DEPARTMENT OF AGRICULTURE, VICTORIA.

SCHOOL OF HORTICULTURE.

Established May, 1891.

MONTHLY LECTURES

DELIVERED AT

SCHOOL OF HORTICULTURE,

BY VARIOUS SPECIALISTS,

DURING

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DEPARTMENT OF AGRICULTURE, VICTORIA.

School of Horticulture, Richmond.

ESTABLISHED 1891.

Members of Horticultural Board of Advice:

D. MARTIN, ESQ., SECRETARY FOR AGRICULTURE, CHAIRMAN.
HON. WILLIAM ANDERSON.
HENRY BOYCE, ESQ.
CHARLES DRAPER, ESQ., J.P.
JOSEPH HARRIS, ESQ., M.L.A.
JAMES LANG, ESQ., J.P.

Curator:

MR. GEO. NEILSON, C.M.R.H.S.L.

Lecturer on Botany, Vegetable Pathology, and Agricultural Science bearing on Horticulture:

MR. D. MCALPINE.

Practical work in the Gardens and the Lectures are continued throughout the year.

The Lectures are free to all interested in Horticultural Pursuits, Ladies included.

Country Horticulturists when in town may avail themselves of the privilege of attending any of the Lectures.

PROSPECTUS.

SCHOOL OF HORTICULTURE.

1. The maximum number of students is twenty-five (25).

2. The instruction is free.

3. Students are non-resident.

4. Applications from intending students will be received by the Secretary for Agriculture, Public Offices, Melbourne.

5. Applications for vacancies which may occur will be dealt with in the order of priority of application.

6. Each student on admission must be over the age of fourteen years, and must produce a State school certificate, or an equivalent thereto, as to his education, together with a certificate of moral character from some person of known good repute, a justice of the peace, or a clergyman.

7. A moiety of the students may be adults, who may not be required to furnish school certificates.

8. All applications for admission as students must be accompanied by a sum of Five pounds (£5) as a guarantee for good behaviour, and which may be used for payment of fines.

9. Students are received for a term of not less than six months, and not more than three years.

10. Each student shall conform to the rules and regulations for the time being in force for the government and management of the gardens, under penalty of expulsion or of such lesser punishment as the board of advice may impose.

11. The course of instruction will include practical horticulture in its various branches, botany, vegetable pathology, and agricultural science as applied to horticulture.

12. An examination of students will be held at least once in each year by examiners to be appointed by the board.

13. Students who shall, at the end of the second or third year's training, have passed a satisfactory examination in the subjects taught may be granted a certificate of proficiency.

As the lectures, which were intended for the instruction of the students in the School of Horticulture, contain an amount of information of general utility—and although the public were admitted to the lectures, there is necessarily a large number of persons engaged in horticulture who, from the nature of their employment, and the fact of their residing at a considerable distance from the metropolis, were unable to avail themselves of the privilege of attending the lectures—it has been decided to publish the series delivered during the present year, in the hope that the information contained therein may be disseminated with profit to persons engaged in rural industries.

Copies may be obtained on personal or written application.

D. MARTIN,
Secretary for Agriculture.

Melbourne, 20th December, 1893.

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BOTANY IN ITS RELATION TO HORTICULTURE.

A lecture delivered by Mr. D. McAlpine, Government Pathologist, at the opening of the School of Horticulture at Richmond.

Introductory.

We are met here to-day to publicly inaugurate the new School of Horticulture, which has already been open for the reception of students since the month of May ; and as I understand that this is the first institution of the kind in Australia devoted specially to the instruction of students in the principles and practice of horticulture, I think you will agree with me that the occasion is one of more than ordinary importance.

The chairman has already briefly sketched its history, from the time when the proposal was made to take over the Royal Horticultural Society's Gardens by the Department of Agriculture until the establishment of a School of Horticulture has become an accomplished fact. And it now remains for me to show, before entering upon the special subject of my lecture, how this school proposes to fulfil the objects for which it has been called into existence.

Necessity for School of Horticulture.

