletin for December, 1901. Mr. Watson thinks that if the banana of the shops [Canary Island Banana] is worth a penny, then 'Ram Kela' is worth a shilling." Our correspondent on the contrary classes the 'Ram Kela' with the 'Red Banana' as being an inferior fruit with a soapy taste and a disagreable smell It is probable that the fruit varies somewhat on different plants, and we shall have to watch the plants carefully and select the best of its kind for propagation by suckers.

The "guindy" from Madras is spoken highly of by our correspondent, though he does not consider it as good as the Jamaican Banana. We are told by one who lived some years in Ceylon that the variety known there as "Suaandell" is even superior to the Jamaican. The banana,

which is exported at the rate of ten millions a year from Jamaica is therefore now rightly termed 'Jamaican' was introduced from Martinique by Mr. Pouyat, and was known originally as the Pouyat or Martinique Banana; the story of its being brought to Jamaica is related in the Bulletin for October, 1901.

CULTIVATION OF PINEAPPLES.

By W. Cradwick, *Travelling Instructor.*

Soil.—The best soil for Pineapples is a rich well-drained loam, they cannot be grown profitably on any other. The colour of the soil does not matter, but there must be at least fifteen inches of good sweet top soil on the land in which the Pines are to be grown.

Drainage.—The top soil must be thoroughly ploughed and broken up. If below this, the soil is the least bit heavy, trenches to the depth of two feet must be dug to thoroughly drain it. If the lower layers of soil are clay, trenches three feet deep must be dug, If the level is so low that water lies at or near the surface, raised beds 3 feet high should be made on which to plant the suckers. This plan has been very successful near Hope Bay. Pineapples must have the best drainage possible or they will get all sorts of "disease."

Preparation of Soil.—Next to drainage in importance is the thorough forking and breaking up of the soil. There is an old Creole proverb that a Pineapple sucker "planted with one chop bears in one year, with two chops in two years, and so on." The origin of it in my opinion is that when planting in new rich soft land, when a hole big enough to receive the sucker was easily made with one chop of hoe or digger, the pine sucker invariably produced a fruit within the year. When planting in old hard land where it was necessary to make two or three chops in order to make a hole big enough to receive the sucker, the sucker for want of cultivation or soil naturally soft, took two years to fruit. This explains how necessary it is to cultivate the land thoroughly.

Selection of Suckers.—Plant nothing but good strong fresh stout *young* suckers; the proper size is from twelve to fifteen inches. Anything bigger or smaller is a mistake. Thin weedy shade-grown suckers are dear at a gift. Overgrown plants are not suckers, and should only be used to grow suckers from. In purchasing suckers, see that they are pointed just as they are torn away from the parent plant; for old long suckers can readily be trimmed down to look as short as young suckers.

Planting Suckers.—As soon as the sucker is taken off the old plant, it should be planted. If it is a fresh healthy one, it wants nothing at all done to it. If it is not a good healthy one, burn it. If you plant a poor sucker it will be a trouble all the days of its life. Never let suckers lie about in heaps, never let them get wet.

Have your land properly prepared and when the suckers are taken off, plant them as quickly as possible. The land should be so soft that the suckers can be pushed down to the proper depth without having to use anything to make a hole with, Plant the suckers in beds

not wider than can be weeded from the sides without having to step on them. Pineapples must have soft soil, and if the beds are walked on every time they are weeded, they soon get hard and stop the roots growing.

Cultivation.—Never allow the weeds to grow. Stir the soil often, using a dutch or push hoe, this is much better than the draw hoe which is very liable to bruise and shake the suckers when trying to dig out weeds which grow close to them.

Distance.—Different varieties can be planted at different distances: the Ripleys and Bullheads eighteen inches; Smooth Cayennes two feet to two feet six inches.

Replanting.—Replant every year, never trust to ratoons. It is only by replanting every year that the quality of the fruit can be kept up, and the fruit made to come in at the right time. Ratoons will nearly all come in at the time of year when pines are not wanted. Pineapples are worth very little after the May rains begin, and everybody should make experiments in planting so as to find out the right time to plant to make their fruit come in at the right time, that is from Christmas up to May. The time will be different in different places.

IMPORTATION OF COCOA PLANTS.

A fungoid disease on the branches of Cocoa trees in Surinam has caused a great loss to planters, as it reduces considerably the bearing powers of the tree.

The fungus causes 'witch brooms' to be produced in the branches of the trees attacked. These are composed of a bunch of greatly enlarged gouty twigs which show a tendency to grow in a vertical direction.*

Dr Morris, Commissioner of the Imperial Agricultural Department for the W. Indies, has called the attention of the various Governors in the W. Indies to this disease, and the following proclamation has been issued in Jamaica.

A. W. L. Hemming.

A PROCLAMATION.

By His Excellency Sir Augustus William Lawson Hemming, Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George, Captain-General and Governor-in-Chief in and over the Island of Jamaica and its Dependencies.

BY virtue of the power vested in me in that behalf by Law 4 of 1884, entitled "The Seeds and Plants Importation Law of 1884," I do hereby by this my Proclamation prohibit the importation into this Island of Cacao Plants, seeds, cuttings, buds or other parts of the Cacao plant from any of the countries named below, namely,

* West Indian Bulletin, Vol. II. No. 5, p. 205.

Mexico, British Honduras, Honduras, Guatemala, Nicaragua, San Salvador, Costa Rica, Colombia, Venezuela, Guiana (British, Dutch, and French), Ecuador, Peru, Brazil, Paraguay, Argentine Republic, Chili, Bolivia.

Given under my hand, and the Broad Seal of this Island, at King's House this Nineteenth day of April, in the second year of His Majesty's Reign, Annoque Domini, 1892.

By Command,

SYDNEY OLIVIER, Colonial Secretary.

OIL FROM CITRUS PEEL.

The essential oils of the orange tribe were dealt with in an article in the Bulletin for September, 1895.

The object of this note is to publish information received from Mr. J. Ch Sawer, author of "Odorographia," on the ècuelle-à-piquer, the instrument used for obtaining the oil from the peel. He says:—

"The *ècuelle-à-piquer* (used in the South of France and North of Italy) is a saucer-shaped vessel about 8 to 10 inches in diameter, usually made of copper, tinned inside, and covered inside with short spikes about $\frac{1}{4}$ to $\frac{1}{3}$ inch long. In the bottom of the saucer is a hole about $\frac{1}{2}$ inch diameter leading to a tube about 4 or 5 inches long, closed at the lower end. This tube consitutes the handle of the tool, also the receiver of the oil running into it from the saucer above.

"There are larger machines used for obtaining the oil from a number of fruits at a time, with spikes in the lid, which is revolved by machinery.

"I believe the best makers of all utensils used in the perfume industry are in France and I would suggest that you apply to Mr. Deroy fils âiné, 73 Rue du Théatre, Paris, stating whether you wish a machine to extract the oil on a large scale or only experimentally. If he cannot supply you doubtless he can name someone else."

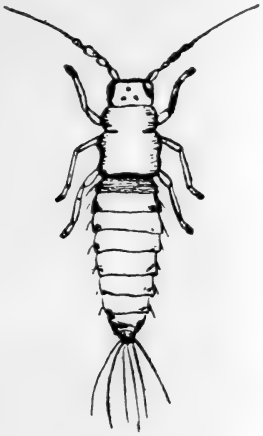
THRIPS ON COCOA.

Samples of Cocoa pods have been sent to Hope Gardens for some time back shewing discolouration, and although only the outer skin was affected, planters were naturally and rightly anxious to ascertain its nature, and the possibility of its eventually becoming a pest, and interfering with the crop.

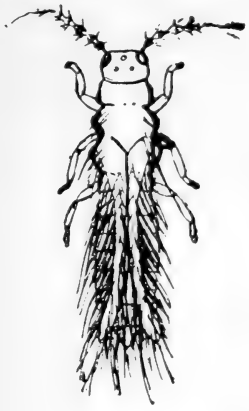
The discolouration of the skin caused at first, some trouble with the pickers, as they said the could not tell when the pods were ripe. However that difficulty was soon overcome by scratching the skin with the finger-nail, for, if the flesh had changed from a greenish to a yellowish appearance, the pod was ripe.

The discolouration is due to attacks by a minute, but exceedingly active insect, called "thrips." These insects are not more than one-tenth of an inch long. Their bodies are slender, and the adults have narrow wings, fringed with hairs and lying flat along the back. They puncture the softer parts of plants, and seem to poison the cells

attacked, for they lose their green colour and become brown. The clichés for the figures were kindly lent by Dr. Morris, Commissioner of the Imperial Department of Agriculture for the W. Indies.



Young thrips.



Mature thrips.

The Entomologist of the Department, Mr. H. Maxwell-Lefroy, was sent by Dr. Morris to investigate the injury alleged to have been caused by thrips on cocoa estates in Grenada, and his reports are published in the West Indian Bulletin, Vol. I. No. 3.

Mr. Lefroy found that the cocoa was "suffering from damage in four distinct ways:- (a) the leaves of the young trees are attacked, leading to the death of badly attacked plants; (b) the leaves of the older trees are attacked; (c) the young pods are attacked, and their development arrested or retarded; (d) the mature pods are attacked."

Little damage appeared to be done by attacks on the leaves, but if thrips became very abundant, their attacks might be serious.

When half-grown pods are attacked, they, as a rule, mature, but a longer period is necessary before they are fully ripe. When a small pod is attacked by a large number of thrips, it shrivels up; but this should not be confused with the drying up of a large number of small pods which usually occurs on every tree in a natural manner.

The most general form of attack was that in which the pods turn a deep brown colour as they mature. Young thrips carry a drop of brown liquid at the end of the body, which is deposited on the pods, and dries up into brown flakes. These brown flakes are characteristic of the presence of thrips, but are not the cause of the brown colour of the pod.

The thrips is also found on cashew, guava, and Liberian coffee, and the cashew loses its leaves when badly attacked.

So far, Mr. Lefroy states, the damage done in Grenada is slight so that no remedy is necessary. But to prevent the spread of the insect, he recommends that as soon as the beans are taken from the pods, the shells should be at once buried, burnt, or scorched, or covered with lime.

If thrips increases much, the pods should be sprayed, before they are ripe, with kerosine emulsion, or rosin wash.

NUTS. II.*

From Report by Messrs. JENMAN & HARRISON B. Guiana.

Wherever the water lily, *Nelumbium speciosum*, has been established in the trenches of sugar estates, the coolies gather the seeds and use them for food. They also use *Nymphæa* seed, pounding or rolling it into a flour-like paste. Adding the seed of the native *Victoria regia*, which, so far as we know, is not used, but which, judging by the few that grow in the trenches where the plants exist, out of the great abundance produced, seems to be eaten freely by water animals, we resolved to ascertain their respective composition as food stuffs by chemical analysis Though differing much in their composition, the analysis show that all are valuable food stuffs The *Nymphæa* seed was obtained from *N. Lotus* and some of its varieties, but no doubt all the species of this genus would show the same composition.

Composition of a sample of Nelumbium speciosum seed:

Flour 60·5 o/o Husk 39·5 o/o

		Air dried flour.
	Water	12·17
	Fats	2·44
a.	Albuminoids	17·67
	Glucose	7·79
	Sucrose	5 50
	Dextrin	8·17
	Starch	6 47
	Digestible fibre	34 34
	Indigestible fibre	1·65
	Ash (Mineral matter) ...	3·80
		100·00
a.	Containing Nitrogen ...	2 83

The flour of this is rich in albuminoids, carbo-hydrates, and fairly so in fats and digestible cellulose, the composition proving generally that of a very valuable foodstuff.

Nymphæa seeds, air dried.

	Water	10.05
	Oils & Fats	1 29
a.	Albuminoids	8.75
	Sucrose	—
	Glucose	trace
	Starch	24.15
	Gums, etc.	4.09
	Digestible fibre	46.12
	Indigestible fibre	3.76
b.	Mineral matters (ash) ...	1.76
		100.00
a.	Containing nitrogen	1.40
b.	Soluble ash	66

* Continued from *Bulletin of the Botanical Department, Jamaica, June, 1901.*

These seeds are rich in starch and digestible fibre, elements which constitute valuable food, though the albuminoids are rather low. They are produced in great abundance, and must contribute largely to the food of fishes, and perhaps other water animals.

Composition of a sample of Victoria regia seeds:

Flour 75.66 o/o ... Husks 24.34 o/o

		Air dried flour.
	Water	18.03
	Fats	21
a.	Albuminoids	3.26
	Glucose	34
	Starch	1.71
	Tannin, Gum, etc.	54
	Degestible fibre	74.95
	Iudigestible fibre	44
	Mineral matter (ash)	52
		100.00
a.	Containing nitrogen	.52

The prominent feature in the flour of Victoria seed is the very high proportion of digestible cellulose they contain. The other constituents are low.

CANE-FARMING IN TRINIDAD.*

Sugar, if not the chief product, is the chief manufacture of the Colony. A hundred years ago the boiling house was a mere adjunct to the cane-fields; but the modern usine represents an amount of capital exceeding the value of the land from which it is supplied with canes. To give an illustration: The usine of St. Augustine with its groups of estates, comprising about 4,500 acres, lying near the old capital of St. Joseph, was closed last year; and though the usine contained machinery which had cost, apart from buildings and tramways, £30 000, yet, as there was no demand for it as a going concern, the Government was able to acquire the whole property for £9,100. Improvements in the process of manufacture, and the development of machinery have led to concentration of capital, a reduction in the number of factories and the consolidation of estates. Though last year sugar was made at twenty-six factories, thirteen manufactured less than a thousand tons. One usine was closed last year and one this. Though the so-called planter has long been primarily a manufacturer, his factory has, until recent years, been fed entirely from his own estates. Under this system the losses suffered in bad seasons have fallen on a small number of owners, and their capital and credit has been often insufficient for the heavy calls upon them. Lately, however, the cane-farmer has come into existence, and the rapid growth of the industry is shown in the following table, prepared by the Government Analyst from returns published by the Agricultural Society.

* Extract from Colonial Reports—Trinidad and Tobago, 1900.

Year.	Total Sugar Production.	Estate-grown Canes	Cane Farmers.			
			Canes.	Price paid.	Number and Nationality.	
	Tons.	Tons.	Tons.	Dols.	E. Indians	W. Indians.
1895	55,000	–	35,000	–	–	–
1896	59,000	–	75,000	–	3,744	
1897	55,000	–	–	–	–	–
1898	58,000	–	105,000	203,000	2,326	3,824
1899	58,800	426,000	106,000	219,000	2,826	3,870
1900	46,000	364,000	106,000	228,000	2,826	3,591

In the present year the quantity of farmers' canes ground has been nearly 170,000 tons.

Many of the cane farmers are small peasants owning or renting only a few acres, which they and their families can cultivate without additional labour. They are generally dependent upon advances from the manufacturer, and the weak point in the system, from their point of view, is that owing partly to geographical position, and partly to indebtedness, they have generally only one market to which they can take their canes. A sliding scale, however, regulating the payment for canes, is generally adopted by the parties, the price paid being determined by that ruling in the London or New York market at the time of delivery. Movements, moreover, are on foot in two parts of the Island, one in the North and one in the South, for the establishment of small co-operative societies to supply the farmers with the requisite advances. Of these one is proceeding on the well-known lines of the Raffeisen Banks, the other will allow the division of profits. Co-operation not only gives hope for greater stability to the sugar industry by making the labourer share profits or losses with the capitalist, but it probably operates to cheapen labour, as Creole and Indian alike prefer growing canes in their own plot to working as labourers on the estates; and they are willing to sell the canes at a price that is below that which the estate can, at any rate with free labour, produce them. It is interesting to record that since the closing of St. Augustine, which it was feared would lead to much local loss of employment and consequent distress, the land has been readily let in small holdings to farmers, and it is possible that within a few years as large an acreage will be under canes as was the case when the estate was worked as a whole. One drawback to cane farming must, however, be pointed out. The farmer is less alive than the estate owner to the advantages to be derived from economic cultivation, the use of manure, the adoption of improvements, and the selection of canes.

THE ORANGE IN NORTH CALIFORNIA.*

By D. H. Murray, of Oroville.

The question is often asked by strangers on arriving at some abandoned grove, "What is the cause of the trees all dying"? The reason in some cases is neglect. Many have been informed that all they have to do is to get the ground, plant the trees, and at the end of two years they would have paying returns. They find out about that time that it takes considerable cash to take care of an orange grove as it ought to be cared for, and the consequence is that they try to cut down expenses by letting the cultivation go. In consequence, the trees all turn yellow and eventually die. The following year the grove looks so bad that the owner in many cases abandons the place althogether, and swears the orange business is a fraud.

I would always advise a person, with the view of having a model grove, to test and examine the land thoroughly. You may be told it is a beautiful loooking tract, but remember it may be only skin deep, and below the surface you will find hardpan, cemented gravel, pipeclay, or some such subsoils which are undesirable, and have caused many an orchardist disappointment and loss. In fact, so much so that I have known them to abandon the place altogether.

Everything depends upon the character and situation of the land to be planted, and according to these you must select and arrange your grove.

The orange delights in a warm, deep, fertile, and well-drained soil, and under these conditions will give to growers a bounteous crop. A cold and damp soil breeds disease, and death is sure to follow. Always select a position for an orange grove in a rich, deep, porous soil, where the trees will grow strong and vigorous. Better never plant a tree than put it in heavy, low ground, or where water can be reached within three or four feet of the surface. The orange must not at any time stand in water, which in a very short time will cause the roots to die, and your tree will soon be beyond recovery.

The orange is sometimes root-killed by winter rains, although as a rule it is well on in the spring when the trees show the damage by turning yellow and the limbs begin to die. Drainage, as I will hereafter state, will overcome the trouble by lowering the water table and keeping the roots dry.

Throughout the northern countries the soil is of a red, gravelly loam, particularly so in the foothill lands, and is charged heavily with oxide of iron, which gives our oranges a much richer colour than that of the orange in many other parts of the State.

We are more inland and have a much higher temperature during the summer, which certainly ripens our fruit five or six weeks earlier than the orange matures in the South.

The soil on the river bottoms is sandy on top and adobe below in many localities, which has a tendency to make the fruit coarse and

* From "Proceedings of Twenty-Sixth Fruit-Growers' Convention of California", Dec., 1901.

thick-skinned, as well as much later in maturing than is usual on the higher ground.

A few words concerning drainage will not be out of place, as drainage is of the utmost importance. It increases the fertility of the soil, and promotes the health and vitality of the tree. In fact, this cannot be too strongly impressed upon the minds of those who desire to make a success of orange culture. I have put in a great many drains in the past fifteen years, and it is really remarkable the improvement they have made in the trees. Not only that, but you can work your ground easier and during a longer period, as the soil is usually loose and mellow. It is too commonly regarded as sufficient to sink the drains merely out of the way of the plough, or, at most, out of the reach of the subsoil implements. But there are reasons founded upon ascertained facts why drainage systems should be deeper laid.

The oranges to be grown in the northern counties may well be headed with the Washington Navel, which may be styled king of all varieties, and on account of its earliness it is certainly the leading variety for us to grow. The Jaffa is an early variety, and is a great favorite with many. Another variety which has taken a leading position among the growers, is the Dancy Tangerine and Satsuma or Oonshiu, which are both early and very fruitful. There are many other varieties grown which really ought not to be encouraged as profitable trees in this section, on account of their lateness.

A few words in regard to pruning, and then I am done. If carefully watched in their growth the trees will require little pruning. Remove all crossed branches, to prevent chafing, which might terminate in the dreaded gum disease. Pruning is certainly overdone in a great many cases, especially by those who go about styling themselves "pruners." They care little for the tree or its appearance, but have a great care for the "dollars" in sight. Not one in twenty understands the object and gain of well-considered pruning. Pruning regulates the form of the tree and causes it to become more fruitful, with larger and better fruit. If practiced to too great an extent, the desired result is not obtained, for every tree must have a sufficient amount of foliage to absorb the flow of sap, otherwise it will send forth a great number of suckers, which are certainly injurious to the tree. Blossom buds are produced less abundantly, as the foliage is necessary to promote the health and vigour of the tree. On the other hand, all dead and surplus limbs, which are only harbours for dirt and vermin, should be removed from the centre of the tree, to encourage fruitfulness in the centre of the tree as much as possible. It should be borne in mind, however, that the citrus family has always a luxuriant and heavy growth of foliage.

As a conclusion to the above remarks, the best rule that can be given is this: Watch your trees carefully, give them plenty of care, and keep them clean, healthy and vigorous. The golden harvest will soon follow, and with it success and profit.

ADDITIONS AND CONTRIBUTIONS TO THE DEPARTMENT.

Library (Serials).

Europe.

British Isles.

Board of Agri., England, Leaflets, Nos. 71, 72, & 73; Journal, March [Secretary.]
Botanical Magazine, April. [Purchased.]
Bulletin, Kew Gardens, Apps. III. & IV. [Director.]
Chemist and Druggist, Mar. 22, 29, April 5, 12, 19, 26. [Editor.]
Colonial and Diplomatic and Consular Reports, Jan., Feb. [Col. Sec.]
Garden, Mar. 29, April 5, 12, 19, 26. [Purchased.]
Gardeners' Chronicle, Mar. 22, 29, April 5, 12, 19, 26. [Purchased.]
International Sugar Journal, April. [Editor.]
Journal of Botany, April. [Purchased.]
Nature, Mar. 20, 27, April 3, 10, 17. [Purchased.]
Pharmaceutical Journal, Mar. 22, 29, April 5, 12, 19, 26.
R. Colonial Institute, Journal, April.

France.

Sucrerie indigène et coloniale, Mar. 25, April 1, 8, 15, 22, 29. [Editor.]

Germany.

Beretning om den botaniske Haves Virksomhed. i. 1901. By Dr. Eugene Warming. [Director.]
Tropenpflanzer, April. [Editor.]

Switzerland.

Bulletin de l'Herbier Boissier Vol. II, Nos. 4 & 5. [Conservateur.]

Belgium.

Bulletin Société d'Etudes Coloniales. Nos. 2-3, Feb.-Mar., No. 4 April [Editor.]

Asia.

India.

Agricultural Ledger (Calcutta) No. 13. [Lt. Gov. Bengal.]
Planting Opinion, Mar. 1, 8, 15, 22,29, April 5. [Editor.]
Proc. & Journal, Agri. & Hort. Soc., Oct.-Dec. 1901. [Sec.]
Proc. United Planters' Association of Southern India, 1901. With Appendices. [Secretary.]
Report on the Trivandrum Museum & Public Gardens, 1900-1901. [Director.]

Ceylon

Times of Ceylon Mar. 6, 13, 19, 27, April 3, 10. [Editor.]

Java.

Proefstation East Java, No. 37. [Director.]

Australia.

N. S. Wales.

Notes on the Botany of Pitcairn Island. Australasian Assoc. By J. H. Maiden. [Author.]
On Eucalyptus dives in Victoria. By J. H. Maiden. From the *Victorian Naturalist*, Vol. XVIII., No. 8. Dec. 5, 1901. [Author.]

A new species of Acacia. By J. H. Maiden. From the *Proc. of the Linnean Soc. of N. S. Wales, 1901*, Pt. I., March 27. [Author.]

Notes from the Botanic Gardens, Sydney, N. 7. By J. H. Maiden & E. Betche. From the *Proc. of the Linnean Soc. of N.S. Wales, 1901, Pt. I. April 24.* [Author.]

Further Notes on supposed Hybridisation amongst Eucalypts (including a description of a New Species.) By H. Deane & J. H. Maiden. From the *Proc. of the Linnean Soc. of N.S. Wales, 1901, Pt. 2. July 31st.* [Author.]

Miscellaneous Publications. By J. H. Maiden, No. 509 & 532. Useful Australian Plants. No. 510, Miscellaneous Notes. No. 531, Some Australian Food-adjuncts. From *Agri. Gazette of N.S.Wales. Oct. & Dec. 1901* [Author.]

Agricultural Gazette, Feb., Mar. [Dept. of Agri.]

Queensland.

Queensland Sugar Journal, Feb. 15. [Editor.]

Western Australia.

Journal of the Dept. of Agri., Mar. [Dept. of Agri.]

Africa.

Cape of Good Hope.

Agri. Journal, Feb. 27, Mar. 13, 27. [Dept. of Agri.]

Natal.

Agri. Journal and Mining Record, Feb. 28, Mar. 14, 28. [Dept. of Agri.]

Natal Plants, Vol. 3, Part III. By J. Medley Wood. [Author.]

Central Africa.

C. African Times, Jan. 25, Feb. 1, 8, 15, 22, Mar. 1, 8. [Editor.]

West Indies

Barbados.

Agricultural Gazette, April, May. [Editor.]

Agricultural News. A Fortnightly Review of the Imp Dept. of Agri. for the W.I., April 25, May 10.
West Indian Bulletin, Vol. III., No. 1.
} [Commr. Imp. Dept. of Agri.]

Report of the Agricultural Work for 1900. Carried on under the direction of the Imp. Dept. of Agri. [Prof. d'Albuquerque.]

Jamaica.

Journal, Jamaica Agri. Soc., April, May. [Secretary.]

Trinidad.

Bot. Dept. Bulletin, April. [Supt.]

Proc. of Agri. Soc., Vol. V. & Soc. Paper, No. 174—Report of the Committee for 1901. [Secretary.]

St. Lucia.

Annual Report on the Botanical Garden, 1900. [Curator.]

British North America.

Ontario.

Experimental Farms Reports for 1901.
Report of Agri. & Experimental Union, 1901.
Report of the Entomological Society, 1901.
} [Dept. of Agri.]

Montreal.

Pharmaceutical Journal, March, April. [Editor.]

Nova Scotia.

Annual Report of Sec. for Agri. for 1901. [Secretary.]

United States of America.

Publications of the U. S. Dept. of Agri. [*Directors.*]

Scientific Bureaus and Divisions.

Bureau of Plant Industry.—Bull. No. 7. The Algerian Drum Wheats; A Classified List, with Descriptions. By Carl S. Scofield. No. 19, Kentucky Bluegrass Seed: Harvesting, curing and cleaning. By A. J. Pieters and Edgar Brown.

Experiment Stations.

Experiment Station Record, Vol. XIII, No. 7.

Alabama. 118 (Cowpea Culture.)

Hatch, Mass. 80 (Fungicides, Insecticides, Spraying Calendar.) 82 (Orchard Management. Cover Crops in Orchards. Pruning of Orchards. Report on Fruits.)

Idaho. 30 (The Service of Soils.) 31 (Some Spraying Experiments for 1901.)

Kansas 107 (Analyses of Corn, with reference to its improvement.)

Kentucky. 98 (1. Kentucky Forage Plants—The Clovers and their Allies. 2. Notes on True Grasses in the Plots in 1900-1901. 3. Analyses of Forage Plants from the Plots.) 99 (1. Test of Varieties. 2. Treatment for Smut. 3. Test of Fertilizers. 4. Relative value of the Varieties for Feeding.)

Maine. (Annual Report, Part II., 1901.)

Maryland. 80 (Acute Epizoötic Leucoencephalitis in Horses.) 81 Soils & Fertilizers for Green House Crops.)

Michigan. 194 (Report of South Haven Sub-Station for 1901.) 195-6 (Strawberry Notes for 1901. Notes on Vegetables.)

New Hampshire. 86 (I. Growing Watermelons in the North. II. Classification of Watermelons.) 88 (Inspection of Fertilizers in 1901 in Coöperation with the State Board of Agri.) 89 (The Squash Bug.) 90 (Insect Record for 1901.)

New York. 207 (Conditions affecting weight lost by Cheese in curing.) 208 (Stable Manure & Nitrogenous Chemical Fertilizers for forcing Lettuce.) 209 (Treatment for San José Scale in Orchards. 1. Orchard Fumigation.) 210 (The immediate effect on Milk Production of changes in the Ration.) 211 (Director's Report for 1901.)

Oregon. 68 Annotated List of the Birds of Oregon.) 69 (The Coddling Moth & Late Spraying in Oregon.)

South Dakota. 73 (Variations in Cream and Milk Tests) 74 (Drought Resistant Forage Experiments at Highmore Sub-Station, Dept. of Botany.)

Tennessee. (Annual Report for 1901.) Vol. XV., 1 (The Value of Corn, Skim Milk and Whey for fattening Swine.) 2 (The early growth and training of Apple Trees.)

Vermont. (Annual Report, 1900-1901.) 88 (Analyses of Commercial Feeding Stuffs.) 89 (Plum Culture.) 90 (Apple Growing in Addison County.) 91 (Analyses of Commercial Feeding Stuffs.)

Wisconsin. 51 (On the Sensitiveness of the Coherer.)

American Journal of Pharmacy, April, May. [Editor.]

Botanical Garden New York, April. [Director.]

Botanical Gazette, Chicago, April. [Editor.]

California Floriculturist, March.

Bull, 71. Insect Pests & Remedies. Latest approved formulas.

Horticultural Officers of California. Nov. 1st, 1901.

Horticultural Statutes of California, with Court Decisions and Legal Opinions relating thereto.

Report of the Twenty-sixth Fruit Growers' Convention of California.

[A Craw, Quarantine Officer, State Board of Horticulture San Francisco.]

Fern Bulletin, April. [Editor.]

Forestry and Irrigation, Vol. VIII. No. 4, April.

Mycological Notes, No. 9, April. By C. G. Lloyd. [Author.]

Torrey Club Bulletin, April. [Editor.]

Central America.

Boletin del Instituto Fisico-Geografico de Costa Rica, Nos. 13, 14, 15. [Director.]

South America.

Boletin Mensual Del Observatorio Meteorologico de Leon, Mexico.

Polynesia.

Planters' Monthly, Hawaii, March, April. [Editor.]

SEEDS.

From Mr. H. Constantine Thomas, Green Island.
Naseberry, Star-apple.
From Botanic Dept., Trinidad.
Theobroma bicolor.
From Botanic Station, British Honduras.
Mahogany.
From Messrs. Reasoner Bros., Oneco, Florida.
Rubus trivialis var.
From Director Royal Gardens, Kew.
Cordyline sp.—New Zealand, (" Ti" or " Cabbage Tree.")
From Govt. Botanic Gardens, Ootacamund, India.
Acer oblongum: Acrocarpus fraxinifolius: Cardamom: Celtis serotina: Cupressus torulosa: Exacum bicolor: Fodder Grass from Wynaad: Ilex Wightiana: Lasiosiphon eriocephalus: Lilium neilgherrense. Litsea Zeylanica: Meliosma Arnottiana: Michelia nilagirica: Microtropis ovalifolia: Osbeckia sp.: Pedicularis zeylanica; Phœnix rupicola: Photinia Lindleyana: Pinus longifolia: Pittosporum tetraspermum: Pterocarpus Marsupium: Rhodomyrtus tomentosa: Rosa gigantea: Santalum album: Turpinia pomifera: Urceola esculenta: Vernonia.

PLANTS.

From Messrs. Reasoner Bros., Oneco, Florida—
Myriophyllum proserpinacoides.
From Lady Hemming, King's House—
Epidendrum alatum, Peristeria elata
From Mr. W. Jekyll, Robertsfield—
Myosotis.
From Mr. Robert Thomson, Maryfield—
Cecropia sp., Banana from Central America.

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BULLETIN

OF THE

BOTANICAL DEPARTMENT, JAMAICA

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.

Director of Public Gardens and Plantations.

CONTENTS:

PRICE—Threepence.

A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Kingston P.O.

KINGSTON, JAMAICA:

HOPE GARDENS.

1902.

JAMAICA.

BULLETIN

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Vol. IX. JUNE, 1902. Part 6.

REPORT ON CASSAVA.

MR. ROBERT THOMSON, to the Colonial Secretary.

Halfway Tree, 26th April, 1902.

SIR,

With reference to your letter dated 10th instant, requesting me to furnish the Board of Agriculture with a report on the results of my experiments with cassava, I accordingly have the honour to submit the following remarks.

The people of Jamaica are constantly reminded of the great advantages accruing from the cultivation of innumerable "minor products." I feel convinced that attention should be more exclusively confined to a few of the more important products and to their adequate cultivation. Far better to have great fields of sugar-cane, of coffee, of cocoa and bananas than a hundred species of insignificant minor products. Hitherto cassava has been one of these minor products. Probably throughout the Island there are altogether some 200 acres of cassava. As this is indiscriminately cultivated, usually interspersed with other products, it is not likely that the total value of the hap-hazard crops would amount to £1,000 a year.

But cassava cultivation in the island, under systematic cultivation, is capable of ranking next to sugar and bananas in a few years time. And from a remunerative point of view it is likely to surpass both. Moreover this cultivation can be adopted with the utmost facility by the peasantry. The importance of the inauguration and establishment of this cultivation in Jamaica on a commercial scale cannot be overestimated. No other plant of equal value could be recommended to form a new staple cultivation.

This valuable plant attracted my attention many years ago in the Republic of Colombia. In many parts of that country it is the staple article of human food, this from several excellent varieties. Other varieties are peculiarly rich in starch. The West India "bitter" variety is unknown there, and probably if it were known it would be discarded owing to the noxious principle its sap contains, namely, hydrocyanic acid. Last year I introduced from widely separated provinces of that country some 20 varieties which I have under cultivation here. They are at present in nursery beds, and are now fit to be propagated to a considerable extent. As these have been grown in

nursery beds, closely planted, it would be premature to test them by analysis. I may mention that cuttings of these have been successfully forwarded to the Governments of Bombay, and the Punjab In this connexion I make the following extract from a letter of mine to the Secretary of State for India a few years ago.

"The disasters attendant upon widespread famine throughout vast areas of India, areas absolutely dependent upon heavy rainfall for the production of the great staple food, Rice and Millets, would be most materially mitigated by the introduction of the food plant I recommend. In other words cassava is preeminently a drought resisting culture requiring for the perfect development of the crop only from 14 to 16 inches of rain per annum as compared with from 50 to 60 inches for Rice."

The Liguanea plain is one of the most arid districts in the island, and the scorching sea-breeze in the dry seasons intensifies the aridity. Consequently there is little or no planting enterprise on this plain

In the centre of the plain where I am experimenting with a few acres of pineapples which withstand considerable drought, I have planted about three acres of cassava, the common "sweet" and "bitter" varieties. The October rainy season is the most propitious season for cultural operations, for the rain as a rule begins in September and continues in showers until December. Hence the best time to plant cassava on the plain would be anterior to the October season, say in August. Subsequently the soil becomes completely saturated by superabundant rain. Three months establishment of the plant under such climatic conditions is ample for the plant, for the subsequent three months of drought matures the crop.

This initial experiment to determine the practicablity of growing cassava on a commercial scale with *minimum* conditions of moisture was unavoidably started late in the season, thus the cuttings were planted in December instead of August. Anyhow the result is interesting, for it has proved the drought resistant capacity of the plant. The three acres were planted during the first two weeks of December. The ground was moist. After the cuttings were planted we had nearly two inches of rain in that month. In January 2.28, February a drizzle, March 2.20, April (to date) 2.42. In all 8.90. The rainfall thus stated I feel confident is sufficient to mature the crop in about three months without further precipitation.

Unfortunately only one acre of land was ploughed wherein the cuttings were set. The other two acres were set in places dug with the hoe only It is well to remember that when land is properly prepared with ploughs and cultivators the humidity of the soil is conserved to a remarkable extent. For instance in arid regions of America where the rainfall is only 10 and 12 inches a year, by means of these enlightened methods of cultivation splendid crops of wheat are obtained.

This experimental cassava growing has therefore been conducted with a *minimum* quantity of moisture. Hence as the plant is amenable to the most simple cultural requirements it can be grown on a considerable scale on the Liguanea plain. In all probability it can be planted twice a year, *i.e.*, in March as well as in August.

Fortunately for this important culture it flourishes under a wide range of climatic conditions under congenial conditions of soil, thus with a rainfall of more than 100 inches a year. In the seasonable parts of the island the conditions requisite for its most successful cultivation are available to a vast extent.

I have recently been in communication with several parties who desire to embark upon this cultivation for the manufacture of starch in Jamaica. In my report on pineapples and other products of Florida, published by the Government, I commented upon the establishment of this industry in Florida. Roots are only obtainable in that State during one or two months of the year. I have pointed out that supplies are producible in Jamaica throughout the year. To ensure this, planting must be resorted to at least twice a year. A one hundred acre field, for example would yield return in six months, but the crop may advantageously remain growing until it is nine months old. Thus between the 6th and 9th months supplies are forthcoming. Successional crops may thus be obtained to supply a manufactory all the year round. The manufactory in Florida only works four months a year. (A gentleman in Jamaica recently obtained 25 per cent. of starch from roots nine months old.) It will be observed that two crops are obtainable here. This means moderately computed 20 tons a year per acre.

Cost of planting and growing 3 acres of cassava at Maryfield :—

Ploughing 1 acre ...	£1	0	0
Digging holes, about 2 acres among young mango trees ...	4	0	0
Planting 3 acres ...	0	18	0
Weeding twice, about ...	3	12	0
Purchase of cuttings for 3 acres ...	0	14	0
Another weeding before cropping	2	0	0
	£12	4	0

The total cost of planting and growing will therefore amount to about £4 per acre by the time the crop of tubers is matured My estimate of the crop of tubers obtainable from the 3 acres is about eight tons per acre—to be cropped in the course of a few months. They are planted 4 feet apart (2,722 to the acre). The actual cost of production would therefore be about ten shillings per ton. Digging up the roots would cost about one shilling per ton more. It is interesting to note that on examination several of our medium sized plants, though only 3½ months old, had incipient tubers weighing from 3 to 5 lbs. each, and these contained 10 per cent. of starch.

Subsequent plantations can be much more economically carried on, for the hoe must be supplanted by ploughs and cultivators, thus tubers may be produced at say five shillings per ton. Ten tons per acre yield two tons of starch. The cost of manufacturing one ton of starch is about £2. A ton of starch can therefore be produced at less than £4.

I make the following extracts from a United States Experimental Station Report :—

Analyses of Station Cassava.

	Per cent. dry root.	Per cent. natural root.	Per cent. water free.
Water ...	5.18	66.02	...
Protein ...	2.38	0.85	2.51
Fat ...	0.55	0.20	0.58
Resins, alkaloids, &c. ...	0.35	0.13	0.37
Amids & Sugars ...	16.35	5.86	17.24
Crude fibre ...	4.81	1.73	5.08
Starch ...	68.50	24.53	72.24
Ash ...	1.88	0.68	1.98
Potash ...	0.76	0.27	0.80
Phosphoric acid ...	0.24	0.08	0.25

"The first important fact shown from the above analyses, is that cassava contains a larger amount of non-nitrogenous extract matter than is found in any other crop. This matter is composed largely of starch, of which it contains much more than either Irish or sweet potato. A very considerable quantity of sugar, however—about three per cent.—is also included in this material. Cassava, therefore presents marked characteristics of both potatos and sugar beets, but contains very much more total food, because of its greater solidity and smaller content of water....

"Cassava as a raw material for manufacturing purposes:

"It now becomes necessary to refer again to the composition of cassava, since its utilization in manufactures rests solely on the extraction of certain of its constituents.

"There are two products for which this crop offers superior material, namely, starch and glucose. The former, however, is the only product thus far actually ccommercially produced from cassava in this country. The starch supply of the world has heretofore depended upon potatos and corn as raw materials. By comparing the actual yields of starch from these three raw materials in the factory we find that the average amount of starch produced is as follows:—

Corn 53 per cent.
Potatos 17 per cent.
Cassava 20 " "

"An acre yielding 40 bushels of corn would at this rate produce 1,187 pounds of starch, while an acre of cassava producing 6 tons would yield 2,400 pounds of starch. Two other conditions, however, must be considered as bearing upon the economy of manufacture, namely, the relative cost of the raw material supplied in these different forms, and the cost of manufacturing of the finished product.

"On the former point the market value of the three different sources of starch, and the amount of starch produced by each furnish a correct basis for estimating the relative value of each crop for this purpose. At the present, price of corn and potatos in Chicago which is a starch and glucose producing centre, and of cassava, at De Land, Florida,

where the only cassava starch factory in the world is located, we find that unmanufactured starch in the form of corn, at 45 cents per bushel, costs four cents per pound, and the same material in the form of potatos at 50 cents per bushel, costs the manufacturer six cents per pound, while cassava yields raw starch at one cent per pound.

"It thus appears that cassava is to-day the cheapest known source of starch, costing at present market values of raw material only about one-fourth as much as its nearest competitor.*

"The matter of the relative cost is one for which no actual data exist, other than the experience of the single company, which has had two years experience in the manufacturing of cassava starch. The process however with the latter crop, is essentially the same as that in use by potato starch manufacturers, and therefore, the higher starch yield and greater freedom from impurity should render the process less expensive and therefore more remunerative.

"In this connexion it should be stated that cassava starch possesses certain properties not found in other starches, which seem to make it a favourite in markets into which it has been introduced, so that there appears to be a steadily growing demand for the product at prices considerably higher than are quoted for other starches... ..

"With either starch or glucose manufactured from cassava, there must necessarily result very large quantities of waste products, which would be found valuable as either stock foods or for fertilizing purposes. In either case the chief of these would be the pulp which contains most of the cassava except that its starch has disappeared."

One of my correspondents in Florida, an expert on starches, says, in a recent letter :—

"Looking to the present value of Indian corn starch the standard value of the starches in New York, viz: £15 10s. to £16 10s. and that it takes 100 bushels of corn to make one ton of starch, that corn is at present selling at 60 cents in Chicago.....equal to £12 10s. cassava starch should be worth at least £13, f. o. b. in Jamaica."

In order to indicate the importance of another product of cassava I quote the following from the "Encyclopedia Britannica."

"*Starch Sugar.*—This, known in commerce as glucose or grape sugar, an abundant constituent of sweet fruits, &c, is artificially elaborated on an extensive scale from starch. The industry is most largely developed in Germany, where potato starch is the raw material, and in the United States, Indian corn starch being there employed. The starch is acted on by a weak solution of sulphuric acid, whereby soluble starch is formed, whichultimately results in a mixture of glucose and dextrose in varying proportions, constituting the starch sugar of commerce. The operations embrace the boiling of the starch with water containing the requisite proportion of acid, the neutralization of the acid with lime, and the formation of a precipitate of ulsphate of lime, which is separated by filtration in a filter press. The filtered liquid is, when necessary ,deprived of colour by passing it through a bed of animal charcoal, and then it is concentrated to a density of from 40 to 45 Baumé in a vacuum pan. If the resulting syrup contains little

* One or two of these extracts have already been quoted in myReport on trip to Florida.

dextrin it will on cooling slowly solidify into a granular concretionary mass; but if much dextrin is present it remains in the condition of a syrup. Starch sugar is very largely used by brewers and distillers, and by liqueur makers, confectioners and others for making fruit and other syrups. Burnt to caramel, it is also employed to colour beverages and food substances. As an adulterant it is largely employed in the honey trade and for mixing with the more valuable cane sugar. In 1885 there were about fifty factories in Germany engaged in starch sugar making, in which 10,000 tons of hard sugar, 20,000 tons of syrup, and 1,250 tons of 'colour' were made."

Tapioca, an article of considerable importance is an exclusive product of cassava. Alcohol, also, from cassava will rival that made in Germany from potatoes.

The following extracts from the aforementioned Florida Experiment Station Report with regard to cassava for feeding animals is peculiarly applicable to Jamaica, inasmuch as the quantity of salt pork imported in the year ended March 31st, 1901, was no less than 9,458 barrels valued at £29,321.

"Corn which is the standard fattening food of the Western Hemisphere and the material on which probably 95 per cent. of the fat hogs of American markets are finished off preparatory to slaughtering, makes but a poor showing as compared with cassava, though it ranks second in the list of foods tried, its percentage gain being 70 as against 95.2 with cassava. The difference between the two rates of gain 70 and 95.2, is 25.2 per cent. in favour of the cassava pigs. The actual comparative gain, however, is considerably greater since 25.2 is 36 per cent. of 70, and therefore, the real difference in value between these two foods is 36 per cent. in favour of the cassava. In other words the experiment shows that pigs fed on cassava will make 36 per cent more meat during a given interval than if fed upon corn. A different statement of the same fact is, that there is more than one third more profit from the feeding of cassava than corn, in fattening pigs, where the cost of producing the two foods is the same. When it is borne in mind, however, that the actual cost of producing cassava, food value for food value, is very much less than with corn, the advantage of the former appears still greater, and there can be no question of the place of cassava as a 'money crop.' The daily cost of these two foods as nearly as it can be estimated was 0.75 of one cent per day each for the cassava fed pigs, and 2.40 cents each for the corn fed lot The total cost, therefore, of the amount of food consumed during the 75 day period was $5.52 for the cassava pigs and $18.07 for the corn fed lot. This amount divided by the gain in weight for each lot shows that the actual cost per pound of the meat made from the food consumed was 1.04 for the cassava and 3.06 cents for the corn fed pigs.

"The actual market value of the live pork and of corn at the time the trial was in progress being known, have been used as a basis for the calculatisn. As to the basis with cassava, however, no actual market value then existed. Where starch factories have, however, been established in the state $6 per ton is paid for the roots, and this has, therefore, been adopted as the standard of value, although as a matter of fact, our own experience shows that the crop can be grown and

harvested at $14.00 per acre, which with our average yield makes this actual cost of the cassava only about $2.00 per ton, on which basis the relative profit of feeding the same pigs, would have been three times greater than appears in this estimates of the table."

"Fattening Beef upon cassava.—The result of the feeding was an actual profit of 59.10 per cent. on an investment for 75 days..... "The market value of the beef was tested by three judges, beef fed on cassava was marked "first choice" while beef fed on corn meal and cotton-seed products, respectively, were given second and third choice. "This judgment was demonstrated as meeting practical approval in the market, where purchasers invariably called for the cassava fed beef and preferred the same in preference to that from the other two lots."

I have the honour to be,
Sir,
Your Obedient Servant,
ROBERT THOMSON.

The Honourable,
The Colonial Secretary,
Kingston.

THE ORANGE IN SOUTHERN CALIFORNIA.*

By J. W. JEFFREY, of Azusa.

The south has practically settled upon two varieties as the standards for general cultivation. The first in importance is the Washington Navel. Public sentiment, both from the growers' and from the consumers' standpoint, has always given this orange the preference. The tendency of this variety to sport back to worthlessness, and the consequent mistakes of the early propagators in their selection of stock from which to grow trees, are the only valid arguments that have ever been used against the general adoption of this orange. Later years have shown that a typical tree once established will always remain so, and that has thrown the burden of purity of stock upon the nurserymen. Planters understand this so thoroughly that they now spend more time in the selection of their nurserymen than formerly, and the younger orchards are coming to maturity with a minimum of "sports" and in many cases a full complement of typical trees. Tens of thousands of dollars have been spent in budding-over off-quality Washington Navel trees, but the progress of to-day recognizes very little necessity of starting an orchard subject to this fault. Perhaps these weaknesses in this variety have caused its utter failure in Florida, and this may be another case of compensation. At least it is not a cause of anxiety upon the part of California growers.

The other standard orange is the Valencia Late, a somewhat seeded variety, and hence not subject to the inconstancy of the Navel, and rarely if ever missing in typical quality through the faults of the parent tree. This orange, in a few localities, vies with the Navel for supremacy of acreage, but generally is of small importance in the crop totals. It is not prepossessing in colour, it is uniform in quality, size, and productiveness, and could it be shipped skinless would sell better upon its colour, texture, and solidity.

* Proceedings of Twenty-sixth Fruit Growers' Convention of California, December, 1901.

There is nothing new in the practice of preparing the ground for trees. Experience has shown that the land must be graded with special reference to its irrigation. There are many misfit orchards among the oldest plantations in this respect, entailing great loss in the congestion of fertilizers, inequalities in irrigation, and impossible irrigation in some cases. The intelligent planter no longer prepares his land improperly or by fixed rule, but proportions his grade as far as possible to the character of his soil and the methods of irrigation he wishes to use. I need not describe the different plans of orchard formation. The square, the five square, and the triangular each has its advocates; but since the orange has been found such a ravenous feeder that its roots soon ramify its feeding-ground entire, we hear little of the arrangement of the trees, but much of their planting distances.

Aside from the fact that the square formation has the advantage of all others in economy of cultivation, especially in alluvial soils where the ground near the trees does not need cultivation, it has been found advantageous from the fumigator's standpoint. There is nothing more bothersome to the tent men upon a dark night than to keep tab upon every tree in a five-square or triangular arrangement. As to subsoiling, that is not practised extensively of wet years, and may be superseded altogether by the orchard plough At any rate, the square method allows sufficient room for the subsoiler, even far more than one furrow to the row, which gives the same results as is claimed from the other systems of planting. Plant in square 20 feet across if your land is not strong, 22 by 24 feet where the soil is heavy and the tree growth abundant.

It is impossible to fumigate many of the old orchards because of the interlocking of the branches, and the error of close planting will hereafter be carefully avoided for this and other reasons too well known to require notice On the experience that the greater feeding area a tree is given, the less its liability to dangerous fluctuations in vitality and consequent effects upon the quality of the fruit, the average planter would advise 22 by 24 feet as the proper distance to plant, both from the economics of orchard work and from the quantity of merchantable fruit produced.

There is something new in cultivation. Last year Southern California grew the largest and the least resistant crop of oranges ever produced. Among the other reasons given for this, is shallow cultivation, and, following, shallow irrigation. In the wake of these extremely dry seasons came a persistent hardpan, even in alluvial soils. This produced a tendency to strangulation of the deeper roots and a consequent activity of the surface feeders. These surface roots were fed the fertilizers the whole root area should have had, and, being constantly stimulated by irrigation, constantly stirred to hardpan by the teeth of the cultivator, and scalded by the hot sun, the functions of the entire tree were in a state of unrest and partial impotency. It is not impossible that this constant arresting and forcing of the development of the fruit caused the sweetening of the pulp observed in October, the lack of oil formation in the skin cells, and the non-union of the rind and pulp—all so noticeable in last season's crop. At any rate, as soon as the 20-inch rainfall of last winter penetrated the hardpan the trees resumed their normal functions with their old-time vigor, and now it

is a laborious process to separate the rind from even a ripe orange, and impossible to find an abnormal crop in other respects. These points may be thought somewhat theoretical, but they have brought conviction to a large number of practical men, who will hereafter, in the event of a dry, hot season use the orchard plough to train the tree roots down to a safer feeding surface by preventing the formation of a dust pan. In spite of the adversities of last season, I know several cases of deep ploughing which held the fruit intact until May, while many in the same locality were compelled to harvest their crops in early winter where shallow cultivation had prevailed. If the experiences of the past three years have demonstrated that dry-year crops may be improved by superior cultivation, a repetition of the troubles that befell the orange-grower last season may be avoided in the future.

In the pruning of orange trees there is no new item to present. Elaborate articles have been written on this point, but the practical orchardist does little or no pruning. To look after the water sprouts that may distort his trees, and to trim out the branches that die of inanition and thus give the tree an inside bearing surface, are about the limits of orange-tree pruning as practised by the best growers. The orange tree will produce fancy fruit grown so near the earth that it may ripen in the sand, and indeed the best fruit is usually found upon the lower branches.

The question of adaptability of soil is no longer an open one. It has been settled so thoroughly by experiences that the new investor can avoid mistakes by a tour of investigation. Generally, lands which bear light, regular crops produce a somewhat superior orange, while the heavier lands produce slightly inferior fruit, but heavier crops Modern methods of fertilizing have modified these characteristics until it may be broadly stated that there is only an immaterial difference in the fruit grown throughout the true citrus belt. A problem in regard to fertilization presents itself this season for the first time. The facts are that hundreds of groves where hardpanning had occurred for two or three years carried the annual or semi-annual applications of fertilizers to the beginning of this year with but partial assimilation The light rainfall, the sparse irrigation, and other deficiencies caused by three consecutive dry years, together with the light cultivation, must have prevented the utilization of the fertilizers. This has brought a strange experience—the finest condition of trees ever seen, with the lightest crop ever grown from an equal foliage surface. The conclusion is that the trees last winter were supplied with a superabundance of wood-growing, but not sufficient fruit-producing, elements. There is a field for investigation here that the scientific authorities should exploit.

The question of insect disinfection is too large to cover in a paper of this character. In a majority of the citrus growing sections unclean fruit bears its own penalty in washing charges, in falling to lower grades, and in the disrepute it brings to the orchardist. Fumigation is more universal this fall than at any other time. It has been reduced to a science, and while the practice is not always successful, poor work is no longer tolerated without a penalty upon the fumigator. There is little complaint of impure cyanide, but much of its improper application. Daylight fumigation, or more properly warm weather fumigation, is under ban, but many otherwise practical growers have not

discovered it. Two or three of the leading citrus counties do this work at the treasury's expense, afterwards collecting from the lands treated. Los Angeles County still requires the orchardists to do their own fumigation. No new scale pests have developed since the last reports were out, nor is there evidence that parasites have taken the contract to disinfect the orchards of Southern California.

Upon the question of marketing you have heard a greater voice than mine, one that has been heard all along this coast and its influence felt. It is not boasting to say that Southern California has set the pace for coöperative effort among all other farming communities. Great as the actual achievements in this line have been, greater is the feeling of permanent security that has been engendered by the success of the Citrus Fruit Exchange. Were it not for the work of this coöperative institution, there would be no breadth nor vitality in my subject tonight The association has given to the agricultural world its greatest example of the elimination of the unnecessary elements of a great industry, without the formation of a trust. It has increased the profits of the producer without taxing the consumer to do it. The manipulator, speculator, and even honest but depleting fruit merchants have been apportioned to thirty or forty per cent. of the orange crop. They hold on to that through a strenuous endeavour that would appall even our great President. The idea of charging producers just what it costs to sell their fruits has unified the policy of 4,000 orange-growers, and made the Southern California Fruit Exchange the greatest fruit merchant the world has ever seen, giving that organization the record of handling millions of dollars every year, with losses from collections and disbursements so small that they do not amount to the value of 15 carloads in an aggregate sale of 25,800 made since the Exchange assumed control of its own fruit from the orchard to the market end of the line.

WATERING YOUNG TREES AND SHRUBS.

Amateur gardeners as a rule do not understand the art of watering in dry weather. When they see that the flowers and shrubs are drooping, they attach a hose to a stand pipe and thoroughly wet the surface. They rarely think of looking to see how deep the water has penetrated, and would be astonished to find that after half-an-hour's hose play the soil is only wetted to the depth of less than a quarter of an inch Such watering is worse than useless. Far better to mulch the soil, and trust to that for the preservation of moisture than to form a thin layer of damp soil, which only attracts the roots upwards to it that they may be parboiled by the hot morning sun.

A good way to water shrubs is one which we adopted with perfect success in the case of some valuable coffee-trees during a very dry season. We took a number of beer bottles, and, with a tap of a pick on the bottom knob, drove the bottom neatly out These bottles were then buried neck downwards close to the tree. Every night they were filled with water, which slowly drained away beneath the surface—1 foot below. The rootlets then sought the needful moisture downwards instead of upwards, and the plants grew luxuriantly. The surface was never watered, but by capillary attraction it was kept fairly moist.

In India, gardeners bury a porous jar like a water monkey unglazed. They are filled as soon as empty, and a plug on the neck serves to keep out insects and dirt. If gardeners would try this plan they would save many a plant which would die under the ordinary hose treatment.—*Queensland Agricultural Journal.*

ELEMENTARY NOTES ON JAMAICA PLANTS.—IV.

COMMELINA NUDIFLORA.

Water Grass.

In damp shady places we come across a creeping plant with grass-like leaves and petals of the purest blue. We gather it for examination; but, alas, the petals drop off almost immediately,—they are of very delicate texture, semi-circular in shape and with a colourless stalk. The sepals are colourless. Of the six stamens, three have anthers which are at first loaded with pollen, but as soon as they open, releasing the pollen, they begin to curl up The other three anthers have no pollen, but are conspicious each one a golden cross.

The flowers as they open one by one, push their way in succession out of a small leaf, the spathe, doubled on itself length wise; in it the young buds are protected and kept moist. The upper flowers have anthers only, and soon fall; but in the others when the petals fall, the flower-stalk bends down and hides the young seed-vessel.

The seed-vessel has 3 divisions, one of which is rough with little warts, the other two are smooth. The 5 seeds are netted.

Notice how the young flowering shoot comes out between the stalk bearing the seed-vessels and the leaf.

A sister-plant (*Commelina virginica*) has the spathe joined together at the base to form a kind of cup.

The "Wandering Jew" (*Zebrina pendula*) is a pretty plant with purplish-mauve flowers, climbing or hanging on stone walls and such places all over the island,—becoming in some districts a troublesome weed. The leaves are coloured purple below with greyish stripes above. The spathes here again are somewhat like the leaves, they grow two together on a terminal stalk, bearing several flowers within. The stamens, which are attached at the throat of the corolla tube, have peculiar anthers with a broad connective separating the pollen cells.

The "Oyster Plant," as it has been called, (*Rhœo discolor*), grows in rocky places, with stiff straight narrow leaves, purplish underneath, 8 to 12 inches long. The name is given on account of the 2 spathes enclosing the flowers,—they are boatlike and overlap, bearing a fanciful resemblance to an Oyster-shell.

The flowers have white sepals and petals, and triangular anthers with pollen at two edges. The flower-stalk of the bud is short, so that the buds are protected and kept moist within the spathes. As the buds grow, the stalk lengthens, so that the flower opens outside the spathe. When the flower is over, the stalk gradually bends down again, bringing the young seed-vessel within the spathes to ripen.

"Spider Wort" (*Tradescantia*) belongs to the same family, but the flowers are not enclosed within spathes.

Tinantia is nearly allied to the Spider Wort but the flowers have long-stalks on the branches of a long-stalked inflorescence.

Campelia has white petals not deciduous, the sepals became succulent enclosing the seed-vessel.

The following are the general characters of the Family.

COMMELINACEAE.

Flowers generally regular
Calyx and corolla each of 3 parts.
Stamens 6.
Ovary 3 celled, superior.
Capsule bursting at back of each cell, with one or a few seeds in each.
Herbs with narrow soft parallel-veined leaves.

The following may serve as a key to the genera and species:—

I. Stamens, 3 only containing pollen.

COMMELINA.

Flowers enclosed within a spathe

1. *C. nudiflora*, Linn. Spathe simply folded.
2. *C. virginica*, Linn. Spathe united below.

II. Stamens all usually perfect.

A. Flower enclosed between two equal spathes.

RHŒO.

R. discolor, Hance. Stem short with long stiff narrow leaves crowded together Sepals and petals white.

ZEBRINA.

Z. pendula, Schnizl. Stem lying along ground or climbing. Petals purplish-mauve.

CAMPELIA.

C. Zanonia, H.B.K. A robust herb 2 to 4 feet high, with lance-shaped leaves 6 inches long. Petals white.

B. Flower not enclosed between spathes.

TINANTIA.

T. fugax, Scheidw. Flowers blue or purplish with long stalks on the branches of a long-stalked inflorescence.

TRADESCANTIA.

Flowers clustered on a short-stalked inflorescence.

1. *T. cordifolia*, Sw. Stamens with filaments all about equal. Leaves small, not an inch long.
2. *T. multiflora*, Sw. Stamens, with 3 filaments only half the length of the other three. Flowers not only terminal, but also from upper leaves.

AMOUNT OF WATER NEEDED FOR IRRIGATION.*

The amount of water needed for irrigation varies within wide limits, being affected by the climate, weather, kind of soil, variety of crop, manner of application of the water, and by the character of cultivation which the field receives subsequent to irrigation.

Let us first consider the amount needed for a single watering. This must be determined by the amount of water the soil contains at the

* Extract from "Irrigation in Humid Climates" by F. H. King. Farmers' Bulletin No. 46, U. S. Department of Agriculture.

time it is to be irrigated and by the amount it should contain in order that plants may do their work to the best advantage

The maximum capacity of upland field soils for water ranges from about 18 per cent. of their dry weight for the light sandy types to about 30 per cent for the heavy clayey varieties, while the amounts of water these soils should contain in order that plants may thrive in them best is from 12 to 14 per cent. for the former and from 18 to 20 per cent. for the latter. The growth of plants will be seriously checked in sandy soils when the water content falls below 8 per cent., and in heavy, clayey types when it falls below 14 per cent. of the dry weight of the soil.

The dry weight of a light sandy soil and subsoil will average about 105 pounds per cubic foot, and the heavy, clayey tpye about 80 pounds per cubic foot. Hence the maximum amount of water per cubic foot of soil would be about 24 pounds for the clay and 18.9 pounds for the sand. This being true, 4.6 inches of water on the level would completely saturate the surface foot of heavy clay soil, were it entirely dry to begin with, while 3.6 inches would place the sandy soil in a similar condition.

But since water should be applied as soon as the water content of the sandy soil falls to 8 per cent. and that of the clayey soil to 14 per cent, it follows that under these conditions 10.5 pounds of water, or 2 inches, is the maximum amount which would be needed to fill the surface foot of sandy soil and 12.8 pounds, or 2.46 inches. is enough to fill the surface foot of clay soil.

If we consider the second foot of soil to have been dried out to a corresponding extent, and that it is desirable to saturate this with water also, then the amounts just stated would need to be doubled, 4 inches being demanded for the sandy soil and 4.92 inches for the clayey soil. It is quite certain, however, that such an application of water to a field at one time would result in the percolation of a considerable amount of this water below the depth of root action, and hence in a considerable loss of it unless a large crop were growing upon the land at the time. It appears, therefore, that the amounts of water which may be applied to a field at one time will lie between 2 and 5 inches in depth over its whole surface.

How often this watering may need to be repeated, it is not possible to state in anything like definite terms, but practical experience shows that as a rough average the intervals between watering where maximum yields are sought can not much exceed 7 to 14 days, the time being shortest when the crop is making its most vigorous growth.

In experiments at the Wisconsin Station during 1895 corn was irrigated once about every 7 to 9 days, applying at each time 4.43 inches of water. The corn, however, was planted very thickly upon the ground, the rows being only 30 inches apart and the hills 15 inches apart in the row, with from 2 to 5 stalks in each hill. The first irrigation was given June 26 and the last August 15, the total amount of water applied being 26.6 inches. The yield produced was 11,125 pounds of water-free substance per acre.

In the case of the water meadows of Europe very little attention is paid to the natural rainfall, the irrigation waters being applied whenever it is possible to do so, and, whatever rains fall are counted as so much additional gain. It is true, however, that on most lands with

crops other than grass, attention would have to be given to the natural rainfall in the application of water by irrigation lest oversaturation of the soil and a positive waste of water should occur.

If it is regarded that ample irrigation has been provided when 2 inches of water is supplied every 10 days as a minimum and 4 inches as a maximum, then to meet this demand there would be required for 1 acre a continuous flow of water at the rate of 0.5042 cubic foot, or 3.77 gallons, per minute for 2 inches and 1.008 cubic feet, or 7.54 gallons, per minute for 4 inches. An area of 10 acres would require a rate of flow 10 times as rapid, or 5.04 cubic feet per minute for the minimum and 10.08 for the maximum.

These amounts of water expressed in cubic feet and in gallons are as follows :—

	Cubic feet.	Gallons.
For 1 acre 2 inches deep,	7,260=	54,310
For 1 acre 4 inches deep,	14,520=	108,620
For 10 acres 2 inches deep,	72,600=	543,100
For 10 acres 4 inches deep,	145,200=	1,086,200

If these amounts of water are stored in circular reservoirs with vertical sides and 3 feet deep their diameters will be, respectively, 55.5 feet, 78.6 feet, 175.5 feet, and 248.5 feet.

ADDITIONS AND CONTRIBUTIONS TO THE DEPARTMENT.

Library (Serials).

Europe.

British Isles.

Botanical Magazine, May. [Purchased.]
Chemist and Druggist, May 3, 10, 17. [Editor.]
Colonial and Diplomatic and Consular Reports, Mar., April. [Col. Sec.]
Garden, May, 3, 10, 17, 24. [Purchased.]
Gardeners' Chronicle, May, 3, 10, 17, 24. [Purchased.]
International Sugar Journal, May. [Editor.]
Journal of Botany, May. [Purchased.]
Journal, Royal Colonial Institute, May.
Journal, Royal Hort. Society, April.
Nature, April 24, May, 1, 8, 15, 22. [Purchased.]
Pharmaceutical Journal, May, 3, 10, 17, 24.

France.

Sucrerie indigène et coloniale, May, 6, 20. [Editor.]

Germany.

Beihefte zum Tropenpflanzer, May.
Tropenpflanzer, May. [Editor.]

Holland.

Bulletin, Koloniaal Museum, No. 26. [Editor.]

Belgium.

Bulletin de la Société d'Etudes Coloniales. May.

Asia.

India.

Planting Opinion, April, 12, 19, 26. [Editor.]
Proc. Agri.-Horti. Soc., of Madras, Jan.-Mar., April-June, July-Sept., 1901.
The Agri-Horticultural Society of Madras—Annual Meeting, 25th March. 1901. [Sec.]
Dept. of Land Records and Agriculture: Bull. No. 46 (The Sugar Canes of Madras.)
Report on the Operations of the Dept. of Land Records and Agriculture, Madras Presidency, 1900-1901. [Govt. Botanist, Ootacamund.]

Straits & Federated Malay States.

Agricultural Bulletin, Vol. I., No. 6. [Editor.]
Annual Report on the Botanic Gardens of the Straits Settlements, 1901. [Actg. Director.]

Ceylon

Administration Reports of the Govt. Bot. Gardens, 1901.
Circulars & Agri. Journal of Roy. Bot. Gardens, Vol. II, No. 1. [Director.]
Library Catalogue, Roy. Botanic Gardens, Peradeniya, Nov. 1900
Times of Ceylon. April, 18, 24, May, 1. [Editor.]

Java.

Proefstation East Java, No. 38. [Director.]

Australia.

Queensland.

Queensland Agri., Journal, April. [Sec. of Agri.]
Queensland Sugar Journal, March, 15. [Editor.]

Africa.

Cape of Good Hope.

Agri. Journal, April, 10. [Dept. of Agri.]

Natal.

Agri. Journal and Mining Record, April, 11. [Dept. of Agri.]
First Report of the Govt. Entomologist, 1899-1900. By Claude Fuller. [Author.]

Central Africa.

C. African Times, Mar. 15, 22, April, 5. [Editor.]

West Indies.

Barbados.

Agricultural News, May, 24.
Plain Talk to Small Owners at Montserrat. Pamphlet Series, No. 15.
Screw Worm in Cattle at St. Lucia. Pamphlet Series No. 14. [Commr. Imp. Dept. of Agri.]
Reports on the Botanic Station & Agricultural School, Dominica, 1900-1901.

Jamaica.

Cornwall Herald. [Editor.]

British North America.

Ontario.

Annual Reports of Dairymen's Assoc. of Ontario, 1901. } [Secretary.]
" " Poultry " " " }

Agri. College Bulletin 120, Butter Milk and Cheese. }
Eighth Annual Report on the Fruit Experiment Stations, 1901. } [Dept. of Agri.]
Thirty-third Annual Report of the Fruit-Growers Assoc., 1901. }

Ottawa.

Cereals and Root Crops. Evidence of Dr. Wm. Saunders before the Select Standing Committee on Agriculture & Colonization, 1901. [Dept. of Agri.]

United States of America.

Publications of the U. S. Dept. of Agri. [*Directors.*]

Scientific Bureaus and Divisions.

Bureau of Soils. Bull. No. 19. Capillary Studies and Filtration of Clay from Soil Solutions. By Lyman J. Briggs, & Macy H. Lapham.

Division of Entomology. Bull. No. 32. Insect Enemies of the Pine in the Black Hills Forest Reserve. Prepared under the direction of the Entomologist. By A. D. Hopkins.

Experiment Stations.

Experiment Station Record, Vol. XIII, No. 8.

Illinois. 70 (Canker of Apple Trees.) 71 (Experiments with Insecticides for the San José Scale.)

Botanical Garden New York, May. [Editor.]

Botanical Gazette, Chicago, May. [Editor.]

Forestry and Irrigation, Vol. VIII. No. 5, May.

Minnesota Botanical Studies, Index Number. Part VI. May, 15. [State Botanist.]

The Plant World, March (with Index to Vol. IV.) April. [Editor.]

The Rural Californian, May.

Torrey Club Bulletin, May. [Editor.]

South America.

Boletim da Agricultura, São Paulo, Brazil, Nos. 2 & 3. [Sec. of Agri.]

PLANTS.

From Mrs. Robertson, Burnt Ground—
Cuttings of Tecoma jasminoides.
From Mr. Dutton Trench, Hazelymph—
Cuttings of Plum.

[Issued 18th June, 1902.]

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BULLETIN

OF THE

BOTANICAL DEPARTMENT, JAMAICA.

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.

Director of Public Gardens and Plantations.

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PRICE—Threepence.

A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Kingston P.O.

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HOPE GARDENS.

1902.

JAMAICA.

BULLETIN

OF THE

BOTANICAL DEPARTMENT.

Vol. IX. JULY, 1902. Part 7.

CASSAVA.

Cultivation in Florida.

Information has been asked for as to the methods adopted in Florida in the cultivation of Cassava. The following account has been taken from Bulletin 49 of the Florida Agricultural Experiment Station on "Cassava as a Money Crop," by Dr. H. E. Stockbridge :—

It is the "sweet" cassava alone that is known in Florida. It grows like a native except that it rarely matures seed. It thrives best on sandy soils, moderately fertile.

The land is thoroughly ploughed and if the sand or loam has become compacted below the usual depth of ploughing, or if clay approaches the surface, the subsoil plough is used. It is considered very important to use the harrow after the plough to ensure thorough pulverization.

As the crop is worked both ways, it is planted in squares, four feet each way. This is done by running furrows at right angles with the turn plough, and dropping seed at the places where the furrows cross each other.

Fertilisers are used, but only in very moderate quantities,— 250 to 300 lbs. a common high-grade commercial fertilisers per acre giving more economical results than large quantities.

When planting, the seed-canes are cut into lengths of about 4 inches by means of a pruning shears, and dropped 2 at a time at the intersection of the furrows. The covering is done by a turn-plough, or by a cultivator with all the teeth removed except the near teeth on each side, which should be shovels and set as closely together as possible. The teeth are made to straddle the row, and throw the soil toward each other, thus perfectly filling the furrow, and covering the seed canes lying therein. Sowing is usually done in March. The first cultivation is deep, and it may be with a plough. After-cultivation is shallow,—about 2 inches, and with a cultivator or wide sweep. Three or four workings are considered sufficient. When the plants reach well out into the space between the rows, and shade the ground well, all cultivation ceases, and the crop is considered as laid by. At the time of the last cultivation which usually occurs about the first of August, a single row of cow peas is sown in the middle of the rows.

ADVANTAGES IN JAMAICA.*

By Hon. T. H. Sharp.

The question of cultivating cassava in Jamaica on a large scale for commercial purposes is now being seriously considered.

The Jamaica Agricultural Society has experimented, and in its *Journal* for January, 1898, will be found the results. As a Member of the Board of Agriculture I venture to make a few remarks by way of showing that if cassava can be grown to pay at all, Jamaica ought to be able to do so. I believe we have natural advantages over most countries. The subject is one of so much importance that to deal with it in one article is out of the question. I can only hope to briefly state some of the advantages we enjoy.

1stly. Cassava can be grown here so as to be fit for reaping all the year round. This is proved by its being exposed for sale every day in the year in our domestic markets, freshly dug, grown by small settlers.

2ndly. It seeds readily and grows from seed here, proving to be in its natural habitat.

3rdly. It can be grown under irrigation giving enormous returns without any injury to the tubers or starch, unlike ginger which is good for nothing when grown under irrigation. This was clearly demonstrated by the late Mr. George Douet, associated with a committee of the Agricultural Society, who carried on experiments in 1898.

4thly. The driest spots of Jamaica get a rainfall equal to twice the quantity that is necessary for the cultivation of cassava, if the ordinary methods of conserving moisture in the soil are resorted to.

5thly. We are not subject to sudden and extreme changes in temperature by which the system of the plant is so disturbed as to prevent it regularly developing its starch.

6thly. The nature of our low-lying lands is peculiarly adapted to cassava growing, these lands being light and friable, with subsoil drainage and plenty of sunshine and light, which causes it to produce a small tree with large tubers and plenty of starch.

7thly. We grow a varicty of bitter cassava in this island which, when grown elsewhere, changes its properties, but when grown here gives a larger percentage of starch than any variety grown elsewhere, and also produces the necessary substance for making cassareep.

8thly. An ordinary crop of cassava produced on an acre of land in Jamaica is 10 tons. In Florida it is 6.

9thly. From the Jamaica bitter cassava one pint of cassareep, worth 1s., can be obtained from each hundred weight of tubers. In Florida this cannot be produced.

10thly. The starch produced from the bitter cassava of Jamaica is intrinsically better than that produced in Florida.

11th. If we accept the figures as being correct which are set forth in Bulletin 49 of the Florida Agricultural Experiment Station and consider the advantages which the difference in production and peculiar properties contained in our cassava for cassareep making, it brings us out some 50 per cent., in value of produce per acre *in excess* of Florida.

Cassareep, one of the by-products of cassava, is made by evaporat-

* "Daily Telegraph," 27th May.

ing the water of the bitter cassava immediately after it is squeezed from the grated pulp, until it gets to the consistency of molasses. It is of great value and is used as a foundation for the best sauces.

Experience places the age between nine and ten months in Jamaica when most starch can be obtained from the tubers.

The benefits that would be derived from Cassava Factories in Jamaica by utilising the refuse as food for stock would help considerably to solve the problem that has concerned us for a long time past as to how to improve many of our industries—such as dairying and producing meat fit for curing.

LUFFAS AT HOPE GARDENS.

By Wm. Harris, F.L.S., Superintendent of Hope Gardens.

Luffa ægyptiaca, Mill. This is the *Loofa, Strainer Gourd, Strainer Vine,* or *Towel Gourd* It is supposed to be a native of India, but is now naturalized or cultivated throughout the tropics The plant is an extensive climber, with rough, dark-green leaves which are 5-angled or somewhat 5-lobed. The male flowers are clustered near the ends of long stalks; the petals are yellow in colour, and each flower has 5 *stamens.* The female flowers are solitary on short stalks. The fruit is oblong, obscurely angled, usually 12 to 15 inches long, resembling a cucumber, but in some cultivated forms it attains a length of 30 inches. When the fruits are mature they are gathered, and the outer shell is removed, disclosing a dense frame-work of fibres, with flat, black seeds. The seeds are shaken out and the fibrous portion is washed and bleached, and is then ready for use as a flesh brush in the bath, or for making ornamental articles

In India, the young, tender fruits, when they have attained a length of not more than four inches, are much used by the natives in curries, &c. The seeds are said to be emetic and cathartic.

This plant has for long been erroneously known in the W. Indies as *Luffa acutangula,* Roxb., the name of a distinct species described below.

Luffa acutangula, Roxb., *Torooee, Torai, Jhinga.* In general appearance this plant somewhat resembles the preceding species. The leaves, however, are a light green above, and whitish beneath; the male flowers have only *3 stamens;* and the fruit is usually club-shaped, about 1 foot in length, and with 10 very prominent ribs or angles. The fibrous portion of the fruit is hard and stiff, but it is also used as a flesh brush.

According to the "Dictionary of the Economic Products of India," "the seeds possess emetic and purgative properties, and the leaves are used locally in splenitis, haemorrhids, and leprosy. The fruit is highly esteemed by natives, and is much eaten by them, either in curries or dressed with clarified butter. When half grown it is one of the best indigenous Indian vegetables, and when peeled, boiled, and dressed with butter, pepper, and salt is very palatable. When fully developed it is about a foot long, but if allowed to grow longer than 4 inches it rapidly deteriorates in quality, and becomes useless for the table."

We are indebted to Mr. H. W. Griffith of Hodge's Pen for seeds of L. acutangula.

A BANANA DISEASE.*

Note by Dr. Axel Preyer.

For about three years a peculiar disease has been spreading amongst Bananas cultivated near Alexandria in Egypt. The first symtoms of the disease are to be observed in a sudden check of growth, and soon afterwards the leaf-points and the youngest central leaf become black and die. The latter gets rotten, and numerous ants and other small animals inhabit the upper part of the stem, and the putrefaction proceeds downwards. The stem does not die immediately, but it is naturally unfit to bear fruit. Very characteristic is the appearance of a great many small, crippled leaves, instead of a few well-shaped large ones, as is seen in the sound plant.

A strongly infected stem dug out of the earth with roots was cut in a longitudinal direction In the upper part, the youngest leaves were all black and rotten; the outer layers were white and seemed to be sound, only the fourth and fifth layers were dark brown and saturated with a putrid liquid. The lower part of the stem and the root-stalk showed no sign of disease. But on the roots themselves, especially on the root-tips, one could observe small knobs, generally accompanied by an excretion of a resinous substance. Sections of these knobs were first examined under the microscope, and their contents were found to be relatively large egg-sacs of a kind of pest belonging to the Nematodes. The eggs were in different stages of development; even some full-grown Nematodes, possessed with great mobility, had penetrated, into the cellular texture of the root. On further investigation, and by comparing infected with uninfected plants, the Nematodes may be stated to be the cause of the Banana disease; therefore the latter is due to an infection of the roots.

The Nematodes themselves are in shape long, thin, and cylindrical, with a round mouth-end and a fine sharp point at the other end, which is strengthened by a thickening of the epidermis. The whole length is 0.57 millimetre, the maximum diameter 0.014 mm. The pest belongs to to the same genus *Tylenchus*, but its specific identification has not yet been ascertained. This Nematode resembles very much the *Tylenchus acutocaudatus*, Zn., which is the cause of a well-known dangerous coffee disease in Java.

As to the biology of the Banana *Tylenchus*, it is an interesting fact that the pest not only lives in the roots but ascends with the watery liquid streaming upward, and it is to be met with in great numbers in the upper parts of the stem. I could not, however, find any egg-sacs in these parts.

The most important question with regard to the Banana disease is, of course, how to suppress it. In this case the task is rather difficult, because the Nematodes live free in the ground, and seem to have spread over a great area near Alexandria. Experiments are going on by manuring the Bananas with nitrates, and by isolating the plantations by deep canals; but no results have as yet been obtained. In Java

* Journal, R. Horticultural Society, England.

the planters cut out the Coffee-trees infected by *Tylenchus*, and avoid planting Coffee again on the same ground for several years. In Egypt this disease should be carefully watched, as the *Tylenchus* might perhaps attack other plants—for instance, the newly cultivated Sugar-Beet.

Preliminary Report on the nature of the Banana Disease prevalent at Alexandria

By Dr. Looss and G. P. Foaden.

Some time since a short report on the external symptoms and probable cause of the Banana disease prevalent near Alexandria was communicated to the Scientific Committee on December 17, 1901, by Dr. Preyer. [This is the paper printed above.]

In December the writers, at the request of the Alexandria Municipality, visited an infected plantation at Gabarri, where the disease was evidently causing great havoc. In addition to this examination on the spot, portions of leaves, stems, roots, &c., were taken for microscopic examination.

The description given by Dr. Preyer in the article referred to correctly describes the external symptoms of the disease, and microscopic examinations also indicate that his conclusions were correct as far as they went. It is clear that parasitic worms, if they are not absolutely and entirely the cause of the disease, at least play by far the most important *rôle* in bringing it about. They live chiefly in the roots, for on examining the rootlets some little distance from the parent plant it was found that a considerable number of them had died off and were in a state of putrefaction, while others which were still living showed the knobby appearance mentioned by Dr. Preyer; others again were apparently healthy. On removing the finer particles of earth adhering to the latter their surfaces were seen to be covered with numerous dark dots. These proved to be the places where the youngest terminal off-shoots of the roots branch off from the main rootlets. Some of them were still found in connection with the latter, but almost all were in different stages of decomposition, this evidently starting from the base of the offshoots and eventually leading to their death and disappearance.