Of the need of such an institution, and of the time being ripe for its establishment, there can be no manner of doubt. The necessity for something of the kind to stimulate and give direction to an industry which is destined to take a leading place in the development of this colony is clearly shown by the fact that agricultural colleges have supplied a decided want, and the cry is for more of them. Indeed, the incongruity, if I might so call it, of attending to the educational wants of the farmer in agricultural matters, and neglecting those of the fruit-grower, seems to have impressed the Government, for the Hon. Alfred Deakin, presiding (as Acting Minister of Agriculture) over the conference in connexion with the suppression of insect pests a year ago, said—"We have agricultural and viticultural colleges, or we are about to have them; and as far as we can judge by our experience the work done by those colleges is good work, and work the value of which is likely to greatly increase. It seems very desirable that something of the same sort should be done in connexion with horticulture. I hope to be in a position in a short time to make public the conditions under which something like a horticultural college, of course with gardens attached—a practical horticultural

college—could be called into existence." The hope of a year ago is a realized fact to-day, and the horticulturist, as well as the agriculturist, has his training school, to which he or his sons may go, provided by a paternal Government. Then, again, the monetary value of the fruit industry alone to the colony argues the necessity for the best possible training being given to those about to engage in it. I find that while the imports of cereals and preparations thereof have declined within the last ten years from £235,000 (in round numbers) in 1881 to £109,000 in 1890, and the amount retained for home use from £178,000 to £64,000 in the same time, making us almost self-supporting in the matter of grain, in the matter of other vegetable products for food (including preparations), *i.e.*, fresh fruit, dried fruits, &c., the imports have increased from £468,000 in 1881 to £552,000 in 1890, and the amount retained for home use from £328,000 to £552,000 in the same time. The necessity for importing for home use, however, is now likely to become less and less, for, while the area under cultivation for orchards and gardens has been stationary, and sometimes even decreased during the three years from 1887 to 1889, in 1890 there were 1,714 acres approved of for the bonus for planting fruit trees, and this, of course, only represents a portion of the increased area taken in. In the Mildura irrigation settlement alone there are about 6,000 acres devoted to vines or fruit trees, and it is a valuable object-lesson to show what can be done by scientific irrigation and intense culture.

No doubt but we are rapidly approaching the time when we shall be able to supply our own wants with regard to fruit, and have a surplus for others; and, seeing that many of those who are engaging in this industry are novices in the art of husbandry, and that an evident desire is abroad for obtaining the highest practical skill and the best scientific knowledge in the department of horticulture, the necessity for this school and the timely establishment of it will be acknowledged by all.

And even the farmer of the future—in Victoria, at least—will require to grow a greater variety of products than hitherto, in order to survive the competition of the Indian ryot and the Russian peasant, in wheat-growing at any rate. This means that a general training in horticulture is desirable for all agriculturists who do not wish to be left behind in the march of progress, and that the farmer would do well, where the conditions are suitable, to become a fruit-grower in addition. This school, therefore, supplies a decided want in the education of the farmer, and a term of at least one year might profitably be spent here.

Inducements to go to the Country.

We have heard a deal of late of the flocking of the population to the cities causing a congested state of affairs there, so that we

have overcrowded cities and towns, while the country is crying aloud for labour. There are many and complex reasons for such a social condition, and it is not to be remedied at once or by any one specific, but certainly the establishment of institutions such as this, where the practical as well as the scientific training will be acquired, which will equip our young men for successfully cultivating the soil and making it yield its best results, will help towards that end.

I know no better means of inducing those who are dissatisfied with their city surroundings, or those who are looking around for a healthful and profitable occupation, to engage in fruit-growing and kindred pursuits than by affording them the opportunity, such as this school offers, of acquiring the most approved methods of cultivation and the necessary knowledge before entering upon the cares and responsibilities of an orchard on their own account. The question is often asked, and variously answered, "What are we to do with our boys?" I would reply that for many of them the best thing to do would be to send them to the School of Horticulture, where they can qualify themselves for an honorable and profitable career.

Scheme of Instruction.

How it is proposed to carry out this necessary and opportune scheme of horticultural education may be learned in detail from the prospectus of the school and the syllabus of instruction, but I may just draw attention to the main features of it. "Practice with Science" is the motto of the Royal Agricultural Society of England, and is the principle on which this school is to be conducted.

Under the guidance of Mr. Neilson, the experienced curator, students will prepare the soil, then plant, manure, prune, and cultivate the various fruit trees and vegetables grown here. The fruits will also be gathered and stored by them, and packed either for the home or foreign markets. The raising of nursery stock will likewise be attended to, and the general management of an orchard will be learned under the personal superintendence of Mr. Neilson.

The nomenclature or naming of fruits will likewise be attended to, and, generally speaking, pomology, or that branch of knowledge which deals with fruit trees and fruit, will here be taught so thoroughly and practically that every student may be expected to distinguish himself in that particular branch in after life.

But as man ought not to live by bread alone, ought not merely to dig and plant and reap, and thus become a mere hewer of wood and drawer of water, so it is necessary, absolutely necessary at the present time, that he should be trained in the principles, as well as in the practice of his art, that he should have scientific

knowledge as well as practical skill. At present the scientific course is not very extensive, but by-and-by, as the school extends and expands, the scientific will keep pace with the practical, and not merely the subjects of study, but the extent to which they are studied, will widen out, as students pass into their second and third years.