The conclusions which follow have been derived from an examination of these three different aspects of the roots, but the whole trunk of a very diseased plant was also examined together with the entire root system. These main branches of the root did not show, in this case, the knobbed appearance referred to; a few showed the dotted appearance, but the majority were dead. The number of worms present was considerably fewer than in the secondary roots. As far as an opinion can be expressed on evidence before us, it appears that the secondary roots are particularly singled out for attack, and, becoming finallly destroyed, the food supply of the plant is partially cut off, the circulation of the sap is retarded, growth checked, and the external symptons observed and described by Dr. Preyer are the natural consequence. Where putrefaction is going on other minute forms of life are found, and, owing to the favourable conditions present, multiply at an enormous rate. There were found in the plants examined several species in great numbers of *Rotatoria* and *Infusoria*, but all

these animals, in spite of their numbers, have nothing to do with the cause of the disease, their presence being exclusively a resulting consequence.

Microscopic examinations of the roots with the knobbed appearance showed the presence of so-called egg-sacs. To one acquainted with the history of parasitic worms, this fact in itself is sufficient evidence that a species of Nematode was present. The so-called egg-sacs are full-grown females, whose bodies are so strangely swollen as to attain a sac or pear shape and are thus quite incapable of locomotion. Inside the motionless sac the ova of the worm are found in different stages of development. Of this genus (*Heterodera*) three species have hitherto been known. One of them, *H. Schacti* (Schmidt), lives on Sugar-beet, having some twenty years ago caused great damage to the beet crop of Germany; a second, *H. exigua* (*Meloidogyne exigua*, Goldi), infests the roots of the Coffee plant, having caused great havoc during the years 1885-1888, completely destroying plantations in large districts in Brazil. The history of the latter is very interesting and instructive, inasmuch as the disease could be traced back to 1869: that is to say, sixteen years before the outbreak became really serious. Nothing was known of the pest, nor were any attempts made to cope with it, until the year 1887, when an area of about 715,000 feddans was infected and the cultivation of Coffee rendered impossible. The similarity to the present case is striking. It has been known for some three or four years that a Banana disease existed in the district around Alexandria. The disease was first located in a small area, and finally has now spread in the whole neighbourhood, not only infecting plantations, but having found its way into private gardens.

The third species known, *H. radicicola* (Müller), is the most interesting because it is known to attack the roots of Bananas. About 1880 some specimens of *Musa Lacca* and *Musa rosacea*, cultivated in the botanic gardens of the University of Berlin, showed sign of disease and it was decided to transplant them. During this process, the strange knobbed appearance of the finer roots was noticed, and microscopic examinations showed the worms to be present, and their evolutions were studied. It appeared that the ova contained in the egg-sacs or cysts in the adult and immobile females, after having developed and left their egg-shells, escape from their parent. The latter then gradually dies. The worms then make their way through the tissues of the root and enter the soil. They wander about here for some time, growing slowly until they find another root into which they enter, thus transferring the disease from one root to another. Once within a new root they grow rapidly to sexual maturity, and after impregnation the female develops into the original egg-sac or cyst. Such is the life-history of *H. radicicola*, and by analogy it is extremely probable that the species of *Heterodera* infecting Egyptian Bananas is very similar, although the species itself is not *H. radicicola*. This latter possesses within its mouth-cavity a very fine, sharp protrusive boring dart, which apparently serves to pierce the walls of the tissue of the root and thus faciliate the entrance of the worms. In the species found in Egyptian plants this is wanting, thus indicating that the species is not identical.

In the case of the disease found in Alexandria matters are compli-

cated by the presence of at least one other species of parasitic Nematode. It has already been stated that the ova of *Heterodera* are as a rule enclosed in the body of the female parent, the cyst or egg-sac.

The microscopic examination of the specimens first taken of the roots showed, in both the knobbed and the dotted rootlets, the presence of nematode ova differing in shape and especially in size from those of *H. radicicola.* They were also irregularly scattered through the tissues of the root, being accumulated in small numbers in some places, in large numbers in others, and sometimes were found in single specimens. It appears that these ova cannot be derived from the pear-shaped and motionless worms, but must belong to a species the adult females of which are wandering freely within the root, depositing their eggs gradually as they wander about. No trace, however, was found of the females themselves; whereas the larvæ already hatched from their eggs, and clearly differing in size and shape from those of the first species (*H. radiciola*), were found both within the roots and outside in the earth adhering to their surfaces.

In the latter case they were sometimes considerable in number, and they showed signs of advanced growth. They were of various sizes, the most advanced showing the first signs of genital organs, preserving, however, at the same time, their original shape, viz.: a blunt, almost rounded tail, and a fine short dart within the mouth-cavity. From the fact also that no full grown individuals were discovered in the soil, it appears that they do not exist at the present season (December to January).

Owing to the absence of full-grown animals, it is impossible to determine the species, though probably it is one hitherto unknown. There can, however, be no doubt that the young worms found in the soil will finally return to the roots to accomplish their development, thus gradually infecting the whole soil, as previously explained. Owing to the numbers in which they exist, it appears that this unknown species plays a far more important *rôle* in bringing about the disease in the present case than the species first described. It is also likely that to their presence may be attributed the dying off of the small lateral offshoots of the roots mentioned previously, though the evidence at present available does not permit of a definite opinion.

It is not improbable that even a third species of nematode is involved in the present Banana disease, for in some instances there were found in the adhering earth, and amongst the larvæ of the two forms previously described, young worms, which could not possibly belong to either owing to their shape, but which possessed the fine, sharp protrusive dart in the mouth-cavity. The number present, however, was very limited. Such is the result of microscopic examination, from which it seemed to be sufficiently clear that the nematodes are the cause of the disease, and that the second and unknown species described is by far the most injurious.

The most important question to be considered is how to cope with the disease; in other words, how to prevent the propagation of the worms. This can only be arrived at through an exact knowledge of the life-history of the pests.

In order to arrive at this, an examination at one season of the year will not suffice, and with the advent of warmer weather further obser-

vations may be made. It has been seen that all the different species pass a certain period of their life-history outside the plants themselves, that is to say, in the soil, this being a common feature in the history of all parasitic animals, since it is the only means by which they can spread. The time, therefore, in which to institute an attack is when the majority are found in the soil; any attempt to reach the pest when within the plant must be doomed to failure, for it is then in perfect security. In countries where there are well defined seasons with great differences between them, it is more easy to ascertain exactly the different stages than is the case with such a climate as that at Alexandria, where probably devolopment goes on steadily; that is to say, the free worms are always present in the soil. It is, on the other hand, also very likely that their numbers become considerably increased at certain periods in connection with the subsequent generations. Any remedy to be applied would therefore have its maximum effect only if applied during these periods. This matter can, however, only be definitely decided when the life-histories of the species have been followed throughout. Experiments could then be conducted as to the most suitable means to employ. In coping with nematodes attacking the beet crop in Germany, a method was successfully adopted which may be memtioned here. Nematodes are found in, one might say, almost every plant in small numbers. Practically all nematodes living as parasites on plants are not exclusively parasitic on one individual species, for if they find the necessary favourable conditions for existence they will attack another host. Just as a human being or an animal can carry a tape worm or other parasite without apparent injury to health, and only show signs of suffering when the number increases, so within certain limits can plants withstand nematodes, and only show signs of disease when their numbers become excessive.

To combat the pest in the sugar-beet plantations, other plants which were suitable as hosts were used to attract the pest. The seed was sown early in spring, some weeks before the beets were planted. The larvæ of the nematode hibernated freely in the soil and attacked the newly sown plants, which were subsequently removed and destroyed. There were thus removed from the soil vast numbers of the pest which would otherwise have attacked the beet. This did not result naturally in a complete clearance of the pest, but the beet was enabled to resist the number which remained. The adoption of this method in the case of Bananas would require certain modifications, but something might be done in this direction; and then, by providing the plants with suitable conditions for recovery, such as good cultivation and an application of suitable manure, they may recover.

The idea has been expressed that the disease is one of recent introduction, but this does not seem probable. Species of the genus *Heterodera* were found by Dr. Looss in a garden at Alexandria some years since, and these are similar to the *Heterodera* of the Bananas. It is probable that they have now found a most suitable host in Bananas, and have consequently rapidly increased in numbers They have probably been living in Banana plantations for some considerable time, and the result of years of increase has only now become very apparent.

Experiments in the direction indicated should be attempted, first, to ascertain plants most suitable, the time at which they should be sown,

and the time at which they should be removed. The latter information could, of course, be derived by a study of the complete life-history of the pests

Various remedies have been suggested in the direction of applying to the soil some substance which would prove harmful to the pests. We think the most suitable substance to try at first is ordinary lime. This substance is most commonly applied as a remedy for insect pests either alone or mixed with common soot Lime from gasworks might also be employed.

A certain quantity well incorporated with the soil around the plants might have a most beneficial effect, and would probably benefit the crop at the same time It is, at any rate, a practical and inexpensive method Much has also been said concerning an application of nitrates, and many misleading and inaccurate figures published regarding the percentage of nitrates present in the soil. We do not deny that an application of nitrogenous manure may have beneficial effect, not as a direct remedy against the pests, but merely as encouraging and stimulating the plant and helping it, provided the numbers of nematodes are not too excessive, to outgrow and overcome their attack.

Experiments might also show if the worms in question or similar ones are capable of attacking other and more important crops in the country. Wheat and Onions are known to suffer occasionally from the attacks of nematode worms belonging to the genus *Tylenchus*, the *Tylenchus* of the Onion causing great damage in Europe, and being found occasionally in the crop of Upper Egypt.

LACE BARK.

Lagetta lintearia, Lam.

[The following account taken from the Botanical Magzaine, published 1st March, 1850, was written by Sir William Jackson Hooker, Director of Kew Gardens, and by Mr. Smith the Curator.]

Every one has heard of the "Jamaica Lace-Bark," and has inspected the curious and beautiful substance: few have seen specimens of the leaves and flowers, still fewer have seen the living plant, nor was it, we believe, permanently introduced in the latter state to Europe till the year 1844 The year before that, our intelligent Collector for the Kew Gardens, Mr. Purdie, was instructed to take the island of Jamaica on his way to New Granada, and visit the quarters of this plant (the parishes of Vere, Clarendon and Elizabeth), to which it seems to be confined. Mr. Purdie spent some days among woods of this tree, but could find neither flower nor fruit in a state fit to send home. But our wishes being known to Mr. Wilson, the indefatigable Curator of the Botanic Gardens at Bath (Jamaica), he kindly procured seeds and young plants a few months later and has been the means of introducing this rarity to our stoves. Our plants are now eight to ten feet high, and one of them produced, for the first time, flowers and fruit copiously in the summer and autumn of 1849.

It is well known that the liber or inner bark of this tree consists of layers of reticulated fibre, exactly resembling well-prepared lace; and its nature is best exhibited by taking a truncheon from a branch, tearing down the bark, and separating it by the hand into as many

layers as that portion of the tree is years old. "The ladies of Jamaica" Dr. Lunan observes, "are extremely dexterous in making caps, ruffles, and complete suits of lace with it. In order to bleach it, after being drawn out as much as it will bear, they expose it (stretched) to the sunshine, and sprinkle it frequently with water. It bears washing extremely well with common soap, or the "curatoe,' soap, and acquires a degree of whiteness equal to the best artificial lace. The negroes have made apparel with it of a very durable nature: but the common use to which it is applied is rope-making. The Spaniards are said to have worked it into cables, and the Indians employ it in a variety of different fabrics."—Sloane relates that Charles II., had a cravat made of the bark of this tree, which was presented to him by Sir Thomas Lynch. In the days of slavery the negro-whips were commonly made of the branches of this tree, thus:— of a portion of the branch the wood was removed, and the bark twisted into the lash. The lower part of the branch formed the handle, and if it was desired to ornament the latter, it was done by unravelling the bark at the lower end, which thus formed a kind of tassel consisting of spreading layers of lace.

Descr. A tree from twenty to thirty feet high, with branches too straggling and foliage (though of a good size and glossy) too sparse to form a striking object, though really handsome when in flower.

Leaves alternate, on rather short petioles, which are joined on the branch; hence the leaves readily fall off in drying: they are cordato-ovate, acute, glossy, reticulated, palish-green. *Flowers* pure white, or, in bud, greenish-white, arranged in spikes which are solitary and terminal on a main branch, or on short side branches. *Perianth* urceolate, fleshly, four-toothed. *Stamens* included: longer *filaments* arising from a scale: *anthers* subglobose. *Pistil* included. *Ovary* ovate, densely silky. *Style* shorter than the ovary, *Stigma* obtuse. The *fruit* is a smooth oval drupe.

W. J. H.

Cult. In the second edition of the 'Hortus Kewensis' it is stated that the Lace-Bark tree was introduced to this garden by Rear-Admiral William Bligh in 1793: but it appears to have been soon lost, and it had been a desideratum in the garden for many years. Our present plants were received in 1844, and were then only four inches high. For our guidance in their cultivation, Mr. Wilson informed us that "it is invariably found growing in very dry situations on marly limestone hills, where there is not a particle of earth to be seen. The young plants grow in the crevices, or *honeycomb*, as it is called, and in order to obtain them with roots, a hammer or large stone is required to break away the porous limestone." He further adds, that "the soil for growing it in should be composed of one-third marl or lime-rubbish; for I am persuaded that pure loam will kill them." We are always most desirous to pay attention to information as regards the native habitats of plants; but in cases like the present we have found that when too strictly adhered to, successful cultivation does not always follow. In our experience, we have never found any plant thrive by retaining it in its native soil, or in soil too closely resembling it. If we could also imitate all the various influences of climate that modify and control the growth of plants in their native localities, it might then be proper for us to cultivate the Lace-Bark tree in marly soil, like lime-

stone: but our plants afford evidence that such soil is not required when they are grown in an artificially heated atmosphere. We have used good yellow loam, mixed with a little leaf-mould and sand. In this they have attained the height of eight feet, and continue in a perfectly healthy state. In their native place the leaves are deciduous, falling off in the dry season. But the health of a general collection of tropical plants, grown in a hothouse, will not allow us to put them under the influence of their *natural dry season*. We therefore find that some individuals change their habit, and become evergreen. This has been the case with the Lagetta plants; and it is probably to an accidental circumstance that we owe the present production of flowers. One of the plants appeared to have received some check, which caused it to shed its leaves: the consequence was, that just before the unfolding of the young foliage, it produced its flowers. Like many of the Thymeleaceae, the Lace-Bark tree is difficult to propagate. We have never succeeded by planting cuttings, nor by grafting it on species of allied genera; but we now have hopes of propagating it by layering.

J. S.

ARBOR DAY.*

By E. D. Till, F.R.H.S.

"Forward in the name of God: graffe, set, plant and nourish up trees in every corner of your grounds; the labour is small, the cost is nothing, the commoditie is great, your selves shall have plenty, the poore shall have somewhat in time of want to relieve their necessitie, and God shall reward your good minds and diligence."—John Gerhardt, 1633.

Trees are more or less common to the whole surface of our land, whether marsh, moorland or mountain, arable or pasture, arable land, perhaps, excepted, but even arable fields are ofter skirted by trees. There are few altitudes in the British Isles where trees will not flourish. We speak of trees "clothing" the earth, and when they are absent we speak of the "naked" landscape, as though, that which was proper to it was wanting. Trees, therefore are the earth's natural ornament, and it is unnatural for the land to be without them; moreover they are necessary, because trees, and vegetation generally, consume the waste products of animal life; thus they play an indispensable part in the economy of nature.

The carbon dioxide exhaled by animals is inhaled and assimilated by plants, and this is one of the marvellous processes which are a continual witness to Creative design. The silent machinery is ever in motion by which the atmosphere of our planet is purified, and the processes of animal life, find their counterpoise in the processes of vegetable life the one complementary and necessary to the other by mutually operative and immutable law. Were it otherwise, both plants and animals would be poisoned by the respective waste products they exhale.

Treeless areas are not conducive to the retention of moisture; the rain that falls on them either flows away quickly because it meets with no impediment or is rapidly evaporated, whereas forest lands, rendered porous by the roots which permeate the soil, and shaded by foliage, are far more retentive.

* Journal, R. Horticultural Society, England.

Therefore every tree that is planted contributes to the conservation of water, restrains the denudation of the soil by floods, tempers and improves the climate, enhances the beauty of the landscape, and assists, above all, to provide for the constant need of every community in the supply of timber for constructive purposes and for fuel, as well as in bringing forth abundant fruit for man's enjoyment. Nothing tends so much as trees to make the earth a pleasant abode for man. In former days, particularly in North America, the vast expanse of wood was an impediment to the progress of agriculture, and the clearence of the forest for the purposes of cultivation became a prime necessity. But the axe was laid at the roots of the trees with a vengance, and the forests were felled without any regard to the future; present necessity was the sole thought in the minds of the early settlers, and they, like multitudes who came after them, "held the cent so close to their eye as to obscure the dollar beyond"! Forest fires, kindled by accident or carelessness, followed in the train of destruction, until in process of time thoughtful and far-seeing citizens foresaw that the supply of timber would be inadequate, and viewed the rapid depletion of the trees with alarm. Measures of couse vation were then devised. A pioneer settler, the Hon. J. Sterling Morton, in the treeless plains of Nebraska, suggested the inauguration of an annual Arbor or Tree-planting day, and eventually stimulated the popular feeling in the right direction. The response was general; the first observance in Nebraska State was in 1872, and the first Arbor Day holiday occurred on April 22, of that year.

Other States and Territories followed this example—Tennessee, for instance, in 1878—until at the present time nearly every State in the Union has established the regular observance of Arbor Day as a public institution, Delaware, Indian Territory, and Utah being the only exceptions. It is said that in South Carolina a whole week is devoted to tree-planting. Nebraska, once called the Great American desert, is now significantly styled the "Tree-planter's State."

Up to 1896 it was computed that the planting of 605,000,000 trees in Nebraska was directly traceable to the Arbor Day movement, and so extensively has the custom prevailed throughout the whole of the United States that it is impossible to estimate the number of trees planted through Arbor celebrations. From the first the idea was to enlist the interest of children in the work and with such success has this been done that the school authorities throughout the States have been made the chief agents for the promotion of the national observance of Arbor Day: some observe it in November and December, others in January and February. In Nebraska it falls as late as April, and in North Dakota as late as May 6. Washington's birthday, February 22, is the date of its observance in Texas.

Americans consider the custom conducive in a high degree to juvenile education, cultivating in the young the love of Nature and the observance and interpretation of her wonderful laws. For instance, the systematic care and attention to detail called forth by the planting and nurture of even one tree, and watching its growth and development, cannot be without formative effect on character. Probably the introduction of youthful energies into the scheme in large measure accounts for the marvellous success of the movement. Visitors to the

United States and Canada, where the custom also prevails, return home impressed with its advantages.

Australia, New Zealand, and to a partial extent South Africa have adopted the Arbor Day custom. Tasmania has not yet felt the necessity for it, but she would do well, possessing as she does, so much virgin forest, to be wise in time. Italy and Spain have endeavoured to introduce the movement, assisted by royal patronage in each country.

Except in the Kentish village of Eynsford, the custom has not been celebrated in the British Isles. Arbor celebration was begun in Eynsford in the Jubilee of 1897, when farmers and cottagers planted Apple-trees and the school children planted a row of trees on the school bank, arranged so that the initial letters of the name of each tree spell a text of Scripture. The successful defence of Kimberly, Ladysmith, and Mafeking was commemorated by the planting of trees in the village street in 1900, and this year thirty trees have been planted in memory of our beloved Queen Victoria, representing Tennyson's celebrated line "She wrought her people lasting good."

The origin of Arbor Day custom at Eynsford was due to the gratuitous offers of Apple-trees for orchard renewal by the late Mr. W. H. Cullingford, of Tunbridge Wells.

The forces that operated for Arbor Day in the United States are less existent in this country, for there the value of timber annually used and exported exceeds the value of the cereal crop. Here we are so largely dependent on foreign supply that we do not feel the necessity for planting, but we ought to remember that the countries from which we draw our supplies are themselves alarmed at the prospect of forest depletion. There are nevertheless the strongest arguments for extensive planting of timber trees in our land.

A pathetic instance of memorial planting associates our late beloved Queen Victoria and the Prince Consort with our Society. Near the Mausoleum at Frogmore are two handsome Wellingtonias, originally planted in what were formerly the Society's Gardens at South Kensington—one by the Prince Consort, President of the Society, on June 5, and the other by Queen Victoria on June 24, 1861, the year of the Prince's death. They were removed to Frogmore on December 15, 1869, and on the 17th were replanted by Her Majesty near the Prince's Mausoleum. One of the trees died in August 1870, and another was planted in its place by the Queen in December of the same year.

Throughout her whole life our beloved Sovereign was a persistent tree-planter, and there is no more fitting way of keeping her endearing memory green than by her people following her royal example, and for ever commemorating the close of her loving reign by an Arbor Day on January 22—the day on which she entered into rest. Shall we not term it rather the day of her Accession; and say with good George Herbert:—

> "Onely a sweet and vertuous soul,
> Like season'd timber, never gives;
> But though the whole world turn to coal,
> Then chiefly *lives*"?

LIBERIAN COFFEE.

From Messrs. Gillespie Bros. & Co., to Director, Public Gardens.

23, Crutched Friars, London, E. C.
20th June, 1902.

Dear Sir,

As requested, we beg now to report on the present position of the market in Europe for Liberian Coffee.

In sympathy with the low prices current for Brazilian descriptions, prices ruling for Liberian are very low.

The quantities which have been coming forward during the past year or two have been larger than in previous years and sales have been made of ordinary quality at from 24/ to 28/, finer grades occasionally bringing from 30/ to 32/. For the very finest descriptions of Java and Johore Liberian a little more, say 35/, would be obtainable, but to obtain such a price the colour must be very light and the beans very dry. As far as we can at present judge, Liberian Coffee of ordinary quality will always be difficult of sale. and unless growers obtain very much better returns from their crop than is secured from the ordinary coffee, we scarcely think that the cultivation of Liberian descriptions should be encouraged.

In order to confirm our own judgment in this matter we have consulted Messrs. C. M. & C. Woodhouse, who are well known brokers in Mincing Lane, and they have obtained for us three samples of good to fine Liberian Coffee which are at present actually on sale in this market. We are sending these samples to you herewith. The two parcels of Java were offered at Public Auction to day without any bids being made, and were bought in at 40/, which however is of course quite a nominal price. Messrs. Woodhouse report that these two samples are good specimens and have the colour which should be aimed at. The Johore sample you will observe is also of fine quality. Messrs. Woodhouse state that dark and mixed qualities are always very difficult of sale except in a decidedly strong market. They, however, state that they do not remember to have ever seen a sample of *West Indian* Liberian Coffee worth looking at

We are, dear Sir,
Yours obediently,
GILLESPIE BROS. & Co.

THE FERNS OF JAMAICA.

An article on this subject, especially dealing with Filmies, appears in the Transactions of the Botanical Society of Edinburgh (Vol. XXII, pt. I, 1901) by Rev. Dr. Paul, who paid a visit to this Island a few years ago. He compares the area of Jamaica to that of Inverness-shire, and remarks that whereas in the whole of the British Islands there are only 47 species of Ferns, there are 473 in Jamaica. He says that "anyone who loves Ferns, and has means and leisure, would find that a holiday spent in these islands (Jamaica, Grenada, and St. Vincent) would repay him a thousandfold in the interest and pleasure he would experience at the time, and in a store of delightful recollections which would be a cherished possession to him all the days of his life."

ADDITIONS AND CONTRIBUTIONS TO THE DEPARTMENT.

Library (Serials).

Europe.

British Isles.
Botanical Magazine, June. [Purchased.]
Chemist and Druggist, May, 31. June, 7. [Editor.]
Garden, May, 31. June, 7. [Purchased.]
Gardeners' Chronicle, May, 31. June, 7. [Purchased.]
Hooker's Icones Plantarum. Vol. VIII, Pt. II. [Bentham Trustees through Kew.]
International Sugar Journal, June. [Editor.]
Journal of Botany, June. [Purchased.]
Nature, May, 29. June, 5. [Purchased.]
Pharmaceutical Journal, May, 31. June, 7.
R. Colonial Institute, Journal, June.

France.
Sucrerie indigène et coloniale, May, 27. June, 3. [Editor.]

Germany.
Notizblatt, Berlin, May. [Director.]

Switzerland.
Bulletin, de l'Herbier Boissier, Vol. II. No. 6. [Conservateur.]

Asia.

India.
Planting Opinion, May, 3, 10. [Editor.]

Straits & Federated Malay States.
Agricultural Bulletin, Vol. I., No. 7. [Editor.]

Ceylon
Times of Ceylon. May, 8, 15. [Editor.]

Japan.
Bulletin, Coll. of Agriculture, Vol. IV., No. 5.

Australia.

N. S. Wales.
Agri. Gazette, April. [Dept. of Agri.]

Queensland.
Queensland Sugar Journal, April. [Editor.]

Western Australia.
Journal of the Dept. of Agri., April. [Dept. of Agri.]

Africa.

Cape of Good Hope.
Agri. Journal, April, 24. [Dept. of Agri.]

Natal.
Agri. Journal and Mining Record, May, 9. [Dept. of Agri.]

Central Africa.
C. African Times, April, 12. [Editor.]

West Indies.

Barbados.
Agricultural News, June, 7. [Commr. Imp. Dept. of Agri.]

Jamaica.
Cornwall Herald. [Editor.]

Trinidad.

Govt. Stock Farms. Report of the Manage-, 1901-2.

British North America.

Ontario.

Agri. Coll. Bulletin 119, Ventilation of Farm Stables and Dwellings.
Ontario Bureau of Industries; Bulletin 79, Crops and Live Stock in Ontario. } [Dept of Agri.]

Montreal.

Pharmaceutical Journal, May. [Editor.]

United States of America.

Publications of the U. S. Dept. of Agri. [*Directors.*]

Scientific Bureaus and Divisions.

Bureau of Plant Industry:—Bull. No. 18, Observations on the Mosaic Disease of Tobacco. By Albert F. Woods.

Experiment Stations.

Alabama. 120 (The Cow Pea and the Velvet Bean as Fertilizers).
California. 138 (Citrus Fruit Culture). 139 (Orange and Lemon Rot). 140 (Lands of the Colorado Delta in the Salton Basin).
Supplement to 140:—(The Native Vegetation and Crops of the Colorado Delta in the Salton Basin.)
Kansas. 108 (The hardy Catalpa.) 109 (Spontaneous combustion of Alfalfa).
Kentucky. Eleventh Annual Report for the Year 1898.
Michigan. 197 (Sugar Beet Experiments, 1901). 198 (Sand Lucerne). 199 (Cow Peas, Soy Beans and Winter Vetch.) 200 (Some Insects of the Year 1901).
New York. 212 (Miscellaneous Notes on Injurious Insects II). 213 (Treatment for San José Scale in Orchards II).
Tennessee. Vol. XV, No. 2. (The Action of Copper on Leaves. With special reference to the injurious effects of Fungicides on Peach foliage).
Texas. 64 (Insect Pests attacking Truck Crops).

American Journal of Pharmacy, June. [Editor.]

Polynesia.

Planter's Monthly, Hawaii, May. [Editor.]

Seeds.

From Director, Royal Gardens, Kew—
Hyphæne guin ensis.
From Govt. Botanic Gardens, Mysore—
Beaumontia grandiflora.
From M. Herb, Naples—
Agathæa sylvestris: Amaranthus tricolor marmoratus: Angelonia grandiflora: Arctotis grandis: Asparagus Sprengeri: Aster chinensis, fl. pl.: Centaurea cyanus compacta: C. imperialis: C. imperialis alba: Clitoria Ternatea: Cucumis echinoformis: Dianthus caryophyllus, fl. pl.: Dolichos Lablab Sudanensis: Eupatorium brasiliensis: Gerardia hybrida: Helianthus cucumerifolius: Impatiens Balsamina, fl. pl. atrosanguina: Ipomoea imperialis: Leptosyne Stillmanni: Momordica Charantia: Morrenia brachystephana: Pavonia hastata: Physalis Franchetti: Reseda odorata grandiflora: Rohdea japonica fol. var.: Salvia coccinea nana carminea: S. splendens rosea: Uniola latifolia: Vernonia arkansana: Wigandia caracasana.

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BULLETIN

OF THE

BOTANICAL DEPARTMENT, JAMAICA.

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.

Director of Public Gardens and Plantations.

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PRICE—Threepence.

A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Kingston P.O.

KINGSTON, JAMAICA:

HOPE GARDENS.

1902.

JAMAICA.

BULLETIN

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BOTANICAL DEPARTMENT.

Vol. IX. AUGUST, 1902. Part 8.

VANILLA CULTURE AS PRACTISED IN THE SEYCHELLES ISLANDS. *

By S. J. Galbraith.

GENERAL CONDITIONS.

Vanilla cuttings are said to have been first introduced into the Seychelles Islands in 1866, probably from Bourbon (La Réunion), where the plant was grown extensively after sugar began to fail, about 1850. Plantations were gradually established and extended by the multiplication of these original plants and from others subsequently imported, and for many years now the colony's prosperity has largely depended on vanilla.

If kept free from disease it is a plant of extraordinary vitality; and here, where moisture and heat, its main requirements, are both ample, the sort of soil it is grown in seems to be of no great importance, provided that, if it be very poor, the roots are kept well supplied with manure. It is cultivated in the Seychelles from near sea level to 1,800 feet altitude, and does well (except for disease) at all altitudes between these extremes.

The rainfall is generally about 100 inches—that is in Port Victoria, which lies low; in the hills the precipitation is probably from 10 to 30 per cent greater; and in drier districts, away from high lands, where little timber is left, it must be considerably less The fall is fairly evenly distributed throughout the year, but a dry spell, which is necessary to bring vanilla into flower, is to be looked for in July, August, or September, while the heaviest rains most frequently come in December. Even where rain has not fallen for some time the air is very moist, and for want of more exact information on this head it may be stated that, generally speaking, in the hills common table salt will deliquesce in a day or two if left uncovered. The range of shade temperature for day and night from sea level to 1,800 feet, may be put at 90° to 70° F. The former is exceptional, the latter frequent, especially in early morning when the monsoon is blowing. Occasionally 68° may be registered, but seldom lower. Of soils, three very

*U. S. Dept. of Agriculture, Division of Botany, Bulletin No. 21, 1898.

different sorts may be mentioned, in all of which vanilla does well here: (1) Rich vegetable mould, common enough in forest land as a thin surface skin, and also occurring deeper in valley bottoms. For a quick growth this is excellent. (2) A greasy red clay, also in fair quantity, on which vanilla makes good growth. (3) Coarse quartz sand, or gravel, apparently derived from disintegrated granite, not common, but met with in considerable patches here and there. Though so unpromising to look at, this is, perhaps, the best of all. It gives free drainage to the roots, and in wet years plants fixed on it are more likely to crop than those on closer soils, while with ample manuring they grow remarkably well.

The manner of setting out plantations in the Seychelles has undergone changes within the last twelve years. Formerly plantations were seen with the rows of vines planted so close together as scarce to leave room for workers to pass between them. The yield per acre under such conditions was sometimes enormous, but when disease once started in a vanillery thus arranged its destruction was rapid and complete, so this system has been mostly given up. Since the loss of so many close-lined plantations the distance between the rows has been increased. Living wood, i. e., small trees, are used as supports for the vines, these being festooned from fork to fork; but many planters have made use of hard-wood posts and bars, the former being notched on top and the latter laid in the notches, resting thus 4 to 6 feet from the ground, according to fancy. Over these bars the plants are hung being looped up as growth is put on. Wire is sometimes also used instead of horizontal bars. It is much cheaper, but otherwise has disadvantages, notable among which is that it sways with wind and is liable to break the vines, the curvature being too sharp over such a small round surface. However, when plants thicken into a mass this last drawback mostly disappears.

A third, and, as the writer believes, much better way of growing vanilla, is now more generally coming into practice. This is to plant each creeper on a tree of its own, and where land is cheap it is an advantage if these are well apart. So arranged, the general maintenance of a vanillery is certainly more expensive, inasmuch as isolated plants require more manure than when the same number are closely grouped together. The work of flower pollination and crop gathering is also more laborious. But more than a counterpoise to these disadvantages is the increased security this method of planting gives against wholesale destruction from disease; for when so arranged a sick plant can be removed and destroyed with greater chance of this being done before any of its neighbours become affected; whereas when growths of different plants are interwoven, either in their roots or shoots, it is difficult to know when enough has been taken up, and there is every likelihood of the disease becoming established beyond control.

STARTING A VANILLERY.

To give some notion of how a vanilla plantation is set out and carried on in this colony, it will be convenient to assume that the tree method of planting is the one adopted. A great variety of trees will serve the purpose. Here, on most properties, there is an abundance ready for the work; but of course where this is not the case suitable trees

must first be planted. In selecting trees those should be chosen which do not grow too large, but give moderate foliage (about half shade) without ever losing all their leaves at once, and having plenty of branches from 5 to 7 feet from the ground, affording forks enough to train the vines through.

No hard and fast rule can be laid down as to the distance trees should be kept apart Here formerly, as above stated, vanilla was grown in dense masses with great success for a time. Elsewhere it may be advantageously so grown now. However, it is safe to state that overcrowding in any kind of planting invites disease, and the farther plants are kept apart the more likely are they to remain healthy. A 4-foot radius would be a moderate allowance for the roots of a vigorous vanilla plant, and if one foot is kept clear around the circle allowed to each plant's roots this would give 9 feet as the distance between the trees. It would be difficult to insure the plants being kept distinct in less space. Where suitable trees are already growing on the land to be planted, these can be thinned out if too close, or they may be left in small lots of three or four or more together, a sufficient clear space intervening between each lot; but in that case if one vine of a group showed disease, the whole would have to be removed. Many trees stand topping, and it is a great advantage when they do, for on being cut 7 feet or so from the ground branches spring from near the cut part at a convenient height, and the best situated of those can be chosen to train the vines through, the rest that grow awkwardly being removed. About 5 feet from the base is low enough to allow any to grow.

Trees being in readiness, planting may be done at any time of year here. If during a wet spell, vanilla will sprout all the quicker; should it be dry, the plants will delay a little, but there is no fear of their missing if properly planted, and the one danger point to guard is where the vine leaves the earth. This part of the vine is burnt through if not shaded with grass or leaves. However, this also would only mean a little delay in the start of growth; for though they take some time longer about it, vanilla cuttings will grow well enough if merely tied to the trees with their lower ends some inches clear of the ground. Illustrative of the extreme vitality of plants under adverse conditions, it may be mentioned that in neglected plantations, where the vines have been allowed to climb well up into the branches of good-sized trees, and then been broken in attempting to get them down, the broken portions, sometimes partly swinging free, have remained green and capable of growth for upwards of a year, sending down long aerial roots 15 or 20 feet in length, and in some cases where these have escaped injury the broken plant may re-establish connection with the soil and start to grow again. If planted clear of the ground and merely tied to the supporting tree, it is advisable to tie two or three large leaves round each vine for the distance of 3 feet up; thus shaded the aerial roots quickly burst through the stem, and, getting something to cling to at once, soon make their way to earth without injury.

In starting a new vanillery, where the estate has no plants these are readily purchased here at small cost. From 2 to 3 rupees (55 to 90 cents) per 100 fathoms is the usual rate for cuttings, the fathom being what a man can span with outspread arms, a good sweep of the vine

hanging in a curve between his hands. Where choice is possible, although oldish cuttings will grow pretty well, it is best to have the plants of recent growth; in fact, growing shoots, cut off close to where they spring from the parent vine, are preferable. At their point of origin the nodes for some distance are close together, and though roots will strike from any joints, they have a natural tendency to do so quicker at the shoot's base. As to the length of cuttings to plant, opinions differ; but there can be no question that the longer cuttings produce cropping plants sooner than the short ones. If a 2 or 3-foot branch is planted, the shoot it gives is invariably more slender and slower of growth than would be that from a 6-foot cutting, and up to 10 or 12 feet every advantage lies with the longer plants, except the additional expense.

The question as to whether cuttings of that length are to be planted whole or divided into two or three plants should be settled by their cost. It is usual here to loosen the soil with a hoe where vanilla is to be planted, and bury the end, laid horizontally, an inch or two in the earth. Quite as good a way is merely to press the lower part of the plant into the soft soil until it is flush with the surface. On sloping land loosened soil washes away sooner with heavy rain, and in such situations it is best to leave the ground quite undisturbed. In any case the leaves on that part of the vine which rests in or on the ground are cut off fairly close to the stem, and an arm full of leaves, fern, grass, or forest sweepings laid on top to the depth of 3 or 4 inches, for a couple of feet around the plant. Its roots will not need to be mulched for a greater distance than that for some months to come, and to cover a large area would be useless. As new top dressings are laid on, which must be done when the first supply rots down and becomes thin, these can be gradually extended to allow of more root spread, till the limit of 4 feet radius is reached. If well covered, the roots do not run much; only starved vines run far with their roots, seeking nourishment; where this is plentiful they mat in and beneath it. Being entirely surface feeders, should any make their way beyond the cover they can be gently lifted and tucked under the decaying leaves, etc.; but this is a hint that the plant needs a new supply of top dressing. The number of joints laid on or in the soil will vary with the length of the plant, but should not be less than three for this mode of planting, while for long cuttings six or seven joints are needed for a quick start.

If of sufficient length, the free end of the planted vine is hung through a fork of the supporting tree, but it is also advisable to tie it in two or three places to the tree to hinder swinging and chafing. The material used for these ties here is a fibre called *vacoa** which rots in about a year, by which time the plants should have tendril-like roots enough to steady themselves. When once properly planted, the cuttings will need little or no attention for some months, but when the growth becomes vigorous the shoots must be looked after. Such of them as have grown clear of their supports are hitched up and, if long enough, hung through one of the forks. An occasional tie here may also be necessary, but in general a leaf or two of the growing part can

* Obtained from a species of screw pine, *Pandanus utilis*.

be hooked on to some other fixed part of the vine, and in a few days, unless blown loose, the tendrils will have fastened to the leaf, and thus support the plant. Shoots must not be allowed to climb very high among branches of the supporting tree, especially if there be many and close together, or there will be breakages in getting them down. For this purpose, when they get beyond hand reach, a fork stick 6 or 7 feet long is useful. The fork is worked between the tree and climbing vine, and its tendrils in succession are broken by pushing and twisting the stick when they are within the fork. The last two or three tendrils are easily broken or leave the tree without breaking, and care should be taken when the vine is nearly clear to catch the stem of it high up, within the stick's fork; it can then be lowered gently without fear of breaking.

Some judgment is necessary in selecting the fork of the tree through which each shoot is to hang, a fork whose height fits in with a natural bend of the vine, if it has one, being chosen; otherwise one whose height takes the vine between joints is best, since if bent at a joint the vine is apt to snap, especially so when vigorous growth, being then full of sap and brittle. In good growing weather—i. e., warm, still, and moist—healthy, well-nourished vanilla vines grow very rapidly, an inch per day being no uncommon rate.

PREPARING THE VINES FOR CROPPING.

If the plants have done well they should be ready for such preparation in about eighteen months, more or less, according to the season. Formerly in this colony they were allowed to grow on until a spell of dry weather set in prior to the usual blossoming time. The growing ends were then cut off and all new shoots removed as they showed till flowers began to come or till the season for them was past. When the dry spell proved a long one, this seemed to answer pretty well; and indeed, under these circumstances flowers would come in any case, whether growth was checked or not. But now it is more usual to stop the growing ends some nine or ten months, in the first instance, before flowering time. In the majority of cases the terminal bud will push and this new shoot should also be removed when 5 or 6 inches long—not earlier, else the next to the last bud is apt to grow.

After the second checking most vines will shoot, far enough back to allow of the shoots being left These grow on for the next year, and the stopped branches hang down with their lower ends a good foot or more from the ground, being generally from 4 to 6 feet in length, according to the heights of the forks through which they are hung and the positions of the new shoots, though these generally spring just before the last bends of the checked branches, which are to be the cropping parts. The new growths behind these are supposed to drain them of their sap, and thus conduce to flowering. However that may be, these checked hanging branches have certainly more tendency to flower than other parts of the vines. Flowers take some six weeks to develop from the moment they burst through the buds to their time of opening, but this period varies in length with the weather, continuous dryness retarding and moderate showers hastening their development when once started

The growing branches of vines should now be checked again for the following year's crop. These will be less troublesome in putting out

inconvenient shoots, as the plant's sap is more apt to go into flowering branches, where nourishment is now more needed. Could the whole work be performed in a few days, this change in the direction of sap flow should be done preferably ten days or a fortnight before flowers begin to open. In a large plantation, unless the hands are very numerous or the shoots have been arranged beforehand so that there is little else to do than cut their ends, it will take some weeks to accomplish this, and therefore work must begin earlier or finish later. If the dry spell necessary for flowering has lasted a good while and can fairly be depended upon to continue long enough, the growing ends may be cut earlier; but it must be borne in mind that if rain in quantity comes too soon and, in addition to the stimulus given by it, the branches intended for flowering have also the sap from previously growing shoots poured into them, the chance of their cropping well will be much diminished. Many a promise of a fine crop is ruined by too early rain here. The country, climate, and the planters' skill as a weather prophet must govern this undertaking.

An abundant supply of leaf mould should be in readiness for laying on the roots at this season, and should be applied when flowers begin to open, or a little before. If previous dressings have been so timed that vines are in a somewhat straved condition when flowering is expected, the chances of a good blossoming are increased, but this practice needs judgment, or a poor quality of pods will be the result.

There used to be a strong current here, no doubt with some grain of truth in it, to the effect that in a very wet season the only vanilla planter who had any crop was one whose pigs had got adrift in his plantation and spent the night in grubbing up vanilla roots. This method of producing flowers is not recommended, but it is quite possible that careful and systematic root pruning might be carried on with advantage in wet years, if one could tell before hand when these were coming.

POLLINATION OF THE FLOWERS.

The work of flower fertilization (pollination)–for they have all to be fertilized by hand, and that on the day they open—is mostly done by women and children. The operation is a very simple one, and an average negro will acquire the knack after being shown a few examples.

EXPLANATION OF PLATE.*

Fig. 1.—Portion of stem of Vanilla plant, with leaf, aerial root, and cluster of flowers; *a*, front view of Vanilla flower; *b*, side view; *c* aerial root, with root hairs.

Fig. 2.—Single flower of Vanilla, exhibiting the first stage in the process of artificial fertilization The operator provided with a finely pointed piece of bamboo, divides the lip or labellum medially, so that the central lobe is separated from the two side lobes. This exposes the column and organs of fecundation. The instrument is represented as placed against the column, ready to press upwards the anther *a*, and bring the pollinia in contact with the stigma *b*.

Fig. 3.—Single flower of Vanilla, exhibiting the second stage in the process of artificial fertilization; *b* shows position of column exposed by division of the lip [the middle lobe of lip is pulled forward and curled upon itself to show the position of the

* From Kew Bulletin.


a
b
1
a
b
c
2
c
a
b
3
a
b
4
5
a
b
6
a
b
7

column; the side lobes of lip, separated as shown in Fig. 2, are represented at back of the column]; *a*, the position of pollen masses, taken from the anther and placed on the stigma.

Fig. 4.—Enlarged front view of top of the column; *a*, the anther.

Fig. 5.—Enlarged side view of top of the column; *a*, the anther; *b*, the stigma, or viscid surface on which the pollen masses must be placed to ensure fertilization.

Fig. 6.—Enlarged section through top of the column; *a*, one of the pollen masses *in situ*; *b*, the stigmatic cavity.

Fig. 7.—Enlarged section through top of the column; *a*, the pollen masses, having been transferred from *a*, Fig. 6, are now represented in contact with the stigmatic surface. [Although diagramatically shown, these figures give a tolerably good idea of what is actually necessary in order to produce fertilisation in a Vanilla flower.]

The whole affair is very much easier done than described, and with flowers fairly numerous an ordinary hand will fecundate a hundred or so per hour. Early morning, from 7 to 9, is the best time for featilizing; but the work may be started with sunrise and carried on well into the afternoon, though about midday flowers begin to close some and the work goes slower. Most plants in full crop produce many more flowers than it is adviable to fertilize, for other parts of the vines, besides the checked hanging branches, blossom in favourable seasons, and the number of pods which a vine is able to mature properly must be estimated from the plant's size and condition. In the course of four or five years, though by that time the planted cutting will be spent, if well cared for it will have grown a large quantity of vine; and as each new shoot, when long enough, sends down aerial roots in its own behalf, it becomes, so to speak, an independent plant and the parent of others. If none of the shoots from a strong growing vine have been removed the mass of growth in time becomes enormous, and may be equal to maturing a hundred or more good pods. When the supporting tree is stout and furnishes forks enough to admit of the vine being spread out so as to let plenty of air through it the vine may be allowed to accumulate to this extent, and if it gives, say, 20 clusters, each yielding 10 or more flowers, 5 or 6 might be fertilized on each.

But, generally speaking, about 30 pods to a vine is as many as should be left, and he would be a lucky planter who should average that number. In selecting flowers to fertilize those should be chosen which spring from the lower part and from the sides of the flower stalks, from which position they grow straighter pods than those coming out on top. In favourable weather, i. e., moist but not heavy rain (which latter often washes the pollen grains away before they germinate), only a small percentage of flowers will fail of fecundation. In case of failure, the flower drops off in three days or less, but otherwise remains attached to its stalk and slowly withers; the *gynostemium* adheres to most pods till they begin to ripen; thus it is easy to see the number successfully fecundated in each bunch, and where enough are secured the rest can be broken off. Later it is advisable to cut clean off with a knife the flower stalk a quarter of an inch or so beyond the last fertilized flower. Some planters plaster a bit of sticky clay on the cut

surface to prevent it rotting back. Dry lime is perhaps better; this may be dabbed on with a piece of cloth dipped in the powder.

Pods grow to their full size in five or six weeks, but take some eight months, more or less, according to the altitude at which they are grown, or the amount of shade over them, before they ripen. The indication of ripening is a slight yellowing of the whole pod, which is more marked near its free end. When under too much shade the change in color is less noticeable, and many pods grown in such places split before they are gathered, and for that reason lose in value. To guard against splitting, and yet gather them at perfect ripeness, they should be be gone over every other day. In removing them from the flower stalks the pods are grasped one by one near their attached ends, very slightly twisted, and at the same time pressed aside with the thumb. They must be taken off quite clean. If a bit of the flower stalk comes away with a pod, as sometimes will happen, it should be cut off smoothly. Any break or crack in the pod itself, however, near its butt, ranks it as an inferior quality. Buyers are very particular in this respect. After each day's gathering, before the pods are started on their first stage of curing, it is well to sort them roughly into four classes: 1, long; 2, medium; 3, short, and 4, split.

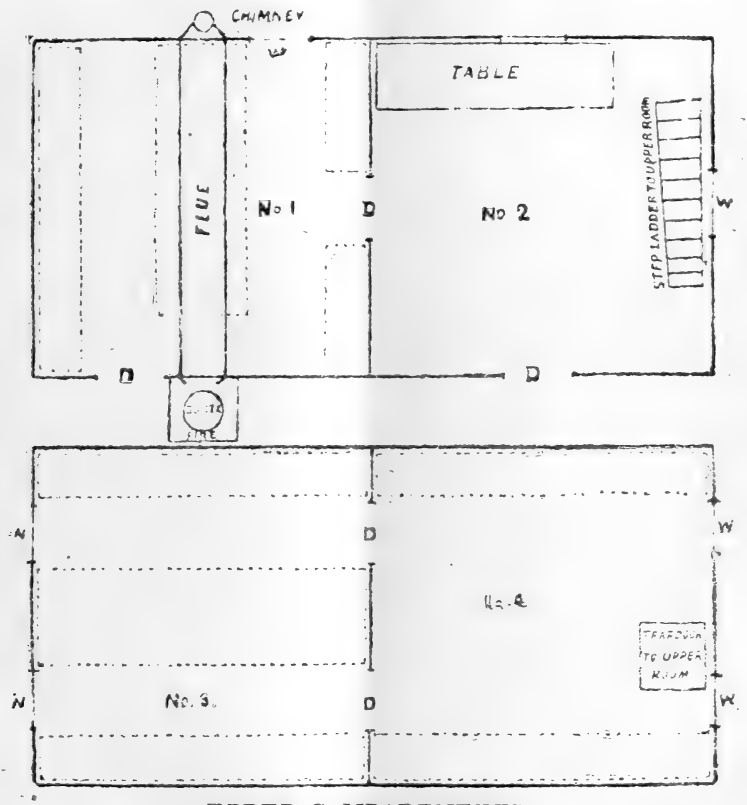
CURING THE PODS FOR MARKET.

There are many different modes of preparing vanilla, but for brevity's sake one alone will be described; it is probably the simplest, and appears to be as successful as any other. About 400 of the longest pods are placed in a basket and plunged into hot water (190° F.) for ten seconds; this is repeated twice, the dips being increased to twelve and fifteen seconds respectively, with intervals of half a minute between each two. After the third dip, when most of the water has drained off, the pods are placed in a wooden box or barrel lined with blankets, and closely covered up with the same material. When lot 1 is finished, lot 2 is similarly treated, and for them the water may be a few degrees cooler, or the dipping times a trifle shortened; and so also with lot No. 3, while No. 4 may be treated as No. 2. Perhaps it is as well to add that 190° F. is not an absolutely essential heat, but is about as high as it is safe to go; while even the longest pods may be adequately treated in water at 170° F. if they are kept in it long enough. An experienced preparer will be guided more by the appearance of the pod after each dip than by any fixed formula. Where small qantities are dealt with less heat is needed, and the above figures are given for a boiler 22 inches in diameter by 12 inches deep. It is best to have good-sized boxes or barrels to sweat the pods in, those holding 2,000 or 3,000 each being preferable, for the more pods there are together the better heat is retained The lots (1, 2, 3. and 4) should be kept apart, a fold of blanket being laid on each if all go into one box. By the following morning they should have changed to chocolate or puce colour, and are then ready to spread on the drying shelves; but if there is a large number together, and the heat has been well kept in, they may be left for another twenty-four hours.

A curing house for preparing a crop up to 2,000 pounds (dry) may have the following dimensions and fixings: 30 feet long, 15 feet broad, 13 feet in height of walls. It should be divided into four compartments, two on the ground and two above, each being approximately 15

by 15 and 6½ feet high. One compartment on the ground floor is used as a hot room, having a flue 2 feet wide covered with sheet iron running through the centre. If the heat is too intense from this, sand may be sprinkled on top to reduce it. Above this flue and around two sides of the hot chamber tiers of shelves are fixed 6 inches apart, on which the pods are spread to dry. The shelves may be conveniently made of laths, on top of which mats or canvas can be laid; or fine-meshed wire netting would serve the same purpose, perhaps, better than anything else. Compartment No. 1 is the hot room. Dotted lines in it and in Nos. 3 and 4 indicates where shelves are fixed; D, door; W, window, etc. The table is used for sorting green pods on, and is otherwise useful at final measuring time and when the pods are ties into packets. No. 3 is above No. 1, and is also a warm room, some heat from No. 1

GROUND COMPARTMENTS.



UPPER COMPARTMENTS.

SCALE: ONE QUARTER INCH=ONE FOOT. D. DOOR. W. WINDOW.

FIG. 2—Plan of curing house. (Dotted lines indicate where drying shelves are fixed).

coming up through the floor. The clear spaces in Nos. 2 and 4 have fibre mats spread on them when required, and on these the pods are handled and sorted as they progress in curing. The worker, sitting on the floor, keeps the four lots of pods—long medium, short, and

split—distinct on the shelves. This facilitates the sorting, the short and split pods needing to be examined sooner and oftener than the longer and sound sorts, as they dry more rapidly.

A good average heat for the hot chamber is 110° F. A few degrees more or less does not matter, but pods are apt to dry too quickly if the heat is much greater. The slower the process the more uniform and better is the result. As they begin to turn soft and show longitudinal wrinkles the pods are removed from room 1 to 3, and after reaching a certain degree of flexibility they pass on to the shelves in room 4 and there finish their curing, If kept too long in either a hot or a warm room the thin ends of pods shrink too quickly, and this is to be avoided. In a large crop there are always some inferior, ill-nourished pods, in which this occurs, but the last remark will be useful to a beginner. When fully cured the pods are much wrinkled and pliable, bending easily around one's finger. There is considerable difference in the degree of dryness preferred by different curers. If the contents move easily all along a pod, without any unevenness being noticed when it is drawn between the finger and thumb, it is nearly dry enough; but the right stage can only be learned by experience

When finished the pods are well wiped with bits of soft flannel and then kept in boxes with close-fitting lids. It is better to sort them roughly into lengths as each day's lot is put away and tie up in the various sizes in bundles of about 200 each if the numbers allow of it, for they have to be examined once or twice a week in order to remove the moulded ones, and this is much more quickly done with bundles than when they are loose. Moreover, it makes the ultimate accurate measuring easier. Either at this time or later the different qualities are more exactly separated, none but faultless pods, without scar or defect in curing, being allowed in the first quality. The rest rank as seconds, etc. The split pods and the pods that have been cut on account of mould are also kept distinct. It is well to keep a crop at least three or four months before marketing. By that tine nearly all shaky pods that are liable to mould will have shown themselves. All are then measured and tied up in neat bundles of 50 pods each of even length, the pods varying in length not more than one-eight of an inch.

The general slightness of a marketed crop has much influence on the price it will bring, and whatever whims buyers get into their heads the producer must conform to or suffer in pocket. Bundle tying is something of an art, and a deft hand at it is valuable. Sixteen or thereabouts of the shapeliest pods in each 50 are selected for the outside; the rest are tied up as a core, being kept in position with a few turns of the fibre tying cord, while the chosen 16 are carefully placed round them. The bundle is tied in either three places, near each end and in the middle, or in two places, an inch or more from the ends, according to the length of bundle. The core-holding string is pulled out before the final tie is fixed. Two-tie packets are boxed as they are. With those of three ties buyers prefer that the end cords be removed before packing, to enable them to examine the bundles inside and see if the contents are of uniform quality. If kept tied some time before being packed the bundles set, as it were, and retain their neat shape. The tin boxes used here for packing vanilla in measure 12½ by 8½ inches in width, are 4½ inches deep, and hold about 12 pounds. Each box has

a label pasted on it which bears the grower's trade-mark, the length and number of packets, their quality, and net weight, and a similar label is put inside. As some chemical action is set up when vanilla rests in contact with tin or iron, thin vegetable parchment paper is placed in the boxes to keep the two apart. The lids are then sealed close with pasted paper and the tins packed in wooden cases, 6 in each, and thus dispatched to market.

MISCELLANEOUS INFORMATION AND NOTES.

A fair crop should average about 100 cured pods to the pound.

	Pods per pound.	
	Fresh gathered (about).	Dry (about).
9 inch pods ...	20	65
8 inch pods ...	25	80
7 inch pods ...	33	110
6 inch pods ...	50	160

The following crops, produce on one estate during the last five years, will serve to show how uncertain are the returns from vanilla growing here :

	Pounds.
1893 (long dry spell for flowering time in 1892) ...	1,800
1894 (rain came too soon and spoiled good promise) ...	120
1895 (next to no dry spell for flowering in 1894) ...	40
1896 (excellent promise mostly spoiled by too early rain)...	500
1897 (similar to the year before) ...	600

Expenses for labour during these years would be about 7,000 rupees (about $1,800 to $2,000). Present price of vanilla (June, 1897) in London market averages about $6 (25s.) per pound. The currency here is in Indian money—that is, rupees; nominal value of rupee, 1s. to 2s., but the actual value varies with price of silver and at present ranges between 1s. 2d. and. 1s. 3d.

The day beigns at 6 a.m. and work continues until 5 p.m., or to 4 p.m. on some properties; 11 to 12 is breakfast time. Rough work is quickest got through by giving "tasks," when the negroes become energetic.

Ordinary estate laborers are paid 12 rupees ($3.40) per month; women for crop curing, etc., are paid 9 rupees ($2.60) per month; women and children for flower fecundating, one fourth rupee (7 cents) per day, the "day" begin when work is over, early or late. Vanilla packet tying, 2 rupees (58 cents) per 100 bundles of 50 pods each; vanilla measuring, 2 rupees (58 cents) for same quantity (5,000 pods).

Straight-stemmed palms, if stout, may be used for supporting the vanilla vines. By driving hard-wood pegs into them obliquely at suitable heights the vines can be hung about them as in tree forks.

When long vanilla cuttings are planted near blossoming time, some of them often give flowers soon afterwards. It is best to cut these off, as cropping a vine when newly planted lessens the growing power, and it may hang for many months, but in a regular plantation vines flowering too heavily may be relieved by cutting off one or more of the flowering branches. These may be planted for the one small crop they will

give—3 or 4, or up to 10 or 12 pods, according to length and vigour. For this they may be planted close together on low bars and posts, and need well-rotted manure for immediate and abundant nourishment. The best time to plant for this is a few days before the first flowers open: if cut earlier many of the flowers will die back.

Cropping branches may be allowed to flower for two years if they have not missed a season, but never more than that, as the pods they then give are invariably very inferior: the best are on young wood a year or so old at flowering.

Prunings, when not too old, may be sent out to rear new plants from. When extending the plantations it is better to plant the shoots from the prunings rather than the prunings themselves, if they are over 2 years old. If flung into jungle, especially amoung rough ground, rocks, etc., where there is shade and decayed leaves, they grow in a wonderful way without any attention and yield the best of cuttings. When shoots are checked for cropping branches, some of their tendrils occasionally elongate into aerial roots, and should then be cut off, or they will keep the branch full of sap and hinder its flowering.

Short varieties of grass seem rather beneficial in a plantation; cumbersome weeds should be hand pulled, never hoed.

During early crop gathering, before ripe pods are numerous enough to make it worth while using the hot room, they are cured under blankets in the sun, but have to be taken in at the hottest part of the day if sunshine is continuous. This used to be the sole method of curing here, and when used now gives excellent results in favourable weather; but dependence upon the sun is risky, and upon the whole the process is cumbersome and costly. Hand trays, that can be piled up on top of each other and carried between two men, are used to spread the blankets on, a fold being below as well as above the pods, and these are supported on low double rails to keep them clear of the ground. In unsettled weather showers have to be watched for, and the trays carried under shelter till the weather again becomes fair.

If there is a pinch for space in the curing house, pods in the hot room may be spread two or three or more deep on the shelves and tumbled up daily i.e., such of them as are not taken off and re-sorted.

In mulching vanilla roots, and especially at crop time, the plants are much more benefited if the mulch be of two sorts, well-rotted leaf mould being put on first for immediate action, and above it a layer of withered fern or the like, which decays more slowly. When heavy top dressings of quick-decaying manure, grass, etc. have rotted down, they get beaten away by rain, the network of roots becomes exposed, and may with advantage be lightly coverd with a thin sprinkling of good soil. Obviously it is better to apply this before the roots become bare or visible. The vanilla roots delight in twisting among stones, large and small, and flattening against their lower surface when not embedded in the soil. When these are of a convenient size and handy in a plantation, the root circuit allowed to each vine may be ringed with them. Vanilla may be grown on trees of thick foliage if these are of a sort that will stand being well pruned annually. Wild cinnamon, which gives dense shade, is sometimes used for th s purpose, the branches being nearly all cut off each year about pod-ripening time, which also lets the sun get at the vines for flowering. The contrast between former some-

what dense shade, which has grow since last branch trimming, and the strong light let in by the pruning seems to help toward blossoming.

Under large, high trees, wide apart, where to plant vines on other small-growing wood between them would make the shade too close, vanilla may be fixed on tripods of durable wood, the three stakes being tied with wire crosswise, some little may from their top ends, so as to furnish forks over which the vine creepers may climb. High up in the hills here the plants may be grown in this way without any shade at all, but the plan is only suitable for level grounds or moderate slopes.

SUMMARY.

The foregoing account of vanilla cultivation, being the outcome of experience gained in the Seychelles alone, and there chiefly in the hills, may need many modifications to adapt it to different circumstances pertaining to other lands, and, indeed, possibly may be of little use for such. For instance, in a drier climate irrigation might be needful, and it would not be necessary with a reliable, sufficient annual dry period to prepare vines for flowering by checking their sap flow in certain branches, as it is in this colony. This is not found necessary in certain districts where the rainfall is not such as to keep plants growing continuously, for they stop growing of themselves and come into flower without coaxing.

Again, under less favourable growing conditions the vines would need more nutriment and attention to stimulate growth.

These and similar considerations which will suggest themselves to the reader may serve to save a brief summary from appearing too dogmatic.

The following conditions of climate, method of growing, etc., appear to the writer to be most favourable to the successful cultivation and handling of the vanilla crop:

Climate.—With shade temperature ranging about 80° F., never much above or below it, and a humid, still atmosphere; a rainfall of 80 to 100 inches or more, evenly distributed through ten months in the year, the remaining two months being dry, with occasional short and very light showers—the ten wet months for continuous luxuriant growth, the two dry ones to check it and bring vines into flower.

Soil.—A skin of rich vegetable mould resting on a porous substratum. Failing that, with the above climate, vanilla should do well on any soil if the roots are kept covered with decaying vegetation.

Situation.—Moderate slopes.

Shade.—Small-leafed trees to let checkered sunlight through.

Plants.—Cuttings 10 to 12 feet long of growing shoots, which should not cease growing if planted after the dry season, but go straight on and flower fully in two years.

Planting.—Either in line on posts and bars, or on shrubs of suitable size and leafage, at the risk of wholesale destruction from disease: or plants well kept apart, each on its own support, so that any vine showing signs of sickness may be removed before infecting its neighbors.

Culture.—Plantations to be gone through bimonthly; shoots on the ground looped up; climbing branches brought down; decayed leaves, etc., laid on roots for manure when needed. Preparations for flowering according to climate.

Cropping.—Flowers to be pollinated in forenoon, preferably such as will hang clear and grow straight pods; quantity regulated according to mass and vigour of each vine, but not such as to hinder the start of new growth for more than two or three months. Pods should be gathered every other day.

Curing.—The slower the better, beginning in a heated room at about 110° F. for some days, then in a cooler one, 90° to 100° F., finishing at ordinary temperature; humidity of air kept down if need be by charcoal braziers.

Marketing.—Qualities and lengths kept distinct, made up in packets of 50 pods, and neatly packed in tins holding about 12 pounds each.

Labour.—Cheapness and intelligence are of the greatest importance in vanilla production. The cultivator must himself have his eyes everywhere; the best of labour known here deteriorates quickly if left to itself.

JAVA VANILLA.

Concerning the profit on the cultivation of vanilla on a small scale, Mr. Ligtvoet, of Java, has given some interesting information at the annual meeting of the Soekaboemi Agricultural Society. He had grown vanilla on a small piece of ground measuring 2¼ acres; the yield was 172 lbs. The parcel of vanilla was consigned to Amsterdam, and sold there at an overhead price of 15f. per kilo. (11s. 3d. per lb.). The total net proceeds, after allowing for loss of exchange, were £82 11s. 4d., and as the expenses in Java had amounted to £2 7s. 2d., the net profit obtained was £80. 4s. 2d.

The author considers that the cultivation of vanilla in Java would be very remunerative for the small grower. The difference in the price paid for Bourbon vanilla as compared with that grown in Java, is due chiefly to the fine aroma of the former, and also to the fact that pracels of Bourbon vanilla are always of equal quality. He attributes the inferior aroma of the Java product to the fact that fertilization of the plants is there produced artificially, whilst in Bourbon it is brought about by insects.—*Chemist and Druggist.*

Present Price of Vanilla.—At auction on Wednesday about 900 tins, chiefly Seychelles, were offered, of which about half were sold at irregular but rather lower prices. Fair to good Seychelles, 7 inches to 8½ inches, sold at from 13s. to 19s. 6d; 5 inches to 7 inches, 6s. 6d. to 14s; 3½ inches to 5 inches, 5s. 6d. to 7s. 3d.; and inferior 3s. 3d. to 8s. 9d. per lb.—*Chemist and Druggist, 19th July.*

NOTES ON PLANTS IN THE GARDENS.

Bombax malabricum, DC.

(Red Silk Cotton Tree or Simal Tree.)

This tree is a native of India, Java and Sumatra. The trunk and branches are covered with large corky prickles. In the winter months the leaves fall, and before they appear again, the ends of the branches are covered with the handsome red flowers. The seed vessel contains red silk-cotton, "simal," which is of the same character as the white silk-cotton, "Kapok" of our native tree, (Eriodendron anfractuosum). Both kinds of silk-cotton are very useful for stuffing cushions, and in

upholstery, but they are too short and too soft to be spun. The kapok fetches a higher price than the simal.—(*Malvaceæ*).

CROTON TIGLIUM, Linn. (Croton Oil Shrub.)

A small tree, 15 to 20 feet high, met with under cultivation throughout the greater part of India; probably indigenous or only naturalized in eastern Bengal and Assam and southward to Malacca, Burma and Ceylon.

The nuts yield an oil which is orange yellow or sherry-coloured, of the consistency of coc nut-oil, has a slight odour resembling that of Jalap, and an acrid flavour. This is a valuable medicinal oil, which is used as a drastic purgative especially when it is desired to act speedily and powerfully, and when only a small volume of medicine can be administered, as in cases of obstinate constipation, in dropsy, in apoplexy, in paralysis, and in cases when the patient cannot or will not swallow, when the oil may be dropped on the tongue. As prepared in India, it is frequently so much adulterated, that it finds no sale in Europe. The nuts are exported chiefly from Bombay and Cochin (often being also Chinese re-exports), and the oil is expressed in England (*Euphorbiaceæ*.)

DURIO ZIBETHINUS, Murr. (Durian.)

The tree producing the celebrated Durian fruit of the Indian Archipelago, is the only species of this genius of *Sterculiacsæ*. It forms a large forest tree attaining sixty or eighty feet in height, with somewhat the general appearance of an elm. The leaves are densely covered beneath with minute scales, which give them a silvery red appearance. The flowers are yellowish green, produced in little clusters upon the trunk or main branches. The fruit is either globular or oval, and measures as much as 10 inches in length; it has a thick, hard rind, entirely covered with very strong, sharp prickles, and is divided into five cells, each of which contains from one to four seeds rather larger than pigeons' eggs, and completely enveloped in a firm luscious-looking cream coloured pulp, which is the eatable portion of the fruit.

This tree is very commonly cultivated throughout the Malayan Peninsula and Islands, where its fruit, during the period it is in season, forms the greatest part of the food of the natives. Considerable diversity of opinion exists among epicures as to the relative merits of several well known tropical fruits, including the durian, the mangosteen, the cherimoyer, and the pineapple, any one of which is made to occupy the foremost place, according to individual taste. The flavour of the durian, however, is said to be perfectly unique; and it is also quite certain that no other fruit, either of tropical or temperate climes. combines in itself such a delicious flavour with such an abominably offensive odour, an odour commonly compared either with putrid animal matter or with rotton onions. It might be supposed that a fruit possessing such an odour could never become a favourite; but it is said that when once the repugnance has been overcome, the durian is sure to find favour, and that Europeans invariably become fond of it.

FICUS RELIGIOSA, Linn. (The Peepul tree.)

A large glabrous, usually epiphytic tree, found wild in the sub-Himalayan forests in Bengal and Central India. Extensively culti-

vated in most provinces of India, though less frequently so in Burma.

The bark yields a tenacious milky juice which hardens into a substance resembling Caoutchouc. The juice is used as birdlime.

Lac is produced on the tree in India. It is there largely planted as an avenue and roadside tree.

The peepul is "believed to be inhabited by the sacred triad, Brahma, Vishnu, and Shiv. It is used at the thread investiture and at the laying of the foundation of a building. Vows are made to it and it is worshipped. So sacred is it that none will destroy it, even when it grows on the crevices of walls and buildings, pulling down the strongest masonry. Of its wood the spoons are made with which to pour clarified butter on the sacred fire." (Urticaceae.)

OIL FROM CITRUS PEEL.

In the Bulletin for May (page 70) a note is published from Mr. J. Ch. Sawer describing the écuelle-à-piquer, and giving the name of a maker in Paris.

The Curator of the Museum of the Pharmaceutical Society of England has kindly interested himself in the subject. He states that in Palermo the sponge process alone is used, an overseer sitting in front of a semicircle of workers. Mr. Holmes also applied to Messrs. Warrick Bros. about the machine, who have written the following letter:—

Messrs. Warrick Bros. to Director of Public Gardens.

7, Portpool Lane, London.
June 19th, 1902.

Dear Sir,

By instructions of Mr. Holmes, of the Pharmaceutical Society of Great Britain, we have pleasure in forwarding you by Parcel Post, 1 Pricker and 1 Scraper, tools which were used at our works at Grasse, Alpes Mari imes, France, in the production of Essences of Lemon, Orange and Bergamot.

You will notice that the points of the Pricker are rather blunt and this is in order that the peel should not be too deeply punctured; the Scraper or rasper was only used after the best oil had been obtained. After the oranges had been treated with the pricker they were rasped and the raspings were distilled which produces an inferior quality oil.

We think that in Italy where large quantities of oil are produced that more up to date methods are employed.

We are, dear Sir,
Yours respectfully,
WARRICK BROS.

These instruments are in view at Hope Gardens.

[Issued Aug. 20th, 1902.]

Vol. IX. SEPTEMBER, 1902. Part 9.

BULLETIN

OF THE

BOTANICAL DEPARTMENT, JAMAICA

EDITED BY

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Director of Public Gardens and Plantations.

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PRICE—Threepence.

A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Kingston P.O.

KINGSTON, JAMAICA:

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1902.

JAMAICA.

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BOTANICAL DEPARTMENT.

Vol. IX. SEPTEMBER, 1902. Part 9.

THE BANANA INDUSTRY IN JAMAICA.

By THE EDITOR.

Prepared for the Agricultural Conference. Barbados, January, 1902.
Reprinted from the West Indian Bulletin, Vol III. No. 2.

THE BANANA PLANT.

The banana plant is not propagated by seed, but by young plants which bud from the underground stem or 'bulb,' as it is called, of an older plant. This bud at first gets all its food material from the parent bulb, but very soon forms leaves and roots of its own. Its first leaves are very long and narrow as compared with those developed later. When the young plant is six or eight months old, it is about 9 or 10 feet high, and its own bulb is 8 or 10 inches across. This is cut clean away from the parent, and the roots trimmed off. It may be planted as it is, but for convenience of carrying, and to prevent its being blown over before its roots anchor it, it is cut down to within 6 inches of its bulb. This bulb soon shoots, both from the centre, and from eyes all round. One shoot takes the lead, monopolizing most of the food-material supplied from the bulb, and this leading shoot is known henceforth as the plant—the others are its suckers.

ROOTS.

The roots push out in all directions horizontally, and some, from the base of the bulb, vertically downwards. The main roots are fleshy, not forming wood, but of the same thickness throughout like stout cords. They do not branch, but short thread-like roots grow out, and on these are the hairs which do the work of absorbing liquid from the soil. If a heavy wind shakes the stem, the thread-like roots are torn off, and perhaps even the cord-like roots are broken, and the effects are noticed for the following three or four months in the bunches coming small.

Cutting the ends of the thick roots appears to encourage the growth of the thread-like roots.

The roots generally do not seem to have the power of adapting themselves, like the roots of many other plants, to overcoming difficulties. On meeting a large stone they do not feel their way under or over it, but apparently become injured. If the soil is either too wet or too dry, they decay; if they are cut through, they burst out at the severed end into numerous branches of equal thickness, which continue to grow in much the same direction. They do not approach the surface nearer than about 2 inches, and the depth to which they descend, depends on the nature of the soil, modified by deep cultivation and drainage. Under favourable conditions the horizontal roots will be found at the depth of 2 feet 6 inches from the surface, and the vertical roots from the base at a depth of 4 feet 6 inches They grow rapidly, when the soil is rich and in good tilth, at a rate of 2 feet in a month for vigorous roots starting from the bulb I have traced them to a distance of 17 feet from the stem, but their length depends on the encouragement, as it were, that they receive for extension

The evidence afforded by their structure, points to the soil best suited to them,—a deep loam, well drained, but retentive of moisture from containing a large proportion of humus.

STEM.

The underground 'bulb' is the storehouse of food-material which is used up in the formation of roots and leaves and in their growth, in the formation of suckers, and finally in the development of the flowering shoot and the fruit. If a sufficient supply of material is not stored up in the bulb when the flowering shoot is in process of formation, the bunch will only bear a few 'hands.' This want of stored material may be due to various causes: the roots may not have been able to do their work properly, the leaves may have been damaged, or new suckers may have been allowed to drain the parent.

When a bunch is cut, or naturally when the fruit has ripened and dropped, the leaves and stem decay while the food-material in them passes down into the bulb. Thence, very slowly and gradually, it finds its way into the bulb of the succeeding plant. The old bulb and its heir, the newer bulb, are connected by a large surface, and threads of communication pass from one to the other. The connexion may last and continue on to a third, a fourth, or a fifth new bulb. The older bulbs are a provision against accidents, giving up their treasured store, grudgingly, as it were, so long as the young plants have roots and leaves by which to supply themselves.

LEAVES.

Compare the leaves with those of the coco-nut, which are divided naturally into ribbons so that they seem to enjoy the stormy winds of the seashore. The leaf of the banana shows very clearly that it was developed under conditions where only gentle breezes lazily move it, and as the structure of the root points to a forest soil as the cradle of the species, so the leaf indicates an open glade sheltered from the rough winds by surrounding woodland Thus we get hints about situation, and the advisability of leaving shelter belts in clearing forest land. In exposed spots where the leaf is torn into threads, it cannot properly perform its functions, and the consequence is that the bunch is small and of little value.

In an allied plant, the 'travellers tree' (*Ravenala*), it is well known that it is possible to get a drink of water by piercing the hollow leaf-stalk; and a banana in a similar way collects the rain drops of a shower, and conducts them along the fluted leaf-stalk into the interior of the 'stem' which is nothing more than the sheathing bases of the leaves themselves. Water supplied in this way, and quite independent of the amount at the roots, is important for the proper shooting of the flower stalk.

The sheathing bases of the leaves act the part of a woody stem in supporting the huge leaf blades and carrying them upwards towards the sun-light. They also enclose in their centre, and protect, the flowering stalk for the six weeks or so while it is pushing its way up from the underground bulb to the top of the stem. Immediately before the flowering stalk appears a small leaf is developed which hangs over and protects it on its birth from the direct sun-light.

The sheaths when cut across, show very large air-spaces, and these are connected with minute pores on the leaves which admit air, a large quantity of which is necessary.

FLOWERS.

If the flowering stalk is examined in the embryo condition in the stem, it will be found that the flowers are arranged in clusters disposed spirally round the axis. The clusters at the base of the stalk become the 'hands' of the fruiting bunch. It will also be found that the flowers in different regions of the stalk vary in the proportion of the length of the ovary to that of the rest of the flower. In those clusters which eventually become 'hands,' the ovary is two-thirds the length of the whole flower; higher up on the stalk are clusters in which the ovary is about one half the length of the flower; and still higher, there is another series in which the ovary is about one-third of the flower. These three sets of flowers clearly distinguishable by the different proportionate length of the ovary are physiologically very different; those with the long ovary are female flowers and become the fruit, those with the short ovary are male flowers; and those with the ovary about half the length of the flower are hermaphrodite and form short, useless fingers in the bunch. The problem of increasing the number of hands in the bunch must be attacked at a stage earlier than its appearance in the embryonic condition described.

VARIETIES OF THE BANANA.

There are several varieties of banana known in Jamaica but the only one cultivated and exported on a commercial scale, is that known formerly as the Martinique or Pouyat banana from the place of its introduction and the person who brought it over some time in the early thirties of the last century. The Director of Kew Gardens has from time to time sent varieties to Jamaica, and we have received some also from the Commissioner of the Imperial Department of Agriculture, from Dominica which came originally from Kew. Many of these are spoken of in very high terms in the East, but so far, we have not found any that, for export purposes, rival the common Jamaican, although that known as 'Guindy' from Madras is considered good.

The red banana gets a high price in America, but merely as a

decorative fruit for the table. The price is maintained by only exporting a small quantity.

The Chinese or dwarf banana is grown in hilly districts, as it is not so liable to be blown over. This species is very productive, but is not suited for export to England as it does not keep well.

ANALYSIS OF BANANA SOILS.

The following analysis of soil from Portland by Mr. H. H. Cousins, the Government Chemist, has been published in the *Jamaica Bulletin* (October, 1901, p. 150). It is reproduced here as an ideal soil for the banana:—

PHYSICAL ANALYSIS.

		Per cent.	
	Stones	—	Fine Earth
	Gravel	0·41	
	Sand	5·46	
	Fine sand	28·89	
	Silt	23·65	
Agricultural Clay	Fine silt	13·77	
	Clay	2·72	
	Combined water and Organic matter	25·10	
	Total	100·00	

	Per cent.
Retentive power for water	44

CHEMICAL ANALYSIS.

(Soil passed through 3 m.m. sieve, dried at 100 deg. C.)

Insoluble matter ..	27·870
Soluble in hydrochloric acid ..	72·130
Potash	·6796
Lime	1·379
Phosphoric acid ..	2·760
Carbonic acid as Carbonate of lime ..	·600
Combined water and organic matter	25·100
Humus (soluble in ammonia) ..	9·860
Nitrogen	·7036
Hygroscopic moisture ..	24·860

FERTILITY ANALYSIS.

Available potash	0·0571
Available phosphoric acid ..	0·0908

OBSERVATIONS,

"This is a remarkable soil. It contains a large proportion of vegetable mould, and is yet possessed of a desirable proportion of fine soil particles. It is both free-draining and retentive of moisture—an ideal medium for the root system of the banana. The subsoil is porous and self-draining. The proportion of nitrogen and phosphoric acid is most extraordinary, the former being seven times and the latter thirty times greater than good average arable land in England. The available potash and phosphoric acid are both high. This is a typical specimen of a Jamaican soil specially prepared, as it were, for the kindly growth

of the banana. I can suggest no manures as desirable or necessary, and conclude that cultivation alone will suffice for full crops of standard fruit for many years to come."

The following analyses by Mr. Cousins are given for comparison, as samples of soils in St. Catherine which grow bananas successfully :—

	Lawrence Field.	Rodens Pen.
Humus ..	1·79 per cent.	1·54 per cent.
Nitrogen ..	·157 " "	·147 " "
Total K_2O* ..	·3827 " "	·4284 " "
" P_2O_5 ..	·2124 " "	·1868 " "
" Ca O ..	·9996 " "	1·5148 " "
" $CaCO_3$ ..	.17 " "	·42 " "
Available K_2O	.0518 " "	·0108 " "
" P_2O_5 ..	.0624 " "	·0695 " "

These figures are calculated on the 'air-dried' soil and not on soil dried at 100 dg. as usual.

CULTIVATION.

As a general example of cultivation, I will take the case of an estate on the north side where the soil is a heavy loam, 9 to 15 inches deep, with the subsoil of stiff clay, and the rainfall 90 inches. The general operations would be as follows : —

For plants, start in January, plough 9 inches deep, throwing a furrow 14 inches wide. This plough will require a team of eight cattle to pull it. Two ploughs will do 3 acres a day. Harrow, and allow it to lie fallow till first week in March. Then plough and cross plough 6 inches deep, and harrow. Line 14 feet square. Dig holes 2 ft. 6 inches every way, and fill in with surface soil.

Dig suckers, beginning first week in February, one month before they are wanted, and only digging each week what can be planted each week a month later. Plant the second week of March to the end of April. Keep stirred with the plough 3 to 4 inches deep in fine weather, say every eight weeks, but in wet weather simply bill with cutlass. Select the strongest shoot for the plant, which will fruit in the following February or March.

Prune off all suckers until June, then leave one sucker just coming out of the ground, which will fruit in the following April. In October leave another on the opposite side of the stem, which will fruit the following spring twelve months. In February leave another, which will fruit in 15 or 16 months.