Agricultural science in its relation to horticulture will be taught, and will deal with such fundamental and important subjects as soils, tillage, drainage, irrigation, and manures; and the insect foes of the orchard will be attended to as may be considered desirable by the Government Entomologist.

Botany in its bearings upon horticulture will also be dealt with under the three principal headings of Vegetable Physiology, or the healthy life and growth of plants and the conditions suitable thereto; Systematic Botany, or the arranging and classifying of plants in their proper families, &c.; and Vegetable Pathology, or the diseases of plants.

Horticultural School for the Good of the Community.

But I may digress here for a little to point out that the Horticultural School will not merely exist for and benefit those inside its walls, but it will prove an educative and improving influence for the entire horticultural community. The school possesses in the experimental gardens attached to it a means of education not only for students who may attend there, but for the fruit-growing and gardening community at large.

No doubt horticulture is being specially attended to in the sister colonies, as is evidenced by the decision in New South Wales to appoint a thoroughly competent pomologist; the labours of the Agricultural Bureau in South Australia; and the project in Queensland of instructing pupils in horticulture by gentlemen connected with the Botanic and Acclimatisation Gardens; yet, as already stated, it has been reserved for Victoria to open the first School of Horticulture, devoted wholly and solely to instruction in practical and scientific work.

Such places are of great practical value, and have become a necessity of our time. They afford the means whereby the teachings of science are translated into the language of ordinary life and put into practice. They supply that "connecting link" between science and practice which bridges the gulf between the two.

The place that science should hold in a scheme of agricultural or horticultural education is not yet definitely agreed upon, but it is generally acknowledged that a scientific training, added to practical experience gained in the field, is necessary in the keen competition of modern life. "Our theory here is that it is better to

educate farmers to some knowledge of science than scientists to some knowledge of farming" is a practical and common-sense view of the matter. The farmer or fruit-grower does certain things in his work, and he goes to science to explain to him the reason why, and to help him perhaps to do them better and to greater profit. By reducing science to practice in an experimental field or garden, science is then expressed in terms of daily life, and the grower can follow and profit by it, but in its abstract form as accurate knowledge he fails to get the benefit from it. The multiplication of such experimental gardens, if the experiments are properly conducted, is simply so many scientific lessons conveyed in a language which the fruit-grower can readily understand and appreciate.

In Mr. Neilson's department the merits of the different varieties of fruit trees in the market may be tested, so that growers may know the best kind to use, making due allowance for the different districts. And this is particularly important at the present time, when tea and other travellers are turning their attention to tree peddling. In several districts I have visited the tea agent has been about, and effected sales at a high price, while no guarantee was given that the trees supplied were what they were represented to be. The next step will be that the country will be overrun with seed-mongers, who may provide a very inferior article, unless the schoolmaster is abroad to enlighten the buyers. It is to be hoped that the kind of knowledge scattered from this horticultural centre will soon cause the "tree peddlers," like Othello, to find their occupation gone. Experiments will also be made in hybridizing, cross-fertilizing, and selection, whereby improved varieties of various kinds may be raised. Cross-fertilization takes place between flowers of the same plant or between flowers of different plants of the same species, whereas hybridization is a further extension of this process, or a crossing of the flowers of different species. The gardener has already largely used it for combining desirable qualities in the same plant.

Experiments also as to the different and best modes of cultivation, propagating, and pruning, as well as in the application of manures, and even the effects of irrigation will be tested when water is available.

In my own department the effect of various remedies on diseases of plants are being tried, and this is a most important use to which the experimental gardens may be applied. Disease, like the poor, we have always with us, and here test experiments can be carried out under personal control, the results of which will be available for the colony at large. Of course, we do not wish and do not expect to have a great variety of disease to deal with here, but in different districts there are experimental plots, as we might call them, where the owners are willingly carrying out experiments

under my direction. Thus in raspberry-growing, strawberry-growing, and peach-growing districts the diseases belonging to each are being treated with different re-agents to find out the cheapest and most effective remedy.

There is also a plot here in which various remedies will be tried for the treatment of rust in wheat. This may seem at first sight as having little bearing on horticulture, but when I tell you that rust in wheat, peach and plum leaf rust, and celery rust are all due to fungi belonging to the same genus (*Puccinia*), but of different species, you will see that remedies found effectual for the one may also be useful for the other.