On such an estate 66 to 70 per cent. of plants, and 88 to 90 per cent. of first ratoons should give bunches. Taking a seven-year period, the yield should be 330 payable bunches per acre per annum.

On the south side after lining at 15 by 15 feet, the irrigation canals would be laid out and water supplied to young plants every 5 or 6 days, to ratoons every 10 days, at the rate of 2 to 2½ cubic yards to

* K_2O represents Potassium oxide.
P_2O_5 represents Phosphoric anhydride.
Ca O represents Calcium oxide or lime.
$CaCO_3$ represents Calcium carbonate.

each acre. No plough is used for the first three years on this light soil, but instead the hoe and the assam fork.

I will now go more into detail.

PREPARATION OF LAND.

Clearing,—In ground covered with forest or woodland some are content to cut down and burn, leaving the stumps to decay; but it is better if it can be done, so to cut the trees that they will tear up their roots in their fall. The trees should be carefully selected, marked and cut up for their special uses—timber, posts, piles, tramway sleepers, firewood, etc. The underwood and brush can be used to burn up the roots and the trunks of useless trees such as Guango, Bastard Cedar, etc.

The ground should finally be carefully stumped. Even if the land is virgin soil and does not require ploughing, it is better to stump at first. The plants can then be put in at regular distances at once,—an important matter in many ways. and if ploughing is necessary at a later period, there is no delay caused by digging out stumps. Stumping also facilitates cutting and carrying the fruit.

If the land is not the virgin soil of a forest, and especially if it be old cane land or pasture, it should be first thoroughly ploughed at least 9 inches deep, and harrowed. If the situation is on hill-sides where the plough cannot be worked, the pickaxe for stony ground, and the fork for soft ground should be used.

Distance.—The usual distance is 15 by 15 feet, or 14 by 14 feet, but these distances are modified according to circumstances, and planters are continually trying experiments with other distances. One planter finds that a hill-side of 15 acres on the north side planted 8 by 8 yields, 8,000 straight, or more than 500 to the acre. Another, in a hot, flat district on the south side, finds it advantageous to plant 8 by 8 in order to shade the ground as soon as possible. It stated by the advocates of close planting that the crop comes in sooner, that it can be regulated with greater success so as to come in during the five months of high prices and that less weeding and less water are required. On the other hand, it will be found necessary to remove every alternate row for first ratoons, and probably for third ratoons to reduce the field to stems at distances of 16 by 16 feet. Where there is too much shade, the bulbs are apt gradually to grow higher out of the ground with less hold against the wind, and the plants run up with a weak stem and irregular bunch. Another system is to increase the distance between the rows, and decrease it between the plants in the row, making the wider intervals run north and south. A planter who reaps 330 payable bunches per acre, planting 14 by 14, gets a yield of 400 per acre where he has planted 10 by 10 feet.

A planter who is planting cocoa and utilizes the banana for shade, says that he has generally planted 14 feet square with cocoa in the same line. If cocoa is planted in the centre of the square field implements, of course, cannot be worked either way, but by planting in the same line as the banana, they can be used for two or more years without apparent injury to either plant. However, he states that, after some experience, he thinks 16 feet square would be preferable both for banana and cocoa cultivation, but there are considerations of locality, soil, fertility and so on which prevent a hard and fast line being laid down.

'In wide planting there is less risk of a falling tree carrying another with it. The roots of the banana appear to require a radius of at least 8 feet, and wide planting has always commended itself, in my experience, as the best agriculture; that is to say, sufficiently wide planting to give the plant or tree space admitting of its full and best development. Among other advantages cultivation is easier; and beyond question the higher the cultivation the better is the fruit obtained.'

Digging holes.—Some planters are content with shallow holes about one foot deep. But better results are obtained when holes 2 feet 6 inches every way are dug: the roots get a better start, and a better hold on the ground, so that the plants are more forward and are not so liable to be blown down.

A planter who prepares holes 3 to 4 feet wide and from 2 to 2½ feet deep, writes:—'It is not always possible to get the labour to make these holes, but I am convinced of the advantage and ultimate economy of making them large and deep, for among other reasons, the plant gets a start at once; a good root is formed in the loosened earth which practically "anchors" the tree, and enables it to resist high winds, and when planted in this way, the tendency of the root to come to the surface is greatly obviated.'

PLANTING.

Time of year.—If the aim is to get the main crop in for the American market from March to June, planting is generally done from January to April. Otherwise planting may go on at any time when rain or irrigation water can be relied on to help on the young plants. There is no doubt, however, that March and April is the best time for planting when all vegetation is springing naturally. In April there are always showers which help to start the eyes of the bulb in putting out leaves and roots, and when the May rains come, the young suckers rush along faster than at any other time of the year.

Seed-suckers. Size.—Suckers are selected for planting 6 to 8 months old; they would then be about 10 feet high, with large swollen bulbs 8 to 10 inches across. They should always be suckers which have not been pruned, and these are indicated by the first leaves being very narrow in proportion to their length, hence called 'sword' suckers.

Preparation.—They are cut down to within 6 inches of the bulb, and the old roots cleared off. Some planters put them in the ground at once, others leave them to dry for 3 or 4 days, and then plant. Others again find that they get better results by piling them in heaps 8 to 10 deep, then trash is thrown over them to keep off the sun, and they are left a month. The best way to pile them is to erect fences 3 feet 6 inches high to enclose a convenient spot 6 feet wide and of any length necessary.

Position.—They are placed in the ground with the eyes 3 inches below the surface. On hill-sides they are put in slanting, and an eye at the side develops into the plant. On the flat they are set upright; if the centre sucker happens to shoot, it is left; if not, the best of those growing all round is selected. Some planters, even on level ground, plant their suckers slanting, as few eyes develop into suckers, and the

strength is thrown into the formation of the bunch which is consequently finer; but the plant has not such a good hold of the ground, the bulb decays and leaves a hole, and the plant is liable to be blown over. The soil should be well drawn up over the bulb when planted.

IRRIGATION AND DRAINAGE.

Trenches.—The water channels should be close to the suckers when first planted, but when the plants are well established, the channels should be made in the centre of the rows, for if the water is applied close to the base of the stem, it encourages the production and growth of suckers, and in this way unnecessarily weakens the plant.

Drainage.—Perfect drainage is absolutely necessary for bananas. It is even more important to elaborate a system of drains for an irrigation district than to provide water canals, for more harm is done by having too much water than too little. But drains are equally important on clay soils or subsoils when the water is supplied by the natural rainfall. On ground where there is not much fall, the drains naturally follow the slope. But on hill-sides they should be made across the slope with only just sufficient fall to carry off the water; if there are natural gullies the drains are led into them. In making drains it is a great mistake to make them too shallow from motives of economy.

CULTIVATION AFTER PLANTING.

Various opinions are held by banana planters about ploughing. Some who have planted in light, loamy soils have been reaping excellent crops for some years without any ploughing. Others, with heavy soil, plough every 8 weeks with a 6-inch plough, alternately one way and across. Others again plough only once a year.

My friend who is establishing a cocoa walk with bananas—before planting—ploughs, cross-ploughs, harrows and, when necessary, trenches, afterwards he ploughs with a small plough (with mooncoulter attached) three to six times a year. On banana lines, where a plough cannot work, he forks occasionally and hoes frequently. He says that the plough is far more effectual in breaking up the soil than any other implement he has tried, and it keeps the land clean much longer. The plough works from 4 to 6 inches deep, and the cultivator 2 to 3 inches. Another planter forks once a year, and uses the cultivator to keep the weeds down. When the grass is too high for the cultivator he uses hoes, and only substitutes the plough for the hoe, or cultivator when labour is scarce. Both plough and cultivator are kept to two inches in depth in order to avoid destroying roots.

Keeping down weeds, maintaining a surface mulch, and loosening the soil, are all important matters in the cultivation of bananas as of other plants, and I am of opinion that a judicious pruning of the roots by the plough is also of great value, for as the roots do not naturally branch but grow straight out to great distances, pruning the roots induces branching at the severed ends, and a further production of roots from the bulb.

A planter, for whose judgment I have the greatest respect, writes as follows:—'I do not think that ploughing close to the banana and cutting through the roots does any harm. On the contrary, I am certain it does good—principally I think because the cutting gives fresh impetus to the roots, and this activity increases the growth of

the plant. Take, say potatoes or turnips, which are usually grown in drills 27 inches wide; so long as a horse hoe can work in these rows it is good cultivation to keep working, even to the damage of some of the leaves. Every time it is put through, all the roots crossing the drills must be cut, yet you see the greatest improvement in the growth of these plants.'

The following experiment, made at a banana plot in Hope Gardens, throws light on the subject of the formation of new roots induced by cutting them back. In planting the plot holes 3 feet wide and 2 feet deep were dug, the soil was returned to the holes and the suckers planted therein. The surrounding soil was ploughed and cross-ploughed after the plants began to grow. The soil is deep, rich, black, and rather heavy.

On November 19 a trench one foot wide and 2½ feet deep was dug halfway round a one-year old banana stool at a distance of 3 feet from the stem that was about to fruit, and the soil returned. In doing this the thick fleshy roots, some of them 5 feet to 6 feet long, were severed. No roots were found below 6 inches from the surface. Ten days later the soil between the first trench and 8 inches from the stem was removed to the depth of 2 feet 6 inches and returned, cutting off all the roots with the spade to within 8 inches of the stem. It was noticed when doing this that the roots that were cut off at 3 feet from the stem had thrown out numerous fibrous roots down their entire length.

A month later, on December 30, the soil was opened up from 3 feet inwards New roots were seen to have grown out 3 feet from the stem down to a depth of 2 feet from the surface. These roots were carefully followed back to the stem: some proved to be new roots direct from the stem, whilst others had grown out from around the cut ends of the original roots, one root giving rise to five or six vigorous feeders.

Some of the cut roots did not grow at all but remained just as they were, except that they died back some 2 or 3 inches; this was more noticeable near the surface where they would come under the influence of dry weather Some deeper ones had, however, rotted back a few inches, due perhaps to the ragged cut by the spade, or the root itself being injured at its junction with the stem by the pull of the cut.

The roots on the undisturbed side of the plant simply lengthened out a little and remained near the surface, 5 inches being the lowest depth at which roots were found.

The plant does not seem to have suffered any ill effects from the disturbance of its roots on one side.

In my opinion ploughing so as to cut the roots close to the stem should not be allowed when it is possible that the embryo bunch is being formed, as the stored food material would be used to form new roots instead of being utilized in the bunch. How this loss of food-material affects the bunch we do not know,—whether it delays the shooting, or affects the size of the bunch or the fingers. This subject of the use of the plough was discussed at the Banana Conference in Jamaica, and as a result some planters do not now plough except after the main crop for the American market is reaped, and not later than November.

Where ploughing is not the practice, the fork is used to great advantage when the young suckers are two months old.

Where the rains are constant, and the soil heavy, the cutlass is the best tool in weeding. The hoe and the assam fork and the cultivator are tools used under different conditions. The disc-harrow is an admirable instrument, and should be in constant use so long as the soil is sufficiently dry. If the ordinary plough forms a pan, a subsoil plough is used occasionally to secure good drainage.

TREATMENT OF SUCKERS.

Reason for Pruning.—Pruning away such suckers as are not intended to yield fruit is a most necessary and important operation. It should be done when the sucker is not more than one or two feet high. The larger the sucker grows, the more food-material it abstracts from the parent bulb, and the more its young roots interfere with the root system of the plant—in both ways injuring the future bunch.

Method.—Care should be taken when cutting away the suckers to apply the cutlass so that it does not point towards the plant otherwise it is very easy to injure it. If the sucker is not cut away quite down to the white, hard part, it will soon spring again, and therefore time and labour are saved by doing it thoroughly at first.

Choosing and timing.—Suckers shoot from the newly-planted bulb from eyes all round, and sometimes from the centre. Some planters cut away the central sucker; others leave it, as it gives a fair bunch if the bulb is vigorous. On the south side, in irrigated land, two or three suckers may be left at equal distances round the bulb. It is well to take those that start from eyes placed low down, so that the roots have a good hold on the ground. One sucker takes the lead, as a rule, and becomes the plant, fruiting in ten or twelve months; another comes in as a second sucker, giving a finer bunch four or five months later. Occasionally all the suckers will bear at the same time, when the bunches will not be so fine. It is the practice with some planters, on the north side after planting in March and April for fruit in February or March to prune off all suckers till June, then to leave one just coming out of the ground which will fruit in the following April; in October another is left on the opposite side of the stem, and in February another which will fruit in fifteen or sixteen months. On the south side two suckers would be left instead of one in June, October and February.

Plants vary according to soil, situation, tillage, etc., in the time they take to produce fruit, but the usual time is ten months to shoot, and two and one-half to four months more to ripen. Ratoons usually bear in fifteen or sixteen months. Judging from experience of his own estate, the planter can by careful pruning so regulate his banana walk when once established that the great proportion of the crop shall come in during the months of high prices, from March to June.

PRUNING LEAVES.

As the first leaves decay, they hang down all round, protecting the stem from the full glare of the sun. If they are cut away, the sheafing leaf-stalks on the outside of the stem dry up, and do not perform their proper function. It is well to leave them even in the shade of a banana walk unless it happens that the plants are clustered closely together, when too much shade causes the stem to lengthen out and

become weak and brittle. In such a case some of the dead hanging leaves may be pruned away and some even of the living green leaves. In pruning the green leaves a semi-circular instrument is used mounted on a long handle; the convex edge is uppermost, and with this the leaf-stalk is partly cut through, when it falls over and hangs like one which has died naturally. Sometimes a leaf is seen to be growing through a bunch, and as it would, if left, cause some deformity or discolouration of the fruit, it is carefully removed from its position with the pruning tool. The hanging dead leaves should not be allowed to trail on the ground, as they encourage the production of roots coming to the surface.

HARVESTING.

When the bunch is to be cut, the stem is partly cut through five or six feet from the ground, and the bunch with the whole top of the plant topples slowly over. Care is taken that it does not fall against and injure any other plant.

The usual custom is to cut fruit by the hundred stems, each cutter by himself, without help, cutting the fruit with a cutlass, and catching it. This is, perhaps, a doubtful practice, as owing to want of method, cutters running through the walks miss or roughly cut much of the fruit. A better plan is to employ a cutter and a helper who work together. The cutters with their helpers, twelve or fourteen in number, work in line, each cutter having three rows assigned him, or, in close planting, only two rows.

On some estates particular care is taken in harvesting; one man with his pruning tool cuts and manipulates the fall of the head, while another catches the bunch and when the stalk is cut, hands it to one of the women who are employed to carry it to a particular spot. This is necessary when we remember that a bunch weighs from 80 to 100 lbs. Here a book-keeper enters it in his book under its proper denomination as a bunch or of 8, 7 or 6 hands, or he rejects it if necessary, as not full enough or too full. Several book-keepers on a large estate will thus be entering up the bunches, while the owner or the manager, riding from one to the other, controls the number cut for delivery that night or in the early morning at the wharf. The bunches are wrapped in trash and handed up by two men to another in a waggon, who packs them in carefully so that there shall be no bruising. It is singularly picturesque to ride through the shady rows of bananas, with here and there, all round, majestic heads falling, and figures moving swiftly at their work,—to note the quick movements of the men with keen upward glances, the stately walk of the women with a bunch balanced on their heads, all accompanied by the noise of the large leaves in their descent, the cries of the men, and the peculiar call for the women when they are wanted.

When the bunch is cut off, the head is completely severed from the the stem 2 or 3 feet above where it was partly cut in order that the bunch might fall. Thus an elbow remains on the stem, and the whole is left to decay while the top part of the stem and the leaves as well are cut up into small pieces with a cutlass. When both are fresh cut, a man can easily chop 100 stems a day. The chopped up stems are spread over the land which can then be ploughed without obstruction, while they help to manure it.

I have no doubt that if the head were not severed, but could be conveniently left to decay, a large proportion of the food-material elaborated and actually present in the leaves would pass from them down into the bulb, just as, in deciduous trees, the leaves send all that is of value into the stem before they fall off. This would be a decided advantage to the plant as there would be no loss of energy in working up again the mass which had been left to decay and to manure the ground, and the succeeding suckers would immediately benefit. But probably it would be very inconvenient to have the heads projecting into the passage ways.

I have been in correspondence about the value of the fibre of the cut stems. It seems that it could not compete with other fibre for rope-making, but it is possible that it may be of value as material for making paper.

REPLANTING.

It is considered advisable to re-plant a banana walk after an interval which varies from three to six years. A certain proportion is taken each year, so that every year some planting is going on. It is the custom with some to sow velvet beans and bonavist beans* in the field that is to be thrown up. These leguminous climbers soon cover up the old suckers and kill them, and after some time the whole may be ploughed up and replanted. Some are trying planting between the rows of first ratoons, as it is easier to regulate plants and first ratoons for the American market than later ratoons.

The question of re-planting must be decided from various considerations: the field may be getting out of shape from the various ways in which the suckers have sprung from the parent plant, making it difficult to cultivate; the soil may require rest or a more thorough ploughing than can be given while stems are growing; and the commercial question of paying better to plant for the American market.

DISEASE.

In Trinidad the banana stems are said to suffer from the attacks of a fungus (*Marasmius*). A year ago Dr. Morris pointed out stems in Jamaica which he considered were affected by the same disease, However, after careful watching ever since by many of the largest growers. it appears that the disease is not likely ever to do any damage, under the circumstances obtaining in ordinary cultivation.

A planter who has great experience writes as follows:—

'With regard to the disease on the banana plant pointed out by Dr. Morris, I am of opinion that it only makes its appearance upon young trees that are growing on very poor or water-logged land. I have seen it in my fields repeatedly, but it has no detrimental effect on healthy trees.

'The sucker that it makes its appearance on is generally a weak one, which in any case would not be kept to come to maturity.

'I do not know whether the disease is a fungus or bacteria, but it seems harmless, as I find it plentiful in my banana walks upon such suckers as have suffered injury, but it does not attack the strong healthy ones. It seems to me to be the seat from which decay will start in a weak sucker first. Personally, I have no fear of its doing material damage.'

* *Dolichos Lablab*, var. *albiflora* (Sem, Sim or Sembi of India).

Another who has planting control of more estates than anyone else in Jamaica, writes :—

'I am of the opinion that there is no real disease here. Unhealthy conditions can always be traced to soil, locality, or the cultivation they receive.'

COST OF CULTIVATION AND RECEIPTS.

In considering the cost of preparing land and of cultivation afterwards, certain expenditure, for instance that on buildings, roads, fences, tram-lines, may well be entered as charges to be spread over a certain number of years.

In the irrigated district of St. Catherine, a fair average amount that should be allowed for preparation of land and cultivation until the bananas begin to bear, is £15 an acre, and the annual expenditure afterwards would be £10 an acre

The yield ought to be at the rate of 225 to 230 bunches paid for per acre, and taking the contract price all the year round at £8 15s. 0d. per 100, the receipts would average £20 an acre.

Whether the same price is paid for bananas throughout the year, or whether it varies as it does for the American market, the total annual receipts for a number of years average double the amount of the expenditure.

In the banana districts of the northside, taking the average of the whole run of estates from Port Antonio westwards to Rio Bueno, the cost to bring an estate into bearing would be about £10, and the maintenance afterwards £7 10s. 0d. The yield may be put down at 175 to 180 payable bunches per acre.

I have been favoured by a banana planter with the following abstract of accounts for one year. It refers to an estate of 200 acres in an irrigated district on the southside. The details will be useful to those who are thinking of going in for the cultivation :

EXPENDITURE.

	£	s.	d.	£	s	d.
Cultivation.						
Preparing Lands ..	11	13	1½			
Lining ..	0	15	0			
Planting ..	1	12	6			
Trenching ..	5	4	1½			
Forking 240 acres ..	52	10	4½			
Stumping ..	0	4	6			
Weeding 775 acres ..	252	18	5			
Pruning ..	75	1	0			
Propping ..	1	11	3			
Suckers : carting, supplying, etc.	26	17	8			
Manure ..	1	11	10½	429	19	10
Irrigation.						
Cleaning trenches ..	11	18	1½			
New trenches ..	3	16	3			
Irrigating ..	124	19	9			
Water rates ..	176	2	2	316	16	3½

Removing Crop.							
Cutting and carrying	..	205	8	7½			
Carting	..	123	3	11½			
Carriage by railway	..	206	10	1			
Wharfage	..	178	3	10½	713	6	6½
Supervision	..		..		203	12	6
Rents, Taxes and Insurance	..		..		260	9	8
Miscellaneous							
Fences, Carts, Posts, etc.	..	7	4	4½			
Roads	..	4	17	9			
Buildings	..	9	11	6			
Supplies	..	16	8	7			
Tax on Coolies	..	19	3	0			
Headmen, watchmen, messengers		44	16	9			
Sundries	..	12	7	7	114	9	6½
					2,038	14	4½

BANANA ACCOUNT.

Bunches	Eights	Sevens	Sixes	Total cut	Payables.
24,356	16,016	12,778	4,468	57,612	43,827

Average of payables out of total cut—76 per cent.

RECEIPTS.

			£	s.	d.
Bananas	..	..	3,589	13	5
Suckers	..	..	35	15	5
Miscellaneous	..	..	10	1	10½
Total			£3,635	10	8½

ON ANOTHER ESTATE.

The following selected details from a non-irrigated district on the northside will be useful by way of comparison. The soil is loose and gravelly without clay, rain 150 inches. Thirty-one acres were planted to produce a crop the following year. There were besides 135 acres yielding fruit, of which fifty acres were plants, and eighty-five ratoons:—

			£	s.	d.
Cleaning and preparing land		..	10	15	10½
Stumping	..	..	13	9	10½
Ploughing	..	..	43	19	1½
Trenching	..	..	16	7	7½
Procuring plants and forking		..	33	18	4½
Planting	..	..	9	6	4½
Weeding 470 acres	..	..	148	3	4
Ploughing and harrowing 580 acres		..	121	13	4½
Pruning	..	..	28	6	4
Propping	..	..	5	16	10½
Reaping	..	..	78	17	10
Carting	..	..	12	5	3

The total expenditure was £1,250.

The payable bunches amounted to 40,916, or 303 to the acre.

The receipts were £458 from miscellaneous sources,—coco-nuts, cattle, cocoa, and £2,210 15s. 3d. from bananas.

I will now give an example of the receipts and expenditure on a portion of woodland of fifty acres of a pen which has been utilized for cultivating bananas.

The operations were commenced in October, 1899, and the expenditure to date amounts to £1,312, which includes interest at 6 per cent., barracks of six rooms, purchase of suckers, and cutting down forest land.

The receipts month by month are given below :—

	£	s.	d.
1900.			
December	2	19	1
1901.			
January	7	17	11
February	31	19	9
March	154	4	11
April	526	2	7
May	425	15	6
June	367	5	0
July	185	12	6
August	97	0	3
September ...	84	9	11
October	128	18	11
November	75	0	0
December	68	0	0
Total	£2,155	6	4

A word of caution is necessary in considering the receipts. Every one who has had experience of growing bananas knows how a sudden 'blow' may level hundred of acres of stems, and this may happen just when the bunches are ready for the harvest, and a year's work and expenditure are lost beyond redemption. The planter should therefore insure himself in some way so as not to be left stranded without money to carry on cultivation for another year.

BANANA DISTRICTS,

Number of acres under cultivation in bananas in the various parishes of Jamaica during the year 1901 :—

St Andrew	465
St. Thomas	3,679
Portland	3,815
St. Mary	12,965
St. Ann	815
Trelawny	107
St. James	422
Hanover	370
Westmoreland	58
St. Elizabeth	32
Manchester	24
Clarendon	367
St. Catherine	6,163
	29,282

EXPORT.

During the last five years the exports of bananas have nearly doubled, as shown by the following table which gives number of bunches and value to end of March in each year :—

Years.	Quantities.	Values.		
	Bunches.	£	s.	d.
1901	8,248,485	618,636	7	6
1900	8,046,404	603,480	6	0
1899	7,497,281	468,580	1	3
1898	6,981,858	445,866	3	9
1897	4,838,645	302,415	6	3

The Direct Line of steamers from Jamaica to England commenced running at the beginning of the year 1901. The following table gives the exports for the last nine months to December 28, as compared with those of the same months the previous year :—

Countries to which Exported.	From April 1 to Dec 28, 1901.	From April 1 to Dec. 29, 1900.
United Kingdom ...	573,392	861
United States ...	8,146,493	6,496,300
Canada ...	1,505	3,393
Other countries ...	1,778	1,428
Total	8,723,168	6,501,982

PRICES.

In England the best prices are obtained in March, April, May, and, later in the year, in August, September and October. Bananas from the Canary Islands average 5s. to 10s. per bunch packed in crates ; those from Jamaica are sold as low as from 3s. 6d. to 5s. in order to encourage the sale. The rates paid by Messrs Elders, Fyffes and Co. in Jamaica are 1s. 9d. per bunch of at least 9 hands,—one of 8 hands being counted as three quarters of a bunch, and one of 7 hands as half a bunch.

The following were the wholesale prices in New York :—

1900.

August, $1.00, September 90c., October 90c, November $1.00, December 90c.

1901.

January 90c., February 90c., March 90c., April $1.25, May $1.20, June $1.25, July $1.25, August $1.30.

The prices given by the United Fruit Company per 100 bunches to those who contracted to supply a certain number all the year round are as follow :—

January £6, February £7 10s., March £10, April £12 10s., May £12 10s, June £11 10s., July £7 10s., August £5 10s., October £6 5s., November £6 5s, December £5 10.

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BULLETIN

OF THE

BOTANICAL DEPARTMENT, JAMAICA.

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.

Director of Public Gardens and Plantations.

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A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Kingston P.O.

KINGSTON, JAMAICA:

HOPE GARDENS.

1902.

JAMAICA.

BULLETIN

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Vol. IX. OCTOBER, 1902. Part 10.

ELEMENTARY NOTES ON JAMAICA PLANTS, V.

5, 6, 7.—Carludovica jamaicensis, Lodd.

Ippi-appa, or *Broom Thatch.*

By the Editor and W. Harris, F.L.S.

The leaves of the Ippi-appa plant (Plate 5) may be seen here and there in damp, shady places in the bush, rising four or five feet from the ground. At the first glance they look as if they belonged to one of the palms with fan-shaped leaves, but on examination it will be seen that the Ippi-appa leaves are divided into four parts by cuts running nearly down to the stalk, and the flowers are quite different Take the unopened leaf growing up from the centre of the plant that looks more like a dark green stick than a leaf, and examine how wonderfully it is folded,—quite differently from the rolled up young leaf of the banana. The stalk runs up a short distance at the back of the leaf, and a few inches above this, it will be found possible to insert the thumb nail, and split the green rod upwards into two equal parts. Using one's nail again, it will be found possible to open out the leaf which is folded exactly like a fan. Counting from the central cut there are 12 folds on each side, then we come to the other cuts which go even deeper down towards the stalk than the central one; and beyond these there are about 13 more folds. (Fig. 11 on plate 7 shows the 4 divisions of the unopened leaf, and they can also be seen in Plate 5).

The stalks are round and smooth 2 to 5 feet high. The blade of the leaf measures 1 to 3 feet in length, and 1½ to 4 feet across the middle.

Root-stock. It has a stout, fibrous rootstalk, with long, cord-like, fleshy roots after the manner of the banana plant, and like the banana too, it produces numerous suckers from the base and sides of the root-stock; these suckers grow and in time produce other suckers, and in this way the plant spreads and forms dense clumps or patches.

The plant is stemless, or, in the case of an old root, with a stem 6 to 9 inches high. The bases of old, decayed leaves are persistent, and these, through exposure to the weather, become frayed into tough, brown fibres which form an excellent protection for the dwarf stem and crown of the plant. Each crown, or stem supports about half a

dozen leaves in various stages of development. (See Fig. 1 of Plate 6 in which all the roots are cut off except two.)

The flowering part is not at all like that of palms, but comes much nearer that of the Aroid family which includes cocoes, five-finger, and Caladium. From the base of the plant arises the flowering portion enclosed at first in 3 or 4 spathes somewhat like a cob of corn. (See centre of Fig 1 of Plate 6). When the spathes are drawn back, we find a mass of thickish, yellow threads (Fig. 2 of Plate 6). For closer examination, we must cut off the flowering part, and then divide it lengthwise down the middle. There are well defined spots from each of which four of the long threads proceed. If one of these is picked out with the point of a pocket knife, and looked at with a magnifying glass (Figs 2 and 3 of Plate 7) it will be seen that there are four petals, and four stigmas like a cross in the centre of the pistil. Cut across the lower part of the pistil, and also vertically, and the ovules will be seen (Figs. 4 and 5 of Plate 7). There are no stamens, but the long threads are opposite to the petals. Now examine the spaces between these pistillate flowers, carefully digging out with the point of the knife, and it will be found that there are four staminate flowers together (Fig. 6 of plate 7)—each has numerous petals and numerous staments (Figs. 7, 8 of Plate 7). Fertilisation no doubt takes place by insects walking over the surface, and scattering the pollen on the stigmas. As the fruiting stage comes on, the stalk grows to a height of 2 feet or more, the threads die off, (Fig. 10 of Plate 7) then as the ripening takes place, the ripe portion peels off from the central core, is pecked at by birds, and the seeds which are embedded in orange-scarlet pulp are by their agency dispersed (Fig 1 of Plate 7).

The Ippi-appa plant is a species of Carludovica (*C. jamaicensis*, Lodd). There are 40 species of Carludovica, all natives of Central America, South America and the W. Indies.

The family—Cyclanthaceæ, to which Carludovica belongs, is only found in the New World. As has been said above, it is not a tribe of Palms, but is more nearly related to the Aroid family, the Bulrush family and the Screw Pine family, with all of which it agrees in having the flowers arranged on a spadix, differing in having the spadix surrounded by several spathes, and in the character of the leaf.

Carludovica palmata, which grows in the damp forests of Ecuador, Peru, and New Grenada, yields the straw from which are made the Panama hats, cigar cases, &c.

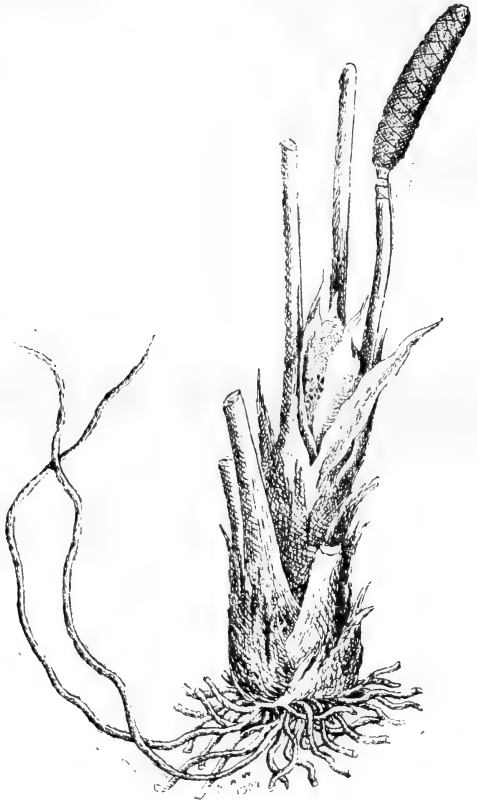
The Ippi-appa plant is plentiful in warm, humid districts in certain parishes e.g, the Castleton district in the Parish of St. Mary. It delights in sheltered valleys near river-courses or streams, and it produces much larger and finer leaves under shade than in the open.

It could be cultivated largely in its native districts, and in others, e.g., in parts of St. Catherine, along the banks of irrigating canals in the banana plantations. In such situations it would not interfere with the banana cultivation, and if the Ippi-appa hat industry develops, this would become a valuable minor product, as the supply of suitable straw is getting scarce in districts where hats are made.

There can be no doubt that the continual cutting of the young leaves weakens the plant, if it does not kill it outright, and weak plants do not yield good straw suitable for hat making.

Photo Process, Govt. Printg. Office.

Carludovica jamaicensis, Lodd.



H. A. Wood, del.

FIG. 1.

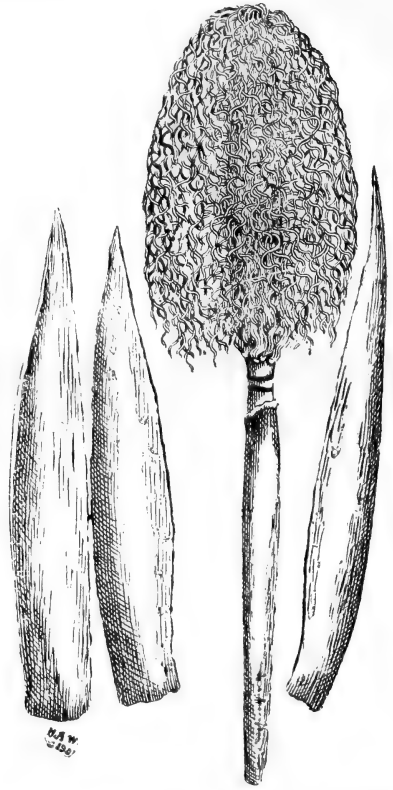


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FIG. 2.

JAM. IC., 7.

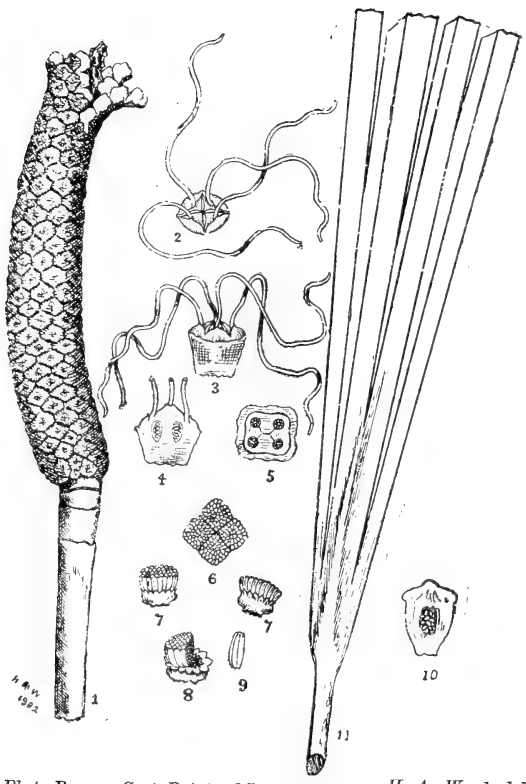


Photo Process, Govt. Printg. Office. *H. A. Wood, del.*

Straw prepared from leaves of vigorous plants growing in the shade is considered the best. Leaves from plants growing in open places, where they are fully exposed to the sun, yield a straw that is coarse in texture and assumes a reddish tint, and is, therefore, only suitable for coarse work

The leaves of this plant are also largely used for thatching houses. If good, ripe leaves are used, and the thatcher is an experienced hand, taking care to give the roof a thorough fumigation after thatching, the material will remain in good condition for a period of twenty to thirty years.

Preparation of Ippi-appa Straw for Hats, &c.

Young, unopened leaves are used for preparing the "straw". The leaves should be gathered when the leaf-stalks are from six inches to two feet in length. If the stalk has attained a length of more than two feet the straw obtained never becomes white but assumes a dirty yellowish tint.

Having selected the leaf, it is divided down the centre into halves, leaving a portion of the stalk attached to each half. From the two sides of each half or division, three or four of the green segments are removed. Then the nerves or "bones" of the segments must be removed, and at this stage the operator has to decide whether coarse or fine straw is required. If coarse straw is desired, then only a few of the leaf segments are torn away with the nerves, but if the operator wishes to secure fine straw, a broader section is removed. This is done by again slitting one of the original divisions at each side, guaging the width of the straw required, which will be obtained from the central part after removing the outside portions.

The selected straw is now placed in a pot of water which should be boiling, and it is kept boiling for about half an hour till the stalk to which the straw is attached becomes somewhat soft. If boiled too long the stalk will get so tender that the straw will drop off, and it cannot then be bleached and cured.

When taken out of the boiling water, the segments must all be carefully separated down to the stalk, the straw is then hung thinly on lines in the open air where it is exposed to the sun and dew for three days and nights. Slight rain does no harm, but rather assists in the bleaching process, heavy rain, however, may spoil the straw. On the whole it is considered safer to move it under cover during rain, as it might get soaked, and, in the absence of sun for any length of time, it would probably become mildewed, and consequently useless.

This bleaching and drying constitutes the curing process, but before the straw is used, it is damped to render it pliable for plaiting, just sufficient straw being moistened at a time to keep the plaiter supplied with material. To moisten it and cause it to be perfectly pliant, it requires to be dipped in water and put aside in a cool place about ten minutes before use, or it may be kept wrapped in a damp cloth.

One leaf of the Ippi-appa produces what is known as a "head" of straw, and about ten heads are required to make a hat for an adult. For an extra large hat as many as twelve heads are necessary.

The finest straw only is used for hats, and the coarse is worked up into hand-baskets and brooms.

Ippi-appa.

1. Ripe fruit, beginning to burst open.
2. Pistilate flower (seen from the top.)
3. The same,—side view.
4. Vertical section of pistillate flower.
5. Transverse section of same.
6. Group of staminate flowers as they are set between the pistillate.
7. Single staminate flower,—seen in two positions.
8. Staminate flower with some of the stamens removed.
9. Stamen.
10. Vertical section of ripe fruit.
11. Part of young leaf, showing the divisions,—length of leaf from where it joins the stalk to tip, 29 inches.

TOBACCO: CULTIVATION AND CURING. III.

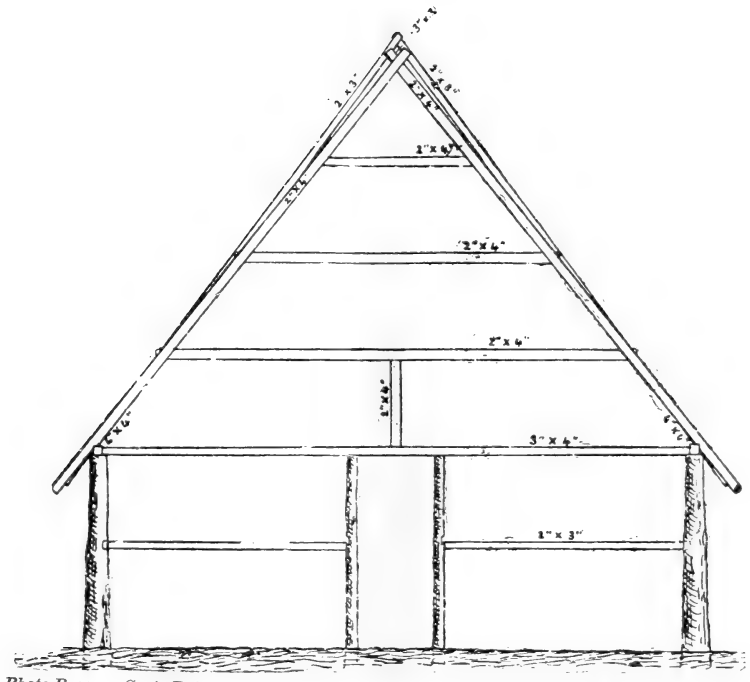
By T. J. Harris, Asst. Supt., Hope Gardens.

Whilst the planting operations are proceeding, some attention should be given to the curing house in the way of preparing it for the reception of the crop; if no curing house exists it will be necessary to build one, and if this is contemplated the following simple directions may be found useful.

A tobacco curing house should be constructed in such a way as will enable the operator to shut out very dry, and very damp air when either of the two extremes occur, as it is most essential when tobacco is drying that the atmosphere be at all times warm and dry but not of a parching dryness. The non-conducting thatched roof, and shutters constructed as in drawing No. 2, with the assistance of the door as a means of ventilation, will ensure this. Each "room" should be 14 ft. long, with a space of 3 ft. between to enable the workmen to move the bars of tobacco from one "barradera" to the other, and for ventilation. The posts should be so arranged that each room of tobacco is supported by four of the stoutest, the latter being about 3 ft. in the ground. These should be of good durable wood and not less than 8 inches in diameter at the top; the two smaller posts support the shutters and, to some extent, the roof. The posts that form the central passage (Fig. 1.) may be 3″ in. to 4″ in. diameter, perfectly straight and smooth.

A house of three rooms of the dimensions shown would be capable of drying a crop of two acres of tobacco.

Having decided how many rooms will be required, the first operation in the building is to line off, peg, and dig the holes for the posts; when this has been properly started the barraderas and frames should be made and stacked ready for putting in position. The posts are then set up, plumbed and lined, half filled in and rammed, then sawn level at the top to a line stretched from one end of the house to the other; they are then plumbed again and filled in and rammed firm. The next to go up is the 4″ x 4″ plate; this will have been constructed and lightly put together on the ground so that it can be put up in sections; the splices should always be at the top of a post, and a main one if possible. The next to be fixed up is the 3″ x 4″ barraderas (fig. 1.) join-



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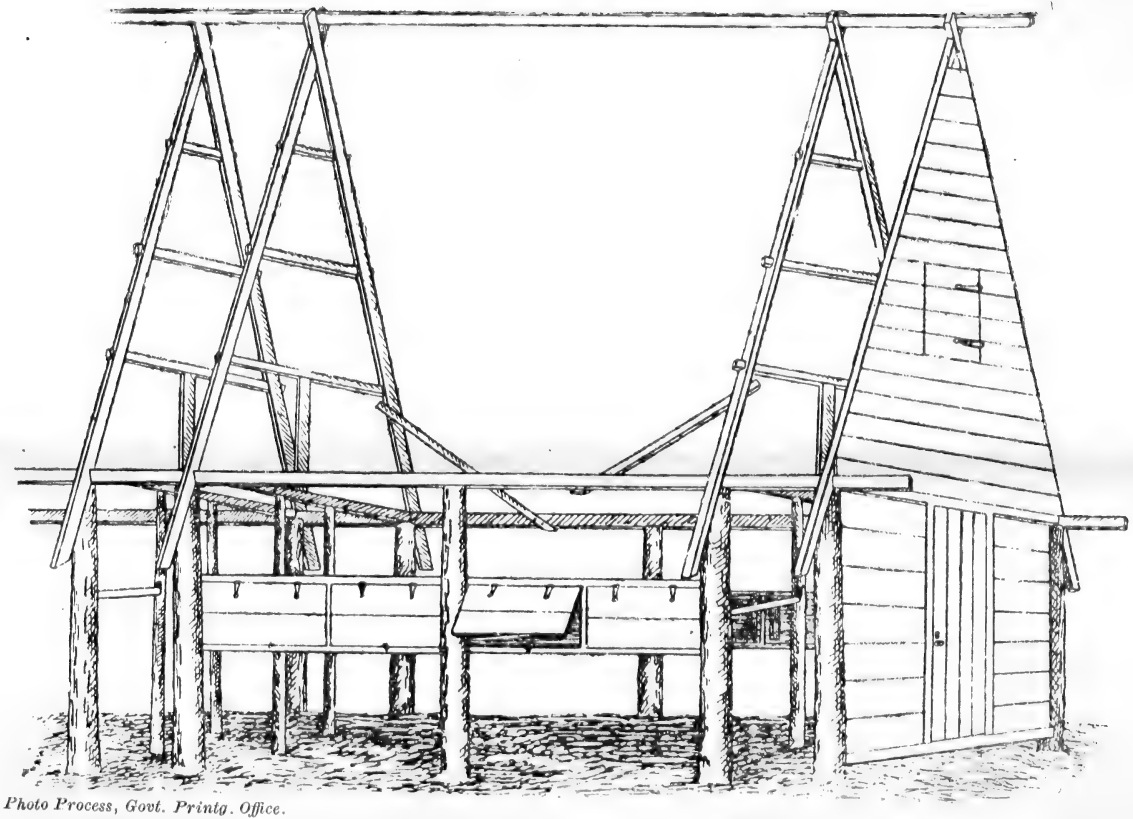
$\frac{1}{8}$ in. = 1 ft.

Sketch of Interior of House—showing Barraderas.



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Sketch of Tobacco Curing House—showing mode of construction.

ing the 4″ x 4″ plate at both sides of the house and the main posts; after these the barradera frames braced as shown in fig. 2, the 3″ x 3″ scantling at the top, then the ends and shutters; after these the roof rafters, the 2″ x 3″ movable barraderas (Fig. 1), and then the thatch; and lastly "wattl. and clay" the walls.

For two acres of tobacco about 350 bamboo bars, 15 ft. long and 3″ in diameter will be required on which to hang the green tobacco, and a good quantity of dried Ippi-appa thatch heart should be procured for tying the plants in pairs preparatory to hanging on the bars. If a careful watch be kept on the field it will be noticed that some few of the plants will begin to ripen, these may not be cut yet until a sufficient number has ripened to fill at least ten bars; then go through the whole field and cut out all that are quite ripe and those that have not quite finished ripening the top leaf

The best time to commence to cut is about 3 o'clock in the afternoon, and continue until dark. The leaves then contain very little moisture and are on that account less brittle and less liable to break, and they also dry much quicker than when cut in the morning This however may be done only when there is no danger of rain falling in the night, as the plants have to remain on the ground until the next morning; a light shower will not affect them and heavy rain only does so by splashing them with dirt.

The best method of cutting is to lay hold of the top of the stem with the left hand, bend the plant over a little, and cut it off at the level of the ground, taking care not to injure the young ratoons that are springing from below the surface. The cut plant may then be turned upside down and the base of the stem, as far as the first good leaf, cut off; (at the base of the ripe plant there are usually one or two small leaves that are over-ripe, spotted and blistered, and of very little value commercially) they are then laid on the ground in heaps of 3 or 4 plants in the interval next to that in which the workman is cutting, each man taking two rows, one on each side of him. Whilst it is much better if the plants are allowed to remain on the ground all the night it is more advisable to cut in the morning if the weather is at all unsettled; the only difference is that great care is necessary to prevent the plants getting scorched when lying on the ground to "quail;" they must remain in that position until the leaves have lost their brittleness and have become pliable, and as soon as they have reached that state they must be removed into the curing house, or some other shady place. If the plants are cut in the afternoon there is no danger of their getting scorched and they are as pliable as kid skin the following morning. There is an idea among the Cubans that the tobacco burns better if a heavy dew falls on the leaves after the plants are cut.

If the cutting is done in the afternoon, do not take the plants from the ground to the house until the dew has dried off them, and if it is decided to cut in the morning do not commence until the dew has disappeared.

To secure sufficient tobacco for the three days cold sweating a cutting right through the field should be made every five or six days rather than every day, cutting out, of course, only the ripe tobacco; should there be indications of continued rain storms, every effort should be made to cut in as much ripe and nearly ripe or "full" tobacco as pos-

sible; if rain happens to fall without due warning the ripe tobacco may be cut during the following day and a half, but if it is not cut out by that time it must be left, as the moisture has then got up into the plant and turned it green again or unripe; in this case the plants must remain in the field until they ripen again.

When the plants are carried to the house preparatory to tying and hanging they must be spread out as thinly as possible, say three or four plants deep; for if allowed to remain in heaps for more than half an hour they will ferment, get hot, and spoil. It is hardly necessary to point out that the greatest care should be exercised in the handling of the plants from first to last so as not to break the leaves.

When all the cut plants have been transferred to the tobacco house, the work of tying and hanging should be commenced and continued until the whole has been safely hung in pairs upon the bars; the tying material must be passed around the stem and under the leaf that is nearest the base and then drawn tight to prevent the plant slipping out of the tie. The pairs of plants must be placed at a distance of 4 to 6 inches from each other so that they just touch without pressure; a fourteen ft. bar will usually hold from 34 to 40 pairs of plants. As the bars are filled they are packed close together on the lowest barradera and are allowed to remain so for three days and nights or 72 hours; at the end of this time the bars are spread out to a distance of 1 ft. or 15 inches apart, giving the bars a shake to separate any leaves that may be sticking together, filling up the top barraderas first, 1 ft. apart when the atmosphere is very dry and 15 inches when moist. In rearranging the bars care should be taken to open out the plants at each end that are liable to slide towards the middle of the bar during removal, for if several pairs are allowed to remain packed together, fungus will make its appearance and cause what is known as "sweated" tobacco. This is easily recognised when it appears by the black spots that it makes on the still half-green leaves, though the really first indication of sweat is the swelling or thickening of the leaves, their cold wet feel, and the appearance of moisture on the surface; these spots increase in size until the whole of the leaf is covered, and once this fungus gets a start it will extend its operations into the tobacco that is not too closely packed and eventually go through the whole house. The fungus breaks down the tissues of the leaves and renders them absolutely useless as cigar tobacco, and the very best leaves can in this way be reduced to the status of "*fonque.*" The fungus will also make its appearance on partially dried tobacco if the weather suddenly changes to cold and wet after a fairly long dry spell; if the cold wet weather continues for more than a day it will be necessary to procure several old zinc buckets, knock some holes in them, make charcoal fires and keep moving them about from place to place under the tobacco; *but to ensure no smoke reaching the drying tobacco, the fires should be started at a distance away from the house, and not taken in until there is a nice glow on.*

If the fungus has been overlooked and has had a good start, it can be stopped by removing the affected bars to temporary barraderas erected outside the house on the side that gets the morning sun · three hours sharp sun, say from nine to twelve, will be quite sufficient to check it effectually. If bright sun be not forthcoming the charcoal fires must

be kept going until the atmosphere in the house is too warm and dry for the fungus to live. The tobacco that is put out to sun should be taken in on the least indication of rain or the lightest shower will spoil it; on the whole it is much the best to be on the safe side by burning charcoal fires inside the house whenever partially dried tobacco is subjected to a cold damp atmosphere. It must be borne in mind, however, that whilst, obviously, it is possible for the atmosphere in the house to be too cold and damp there is also the danger of going to the other extreme; whenever hot drying winds prevail all the shutters and doors should be closed to prevent the tobacco drying too quickly; and on the other hand they should be closed when warm, dry, calm weather changes to cold and wet.

The last part of the leaf to dry is the base of the midrib and when it is observed that this part of every leaf is dry and shrivelled the bars may be double packed, that is, the pairs of plants may be closed up so that each bar may carry the tobacco that was dried on two bars. The double packed bars can then be placed at a distance of six or eight inches apart in the room nearest the press, and allowed to remain there until taken down to ferment. This re-arrangement is best done when the leaves are not *crisp*, but soft and pliable; dry tobacco becomes *crisp* when the air is very dry and *mild* after a day's rain, and sometimes before rain; indeed the softening of the leaves is a reliable indication of an approaching storm.

The closing up of the dry tobacco is necessary for prolonging the final drying stages and rendering it less liable to be affected by atmospheric changes, and also provides more room and bars for the tobacco that is being brought in from the field as the plants ripen.

The Press: The word "press" conveys to the lay mind an instrument constructed with numerous screws for the purpose of exerting pressure upon any substance placed under it; in reality the tobacco press is nothing of the kind, but is merely a pile (Cuban pilon) of tobacco stacked together to ferment in the same way as a mixture of manure and leaves is prepared in England for making hot beds for cucumbers and melons, in fact, it may be said that anyone who has had experience in the work of the forcing department of an English garden could with safety undertake the curing of tobacco after seeing one crop cured by a Cuban; or, I may be allowed to hope, by following carefully the directions set forth in these notes. For the benefit, however, of the large majority who have not been fortunate enough to have had opportunities for observing the changes that occur during vegetable fermentation, it will be necessary to set down all the details concerning the actual curing of tobacco.

The press, then, is simply the pile of tobacco; the term however, is also applied by the Anglo-Cuban to the receptable in which the tobacco is stacked; and when he wishes to convey the information that he is about to ferment a "pilon" of tobacco he states that he is going to "put press;" to an outsider a most mysterious phrase. This receptacle may be made of ordinary deal boards (though cedar is the best) lined sides and floor with "jagua," the skin or "bark" stripped from the inner surface of the broad leaf-sheath or petiole base of the matured and fallen leaves of the Royal Palm (Oreodoxa regia); if a sufficient

quantity of this material is not obtainable a lining of dry banana leaves (thrash) some three inches thick, will answer almost as well.

A perpectly round press is undoubtedly the best, though a hexagonal or six sided one does almost as well and is much easier to construct; if the tobacco house has a wooden floor the sides of the press may be be built upon it; if an earth floor the wooden floor of the press must be raised about six inches from the ground It is most convenient to build the press in one of the rooms of the curing house in a part not exposed to the wind It is best under any circumstances to have sufficient banana trash in the bottom of the press to cover it to the depth of at least six inches when pressed down by the weight of the tobacco that is put upon it. The heat that is evolved by the fermentation has a tendency to rise towards the top and as a consequence the bottom is liable to become chilled if it is not snugly packed and almost air tight; whenever tobacco is being fermented, and it becomes chilled, fungus is sure to grow. The dimensions of the press should be nine ft. in diameter by five ft in depth; no pilon should be less than nine nor more than ten ft. in diameter if nicely fermented tobacco is required; about two hundred double packed bars will fill a press of this size.

The tobacco having come safely through the drying process and the press being ready, advantage should be taken of the first opportunity to "put press";—this occurs after a day's rain, when the leaves lose their crispness and become "mild" i.e. as soft and elastic as kid skin. The early morning is the best time to begin the work of transferring the tobacco from the bars to the press as everything must be finished before the atmosphere is hot and dry enough to make the leaves crisp again. On the night following the rainy day all the shutters and doors must be left open to allow the moist, dew-laden air to circulate among the plants, and before day-break in the morning all hands should be at work. In preparing the tobacco for the press the pairs of plants should be tied into bundles of about twenty (four bundles to a double packed bar) by passing a strand of thatch-leaf along the bar under the strings and tying them together not quite as tightly as it is possible to tie them; this will allow a loop to lay hold of when handling the bundle, and is also convenient in other ways. The bundles are then lifted off the bar and handed to a man armed with a mallet-like piece of wood with which he gently taps the ends of the stalks, whilst holding the bundle under the left arm, until they are quite even; after which he hands the bundle to the man who is in the press to stack the tobacco; the latter gives the bundle a good squeeze and lays it down in the press with the tips of the leaves pointing towards the centre and the stalks pressed tight against the wall. When he has filled up all round the inside of the wall of the press, he must commence the next layer about eighteen inches from the wall, and the next about two and a half or three feet from the wall according to the length of the plant; so that the whole of the bottom of the press may be covered. When this is done he is to commence at the wall again and continue in the same way as he began until the press is filled, kneeling on and drawing the bundles tightly together as they are put in. A halt, however, must be cried when the press is half full for the purpose of inserting the thermometer, or rather the bamboo that is to hold it; this latter should be about an inch in diameter

(inside) perfectly straight, and should have the partitions between the hollow joints cut out with the chisel, after making small window-like apertures on alternate sides at the nodes. The bamboo should be long enough to reach the centre of the press and should be placed thin end in, with the windows at the sides, for if the apertures are turned up and down the tobacco will press into them and interfere with the passage of the thermometer when it is taken out to observe the temperature. A hole about twelve inches long and two inches in width should be made in the wall of the press through which the bamboo is thrust; the twelve inches is to allow the bamboo to sink with the tobacco as the fermentation proceeds. When the press is full the tobacco is to be covered snugly with mats made of corn bags opened up and sown together; one thickness being sufficient in damp weather, two when the air is dry. Weights must now be put on to start the heat as quickly as possible; straight smooth logs about nine inches in diameter laid closely together all over the top of the pilon is the usual method of applying pressure.

The last thing to be done is to insert the thermometer into the bamboo that was placed in the centre of the pilon; the bulb of the instrument should be packed neatly in cotton-wool or some such nonconducting material to prevent the mercury running down before the temperature has been read The thermometer may be attached to a piece of wire just long enough to reach to the end of the bamboo, which is, of course, the centre of the pilon; care being taken to keep the outer end of the bamboo plugged tightly with dry moss or a piece of rag.

In dry weather, as soon as the thermometer reveals a temperature of 118° F., the logs of wood should be removed; if the atmosphere is damp they should be taken off when 108° F., is reached. The temperature rises much more rapidly during wet thundery weather, registering 120° in two days, whilst in dry weather from three to seven days are required to secure the same degree of heat. Whilst the tobacco is fermenting small boxes should be got ready for the purpose of moulding the bundles of leaves, when striped from the stalks, into "matulas;" they should be of cedar and constructed as follows:—

Cut three pieces 2 ft. long by 7 inches deep, two for the sides and one for the bottom; cut one piece 7 in. deep by 7 in. long at the top and 5 in. at the bottom for the one end; these are put together, and when finished the box is troughlike and open at one end, the bottom being 5 inches wide inside. Three ordinary fencing staples are hammered into each side at about 5 in. apart for holding the strings of the matula while the box is being filled with the fermented leaves as they are stripped. When the thermometer that is in the press shows a temperature of 128° F. stripping should be commenced. The shutters must be closed and all sources of draught plugged; banana or bag mats spread over the floor, low rough seats arranged around the room, with plenty of spare bag matting for covering the matulas when made; two thirds of the men should have a box each, and all a supply of "thatch-heart" strings.

When everything is in readiness the first few bundles are taken out and handed to the men without boxes who cut all the strings and pick the "fonque" leaves from each plant; the plant is then passed along to the man who is to pick "carpa," then on to the 'tripa" picker.

The carpa man uses three strings to his matula, the tripa matulas have two, whilst the fonque is known in future manipulations by its being tied in small round bundles about one third the size of a matula. As the leaves are stripped they should be laid in the box over the strings with the base (the end nearest the stem) against the closed end and the tips towards the open end. When the box is full they should be pressed firmly with the open hand and the strings tied; the matula is then turned out, stacked with the others in a warm corner and covered up with bag mats. The tobacco in the press must also be kept closely covered when not getting out bundles. The fonque leaves are those one or two near the base of the plant that were over-ripe and had become badly spotted and broken in the tying and hanging; it always follows that the better the cultivation and handling the smaller will be the proportion of fonque to the rest of the crop; this proportion must, however small, be kept out of the good tobacco The carpa are the perfect leaves and are known by their kid-like texture. The workman who picks carpa draws every leaf from end to end between thumb and fingers, taking off the soft and perfect leaves and leaving on those that have a dryish stiff feel which are the tripa leaves It may here be stated that another receptacle will be required of the same dimensions as the first for the accommodation of the matulas, another press in fact. The second press should be square as it is more convenient for the neat and close stacking of the square brick shaped matulas. The two presses Nos. 1 and 2 will be needed for a crop of three acres, and for each additional three acres a matula press must be provided, reserving No. 1 for the first fermentation. All the presses must be of the dimensions shown, as, to a large extent, *the quality of the tobacco depends on the quantity put together to ferment;* it may be too much or too little.

The stripping of the leaves and making up into matulas must be done as quickly as possible, for if the temperature of the the press rises to 130° F. before a quarter of the tobacco has been stripped the work is going too slowly, and there is danger of the remaining bulk getting too hot, causing what is known as *wet* tobacco; if nearly half the press has been stripped when the thermometer shows 130° the work is going right. It should be borne in mind that from the first the tobacco should be kept warm and bulked together tightly, never allowing it to remain spread out any longer than necessary. It is desirable, therefore, that stripping should be done quickly, and the leaves packed into the matula box before they lose their natural heat, and that the matulas are packed closely together into No 2 press and covered.

Occasionally a wet leaf will be discovered, and these must never be allowed to go into the matulas until after they have been laid out in the shade to dry; this is most important as the wet leaves unfailingly cause the growth of fungus, and this will spread through all the adjacent leaves and spoil the lot.

When the whole of the pilon has been picked it will be seen that the resulting matulas occupy about a third of the space that the bundles took up, and if then the matulas are spread over the bottom of press No. 2 there will not be sufficient depth to retain the existing heat, much less generate more; in other words fermentation will cease. It, therefore, becomes necessary to re-arrange the matulas and make

them up into a neat *cube* in the snuggest corner of the press. This may be done by the aid of boards kept in position by props from the sides of the press, remembering to put a layer of banana trash between the tobacco and the boards, *and to do the work quickly*. The fonque may be packed on the top or kept separate until it is sold, no more attention being given it in the way of curing. As soon as there is sufficient tobacco dry, another pilon should be fermented and the matulas packed firmly into the space between the wall and the cube of matulas in No. 2 press, taking away the boards and trash; the next lot that is fermented just about filling the press. A thermometer should be placed at the centre as in No. 1 press and should be read once a day; it will then be observed that heat is not generated as quickly as in press No. 1, requiring some two and a half or three weeks before the temperature arrives at 125° or 130° F. When the latter figure is reached the whole pilon must be taken out and repacked, turning the bulk upside down and inside out The room must be closed, mats spread over the floor, and the work done quickly. Four heaps should be made, one of the top matulas, one of the outside, one of the middle and one of the bottom; this ensures accuracy in repacking. The matulas are then stacked as closely as possible in the press again, remembering the thermometer, and carefully covered as before with the corn-bag mats. This time the temperature will rise even more slowly but will eventually reach 120° to 130° and go as gradually down again; if, however. wet weather prevails for some time the temperature will rise quickly, and, if the tobacco is not taken down and re-stacked, would probably go over the mark, i.e. 130°, and spoil; and if left long enough would catch fire. When the temperature of press No. 2 has risen and fallen as described, the tobacco must be allowed to remain undisturbed until the whole crop has been through the same processes, when the classing is commenced; beginning, in a large plantation, with press No. 2, No. 3 and so on. The "classing" of the crop is for the guidance of the manufacturer who buys it.

Classing: this operation is a very important one, and requires considerable practice before it can be done at profitable speed; it entails the handling and inspection of every leaf. Six classes are made, three of carpa and three of tripa;—*carpa larga, carpa mediana,* and *carpa courta; tripa larga, tripa mediana,* and tripa *courta;* meaning respectively long, medium and short wrappers, and ditto fillers.

As before mentioned, the tobacco is classed roughly when taken out of the first press and made up into matulas, square bundles some five or six inches thick; now, after the last slow fermentation the matulas are opened up and the leaves made up into "manitas;"–small neat bundles that can easily be encircled by the thumb and forefinger (about 40 leaves) at the place in which it is tied, i.e., about 1½ inches from the base end; this time exercising greater care in the selection of the leaves. It will then be found that owing to the rapidity with which the stripping had to be done after the first fermentation some tripa leaves had crept into the carpa matulas and carpa into the tripa matulas. It would appear that the first rough classing is unnecessary since the leaves have to be carefully gone through a second time; in practice, however, it is not so; if it were not that a carpa matula

contained mostly carpa or that a tripa matula could not be depended on to yield 90 o/o of tripa a large number of leaves would be exposed to the air unnecessarily, and this exposure means loss of aroma. The work of classing and making manitas must, therefore, be so arranged that the leaves are exposed as little as possible.

A broad table is erected in one of the rooms around which the workmen are seated; those on one side take each a tripa matula and those on the other take the carpa; the former when classing and making up, put out the carpa and the latter the tripa; these being gathered every few minutes by the man at the end of the table who makes them up. A few fonque leaves will also turn up and must be relegated to that despised pilon at the other end of the house. In making up the manitas all the leaves must be placed so that the bases are even and that the surface or face of each leaf is *turned in towards the centre;* they should be neatly rounded off and tied with a strip of thatch-heart. As they are finished they are quickly packed away closely in a small improvised pilon, carpa on one side and tripa on the other; and at the end of the day, carpa and tripa are weighed off separately and stacked neatly side by side in rows, with the heads of the second row of manitas covering about ¼ of the width of the first, in press *No. 1,* which is now empty, as the whole of the dry tobacco has been fermented.

If the matulas after having undergone the long slow fermentatiou have become somewhat dry on the press being opened for classing, they should be treated in the following manner :—

Without disturbing a leaf, the surface of the tobacco in the press should be lightly sprayed with a mixture made up of one ounce of essence of peppermint to one gallon of water, then covered with one thickness of corn-bag mat, and over this Guinea-grass (that has lain spread out in the shade for one day) packed closely to the depth of about three or four inches. Two days after, on the removal of the grass, the tobacco will be in excellent condition for handling and classing. The peppermint counteracts the smell of the grass, and if, as the tobacco is taken out and a fresh surface exposed, it is found to be dry, it will be necessary to allow the grass to remain, spraying lightly as before with the mixture at the end of each day until the whole is classed. Some cigar manufacturers who use native wrappers in preference to Sumatra, insist on the carpa leaves being classed in their various colours :—

claro	light yellow
colorado claro	brownish yellow
colorado	brown
colorado maduro	darker brown
maduro	dark

but as the use of the Sumatra wrapper is rapidly gaining ground the classing by colour will soon be unknown in Jamaica. The native wrapper being used as the "binder" (Cuban "capoti"), which is the layer of tobacco between the "filler" of the cigar and the wrapper.

ADDITIONS AND CONTRIBUTIONS TO THE DEPARTMENT.

Library (Serials).

Europe.

British Isles.

Annals of Botany, June. Vol. XVI. [Purchased.]
Botanical Magazine, July, Aug. [Purchased.]
Chemist and Druggist, May, 31, June, 14, 21, 28, July, 5, 12, 19, 26, Aug. 2, 9, 16, 23, 30. [Editor].
Colonial and Diplomatic and Consular Reports, April, May, June. [Col. Sec.]
Garden, June, 14, 21, 28, July, 5, 12, 19, 26, Aug. 2, 9, 16, 23, 30. [Purchased.]
Gardeners' Chronicle, June, 14, 21, 28, July, 5, 12, 19, Aug. 2, 16, 23, 30. [Purchased.]
International Sugar Journal, July, Aug. [Editor.]
Journal Board of Agri., England, June [Sec. Board or Agri.]
Journal of Botany, July, Aug. [Purchased.]
Nature, June, 12, 19, 26, July 3, 10, 17, 24, 31, Aug. 7, 14, 21, 28. [Purchased.]
Pharmaceutical Journal, June, 14, 21, 28. July 5, 12, 19, 26, Aug. 2, 9, 16, 23, 30.
R. Colonial Institute, Journal, July.

France.

Sucrerie indigène et coloniale, June, 10, 17, 24, July 1, 8, 15, 22, 29, Aug. 5, 12, 19, 26. [Editor.]

Germany.

Berichte über Land-un Forstwirtschaft in Deutsch. Ostafrika, Band 1, Heft. 1 & 2.
Notizblatt, Berlin, June. [Director.]
Tropenpflanzer, June, July, Aug. [Editor.]

Switzerland.

Bulletin, de l'Herbier Boissier, Vol. II. No. 7. [Conservateur.]

Belgium.

Société d'Etudes Coloniales. No. 6. June, No. 7. July, No. 8. Aug.

Asia.

India.

Planting Opinion, May, 17, 14, 31, June, 7, 14, 21, 28, July 5, 12, 19, 26, Aug. 2. [Editor.]
Proc. & Journal of Agri. & Horti. Soc. of India, Jan.-Mar. [Sec.]
The Planting Directory of South India, 1902.

Straits & Federated Malay States.

Agricultural Bulletin, Vol. I., No. 8. [Editor.]

Ceylon

Times of Ceylon. May, 22, 28, June, 5, 12, 19, 25, July, 3, 10, 17, 23, 31, Aug. 2.

Java.

Proefstation West Java No. 55.
Ditto East Java, No. 39.
Verslag over 1901, van het Proefstation voor Suikerriet in West Java "Kagok" te Pekalongan.

Australia.

N. S. Wales.

Agri. Gazette, May, June, July. [Dept. of Agri.] [Editor.]

Queensland.

Qneensland Sugar Journal, May, June, July. [Editor.]
Queensland Agri. Journal, May, June, July. [Sec. of Agri.]

Western Australia.
Journal of the Dept. of Agri., May, June, July. [Dept. of Agri.]

AFRICA.

Cape of Good Hope.
Agri. Journal, May, 8, 22, June, 5, 19, July. [Dept. of Agri.]

Natal.
Agri. Journal and Mining Record, May, 23, June, 6, 20, July 4, 18, Aug. 1. [Dept. of Agri.]

Central Africa.
C. African Times, April, 19, 26, May, 3, 10, 17, 24, 31. [Editor.]

Zanzibar.
Annual Report of the Agricultural Dept., 1901.

WEST INDIES.

Barbados.
Agri. Gazette, June, July, Aug. [Editor.]
Agricultural News, June, 21, July, 5, 19.
Hints on Onion Cultivation at Montserrat.
Plain Talk to Small Owners at Montserrat.
Report on the Botanic Station, Agri. School & Land Settlement Scheme, St. Vincent, 1901.
Report on the Experiment Station at Montserrat.
[Commr. Imp. Dept. of Agri.]

Jamaica.
Cornwall Herald. [Editor.]
Journal, Jamaica Agri. Society, June, July, Aug. [Sec.]

Trinidad.
Annual Report Botanical Dept. for 1902. [Supt.]
Proc. of Agri. Soc., April 8, June 10. [Sec.]

British Guiana.
Report on the Botanic Gardens and their work for the year 1901-2 [Actg Supt.]

BRITISH NORTH AMERICA.

Ontario.
Agri. Coll. Bulletin 121, Ripening of Cheese in Cold Storage compared with ripening in the ordinary Curing Room.
122, Spray Calendar, Directions for treatment of Insect Pests and Plant Diseases.
[Dept of Agri.]
Annual Reports of the Live Stock Assoc. of Ontario, 1901. [Sec.]

Ottawa.
Cereals and Root Crops. Evidence of Dr. William Saunders before the Select Standing Committee on Agriculture and Colonization, 1902.

Montreal.
Magill University Faculty of Medicine Annual Calendar, Seventy-first Session 1902-1903.
Pharmaceutical Journal, June, July, Aug. [Editor.]

UNITED STATES OF AMERICA.

Publications of the U. S. Dept. of Agri. [*Directors.*]

Experiment Stations.

Arizona. 41 (Irrigation at the Station Farm). 42 (The cool side of a house in Arizona).
Arkansas. 71 (Why Apple trees fail).
Maryland. 82 (Thinning Fruits) 83 (Investigation as to the cause of Pithiness in Celery).

Minnesota. (Ninth Annual Report, Fiscal Year July 1, 1900, to June 30, 1901).
New Hampshire. 87 (Thirteenth Annual Report) 91 (Killing Wood-chucks with Carbon Bisulphide).
Idaho. 32 (1 Steer Feeding. 2 Feeding Lambs. 3 Analysis of Stock Foods) 33 (Some Grasses and Clovers and how to grow them in Idaho).
Indiana. LaFayette. 91 (The Modern Silo) 92 (Fertilizer Tests on Tomatoes).
Iowa. 63 (Sheep Feeding Experiments) 64 (Notes on Strawberries).
Ohio. 127 (Miscellaneous Chemical Analyses of Feeds, Foods, Grains, Fruits, Insecticides, Fertilizing Materials, Limestones and Mineral Waters, 1892-1901) 128 (Twentieth Annual Report for 1900-1901) 129 (Field Experiments with Wheat: I. Comparison of varieties. II. Cultural Investigation) 130 (Spraying for Grape Rot. The Relation of Grape Spraying to Public Health) 131 (The prevention of Onion Smut) 132 (Sugar Beet Investigations in 1901) 133 (Potatoes: comparison of varities, Fertilizer Tests).
Vermont. 93 (Commercial Fertilizers) 94 (Vermont Grasses & Clovers) 95 (A poisonous Plant. The Common Horsetail—*Equisetum arvense*)
Wyoming. 50 (Native Vines in Wyoming Homes).
American Journal of Pharmacy, July, Aug. [Editor.]
Botanical Gazette, Chicago, June, July, Aug. [Editor.]
Contr. from the N. Y. Botanical Gardens, No. 26 (Chemical Studies of the Cocoanut, with some Notes on the changes during germination. By J. E. Kirkwood & Wm. J. Gies. [J. E. Kirkwood.]
Forestry & Irrigation, Vol. VIII. No. 6. June, July, Aug.
Plant World, May, June, Aug. [Editor].
Sunset, June. [Publishers.]
The Geastræ. By C. G. Lloyd. [Author].
Torrey Club Bulletin, June. [Editor.]
Trans. of the Mass. Hort. Society for 1901. Part I. [Secretary].

CENTRAL AMERICA.

Boletin del Instituto Fisico-Geografico de Costa Rica, Nos. 16, 17, 18. [Director.]

SOUTH AMERICA.

Boletim da Agricultura, Sao Paulo, Brazil, No. 4. [Sec. of Agri.]

POLYNESIA.

Planter's Monthly, Hawaii, June, July, Aug. [Editor.]

LIBRARY (Books.)

Colonial Office List for 1902. [Col. Sec.]
Engler (A) Drs Pflanzenreich. Regni vegetabilis conspectus. IV. 48. Marantaceæ. By K. Schumann. Leipzig. 1902. 8vo.
Do. do. IV. 131 Tropaeolaceæ. By Fr. Buchenau. Leipzig. 1902. 8vo.
Do. do. IV. 236. Myrsinaceæ. By Carl Mez. Leipzig 1902. 8vo. [Purchased].
Leonard (J. H.) A first Course of Practical Science. With a Preface by Dr. J. H. Gladstone. London. 1902. 8vo. [Purchased].
Ovenden (C. T.) The face of Nature. Popular Readings in Elementary Science. London. 1902. 8vo. [Purchased].
Ward (H. Marshall) Grasses. A Handbook for use in the Field and Laboratory. Cambridge. 1901. 8vo. [Purchased].
The Record of Technical and Secondary Education. Vol. XI. No. 46. London. New York. 1902. [Purchased.]

SEEDS.

From Messrs. Vilmorin-Andrieux & Co., France.

Amarantus bicolor: A. bicolor ruber; Antirrhinum majus var.: Balsam, double scarlet and double pure white mixed: Chrysanthemum coronarium,

double mixed : Coreopsis Drummondii, C. picta: Dahlia, single stripe l and mixed : Dianthus sinensis fl. pl. mixed : Godetia Whitneyi : Heliotrope, mixed : Mignonette, sweet scented, large flowered : Nasturtium hybrid mixed : Phlox Drummondii, mixed : Verbena, compact dark violet hybrid white and hybrid scarlet.

From Director, Botanic Gardens, Sydney.
Acacia decurrens : A. pycnantha.

From Messrs. Gillespie Bros. & Co., London.
Sample Fine Java Liberian Coffee : Sample Fine Johore Liberian Coffee.

From Supt. Royal Botanic Gardens, Trinidad.
Luffa ægyptiaca (large fruited variety).

From Hon. J. W. Mitchell, St Jago, Four Paths.
Eucalyptus rostrata.

From Instituto Fiaico-Geografico de Costa Rica.
Cedrela fissilis : Fuchsia corymbiflora.

From the Corporation of the City of Capetown Public Gardens.
Aberia Caffra (Kei apple) : Agapanthus umbellatus : Erica baccans ; Grumilea cymosa : Leucadendron argenteum : Podalyria argentea : Schotia brachypetala : Strelitzia reginæ : Virgilia capensis : Euphorbia caput-medusa : Freezia refracta alba : Sparaxis purpurea grandiflora.

From Hon. Oscar Marescaux, Cherry Garden.
Bombay Mango.

From Director, Botanic Gardens, Melbourne.
Acacia Baileyana : A. elata : A. lunata : Cryptocarya glaucescens Elaeocarpus cyaneus : Eucalyptus botryoides : E. megacarpa : E. occidentalis : Hymenanthera dentata : Hymenosporum flavum : Melaleuca styphelioides : Nephelium leiocarpum : Oxylobium callistachys : Syncarpia laurifolia : Tristania conferta.

From Director, Botanical Gardens, Buenos Aires.
Alstrœmeria peregrina : Argyreia megapotamica : Cestrum pseudoquina ; C. Parqui : Cocos australis : C. Yatay : Copernicia cerifera : Cyclanthera edulis : Cypella Herberti ; Eugenia edulis : Herbertia latensis ; Ilex Paraguayensis : Mimosa sensitiva arborea : Passiflora cœrulea : Pilocarpus pennatifolius : Pithecotenium clematideum : Podocarpas andina : P. angustifolia : Quillaia saponaria : Sisyrinchium grandiflorum : S. leucanthum : Spathicarpa hastata : Trithrinax campestris : Vasconcellia lanceolata ; Xanthosoma sagittifolium.

From Director, Royal Gardens, Kew.
Statice macrocarpa : S. macrophylla : S. brassicæfolia : S. imbricata : Statice sp. (without label) : Coffee.

PLANTS.

From Messrs. Reasoner Bros., Oneco, Florida.
Magnolia grandiflora

HERBARIUM.

From Dr. Grabham, Kingston.
A collection of specimens, and 3 pieces of Satin Wood.

[Issued Oct. 23rd, 1902.]

Vol. IX. NOVEMBER, 1902. Part 11.

BULLETIN

OF THE

BOTANICAL DEPARTMENT, JAMAICA

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.

Director of Public Gardens and Plantations.

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PRICE—Threepence.

A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Kingston P.O.

KINGSTON, JAMAICA:
HOPE GARDENS.

1902.

JAMAICA.

BULLETIN

OF THE

BOTANICAL DEPARTMENT.

Vol. IX. NOVEMBER, 1902. Part 11.

THE CULTIVATION OF PINEAPPLES.

An Address delivered before Teachers of Elementary Schools at The Mico Institution, Kingston.

By Chas. Eugene Smith.

Soil.

The pineapple is a decidedly exacting member of the vegetable kingdom, insisting upon having its wishes and needs respected and provided for, making no allowance whatever for our good intentions, and well illustrating what Miss Greenwood calls "the cussedness of inanimate objects." The soil is of first and most vital importance The pineapple will grow upon soil too poor for other products, but this soil must be light, loose and thoroughly drained. I quote a partial analysis of a typical pineapple soil in South Florida:—

Insoluble Residue	..	97.5085 o/o
Humus ..	.	.24
Nitrogen ..	..	.0378
Total Phosphoric Acid	..	.0336
Total Potash ..	..	.0086
Total Lime ..	..	.2100

What portion of the phosphoric acid and potash given above is available is not stated.

In comparison I also give the analysis of the soils at Barbican and Billy Dun, St. Andrew, as recently furnished by the Island Chemist:—

Barbican.

Insoluble Residue	..	77.40 o/o
Humus ..	..	1.765
Nitrogen ..	..	.1190
Total Phosphoric Acid	..	.0973
Available Phosphoric Acid	..	.0402
Total Potash ..	..	.9887
Available Potash	..	.0134
Total Lime ..	..	.7672

BILLY DUN.

Insoluble Residue	..	80.71 o/o
Humus ..	..	1.32
Nitrogen ..	..	.0770
Total Phosphoric Acid	..	.0973
Available Phosphoric Acid	..	.0411
Total Potash ..	..	.0274
Available Potash	..	.0084
Total Lime ..	..	.6606

The soils of Florida are so barren that the cane or banana planter of Jamaica would pass them by in contempt, yet these soils are made productive and profitable by intelligent use of green manures and commercial fertilizers, as well as by scientific and up-to-date methods of cultivation. Barren as they are, they give in mechanical condition just what the pineapple desires. Stiff, hard, lumpy soils are absolutely unsuitable. If you will strip the lower leaves from a pine sucker you will note that the rootlets are already pressed close to the but. Now, if when planted these rootlets encounter soil, or lumps of soil difficult to penetrate, they continue this winding instead of spreading freely through the earth, resulting in what is known as " tangle root" and the consequent death or stunting of the plant.

I have heard the argument used that whereas the pinguin is allied to the pineapple, therefore any soil upon which the pinguin thrives is suitable for pineapple growing. This is very superficial logic however for it is also true that the Tillandsias and Bromelias are related to the pine, yet I do not think that anyone has advocated setting pineapple plants in the branches of the forest trees. Choose the lightest, sandiest soil you can find. Fertility is of secondary importance.

PREPARATION OF THE LAND.