The museum is another educational agency which has not been overlooked, and, although as yet in its infancy, it will be gradually extended. I hope before long to have displayed, in an attractive form, specimens of the various diseases to which our fruit trees, fruit, and vegetables are most liable, with the most reliable information as to remedies accompanying them so that growers may recognise the disease, when it appears, and apply the remedy accordingly.

New implements and inventions of interest to the horticulturist will also find a place here, and I would just call your attention to the latest addition—the Strawsonizer, which, as a distributor of liquids or powders for the destruction of insect and fungus pests, as a broadcaster of the various chemical fertilizers, and even as a sower of seeds of various kinds with great regularity, is recognised to be the most efficient combination machine we possess at the present time.

There is another instrument—a patent seed germinator—which is found to be very useful in testing the germinating power and vitality of the different kinds of seeds. This is a subject in which the students here will be exercised. Mr. Ellery has likewise promised a complete set of meteorological instruments, and the students, under Mr. Neilson's direction, will watch and record the varying phases of the weather and its effects on vegetation. The desire on the part of the board of advice to make the benefits of the school as largely available as possible is seen in the fact that the lectures are free to all interested in horticultural pursuits, and even the ladies are invited.

Women Students.

It is not to be imagined, however, that Victoria takes the lead in this respect, for at the Swanley Horticultural College, Kent, a ladies' branch has been opened. We learn from a recent issue of the *Queen* newspaper that although this college is still in its infancy, having only been two years in existence, already the experiment of providing for women students is being tried. A modern villa near the college has been neatly furnished, and

placed under a lady superintendent, where the women students board. They have an eight hours day, five for practical and three for theoretical work. The subjects of study include chemistry, botany, physics, zoology, including entomology, and the theory of horticulture, and there is a handsome lecture-hall where the men and women, of course, study together. The inclusive fees for a year's training are from £70 to £80, but arrangements are made whereby ladies can give the work a few weeks' trial, and see how it agrees with them, for a weekly sum. It remains to be seen whether women in sufficient numbers will be found able and willing to undertake the general work of an orchard, although, no doubt, there are certain branches, such as flower-gardening, fruit-preserving, and scent-making in which women might excel. I am in communication with the principal of the college, and the novel experiment will undoubtedly be watched with interest. Nevertheless, the board deserve credit for taking this step, and it ought to meet with a hearty response. Country horticulturists, when in town, are also invited, but I must confess that when a systematic course of study is followed, as will be done here, attendance at occasional lectures, say in the middle of some subject, is apt to prove rather unsatisfactory and disappointing. This suggests, however, that a short continuous and connected course of lectures might be arranged, say six, at certain seasons of the year when absence from the orchard would be least missed. The course could either be on one subject and by one lecturer, or on a variety of subjects, and various experts of the Department could take part in them. The subjects might be similar to those chosen by the British Fruit-growers' Association in response to the invitation of members of the County Council, London, to be lectured on in any part of Great Britain, viz.:—

1. The Principles of Vegetable Life.
2. Soil—Constitution and Management.
3. The Culture of Apples and Pears.
4. The Culture of Stone Fruits.
5. The Culture of Small and Bush Fruits.
6. Gathering, Packing, Marketing, and Preserving Fruits.

This work is already partially done by the experts of the Department, who visit and lecture in various districts, but the idea intended to be conveyed here is to give the fruit-growers an opportunity once a year of getting the benefit of the best and ripest experience, in a connected form, on some important matters bearing on their industry.

But this is only one of the various ways in which the horticultural school may be utilized for the benefit of the community, as I hope that occasional lectures may be delivered here that will benefit even the denizens of our cities or suburbs who cultivate a

flower garden for pleasure and not for profit. Thus, in connexion with my lectures on the "Principles of Agriculture," at the Heriot-Watt College, Edinburgh, I secured the services for occasional lectures of such men as the Curator of the Royal Botanic Gardens there, who gave us, I remember, a thoroughly practical lecture on "Plants Suitable for Room Decoration."

Botany in Relation to Horticulture.

Coming now to the special subject on which I proposed to speak, and that with which I have to deal in the course of lectures here, viz.:—Botany in its relation to horticulture. This relation is a very intimate one, and the place botany will hold in the course of instruction here will be to enable students to understand the why and the wherefore of the various operations they perform.

We sometimes speak of the science of horticulture as dealing mainly with the variation of plants under cultivation and selection, but botany will be regarded by us as the science, and horticulture as the art, which is just botany applied and practised in the orchard and garden. It is not intended to turn out botanists here, but practical horticulturists, and so the subject will always be treated with that end in view, as a means to an end. The subject of botany in its bearing upon horticulture is a very wide one, and would require much more time than can be devoted to it now in order to do full justice to it, so I will just confine myself, in the first place, to the consideration of the value of botany as a means of general training; then, in the next place, its utility to those who intend to cultivate the soil, and to reap the fruits of the earth with the best possible results.