Very few soils exist in Jamaica naturally light enough to give the ideal conditions desirable for the pineapple. We must therefore prepare the land we have selected with the utmost care, being thankful that this increased expense is fully offset by the greater fertility we enjoy here. The land must be thoroughly cleared of all trees and roots and the soil well worked with plough or fork until it is as fine as the seed bed of the market gardener. Drainage is of as great importance as the soil itself, no plant being more intolerant of excessive moisture. In St. Thomas-ye-Vale I find it necessary to run ditches as close as twenty feet apart. In St. Andrew forty feet apart will answer—the ditches being two feet wide and eighteen inches deep. The land between the ditches is divided into beds 10 to 12 feet wide with a four feet path separating the beds. The land should be carefully marked out for planting and it is well to continually bear in mind the fact that we are to engage in *intensive* cultivation.

PROPAGATION.

The pineapple is propagated by *suckers, ratoons, slips, crowns,* and *seeds.* The word " sucker" is used so indiscriminately in Jamaica, often referring indeed to young orange seedlings, tomato plants, &c., that I may be pardoned for defining these terms :—

The true suckers are the offshoots growing out from among the leaves of the parent plant. They are the best, and in a properly managed plantation, the only offshoots available for propagation.

Ratoons are also suckers but are designated as ratoons when thrown out from underground. After the fruit is cut the ratoon is the offshoot allowed to remain to bear the following year as it is more firmly attached to the stock than the higher suckers and has in addition roots of its own. When two ratoons are thrown out one should be removed and planted.

Slips are the offshoots found at the base of the fruit in most varieties. Save that they are slower of growth, they answer as well as suckers for propagating, but, as I have remarked, in a properly managed plantation they are not available, as they should be broken off as soon as formed, so that all the strength of the plant may go into the fruit. The smooth Cayenne has no slips, only suckers, and this is one of several reasons which accounts for the high price for this variety.

The crown is the tuft of leaves on top of the fruit. Crowns will make plants, but are of slow growth, and, save when a fruit has been spoilt by rats or sunburn, they are naturally not available for planting, the crown being an attractive feature to the purchaser.

Seeds are rarely found. I notice they are more common in Jamaica pines than in those from Florida. They are only used after hybridizing for the purpose of producing new varieties.

Planting

The land being properly prepared and the suckers secured—by the way, they should be 12 or 18 inches long and selected from healthy plants which have borne or are bearing fruit—we are ready for planting. Opinions differ as to the best distance. there being arguments in favour of both wide and close setting. Four years ago I commenced planting at the usual Florida distance, 22x22 inches then 24x24 24x30 3x3ft., and even 3x4ft. I have gradually been working back to shorter distances, and have just set 2,400 at 18x24 inches. I believe 2x2ft. may be considered safe, though much depends upon the location and variety. In St. Thomas-ye-Vale where the sky is clouded a great part of the time and there is a heavy rainfall, wide planting seems desirable, but in St Andrew I prefer close planting, so that the ground may become quickly shaded to prevent scalding of the roots. Care should be taken to have the plants set in true lines each way. Many methods of accomplishing this will suggest themselves. My own way is to run a base line the width of the field at right angles to the beds; I then stretch a line along each side of the bed to be planted, staking off these lines at the distance I wish to set the suckers in the long rows. I use a strip of 1x3 board with notches showing where each plant should be set across the bed, and move this strip from stake to stake, planting the suckers with a small hand trowel.

The handle of the trowel may be used for pressing the earth firmly about the base of the plant. The only preperation of the sucker is to strip off the lower leaves, and cut the broken end clean that it may callous readily.

Cultivation.

The cultivation consists in keeping the plants clean all the time. Remember that the pineapple is an aristocrat which will sulk if required to share its surroundings with more plebeian plants. In Florida, where the soil is practically barren of plant food, artificial manuring is necessary, and in the covered pineries about Orlando as much as 3 tons of highly concentrated fertilizers per acre are used. Again, the pineapple shows its patrician tastes in that it is decidedly capricious as to its food. Such organic manures as cotton seed meal and castor pommace invariably give poor carrying fruit, though dried blood does not seem to be objectionable as a test of 193 plots treated with different fertilizing ingredients and combinations of ingredients carried on by the Florida Agricultural Experiment Station resulted in favour of Blood, Bone and Potash. It is also strange that though superphosphates made of bone treated with sulphuric acid are not injurious, yet when the base is of rock phosphate (marine bone deposits) this is generally regarded as poisonous to the pine. I may remark, however, that I have never received any return from the money I have expended for phosphoric acid for this fruit. Up to the present time, Jamaica soils do not seem to require artificial fertilizers while in some cases their use seems to have resulted in actual disaster. It stands to reason, however, that our soils cannot yield 10 to 20 tons of fruit year after year without this drain needing to be made good in time, and I am much interested in a series of experiments now being conducted by the Island Chemist, which may also show some effect in the carrying qualities of our fruit.

Gathering and Packing.

What a sense of satisfaction the grower feels as, after months of anxiety and labour, his fruit approaches maturity and he begins to think that his woefully one sided ledger account may begin to show a better balanced appearance! Yet beware the experience of the glass vendor in "Arabian Nights" whose day dreams had made him Grand Vizier about to marry the Princess when a slip of the foot brought his bright visions and his fragile wares in ruin to the pavement! "Eternal vigilance" is the price of satisfactory pineapple sales, and all your hopes may be dashed even now by careless or improper methods. The woeful inefficiency, indifference and lack of loyalty on the part of the Jamaica labourer makes the unceasing personal attention of the employer absolutely necessary while the fruit is being gathered and packed for shipment. It is impossible for me to explain, save in the field just when a pine is fit for picking. It varies, indeed, with the season of the year and the distance it is expected to carry. One point is vital—the fruit *must* have attained its full size. A pine not properly matured will decay before it ripens, or if it ripens it will be a poor apology in flavour for this luscious fruit. An inch or more of the stem should be left attached to the fruit by which it is hung up to dry for 24 hours or more when it is ready for packing. A number of styles of pineapple crates are used, the important thing being that they should give good ventilation. Until recently I have used the "Orlando Pineapple Crate" 12 x 20 x 22 inches, holding two layers of 8 to 14

Smooth Cayenne or 16 to 20 Ripleys. Later experience however has assured me that a single-layer crate is more desirable, as the fruit seems to carry better. The buyer also prefers it, as it enables him to inspect all the fruit at a glance.

Pines should always be wrapped in something to protect them from bruising. Some use common Manila paper, but this hardly gives the desired protection. I use "Excelsior" made of fine wood shavings. Clean dry hay or straw will answer. Banana trash well dried is also used. In the Azores, corn husks stripped fine with a rasp like a large curry comb is the common packing material. Pines should be packed firmly that they may not fall about, but should not be jammed into the box. In packing, the first pine is placed with the but towards the packer in the lower left hand corner of the box, the second against it the but at the upper side of the box, the crowns overlapping and so on the buts and crowns alternating. If the box contains two layers, the first pine of the second layer goes in the *upper* left hand corner the but coming over the crown of the fruit below it. The two layers will be just reversed, similar to the method of "breaking joints" as it is called in orange packing. Stencil the wood "Top" on both top and bottom sides of the crate that when opened the fruit may be seen in layers just as packed. As far as possible the crowns should be protected from bruising as they add greatly to the appearance and selling value. Exercise every care to make the package neat and attractive, for with fruit as with people—"first impressions go a long way."

Insects and Diseases.

While the pineapple requires, and repays constant attention and care, yet when compared with many other plants it cannot be said that it suffers severely from insects or diseases.

The only insects which seem to affect it are:—mealy bugs, red spider, and scale. The prædial thief of course comes under the head of reptiles. The red spider and scale are rarely serious. The mealy bug may become so if neglected and will cause serious stunting of the plant and fruit. Infesting as it does the white portion of the leaves about the body of the plant the use of sprays is practically unavailing. Much good is done by dipping the base of the sucker in a decoction of tobacco stems, 1 pound of tobacco to 2 gallons of water, before planting, but the only sure treatment is by fumigating with hydro-cyanic acid gas as recently described in a Bulletin issued by the Jamaica Botanical Department. "An ounce of prevention is worth a pound of cure."

The diseases or maladies of the pine are:—"blight," "sanding," "spike," and "tangle-root."

"Blight" is a very serious trouble generally ascribed to a fungus. An acquaintance who was visiting Jamaica last winter, and who is interested in scientific research in an amateur way, kindly devoted much time to a study of this disease, making careful microscopic studies and cultural tests which demonstrated very clearly that healthy leaves can be inoculated through the spores of diseased plants. In practice we have reason to believe that a diseased stock will prove a

centre of infection for surrounding plants. The best course to pursue is to dig up the plant and burn it immediately, saturating the soil where it stood with a strong solution of copperas. A plant if taken up and the but trimmed back to healthy tissues when the wilting is first discovered, may sometimes be saved, but on the whole I think it is wiser to be rid of it at once. Fortunately the disease does not spread rapidly and may easily be checked by the observant cultivator if taken in time.

"Sanding" is not so common in Jamaica as in Florida where the soil is lighter and easily blown into the heart of the plants Ants cause much trouble here, however, by carrying earth into the leaves, but this is an effect, not a cause, and is due to the presence of the mealy bugs which the ants try to protect, being fond of the sweetish secretion with which they cover the leaves.

I am but little acquainted with "Spike" but have regarded it as due to careless selection or non-selection of suckers rather than as a disease. Prof. Rolfs, the Biologist of the Florida Agricultural Experiment Station, seems to consider it as caused by improper or ill balanced fertilizing.

I have already referred to "Tangle-root." Authorities differ as to its nature but I think that in a majority of cases it is simply due to poor preparation of the land, the roots being unable to freely enter the earth and so winding about the but cause strangulation as the stock expands.

Varieties.

I presume that to a majority of people in northern countries a pineapple is a pineapple, just as to the average Jamaican a peach is a peach, yet the different varieties vary greatly in quality, appearance and merits. I think on the whole we should be thankful that propagators have not been too ambitious in rolling up a long list of names as has been the case with oranges. The Florida Horticultural Society tabulates a list of 73 different varieties of oranges and that without synonyms. Counting the synonyms which same enterprising nursery men in Florida insist upon considering distinct varieties, the list swells to something like 110. I am a rather old orange grower, but I doubt if I could identify more than 14 of these, and to do so should have to include 4 of the Citrus noblis class. Of course there are many others highly desirable but I think that the average practical orange grower will make his grove of but 7 or 8 standard kinds. The same authority (and none is higher) enumerates 18 varieties of pines as follows:—

1 Abbaka
2 Antigua, Black
3 Antigua, White
4 Black Jamaica
5 Black Prince
6 Blood
7 Crown Prince
8 Charlotte Rothschild
9 Egyptian Queen
10 Ripley Queen
11 Lord Carrington
12 Prince Albert
13 Porto Rico
14 Pernambuco
15 Red Spanish
16 Smooth Cayenne
17 Sugar Loaf
18 Enville

It is possible that some of the above may be the same under different names On the other hand there are some varieties not included for example theTrinidad of the English hot houses is not mentioned. Possibly the compilers considered it identical with the Porto Rico an error I think, though it may be a seedling or selection of that variety, nor does the list include a sub-variety of the Smooth Cayenne—the "Variegated Smooth Cayenne" bearing the same fruit but noticeable chiefly for its beautiful variegeted leaves, of green, white and red stripes. But one Ripley is mentioned, whereas in Jamaica we know that the Red and the Green Ripleys are very distinct. Still I mention in this connection the curious fact that a Green Ripley plant often throws out a red sucker or bears a fruit having a red crown and vice versa.

There are several varieties in the above list with which I am not acquainted. Probably some of these are known only in hot houses and have not been successful for open air cultivation. You are probably as familiar with the Jamaican sorts as I am, perhaps more so, as my cultivation consists mostly of Smooth Cayennes and Ripleys.

The Red Spanish I think is identical with our Bull-Head, though I know many will differ with me. Certain it is that I have often shipped Bull-Heads under the name of "Jamaica Pines" and my Agents in New York have reported "your Red Spanish have sold for &c., &c." The Black Jamaica is desirable because of its size. It is also a very fair shipper. The "Sam Clark" (which, of course, is not included in the list I have quoted, and which, I believe is not known outside of Jamaica), has always been an interesting native variety to me, as I believe it has considerable possibilities. It is of a good shape packing out nicely, and has a most showy and attractive crown. To a cultivated taste its flavour is inferior, and its acid distinctly "raw." If this can be modified by some generations of cultivation, the variety will prove an acquisition. The Sugar Loaf, as largely grown in Cuba as here, is so badly affected with "black heart" as to be of little value for shipping. While I believe there is a great field in the selection of our native pines, yet speaking from a purely commercial point of view, and considering the rapidity with which the planting of this fruit is being extended in other countries, I can but feel that the time must come in the near future when only the choicer varieties can find a market. The Porto Rico was at one time very popular for open air cultivation in Florida, especially along the East Coast, because of its large size. I had one in Bog Walk, in this Island, weighing 14¾ lbs. Its size, however, is its one and only merit. It is a shy bearer, requires double the room of other sorts, and in quality is no better than our Bull-Head or Black Jamaica. I do not think it is being planted largely now, better kinds having succeeded it.

The Abbaka somewhat resembles a very large red Ripley though more conical at the base. It is much above the average size of pines and is of delicious flavour—none finer for home use. In dry weather it ships very well (though this is equally true of nearly all sorts) but during the rains it is extremely uncertain. Probably no other pine is so productive of slips.

The Charlotte Rothschild is a well rounded pine of quality resembling the Smooth Cayenne, its green crown prettily fringed with fine reddish spines.

The Enville or Enville City is a medium size, excellent quality, and distinguished by having a mass of little crownlets instead of a single crown at the top. I have shipped so few of the Rothschild and Enville that I am unable to express an opinion as to their carrying qualities.

The Golden Queen is excellent in quality and for home use. A poor shipper however, and like the Sugar Loaf very subject to "Black Heart".

The Egyptian Queen was at one time the favourite "fancy" Pine in Florida. It was originally the Cleopatra, its present and better known name evidently the result of a rather shaky knowledge of Egyptian history. It no longer holds its high place in the esteem of planters which it once occupied. It is in every way inferior to our Ripley.

The Smooth Cayenne, everything considered, is to my mind the pine *par excellence*. Its large size, perfect form, excellent flavour and beautiful appearance make it the King of Pines. It originated, I believe, in the English Hot Houses, later was grown in the Azores under glass, but without heat, then carried to Florida where it is the most popular and most profitable variety grown under shelter, and is now being successfully cultivated in Jamaica I must say I have seen specimens here equal in every way to any I have ever seen elsewhere. It is specially valuable for the English markets where size and beauty of appearance count for even more than flavour.

I should be "carrying coals to Newcastle" to describe our famous Ripley before a Jamaican audience. Strange to say it was a failure in Florida—for what reason I do not know—and I hardly recognised it when I came here. In the quality which pleases the palate I considered it ranks above the Cayenne Surely nothing can be finer than our St. Andrew Ripley. It is also a good shipper I have sent it to all parts of England and had excellent reports as to its condition on arrival. I rank it with the Smooth Cayenne as the first among pines. Its one regrettable feature is its small crown. Its warmest admirers have to admit this one weak point. Could we but get the size, form and crown of the Cayenne, combined with the flavour of the Ripley, we should have the ideal, the perfect pine; and in this connection I must express the deep interest I feel in the experiments in crossing these two varietses now being carried on at Hope. Seeds have been obtained from this cross, and the young seedlings were thriving when I last saw them. I sincerely trust that the hopes and expectations of the gentlemen who have devoted so much time and labour to this work may be amply rewarded in the results.

ADDITIONS AND CONTRIBUTIONS TO THE DEPARTMENT.

LIBRARY (Serials).

EUROPE.

British Isles.

Annals of Botany, Sept. Vol. XVI. [Purchased.]
Botanical Magazine, Sept., Oct. [Purchased.]
British Museum Annual Returns, 1901. [Principal Librarian.]
Chemist and Druggist, Sept. 6, 13, 20, 27. Oct. 4, 11, 18, 25 [Editor.]
Colonial and Diplomatic and Consular Reports, July, Aug. [Col. Sec.]
Garden, Sept, 6, 13, 20, 27. Oct. 4, 11, 18, 25. [Purchased.]
Gardeners' Chronicle, Sept. 6, 13, 20, 27. Oct. 4, 11, 18, 25. [Purchased.]
International Sugar Journal, Sept., Oct. [Editor.]
Journal Board of Agri., England, Sept [Sec. Board of Agri.]
Journal of Botany, Sept., Oct. [Purchased.]
Nature, Sept. 4, 11, 18, 25. Oct. 2, 9, 16, 23. [Purchased.]
Our Western Empire, Sept., Oct. [Publishers.]
Pharmaceutical Journal, Sept. 6, 13, 20, 27. Oct. 4, 11, 18, 25.
Preliminary Report on the recent eruption of the Soufriere in St. Vincent, and of a visit to Mont Pelée in Martinique. By Tempest Anderson and John S. Flett. From the *Proc. of the Royal Society, Vol. 70.* [Presented by the R. Soc.]
Rothamsted Experiments. Plans and Summary Tables arranged for reference in the fields. [Committee.]

France.

Sucrerie indigène et coloniale, Sept. 2, 9, 16, 23. 30. Oct. 7. [Editor.]
Journal d'Agriculture Tropical, July, Aug., Sept. [Director.]

Germany.

Berichte über den botanischen Garten und das botanische Museum zu Berlin im Rechnungsjahr. 1901.
Die Pflanzungen und der Botanishe Garten in Victoria (Kamerun) 1900-01. [Director.]
Symbolae Antillanae seu Fundamenta Floræ Indiae Occidentalis. Vol. III. Fasc. II. [Purchased.]
Tropenpflanzer, Sept., Oct. [Editor.]

Switzerland.

Bulletin, de l'Herbier Boissier, Vol. II. Nos. 8, 9, 10. [Conservateur.]

Belgium.

Bulletin, Société d'Etudes Coloniales. Sept., Oct. [Editor.]

Italy.

Atti dell Instituto Botanico dell'Universita di Pavia II Series Vol. VII. By Prof. G. Briosi. [Editor.]
Chronological Tables for Tobacco in America, Europe, Africa, Asia and Oceania. [Dr. Prof. O. Comes.]

ASIA.

India.

Agricultural Ledger (Calcutta), Nos. 1, 2 and 3. [Lt. Gov. Bengal.]
Annual Administration Report of Govt. Bot. Gardens and Parks, Nilgiris, 1901-1902. [Sec.]
Report on Govt. Horti. Gardens, Lucknow, for year ending 31st Mar. 1902. [Sec].
Report on Govt. Bot. Gardens, Saharanpur & Mussoorie for the year ending 31st Mar. 1902. [Sec.]
Report on the Administration of the Govt. Cinchona. Dept. 1901-1902. [Revenue Dept., Madras.]
Proc. & Journal Agri. & Horti. Soc. of India, April-June, 1902. [Sec.]
Planting Opinion, Aug. 9, 16, 23, 30, Sept. 6, 13, 20, 27. [Editor.]

Straits & Federated Malay States.

Agricultural Bulletin, Vol. I., Nos. 9, 10 and 11. [Editor.]

Ceylon

Agricultural Magazine, Colombo, Sept.
Circulars and Agri. Journal, Vol. II, Nos. 1 and 2.
Circulars, R. Botanic Gardens, Series I, Nos. 17-25.
Times of Ceylon. Aug. 14, 22, 28, Sept. 3, 11, 18, 25, Oct. 25. [Editor.]

Java.

Proefstation East Java Nos. 40 and 41.
Ditto West Java, No. 56. } [Director.]

Japan.

Bulletin, Coll. of Agriculture, Vol. V, Nos. 1 and 2. [Director.]

AUSTRALIA.

N. S. Wales.

Agri. Gazette, July, Aug,, and Index to Vol. XII. [Dept. of Agri.]
Miscellaneous publications. By J. H. Maiden :—
Nos. 541, Useful Australian Plants: 550, some Australian Vegetable Fibres: 553, Records of the Sydney Botanic Gardens. Reprinted from *Agri. Gazette of N. S. Wales.* [Author.]
The Gums, Resins and other Vegetable exudations of Australia. Reprinted from *Journ. and Proc. R. Soc. of N. S. Wales.* [Author.]
1. On Eucalyptus pulverulenta, Sims; 2 E. Stuartiana, F. V. M.; 3 E. Gunnii, Hook. J. Reprinted from *Proc. Linnean Soc. of N. S. Wales, 1901. Part 4. Oct. 30th.* [Author.]
Note on *Eucalyptus linearis*, Demhardt (A supposed Tasmanian Species) *Read July 8, Issued July 23, 1902.* [Author.]
On *Eucalyptus Behriana*, F. V, M. From the Transactions of the Roy. Society of South Australia, 1903. *Read Nov. 5, 1901.* [Author.]

Queensland.

Annual Report, 2, Acclimatisation Soc. 1902. [Sec.]
Queensland Sugar Journal, Aug. [Editor.]

Melbourne.

Guide to the Botanic Gardens, Melbourne, with Route, Map, &c. [Director.]

Western Australia.

Journal, Dept., of Agri., Aug., Sept. [Dept. of Agri.]

Tasmania.

Tasmanian Timbers: their qualities and uses. Read before the R. Soc. of Tasmania by A. O. Green, Esq. by courtesy of the Hon. the Minister of Lands and Works, 12 Aug., 1902. [Author.]

AFRICA.

Cape of Good Hope.

Agri. Journal, Aug., Sept. [Dept. of Agri.]

Natal.

Agri. Journal and Mining Record, Aug. 15, 29, Sept. 12, 26 [Dept. of Agri.]
Natal Plants, Vol. 3. Part IV.
Report on Natal Botanic Gardens and Colonial Herbarium from July 1st 1900, to June 30th, 1902 } By J. Medley Wood, [Author.]
Report of Dept. of Agri. on Work done during the year 1901.

Central Africa.

C. African Times, June, 7, 14, 21, July, 5, 12, 19, 26, Aug., 2, 9, 16. [Editor.]

Mauritius.

Bulletins, Station, Agronomique, No. 5, La denaturation de l'alcool et son utilisation.
No. 6 Rapport Annuel, 1901.

Réunion.
Revue Agricole No. 8.

West Indies.

Barbados.
Agri. Gazette, Aug., Sept., Oct. [Editor.]
Agricultural News, Aug. 30, Sep. 13, 27, Oct. 11, 25
General treatment of Fungoid Pests. Pamphlet.
Series No. 17 West Indian Yams, No. 18.
West Indian Bulletin, Vol. III., No. 2.
Reports on Botanic Stations, 1901-2: Dominica, St. Kitts, Nevis, Tobago.
[Commr. Imp. Dept. of Agri.]
Report of the Agricultural Work for the season between 1899-1901, carried on under the direction of the Imp. Dept. of Agri. for the W. Indies. By Prof. J. P. d'Albuquerque and J. R. Bovell. [Authors.]

Jamaica.
Cornwall Herald. [Editor.]
Journal, Jamaica Agri. Society, Sept., Oct. [Sec.]
Jamaica Fruits in British Markets. By W. B. Gill. (Special publication of Jam. Agri. Soc.) [Sec.]
Eighteenth Annual Report, R. Jam. Soc. of Agri. & Commerce & Merchants Exchange, 1901-2.
The Presbyterian. [Editor.]
Weather Report for Aug.

Trinidad.
Bulletin Botanical Dept. July, Aug., Sept., Oct [Supt..]
Proc. of Agri. Soc., Aug. 12, Sept. 9. [Sec.]
The Ferns and Fern-Allies of the B. W. I. and Guiana. By G. S. Jenman. [J. H. Hart.]

Grenada.
Annual Report, Botanic Station, 1901. [Curator.]

Tobago
Report on Tobago Botanic Station, 1901-2. [Curator.]

Cuba
Census of Cuba, 1899. Taken under the direction of the War Dept. of the U.S.A. [Wm. Bulzing.]

Bermuda.
Report of the Board of Agri. for the year ending 31st Dec. 1901.

British North America.

Ontario.
Agri. Coll. Bulletin 123, Cold Storage of Fruit
Crop Bull. 80—August Crop Report.
Thirty-third Annual Report of the Fruit Growers' Assoc. of Ontario, 1901. [Sec.]

Ottawa.
Catalogue of Canadian Plants. Parts VII. Lichens and Hepaticæ. By John Macoun. [Geological Survey of Canada.]
Bulletin No. 40, Clover as a Fertilizer. By William Saunders and Frank T. Shutt. [Dept. of Agri.]
Insects, Fungous Diseases,—Treatments. Evidence of Dr. James Fletcher, Entomologist & Botanist before the Select Standing Committee on Agriculture and Colonization, 1902. [Author.]
Report of the Entomologist and Botanist.
Author's Edition from Annual Report on Experimental Farms for 1901. [Author.]

Montreal.
Pharmaceutical Journal, Sep. [Editor.]

United States of America.

Publications of the U. S. Dept. of Agri. [*Directors.*] *Scientific Bureaus & Divisions*

Bureau of Forestry: Bull. No. 32, A Working Plan for Forest Lands near Pine Bluff, Arkansas. By Fred. E. Olmsted. No. 33, The Western Hemlock. By Edw. T. Allen. No. 34, A History of the Lumber Industry in the State of New York. By Wm. F. Fox.

Bureau of Plant Industry: Bull. No. 12, Stock Ranges of Northwestern California: Notes on the Grasses and Forage Plants and Range conditions. By Joseph Burtt Davy. [Author.] No. 16, A Preliminary Study of the Germination of the Spores of Agaricus Campestris and other Basidiomycetous Fungi. By Margaret C. Ferguson. No. 25, The Seeds of Rescue Grass and Chess. By F. H. Hillman.

Bureau of Animal Industry: Bull. Nos. 29 and 31, American Breeds of Fowls. I The Plymouth Rock. II The Wyandotte. By T. F. McGrew. No. 34, American Breeds of Beef Cattle, with remarks on Pedigree. By Geo. M. Prommel. No. 37, Market Classes of Horses. By Geo. M. Rommel

Bureau of Soils: Bull. No. 20, Growing Sumatra Tobacco under shade in the Connecticut Valley. By Milton Whitney.

Division of Botany: Contrs. from the U. S. National Herbarium, Vol. V. No. 4 (With Index to Vol. VII) Vol VII, Nos. 1 and 3.

Experiment Station Record, Vol. XIV, No. 1.

Bulletins. 15, Handbook of Exp. Station Work. A Popular Digest of the Publications of the Agri. Exp. Station in the U. S. 33, The Cotton Plant: its history, botany, chemistry, culture, enemies, and uses. 86, The use of Water in Irrigation. Report of Investigations made in 1899 under the supervision of Elwood Mead, Expert in charge, and C. T. Johnston, Assistant. Including Reports by special Agents and Observers. 105, Irrigation in the U. S. Testimony of Elwood Mead, Irrigation Expert in charge, before the U.S. Industrial Commission, June 11 and 12, 1901.

Farmers' Bulletins:—46, Irrigation in Humid Climates. 116, Irrigation in Fruit Growing. 138, Irrigation in Field and Garden.

Irrigation Practice among Fruit Growers on the Pacific Coast. By E. J. Wickson.

A Study of Water Rights on the Los Angeles River, California. By Ed. M. Boggs.

Irrigation from the San Joaquin River. By Frank Soulé.

Problems of Water Storage on torrential Streams of Southern California as typified by Sweet water and San Jacino Rivers. By Jas. D. Scheyber.

Report of Irrigation Problems in the Salinas Valley. By Chas. D. Marx.

Water Appropriation from King's River. By C. E. Grunsky.

The Agricultural situation in California. By Elwood Mead.

Irrigation Investigations on Cache Creek. By J. M. Wilson.

Features and Water Rights of Yuba River, California. By Marsden Manson.

The Irrigation Problems of Honey Lake Basin, California. By Wm. E. Smythe. Reprinted from *U. S. Dept. of Agri. Office of Exp. Stations Bulletin, 100 Report of Irrigation Investigations in California.*

Report of Irrigation Investigations for 1900. Nos. 1, 2, 3 and 4. Reprints from *U. S. Dept. of Agri., Office of Exp. Stations Bulletin 104.*

Report No. 63. The work of the Agri. Exp. Stations on Tobacco. Abstracted by J. J. Schulte, with Introduction and Comments by Milton Whitney.

Report No. 65. Physiological Studies of Connecticut Leaf Tobacco. By Oscar Loew.

Growth of the Tobacco Industry. By Milton Whitney and Marcus L. Floyd. Reprint from *Yearbook of Dept. of Agri., 1899.*

The World's Exhibit of Leaf Tobacco at the Paris Exhibition of 1900. By Marcus L. Floyd. Reprint from *Yearbook of Dept. of Agri., 1900.*

Report No. 64. Field Operations of the Division of Soils, 1899. By Milton Whitney, with accompanying papers by others. (With Maps.)

Second Report, 1900. (With Maps.)

Some necessary modifications in methods of mechanical analysis as applied to Alkali Soils. By Lyman J. Briggs. Reprint from *Report No. 64 of the Dept. of Agri.*

A Working Plan for Southern Hardwoods and its results. By John Foley.

Grazing in the Forest Reserves. By Filbert Roth.

The Timber Resources of Nebraska. By Wm. L. Hall. Reprints from *Yearbook of Deyt. of Agri., 1901.*

Cost of Seed Distribution.

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Connecticut. Twenty-fifth Report of Agri. Exp. Station, 1901.

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New Jersey. Annual Report for year ending Oct. 31st, 1901. Special Bull. T. (The Salt Marsh Mosquito *Culex solicitans* Wlk.) 157 (Field Experiments with Nitrate of Soda on Market Garden Crops.) 158 (Soiling Crop Experiments.) 159 (The Rose Scale *Diaspis rosæ*, Bouche.) 160 (Concentrated Feeding Stuffs.) 161 (Alfalfa, Cow Peas and Crimson Clover as substitutes for purchased Feeds. Home-grown Protein versus Purchased Protein.)

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American Druggist and Pharmaceutical Record, July 28, Aug. 25, Sept. 15, 29, Oct. 13, 27.

American Journal of Pharmacy, Sept., Oct. [Editor.]

Botanical Gazette, Chicago, Sept., Oct. [Editor.]

Cotton and Farm Journal, Aug., Sept. [Publishers.]

Fern Bulletin, July. [Editor.]

Forestry and Irrigation, Sept., Oct.

Georgia State Board of Entomology, Bull. 4 Winter treatment of San Jose Scale in the light of recent Experiments. By W. M. Scott and W. F. Fiske.

Mycological Notes, No. 10. 182—Boletus Betula
Notes on the Amanitas of the Southern Appalachians. Pt. 1. Sub-Genus Amanitopsis. By H. C. Beardslee. } [C. G. Lloyd.]

Numerical variation of the ray flowers of Compositæ. By E. Mead Wilcox. [Author.]

Pear Blight in California. By Newton B. Pierce. [Author.]

Flora of the Galapagos Islands. (Papers from the Hopkins-Stanford Expedition to the Galapagos Islands.) *Proc. Amer. Acad. Arts and Sciences, Vol. XXXVIII. No. 4.*

The Relationships of some American and Old World Birches. By M. L. Fernald. From the *Amer. Jour. of Science Vol. XIV, Sept. 1902.* [Contr. from the Gray Herbarium of Harvard University.]

The American Origin of Agriculture. By O. F. Cook. Reprinted from *Popular Science Monthly, Oct. 1902.* [Author.]

The Drainage Journal, Oct.

The Plant World, Aug. [Publishers.]

Torrey Club Bulletin, July, Aug, Sept. [Editor.]

Trans. Mass. Horti. Soc., 1901. Part II. [Sec.]

The following 16 pamphlets on the uses of Nitrate of Soda, are presented by Wm. S. Myers, Director Nitrate of Soda Propaganda, New York:—

Nitrate of Soda a blessing to the Arts and to Agriculture. By John A. Myers. Abstract from *Proc. of the International Commercial Congress held at Phil., Oct. 1899.*

How to use Nitrate. Some Points in Artificial Manuring. A Lecture delivered at Lincoln under the auspices of the Lincolnshire Agricultural Education Assoc. By Dr. Bernard Dyer.

A Review of the present knowledge of sodium nitrate, together with the origin, production and destruction of Nitrates in the soil. Reprinted from *Journ of the Amer. Chemical Soc. Vol. XXI No. 5, May 1899.*

Nitrate of Soda for money crops. Investigation by U. S. Exp. Stations.

How Money Crops Feed. By Peacock and Myers.

Notes on Four Years' Experiments on Hop Manuring, conducted at Golden Green, Hadlow, Tonbridge. By Dr. Bernard Dyer.

Stable Manure and Artificial Fertilizers upon Fruit Trees- Translated from the Germay and Extended by John A. Myers.

The Profitable Cultivation of the Sugar and Beet and other Crops by the use of Nitrate of Soda. Extracts from a lecture delivered by Dr. Maercker. With Supplement I Michigan Agri. Exp. Sta. Bull. 179 (Sugar-Beet Investigatiohs) and Supplement II (Results in Monroe Country, New York).

Nitrate in the garden.

The Manuring of Orange Plantations. Practical Suggestions derived from recognized Authorities.

Can the yield and quality of Grapes be improved by Fertilization? Some Experiments of Prof. Paul Wagner of the Darmstadt Agri. Exp. Station.

Practical Suggestions for the Manuring of Olive Plantations. Erom *Bull 129, California Agri. Exp. Station*

Now Jersey Agri. Exp. Station Bulletins. 136 (Field Experiment with Nitrogenous Fertilizers) 150 I. Losses in Farm Manures. 11. The Relative Usefulness of the Nitrogen in Fresh and in Leached Manures. III. The Comparative value of the Nitrogen in Commercial Forms and in Natural Manures 157 (Field Experiments with Nitrate of Soda on Carrots, Cabbage, Celery, Tomatoes, Peppers, Turnips and Sweet Corn).

Rhode Island Bull. 82 (Grass Experaments).

The following 20 pamphlets are presented by Dr. N. L. Britton, Director New York Botanical Garden:

Coca at Home and Abroad. By H. H. Rusby, M.D. Reprinted from "*The Therapeutic Gazette*" for March, and from advance sheets of the May No., 1888.

A Synopsis of the Palms of Puerto Rico. By O. F. Cook. eprinted from *Bull. Torrey Botanical Club, 28th Oct., 1901.*

A Review of the Genera of Ferns proposed prior to 1832. By Lucien Marcus Underwood. Reprinted from *Memoirs Torrey Botanical Club, 6 : 247-283. 1. D. 1899.*

The Origin of Species by Mutation. By D. T. MacDongal. Reprinted from *Torreya, Vol. 2, No. 5, May ; Vol. 2. No. 6, June ; Vol. 2, No. 7, July, 1902.*

Notes on Agave. By Geo. Engelmann, M.D. From the *Trans. of the Acad. of Science of St. Louis, Vol. III., Dec. 1875.*

Botany and Materia Medica. *Carica Papaya L.* By H. H. Rusby. Reprinted from the *Druggists' Bulletin, July, 1889.*

Additions to the Cactus-Flora of the Territory of the U.S. By Geo. Englemann, M.D.

Briefer Articles. The Tree Opuntias of the United States.

II. The Development of the Ostrich Fern, *Onoclea struthiopteris*. By Douglas Houghton Campbell. (Walker Prize Essay, 1886.)

The Botanical Origin of Coca Leaves. By Prof. H. H. Rusby. From the *Druggists Circular and Chemical Gazette, Nov. 1900.*

Contributions to a knowledge of the Morphology and Ecology of the Cactaceæ: II. The Comparative Morphology of the Embryos and Seedlings. By Wm. F. Ganong. From *Annals of Botany. Vol. XII. No. XLVII. Dec. 1898.*

Journal of the New York Botanical Garden, Jan., May, July, Aug., Sept., Nov., 1902.

U.S. Dept. of Agri. Dir of Botany: Bull. No. 12 Grasses of the Southwest. Plates and Descriptions of the Grasses of the Desert Region of Western Texas, New Mexico, Arizona, and Southern California. Part II. By Geo. Vasey.

Bull. No. 13 Grasses of the Pacific Slope, including Alaska and the adjacent Islands. Plates and Descriptions of the Grasses of California, Oregon, Washington, and the Northwestern Coast, including Alaska. Parts I & II. By Geo. Vasey.

Central America.

Boletin del Instituto Fisico-Geografico de Costa Rica, No. 20. [Director.]

Rio de Janeiro: Contr. du Jardin, Botanique. 1902. [Directer]

Polynesia.

Planters' Monthly, Hawaii, Sept. [Editor.]

Library (Books.)

Piso (W.) De Indiæ utriusque re naturali et medica [accedit] J. Bontii, Historia plantarum, etc. [Ed. 2.] Amstellædami, 1658. fol.

[Rochefort, C. de] Histoire naturelle et morale des iles Antilles de l'Amerique, etc., Roterdam, 1658. 4to. [Presented by Dr. N. L. Britton.]

Seeds.

From Curator, Technological Museum, Sidney.

Eucalyptus pulverulenta.

From Curator, Botanic Station, Tobago.

Luffa ægyptiaca.

From M. Herb, Naples.

Browallia elata alba: B. elata (blue): Canna Crozy, mixed: Dianthus chinensis fl. pleno, mixed D. Heddewigi, fl. pl. mixed: Dahlia Cactus, single: D. var. fl. pl. Cactus: Heliotropium, dark variety, mixed: Impatiens Sultani salmonca: Phlox Drummondi fl. pl. mixed: Ricinus Cambodgensis: R. Gibsoni: Salvia splendens, mixed.

From Mr. R. K. Tomlinson, Lacovia.

Nelumbium luteum.

From Mr. Jekyll, Robertsfield.

Blood Balsam: Pink Balsam, July, 1901, Ditto, ditto Aug., 1901: Balsam Malmaison: Balsam warm white: Nicotiana sylvestris: Zinnia, white and yellow, and coloured: Capparis spinosa.

From Commr. Imp. Dep. of Agri., Barbados.

Cocos amara: Oblong Squash.

From Dr. Plaxton, England.

Melon.

From Botanic Gardens, Mysore (Bangalore).

Millingtonia hortensis (Cork tree).

From Botanic Gardens, Trinidad.
Cocos sp. (New): Bertholetia excelsa (Brazil nut).

From Mr. W. A. Walker, Moneague.
Sanchezia longiflora.

From Botanic Station, British Honduras.
Anona discolor (Tookee)

From Botanic Gardens, Singapore.
Nephelium lappaceum.

From Royal Gardens, Kew.
Statice arborea x Bourgæi: S. arborea x macrophylla: S. imbricata: Dendrocalamus strictus.

From U. S. Department of Agriculture, Washington, D.C.
Sea Island Cotton: Tobacco (Havanna seed, Cuban grown, Cigar Leaf.)

PLANTS.

From Director, Royal Gardens, Kew.
Aberia caffra: Afzelia quanzensis: Alstonia sericea: Antidesma platyphyllum: Anthurium crystallinum: A. intermedium: A. Veitchii: Bauhinia racemosa: Beilschmidtia roxburghiana: Bentinckia nicobarica: Bowenia spectabilis serrulata: Buxus Hildebrantii: Camoënsia maxima: Catophractes Alexandri: Chirita sinensis: Clerodendron splendens: Climber from Angola: Cocos campestris: Coffea Wightii: Cordia Rothii: Encephalartos sp.: Epiphyllum truncatum: Eranthemum graciliflorum: Eupomatia Bennettii: Ficus hispida: Garcinia ferrea (Saigon): Garcinia ferrea: Hæmanthus Lindeni: Hæmatostaphis Barterii: Hevea confusa: Ipomœa sp. (British C. Africa): Khaya senegalensis: Landolphia sp. (Madagascar): L. Tomentosa: Leea alata: Macrozamia Montperriensis: M. spiralis: Marsdenia verrucosa: Mimusops hexandra: Nap leona Miersii: Nepenthes rafflesiana: N. rufescens: Nyctanthes arbortristis: Parmentiera cerifera: Passiflora ambigua: Prestoea montana: Rhynchosia Wallichii: Sapindus edulis: Sapotaceæ (British C. Africa): Strophanthus hispidus: Strychnos nux-vomica: Tabernæmontana Barteri: T. usambarensis: Tecoma filicifolia: Terminalia prunioides: Vangueria edulis: Hylosma hawaiense: Zizyphus oxyphylla.

From Mr. Jekyll, Robertsfield.
Begonia Ascotensis: Double Orange Hemerocallis.

From Mr. Geo. A. Bishop, Supt. Bot. Garden, Bermuda.
Bulbs of Lilium longiflorum, 207 large, 245 medium, 420 small. 3 doz. Amaryllis Bulbs.

From Curator, Botanic Station, Dominica (through Dr. Morris.)
Musa sapientum, vars. Siam, Kelat, Ambon, Raja Kling, Lakaton; Musa africana: Musa Bakeri.

From Mr. Alfred Cartwright, British Consul, Guayaquil.
Carludovica palmata.

From Director, U. S. Bot. Gard., Washington, D. C.
Suckers of Musa sapientum, var. dacca.

From Herr Feodor Deininger, San Salvador, C. A.
Ficus elastica (best kind.)

HERBARIUM.

From Mr. Jekyll, Robertsfield.
Pilea depressa.

From Commr. of the Cayman Islands.
Canella alba bark.

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BULLETIN

OF THE

BOTANICAL DEPARTMENT, JAMAICA

EDITED BY

WILLIAM FAWCETT, B.Sc., F.L.S.

Director of Public Gardens and Plantations.

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A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Kingston P.O.

KINGSTON, JAMAICA:

HOPE GARDENS.

1902.

JAMAICA

BULLETIN

OF THE

BOTANICAL DEPARTMENT.

Vol. IX. DECEMBER, 1902. Part 12.

EDITORIAL NOTE.

The first number of the "Bulletin of the Botanical Department" appeared in April, 1887, three months after my arrival as Director.

The Botanical Department, or according to its official title, the Department of Public Gardens and Plantations, has always been concerned with the agricultural development of the Colony, and the Bulletin has been an index, or outward sign, of the kind of work that is being carried on.

Fifty numbers of the old folio series appeared at irregular intervals to December 1893, and in January, 1894, a new octavo series was commenced, which has been published ever since once a month.

It has been decided now to adopt it as the organ of the Department of Agriculture which was established by His Excellency the Governor last year, with the Honourable the Colonial Secretary as Chairman.

With the wider outlook, and to mark that attention will not be confined to the planting side of Agriculture, it has been thought well to alter the name, and it will henceforth be known as the "Bulletin of the Department of Agriculture, Jamaica."

W. Fawcett.

COTTON CULTIVATION IN JAMAICA.

I.—By Bryan Edwards

Extract from *The History, civil and commercial, of the British Colonies in the West Indies*, 1793.

The plant is raised from the seed, the land requiring no other preparation than to be cleared of its native incumbrances, and the season for putting the seed into the ground is from May to September, both months inclusive. This is usually done in ranks or rows, leaving a space between each, of six or eight feet, the holes in each row being commonly four feet apart. It is the practice to put eight or ten of the seeds into each hole, because some of them are commonly devoured by a grub or worm, and others rot in the ground The young sprouts make their appearance in about a fortnight, but they are of slow growth for the first six weeks, at which period it is necessary to clean the ground and draw the supernumerary plants, leaving two or three only of the strongest in each hole. One plant alone would be sufficient to leave, if there was any certainty of its coming to maturity; but many of the tender sprouts are devoured by the grub. At the age of

three or four months, the plants are cleaned the second time; and both the stem and branches pruned, or, as it is called, topped; an inch (or more if the plants are luxuriant) being broke off from the end of each shoot; which is done in order to make the stems throw out a greater number of lateral branches. This operation, if the growth be over luxuriant, is sometimes performed a second, and even a third time. At the end of five months, the plant begins to blossom and put forth its beautiful yellow flowers, and in two months more, the pod is formed. From the seventh to the tenth month the p ds ripen in succession; when they burst open in three partitions, displaying their white and glossy down to the sight. The wool is now gathered, the seeds being enveloped in it, from which it is afterwards extricated by a machine resembling a turner's lathe. It is called a *gin*, and is composed of two small rollers placed close and parallel to each other in a frame, and turned in opposite directions by different wheels, which are moved by the foot. The cotton being put by the hand to these rollers as they move round, readily passes between them, leaving the seeds, which are too large for the interspace behind. The wool is afterwards hand-picked, that it may be properly cleared of decayed leaves, broken seeds, and wool which has been stained and broken in the pod. It is then packed into bags of about two hundred pounds weight, and sent to market.

If the land is extraordinarily good, four and even five annual crops are sometimes gathered from the same original plants; after which, instead of replanting, it is not uncommon to cut the cotton bushes down to within three or four inches of the ground, and mould the stems in the May rains, and treat them afterwards in the same manner as plants. Some labour is undoubtedly saved by this practice, but in nine cases out of ten, it will be found more profitable to resort to fresh land every third or fourth year. I consider, at the same time, land to be fresh enough which has lain fallow, or been used in a different line of culture for three or four years together, the great intention of changing the land being to get rid of that peculiar sort of grub or worm which preys on the cotton plants.

In Jamaica it is commonly reckoned that one acre of cotton will yield annually 150 pounds weight, and in some years nearly twice as much; but I am afraid that, on an average of any considerable number of successive crops, even the former is too great an allowance.

By accounts which I have procured from the Bahama islands, it appears, that in 1785, 1786, and 1787 (all of which years were considered as favourable), the produce of the cotton-lands, on an average, did not exceed one hundred and twelve pounds per acre, viz.:—

In 1785—2,476 1786—3,050 1787—4,500	acres produced	2,480 3,000 4,380	Cwt. of Cotton.

II.—By Dr. James Macfadyen.

Extract from *The Flora of Jamaica, 1837.*

At present there is no cotton grown in this island for the purpose of exportation. At one time, however, it was an important article of cultivation. The cotton shrub grows best in a light soil, especially in

a limestone district, with a moderate supply of moisture. In a stiff clay, or where there is a clay bottom, it seldom thrives, and generally dies as soon as the root has penetrated to a certain depth. It is found to be unproductive in a wet climate, from the flowers, although produced in abundance, dropping off without forming the fruit. It is grown from seed planted between the months of November and April. The land is prepared by cleaning it of weeds, and digging holes about 18 inches deep, and 12 inches wide, at a sufficient distance to allow the plant free space to spread. About 12 seeds are planted in each hole, and covered lightly with soil. Should the seasons be favourable, they will show above ground in seven or eight days. The young plants are to be carefully kept free of weeds, and repeatedly thinned, till one, or in some cases two, of the healthiest and strongest is left. Very little pruning is required. It is of the greatest importance throughout the whole course of the cultivation, to keep down the growth of weeds. This is the surest method of preserving the plantation in health, and free from the attacks of insects. It has also been confidently stated, that the same intention would be produced by planting *Guinea-grass* through the field, as it would not only keep down every description of weed, but also drive off the numerous insect enemies, which too often disappoint all the hopes of the planter.

The cotton seldom comes into full bearing before the second year; and it continues productive for four or five years. It blossoms and fruits during the greater part of the year: but the principal bearing is between August and December. In the East the whole pod is gathered: but it is considered an improvement, to leave the capsules on the trees, and to withdraw from it the cotton with the seeds, which readily comes away. The capsules open when they are ripe; and as they come to maturity in succession, the field must be frequently gone through. It is of importance to gather the cotton in dry weather; and it is necessary, after it is collected, to expose it to the sun, so as to free it from any damp. A machine, called a *gin*, is employed to separate it from the seeds. With one of these, on the present improved principle, a man is capable of cleaning 300lbs. of cotton in a day.

It is very probable that cotton may yet again come to be an article of export from this island. The cultivation of it is well adapted for small settlers; as it requires very little attention or labour, and the crop comes in gradually, so as to be easily collected. There is no doubt, but that it might be conducted more advantageously here, than in the Southern States of America, as we have not a winter to contend with, and our climate and soil is completely suitable, from the plant being indigenous.

III.—By Richard Hill

Extract from letter in "*Transactions of the Society of Arts of Jamaica*," dated 11th July, 1857.

The unsatisfactory issue of the attempt to revive Cotton cultivation here some twelve years back, was considerably owing to the supposition, that arrangements for growing and taking in a crop of Cotton *within* the tropics, should be those pursued by the American Cotton

growers *out* of the tropics; that is, that they should depend on annual plants;—and on cultivation in large fields, with a proper economy of gangs; and of prickers, frequently traversing the fields to gather in the pods as they successively expand and ripen in crop time.

If instead of cultivating by a system of standard trees, *bearing for a continuance of ten years*, we resort to annual planting, Cottton must always be an expensive and precarious crop. We, within the tropics, are not bound to any such system. If we feel that we have no expeperience *now* to guide us, in what is best for the economy of labour, we must resort *not* to the North American Continent for instruction, but to *China* and the neighbouring *Indian Islands* that cultivate Cotton to a large extent for the Chinese market. We shall show what this is, by some extracts from Richardson Porter's "Tropical Agriculturist."

"The *Chinese* possess both the Cotton tree, and the herbaceous Cotton plant. These are cultivated to a very great extent in different parts of that vast empire, yet its produce is not in sufficient abundance to answer all the demands of the Chinese population, and very considerable supplies of Cotton are drawn from India. The annual shipments of Cotton-wool from the presidency of Bombay to Canton has been stated at nearly *forty millions of pounds.*" (Tropical Agriculturist, page 28.)

"It is customary in China to allow the Cotton shrub to remain on the ground during *three years*, and in ths *fourth* year to root it out and plant the land with grain. In some provinces a different course is pursued, and after *two* crops of Cotton have been taken, two grain harvests are produced, and so on in succession:—it is said that *leguminous plants are never raised from land appropriated to Cotton cultivation.*" (Ibid. page 29.)

"The cultivators of Cotton in the Southern States of the American Union, confine their attention to such plants as are of annual growth." (Ibid. page 34.)

Here you perceive, we have the Chinese in a more torrid climate than the American, getting rid of annual planting and maintaining a system of standard perennial trees—increasing the years of their duration, according to the increase of temperature; and to the extent of that difference, cheapening the cost of culture.

"Both the shrub and the tree species of Cotton are cultivated to a great extent in the *Indian Islands* Of the first kind, there are many varieties differing in the duration of the plant, some being annual, and others perennial. The Cotton produced in Kutung is reported to be the finest; a fact which probably is more owing to *local circumstances than to any real and essential difference in the plants.* Vast quantities are raised in the Kingdom of Celebes, in Timur, Mongarai, Lombok, Bali, and in the productive island of Java, which last, although probably the most improved of all, as respects its agriculture, yet yields the coarsest and least valuable description of Cotton." (Ibid. page 33)

Having shown in these extracts that there are two systems of Cotton planting,—the *annual* and *perennial*: and that dependence on the

arboreal in preference to the *herbaceous* shrub, must diminish the cost of tillage very considerably, we shall proceed to show what is common to all systems in the gathering in of the crop.

"The Cotton pods are not all developed at the same time, a circumstance which makes it necessary to go several times through a field during the period of crop, in order to collect the locks, as they come forward. The intervals between these gatherings *differ according to the variety of the plant.* In some cases the same field requires to be gone over by the prickers at the end of every *four or five days*, while with other varieties, a week, or even ten days may be allowed to elapse between each gathering. In any case, if too long a period is allowed to intervene, the filaments adhere so slightly to the pods, that they either fall or become the sport of the winds which scatter them about, so that, if even they could be all collected, they would be deteriorated. Another reason for avoiding delay, is the probability that wet weather may set in, which would prove highly detrimental to the quality of the Cotton. But if neither of these evils should be experienced; if the lock should still remain attached to the pod, and no rain should supervene, the quality of the Cotton may be injured through the drying of the calyx, which being thus converted into a kind of dust, falls upon the Cotton, and cannot afterwards be removed.

"When the Cotton is gathered, it must be exposed without delay to the heat of the sun, but sheltered from the access of dust; and this exposure must be repeated from day to day, until the seed is hardened. A *wooden platform*, or one of tiles is chosen for this purpose. If the weather is uniformly fine, an exposure for three successive days will be sufficient. The wool should never be thus exposed until after sun rise, and it should always be conveyed under cover before the sun goes down. Should the weather immediately after the gathering prove wet, such an exposure is of course impracticable. In this case, it is desirable to admit the air as freely as possible to the Cotton, in order effectually to carry off the moisture; to facititate which, it should be spread in thin layers, and occasionally turned, that the air may exert its full effect upon the whole in turn" (Ibid. page 20, 21.) *This briefly is cotton culture.*

It is very obvious that in growing cotton by standard cultivation, or in other words, in cultivating trees of perennial growth, gathering in the crop at short intervals when ready for picking, *a system is pursued suited for a family of small settlers.* In a few acres around a cottage, in which cotton fields intermingle with garden grounds, with the customary esculent roots and fruits, and herbs and cereal grains of the tropics, there will be afforded constant employment to a household of both young and old, at morning, evening, and noon-tide, without any exhausting exposure. A friend of mine tried the experiment of setting out several rows of standard cotton plants He found the yielding abundant, and although high grown accessible to the pickers. In four years the trees had spread so as nearly to touch each other at six or eight feet apart. The avenues were clear and open, the picker stood to his work under shelter of the over-spreading foliage, and the plants bourgeoned from year to year without pruning, developing such a con-

stant outpouring of matured pods, that every morning and evening of crop time afforded a gathering. I think I never saw anything more convenient for cottage husbandry than these embowered avenues intermingled with the herbaceous and fruit-bearing plants of the garden they stood in I cannot say what the yielding was as a test of productiveness, but it was very abundant, and very regular and constant.

IV. Extracts from Botany of Cotton.

By Walter H. Evans, Ph.D.

Bulletin 33 of Office of Experiment Stations, U.S.A.

The cotton plant belongs to the Malvacæ, or the mallow family, and is known scientifically by the generic name Gossypium. It is indigenous principally to the islands and maritime regions of the tropics, but under cultivation its range has been extended to 40° or more on either side of the equator, or to the iso-thermal line of 60°F. In the United States latitude 37° north about represents the limit of economic growth.

Among the species recognized to be of more or less economic importance are *Gossypium arboreum, G. hertaceum, G. barbadense.* In the United States only the herbaceous cottons are cultivated to any extent. The shrubby and arboreous are grown occasionally as curiosities, but they seldom or never produce any lint in regions having as low a mean temperature as the cotton belt of the United States.

Gossypium barbadense is indigenous to the Lesser Antilles, and probably to San Salvador, the Bahamas, Barbados, Guadeloupe, and other islands between 12° and 26° north latitude. By cultivation it has been extended throughout the West Indies, the maritime coast of the Southern States, Central America, Puerto Rico, Jamaica, etc., southern Spain, Algeria, the islands and coast of western tropical Africa, Egypt, Island of Bourbon, East Indies, Queensland, New South Wales, etc. It may be cultivated in any region adapted to the olive and near the sea, the principal requisite being a hot and humid atmosphere, but the results of acclimatization indicate that the humid atmosphere is not entirely necessary if irrigation be employed, as this species is undoubtedly grown extensively in Egypt. As a rule, the quality of the staple increases with the proximity to the sea, but there are exceptions to this rule, as that grown on Jamaica and some other islands is of rather low grade, while the best fibre is produced along the shores of Georgia and Carolina, According to Royle* "the quality is influenced not only by temperature, but the balance between the amount of moisture taken up by the roots and that given off by the leaves must be considered, as well as the varied processes of culture and choice of varieties suited to each particular locality." This observation applies to all kinds of cotton, and not to the Sea Island alone.

* Cultivation of Cotton in India.

There is a well-marked form of the Sea Island cotton to which Todaro gave the varietal name of *polycarpum*, to which is usually referred the Bamia variety of Egyptian cotton. It is principally characterized by numerous flowers springing from a single axil, and an erect, slightly branching habit, hence giving a large yield per acre. On poor soil it soon degenerates to an ordinary form of Sea Island. This is considered by Sir J. D. Hooker* as a well-marked seminal sport, with a fastigiate habit, from some kind of Egyptian cotton, the bulk of which belongs to the Sea Island form of *G. barbadense*. In one of the Kew Reports† the idea that Bamia is a hybrid between okra and cotton is shown to be incorrect. The cultivation of Bamia in Egypt is said to require more irrigation than the ordinary kinds.

The yield of lint from Sea Island cotton is less than that from any other kind grown in the United States, but on account of the length and quality of the fibre it is adapted to uses to which the other kinds are not suited, and its high market value compensates for the small yield.

According to Heuzé‡ the time required for the maturity of a cotton crop is divided as follows: from seeding to flowering, New Orleans 80 to 90 days, Sea Island 100 to 110 days; from flowering to maturity, New Orleans 70 to 80 days, and Sea Island about 80 days, making the total period of growth about 5 to 6½ months. According to the same authority, the best average daily temperature for the growth of cotton is from 60° to 68° F. for the period from germination to flowering, and from 68° to 78° from flowering to maturity. Dr. Wight§ says that for the proper maturity of the best qualities of American cotton an increasing temperature during the period of greatest growth is required. The failure to produce in India a quality of fibre equal to the American product from the same kind of seed is attributed to the fact that in the climate of the former there exists a diminishing rather than an increasing average daily temperature.

The effect of too much rain is to form too much plant and not enough fruit, while serious drought causes a stunted growth of the plant in which few bolls are formed and these ripen prematurely. In the latter case the resultant crop is generally short in staple and poor in quality.

The structure of the cotton fibre has been studied to a considerable extent, and the works of Bowman‖ and Monie¶ may be considered as standard on this part of the subject. The first thing noticed in comparing samples of cotton is the difference in the length and the fineness of the fibre, and upon these factors almost entirely depends the commercial grading of the crop. The principal species of cotton vary in respect to the length of their fibre within rather constant limits, dependent upon soil, culture, and atmospheric conditions. The fol-

* Flora of British India.
† Kew Report, 1887, p. 26.
‡ Plantes Industrielles, Vol. I, p. 139.
§ Journ. Agr. Hort. Soc. India, 7 (1849-50), p. 23.
‖ Structure of the Cotton Fibre, F. H. Bowman, Manchester, 1881.
¶ The Cotton Fibre, its Structure, &c., Hugh Monie, Manchester and London, 1890.

lowing table, compiled from numerous measurements taken during a period of years shows the maximum, minimum and average length of fibre for some of the more important varieties, and also the average diameter of the same :—

Length and diameter of the principal cotton fibres.

Variety.	Length of Staple.			Average diameter of Staple.
	Maximum	Minimum.	Average.	
	Inches	Inches.	Inches.	Inches.
Sea Island ..	1.80	1.41	1.61	.000640
New Orleans ...	1.16	.88	1.02	.000775
Texas ..	1.12	.87	1.00	.000763
Upland ...	1.06	.81	.93	.000763
Egyptian ..	1.52	1.30	1.41	.000655
Brazilian ..	1.31	1.03	1.17	.000790
Indian varieties :				
Native ...	1.02	.97	.89	.000844
American seed ...	1.21	.95	1.08	.000825
Sea Island seed ..	1.65	1.36	1.50	.000730

From the above table it will be seen that, as a rule, the longer the fibre the less its diameter. The extreme variation in length of the above fibres, from the figures as shown in the table, is from 0.25 to 0.30 inch. In proportion to their size the variation in diameter is much greater than that shown for the length.

If a very immature boll be cut transversely the cut section will show that it is divided by longitudinal walls into three or more divisions, and the seed will be shown attached to the inner angle of each division. The seeds retain this attachment until they have nearly reached their mature size, and the growth of lint has begun on them, when their attachments begin to be absorbed and by the increased growth of the lint the seed are forced to the centre of the cavity. The development of the fibre commences at the end of the seed farthest from its attachment, and gradually spreads over the seed as the process of growth continues. The first appearance of the cotton fibre occurs a considerable time before the seed has attained its full growth, and commences by the development of cells from the surface of the seed. These cells seem to have their origin in the second layer of cellular tissue, and force themselves through the epidermal layer, which seems to be gradually absorbed. The cells which originate the fibre are characterized by the thickness of their cell walls when compared

with their diameter. The method of growth, according to Bowman* is by the successive linear development of cells, the walls of which are absorbed at the point of contact until an elongated cell is produced, which constitutes the cotton fibre. The continued growth of this mass of fibre assists in bursting open the pod when the period of maturity is reached. The length of the fibre varies considerably on different parts of the seed, being longest on the crown and shortest at the base.

It is claimed that the fibres do not attain their full length until the pod has been opened and the fibres are exposed to the drying and ripening effect of the air and sun.

In their earliest stages the young fibres appear circular in section, but with their increase in length, the walls become thinner and finally collapse into a flat, thin-walled fibre in appearance like a thin transparent ribbon. With the opening of the boll there is a rapid consolidation of the liquid cell contents, which by being deposited on the inner side of the walls give to the fibre a greater thickness and density. As the degree of maturity is increased the fibre once more becomes rounded in section. As this action is not perfectly regular, owing to the unequal pressure and deposition of the cell contents, the fibres become twisted, a character readily recognized under the microscope, and one that distinguishes cotton from any other fibre.

In the early period of their formation the cells are filled with astringent juices whose presence may be recognized by applying the tongue to the cut surface of an immature boll. During the process of ripening these juices are replaced by others of a neutral or saccharine nature, and when perfectly ripe the cotton fibre consists almost entirely of cellulose.

When viewed under a microscope the general appearance of a cotton fibre is that of an irregular, flattened, and somewhat twisted tube, the tubular form sometimes being lost in the completely flattened fibre. The edges of the fibre are somewhat thickened and slightly corrugated. The hollow tubular character and constant diameter of the fibre are maintained for about three-fourths its length, when it tapers to a point, where it is perfectly cylindrical and often solid. From various causes there are often found solid places in the body of the fibre, and where such places exist, the quality of the staple is reduced, owing to the inequality with which such fibres take up dyestuffs.

The twist in the fibre, which seems to be an acquired character not possessed by wild cotton, is explained by Monie† as follows:

The rotary motion begins with the process of vacuation in the fibre, caused by the withdrawal of some of the fluid in the fibre when the seed begins to ripen, and as this is effected slowly and progressively, beginning near the extremity farthest from the seed and gradually receding toward the base, the free end or point becomes twisted on its own axis several times, thus producing the convoluted form exhibited under the microscope.

In every lot of cotton three classes of fibres may be recognized—(1) unripe, (2) half-ripe, and (3) ripe. These conditions are dependent upon several factors, the most important of which is the gathering of cotton before it has been exposed for a sufficient time to the ripening

* Structure of the Cotton Fibre, p. 25.

† The Cotton Fibre, its Structure, &c., p. 25.

action of the air and sun. The other cause is due to the different stages of maturity of the filaments on different parts of the same seed. Unripe cotton when examined with the aid of a microscope appears extremely thin and transparent, and usually with little or no twist, and it is of little use for manufacture. When used it contracts and curls up in the warm atmosphere of the factory, causing yarn spun from cotton containing much unripe fibre to depreciate greatly in value. The half-ripe fibre has the same characters, but to a lesser degree, and is more valuable than the former, but it is only the ripe cotton fibre that possesses all the requisites for perfect spinning and dyeing.

V. Correspondence.

Secretary British Cotton Growing Association to Director Public Gardens and Plantations, Jamaica.

19 Queen St, Oldham, England,
Nov. 10th, 1902.

Dear Sir,

I am much obliged for the Periodicals and Newspaper cuttings which you have so kindly sent me. I am very anxious to get as much information as possible respecting the prospects of cotton growing in your island, and shall be glad to hear from you at your earliest convenience. This Association is about to send a quantity of Egyptian seed to Jamaica through Messrs Elder Dempster & Co. which I hope will get into good hands.

I enclose copy of correspondence, etc. which we have just published.

Yours faithfully,

Jno. C. Atkins, Secretary.

The copy of the published Correspondence alluded to above, may be seen by those interested at office of Director, Hope Gardens.

VI.—Sea Island Cotton in the United States.

The Bureau of Plant Industry of the U. S. Department of Agriculture has under way investigations in the improvement of cotton in the U. S., and as a foundation for such work it is necessary to determine the varieties best suited to each section of the cotton belt. The Bureau is therefore distributing cotton seed of the best strains to test in comparison with the varities already grown.

One of these strains is Seabrook's Sea Island Cotton for distribution in the sections of Georgia and Florida that grow Sea-Island Cotton.

Dr. Galloway, Chief of the Bureau, kindly promised the Director, when in Washington, to help him with seed, and has lately presented 3 pecks of seed of Seabrook's for trial in Jamaica. This will be grown at the Prison Farm under the care of Mr. J. T. Palache. A small patch is planted out already at the Hope Experiment Station for the sake of experiment with various distances for planting, methods of topping, pruuning, &c The following is an extract on the cultivation recommended from a circular distributed with the seed.

"The Seabrook selection of Sea-Island Cotton is adapted to light, sandy land of good fertility It is planted in rows 5 feet apart, with a distance of from 18 to 20 inches between the plants in the row. Greater care must be given to the cultivation of Sea-Island than is usually given to Upland cotton. The land should be thoroughly pre-

pared and well fertilized. A suitable rotation with corn, cowpeas, peanuts, or other crops should be practiced in order to avoid the exhaustion of the soil produced by many successive cotton crops. Cultivation should be very frequent. In the Sea Islands the cotton is cultivated on an average of once a week until August. Here the cotton is grown on high beds and the soil drawn up around the plants in cultivation. This method is not recommended for Georgia and Florida, however, where the more economical method of level culture will probably pay best.

"Particular care is necessary in picking and handling Sea-Island Cotton in order to obtain the highest price. Sea Island Cotton requires to be picked often—every week or ten days—to avoid staining by the weather. All trash, bits of bolls, immature and diseased or yellow locks must be picked out by hand The seed cotton should be spread on an arbour or low roof and exposed to the sun for several hours to dry before storing It must be ginned on a roller gin and be packed carefully in bags without high pressure."

CITRATE OF LIME AND CONCENTRATED LIME JUICE.

By Hon. Francis Watts, F.I.C , F.C.S. Government Analytical and Agricultural Chemist to the Leeward Islands.*

Since the article in the Jamaica Bulletin was written, I have had opportunities of making further inquiries the result of which may fittingly be added.

I find that in Dominica it is customary to carry the concentration of lime juice to a higher degree than 64 oz. per gallon. Concentrated juice from this island ranges in strength from 105 to 120 oz. p r gallon, or even higher. That such a degree of concentration is attainable without considerable loss is due to the fact that juice of good quality is used for concentration : on many estates in Dominica the whole of the juice obtained is c ncentrated, whereas in some places the finer qualities are exported as raw juice while the inferior ones alone are concentrated. These finer juices will contain a larger proportion of acid in relation to the other soluble matters present, and therefore when concentrated to a definite specific gravity will contain more acid than concentrated juice derived from raw juice of lower grade.

Buyers point out some defec.s of West Indian concentrated juice; one is the presence, at times, of considerable quantities of pulpy matter, seeds and other impurities; another defect lies in the presence in some samples of noticeable quantities of iron

Some buyers informe t me that h y were of opinion better prices, both for concentrated juice and for citrate, may be obtained if the West Indian trade were better organized, t eir experience being that small lots of concentrated juice appeared on the market at somewhat irregular times, so thatbuyers were unable to be on the look out for, or to depend on the arrival of West Indian supplies. These lots often ar-

* An article on this subject by Mr. Watts appeared in the Bulletin of the Botanical Department, Jamaica, Vol. V. 1878 pp. 263–9. Mr. Watts read an addendum to this article at the Conference of 1901, which has been printed in the W. Indian Bulletin Vol. II. No. 4 pp. 315–318, and is reproduced here.

rived when there was no particular demand, and after buyers had made their contracts; they therefore sold with difficulty and at lower prices. This may be remedied by better organization, by such methods as making contracts beforehand, by the careful use of marks and brands, by intimations in trade journals of the conditions of crops, their probable quantity, and the probable times of arrival in the market.

So far as I could learn, it appeared possible to make contracts for the delivery at specified dates of lots equal in size to about 25 casks and upwards of concentrated juice as shipped from the Leeward Islands These contracts are made, I understand, from about January to April. It is interesting to note that this year (1901), contracts were made for Italian and Sicilian supplies at about £17 to £19 per pipe, while later in the year the market had fallen to about £13. It seems, therefore, highly probable that better prices may ultimately be obtained for West Indian juice by a closer acquaintance with British market conditions and by the preparation of high class products in connection with known marks and brands.

I have little to add concerning the preparation of citrate of lime: those whom I have consulted emphasize the importance of washing the citrate with hot water before drying it: if this is not done thoroughly very troublesome colouring matters may be present in the citrate and in practice these may be more difficult to remove than the colouring matters which are encountered when working with concentrated juice. If attention is paid to this and a well prepared and well washed citrate, free from impurities,is put on the market there is little doubt that in a short time it will command a better and readier sale than its competitors.

A cacao drier, similar to the one recently erected at the Botanic Station in Dominica, would doubtless serve admirably for the drying of both citrate and cacao.

It is now being made a condition that citrate must not contain more than two per cent. of free chalk, a penalty being imposed if this amount is exceeded. The exact rate at which this penalty will be levied does not appear to have been yet agreed upon.

As regard price, citric acid, whether in the form of concentrated juice or of citrate of lime, has practically the same market value. Citrate of lime is quoted in terms of the standard cask of 305 kilos. (675 lbs.) containing 64 per cent. of citric acid; a standard cask therefore contains 430½ lb. of acid. Concentrated juice is quoted in terms of the pipe of 108 gallons containing 64 oz. of citric acid per gallon, being equivalent to 432 lb. of acid; the quantities are practically identical. At present these two commodities command approximately equal prices; sometimes one, sometimes the other having a slight advantage. I understand that an import duty is imposed on citrate entering France while concentrated juice is admitted free, in consequence of which concentrated juice may at times command a slightly higher price in European markets.

During 1899 prices ranged from £13 to £20 per pipe or cask:

"	1900	"	£13 to £17	"	"
"	1901	"	£17 to £19	"	"

The figures for this year are those for January to April when most of the contracts were made: since then they have gradually fallen to about £13.

Under these circumstances the West Indian producer, in deciding which article he shall make, must ascertain the difference in cost of production and whether the buyers are likely, at an early date, to prefer one article to the other. As matters stand at the present moment I anticipate that citrate will prove more expensive in preparation than concentrated lime juice, the cost of erecting steam heating apparatus and drying chambers and of importing and transporting lime or chalk will more than counterbalance the saving of fuel, the reduction in cost of packages and the saving of acid destroyed in the process of concentration. Nevertheless we have the evidence afforded by Italy and Sicily, the principal sources of supply, where the production of citrate is making steady headway and where, I am informed, the process is found to be better and cheaper than simple concentration. The exports of both articles from Messina and Catania have recently been as follows:—

Dec. 1, 1899, to Sept. 30, 1900.	Concentrated juice	1,671	pipes
Citrate of lime 635½ tons	..	2,085	"
Total ..	..	3,756	"
Dec. 1, 1900, to Sep. 30, 1901.	Concentrated juice	549	"
Citrate of lime 590½ tons	..	1,969	"
Total ..	..	2,518	"

It seems to me highly probable that the manufacture of citric acid will ultimately show a decided preference for citrate of lime, and this as soon as the manufacture of citrate in Italy and Sicily is placed upon a sure footing, so that citrate of uniform and dependable quality comes steadily to market: when that point is reached citrate will begin to command higher prices than concentrated juice. West Indian producers will then have to produce citrate if they wish to obtain the best prices for their goods. This time may not be far distant, for the experiments of the last thirty years have removed most of the difficulties which were encountered, while during the last ten years the advance has been very marked on the commercial side.

The table below is added in order to facilitate calculations dealing with the acidity of raw juice. In some places it is customary to speak in terms of ounces of citric acid per gallon of juice, in others in terms of grains per ounce.

Table showing the quantity of citric acid in grains per ounce equivalent to ounces per gallon, and vice versa.

Oz. per gall.	= Grs. per on.	Grs. per oz.	= Oz. gal.
8	21·875	20	7·314
8·5	23·242	22	8·045
9	24·609	24	8·777
9·5	25·966	26	9·508
10	27·344	28	10·239
10·5	28·711	30	10·971
11	30·078	32	11·702
11·5	31·445	34	12·434
12	32·813	36	13·165
12·5	34·180	38	13·897
13	35·547	40	14·628

Oz. per gall.	= Grs. per oz.
13·5	36·914
14	38.282
14·5	39·649
15	41.016
15·5	42.383
16	43.750
16.5	45.117
17	46·484
17·5	47·851
18	49·219

Difference for ¼ ounce per gallon =·683 grains per ounce.

Grs. per oz.	= Oz. gal.
42	15·359
44	15·359
46	16·091
48	17·554
50	18·285

Difference for 1 grain per ounce= ·365 ounce per gallon.

ADDITIONS AND CONTRIBUTIONS TO THE DEPARTMENT.

LIBRARY (Serials).

EUROPE.

British Isles.

Botanical Magazine, Nov. [Purchased.]
Chemist and Druggist, Nov. 1, 8. [Editor.]
Garden, Nov. 1, 8. [Purchased.]
Gardeners' Chronicle, Nov. 1, 8. [Purchased.]
International Sugar Journal, Nov. [Editor.]
Journal of Botany, Nov. [Purchased.]
Journal Royal Hort. Society, Sept.
Nature, Oct. 30. Nov. 6. [Purchased.]
Pharmaceutical Journal, Nov. 1, 8.

France.

Journal d'Agriculture Tropicale, No. 16. [Publishers.]
Sucrerie indigène et coloniale, Oct. 28. Nov. 4. 11. [Editor.]

Germany.

Tropenpflanzer, Nov. [Editor.]

Switzerland.

Bulletin, de l'Herbier Boissier, Vol. II. No. 11. [Conservateur.]

ASIA.

India.

Fertilizers and Coffee cultivation. Addresses delivered before the United Planters' Association of Southern India. By Dr. Adolf Lehmann, Agricultural Chemist to the Govt. of Mysore, 1899-1902.
Planting Opinion, Oct 4, 11, 18. [Editor.]
The Agri-Hort Society of Madras, Proc. Oct.-Dec., 1901. Annual Meeting, 1902.

Ceylon

Times of Ceylon. Oct. 9, 15, 23. [Editor.]

Java.

Proefstation West Java No. 57. [Director.]

AUSTRALIA.

N. S. Wales.

Agri. Gazette, Sept. [Dept. of Agri.]

Queensland.

Queensland Agr. Journal, Sept., Oct. [Sec. of Agri.]

Victoria.

Fungus Diseases of Citrus Trees in Australia and their treatment. By D. McAlpine.
Wine-making in hot climates. By L. Roos.
Translated by Raymond Dubois and W. Percy Wilkinson.
First steps in Ampelography: A Guide to facilitate the recognition of Vines.

By Marcel Mazade. Translated by Raymond Dubois and W. Percy Wilkinson. [Public Library of Victoria.]

AFRICA.

Cape of Good Hope.

Agri. Journal, Oct. [Dept. of Agri.]

Gold Coast

Report upon the Botanical Dept. for 1901. [Curator.]

Natal.

Agri. Journal and Mining Record, Oct. [Dept. of Agri.]

Central Africa.

C. African Times, Aug. 23, 30, Sept. 6, 13, 20. [Editor.]

WEST INDIES.

Barbados.

Agri. Gazette, Nov. [Editor.]

Agricultural News, Nov. 8, 22.

Pamphlet Series. Nos. 19 & 20, Summary of the results of the cultivation of Seedling and other canes at the Exp. Stations at Barbados 1902, & in the Leeward Islands 1901-1902.

Report on Experiments conducted at Antigua & St. Kitts in the Season 1901-02. Part I.—Experiments with varities of Sugar-cane. With an App. on the Chemical Selection of Sugar-cane.

Report on Botanic Station, Antigua, 1901-1902.

" " " " , Agri. School Plots, and Cacao Exp., Plots, Dominica, 1901-1902.

[Commr. Imp. Dept. of Agri.]

West Indian Bulletin, Vol. III., No. 3.

Scale Insects of the West Indies. By H. Maxwell-Lefroy. Reprinted from the West Indian Bulletin, Vol. III. No. 3. pp. 240-270, 1902. [Author.]

Jamaica.

Cornwall Herald. [Editor.]

Journal, Jamaica Agri. Society, Nov. [Sec.]

Trinidad.

Proc. of Agri. Soc., Oct. 14 [Sec.]

BRITISH NORTH AMERICA.

Ontario.

Report of the Farmers' Institutes 1901. Part I. [Dept. of Agri.]

Ottawa.

Central Experiment Farm. Report of the Director, 1901. [Dept. of Agri.]

General Index to the Reports and Bulletins of the Experimental Farms of the Dominion of Canada, 1887-1901. [Dept. of Agri.]

Montreal.

Pharmaceutical Journal, Oct. [Editor.]

Nova Scotia.

Proc. and Trans. of the Nova Scotian Inst. of Science, X., 2, 1899-1900. [Inst. of Sci.]

UNITED STATES OF AMERICA.

Publications of the U. S. Dept. of Agri. [*Directors.*]

Scientific Bureaus & Divisions

Experiment Station Record, Vol. XIII, No. 12.

Division of Biological Survey: North American Fauna No. 22. A Biological Investigation of the Hudson Bay Region. By Ed. A. Preble, prepared, under the direction of Dr. C. Hart Merriam.

Division of Botany: Contrs. from the U. S. National Herbarium, Vol. V. No. 6, Report on a Botanical Survey of the Dismal Swamp Region. By Thos. H. Kearney.

Experiment Stations.

Arkansas. 72 (Sweet Potato Experiments.) 75 (Alfalfa.)

Kansas, 114. (Growing Alfalfa in Kansas.)

Kentucky. 100 (Inspection and Analyses of Foods) 101 (A comparison of Feeds for Pigs.) 102 (Commercial Fertilizers.)
New Jersey. Report of the Botanical Dept. for 1901.
Virginia. 4 (Preliminary Report on use of Blackleg Vaccine in Virgiana.) 5 (Sheep Scab.)
Wisconsin. 92 (Licensed Commercial Fertilizers and Concentrated Feeding Stuffs, 1902.) 94 (Curing of Cheddar Cheese, with special reference to cold-curing.) 95 (Some observations on Sheep breeding from the Exp. Sta. Flock Records.) 96 (Investigations of Methods of Milking.)
American Druggist and Pharmaceutical Record, Nov. [Editor.]
American Journal of Pharmacy, Nov. [Editor.]
Boring Algæ as Agents in the Disintegration of Corals. By J. E. Duerden. Extract *Bull of the American Mus. of Nat. Hist.* XVI. [Author.]
Fern Bulletin, Oct. [Editor.]
Forestry and Irrigation, Nov. [Editor.]
Plant World, Sept. [Editor.]
Torrey Club Bulletin, Oct. [Editor.]
Plantæ Insulæ Ananasensis. A Catalogue of Plants collected on the Isle of Pines, Cuba, by Don Jose Blain. By Chas. Fred. Millspaugh.
Plantæ Utowanæ. Plants collected in Bermuda, Porto Rico, St. Thomas, Culebras, Santo Domingo, Jamaica, Cuba, The Caymans, Cozumel, Yucatan, and the Alacran Shoals. Dec. 1898 to Mar. 1899. Cruise of the Yacht Utowana. Part I and Ia. By C. F. Millspaugh. [Field Columbian Museum.]
North American Ustilaginæ. By G. P. Clinton. Reprint. *Journal of Mycology Vol. 8 Oct. 1902.*
University of Toronto studies. No. 1. By A. Primrose.
The Morphology of the Central Cylinder in the Angiosperms. By Edward C. Jeffrey. Reprint. *Trans. of the Canadian Institute 1898-99.*

The following are presented by John W. Harshberger, Author :—
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POLYNESIA.

Planters' Monthly, Hawaii, Oct. [Editor.]
1902 Work of the Exp. Station and Laboratories of the Hawaiian Sugar Planters Association. [Director.]

SEEDS.

From Supt. Botanic Station, British Honduras.
Melo-coton (rare Mexican Melon).
From Actg. Curator Botanic Gardens, Aburi., Gold Coast.
Butyrospermum Parkii. Phœnix reclinata: Spondias mangifera.

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* See also Orange.

* See also Citrus.

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