Value of Botany as a Training.

The general advantages of studying botany may be briefly stated as a training in accurate observation, methodical description, and classification.

To observe accurately seems a very simple matter, and yet how few there are who can be implicitly trusted in their observations. The eye sees what it brings with it the power of seeing, and this power has to be developed and trained. I know of no science which can surpass that of botany in this matter of accurate and exact observation. In describing a plant or part of a plant—it may be a leaf, a flower, or a seed—you are expected so to picture it in words, so to present it to the mind of another, that he or she from that word-picture could make an accurate drawing of the object.

This power of accurate, exact, and careful observation is a valuable one, and well worth the trouble of acquiring, not only in the business of horticulture, but in the ordinary affairs of life.

In the gardens there will be many opportunities for the exercise of this quality, in watching the germination of seeds, the development of leaves and flowers, the fertilization of flowers by bees and other insects. But, above all, in conducting experiments is this watchfulness and care and scientific judgment necessary.

After observing carefully and accurately, one has to describe what one sees, and for methodical description botany is acknowledged to hold a high place. Description of plants has to be eminently methodical, in order to leave out nothing of importance, as well as to state the facts in the order of their importance. To such an extent, however, has this minuteness of description been carried in botany that some have overstepped the bounds of common sense, and caused the language of botany to become a jargon of sesquipedalian terms. One remedy for this would be to pay greater attention than has hitherto been the case to the uses of the different parts described, and associating structure with use, as in the varied forms and arrangements of flowers, there would be less mere dealing with words than with the things they represent. To realize in a word that the tree is a living body, feeding and growing, maturing and multiplying, decaying and dying, and subject to the laws of living things. Names we must have, for a technical language is as necessary to the botanist as the terms used by the workman in his special trade, but we must make the language plain by appealing constantly to the things themselves. And in that sense the course of botany here will be thoroughly practical, seeing that we have not only the resources of these gardens to fall back upon, but of the Botanic Gardens and University Gardens as well, and last, but not least, the extensive collection of dried specimens of Australian plants kindly presented to the school by Baron von Mueller, the Government Botanist.

In the matter of systematic arrangement, botany again gives a valuable training. Science has been said to be the detection of identity, and classification is the placing together of those things which resemble one another and the separation of those which differ. In botany, resemblance does not always lie on the surface—in fact, often "things are not what they seem," and the detection of unity in variety and variety in seeming unity exercises the judgment and enlightens the mind.

Utility of Botany in connexion with Horticulture.

While what I have said with reference to the study of botany would apply to its being included in the curriculum of any school or college as a means of education and training, I will now endeavour to show how useful and essential its study is in a school of horticulture.

1. *Vegetable Physiology.*—A knowledge of vegetable physiology, or of the healthy life and growth of plants, is of prime importance to the fruit and vegetable grower. How the roots and leaves take in their nourishment, the one from the soil and the other from the air; how healthy root and leaf action is best promoted; what substances are taken in from the soil and air respectively, and how the resulting sap is best conveyed to its destination, when and where it is most wanted; how the flowers are fertilized and fruit produced, so that where nature fails science may step in and often prevent the barrenness of the flower; the principle of the different modes of propagation; the effects of stock on scion; the theory of pruning; the conditions of germination, and the duration of the vitality of seeds—these are a few of the questions to which vegetable physiology supplies an answer, and the proper understanding of which enables the grower to insure and promote a healthy and vigorous growth, and the attention to which may often mean all the difference between a luxuriant healthy crop and a miserably poor one.

Hybridizing, as well as cross-fertilizing and selection, are also very important from a horticultural point of view, and may result n the production of improved varieties.

The anatomy or structure of plants will also be studied, but only in connexion with their physiology or function, for the use of a part is the main thing for us to learn, and the structure explains the action. We must not treat plants, as is too often done, as mere bits of mechanism, but as living and growing and reproducing organisms, endowed with vital activity.

It will be necessary for the proper understanding of plant-life that a certain amount of chemical knowledge be imparted, such as the composition of the air, the water, and the soil, and various vegetable products. In the meantime this will be given in connexion with the lectures on botany, and as far as practicable by means of illustrative experiments. But chemistry is such a fundamental study, treating of the constitution of matter, and so necessary for an intelligible explanation of various phenomena, that its introduction into the curriculum of study as a special subject can only be a matter of time.

2. *Systematic Botany.*—A knowledge of the classification of plants is also exceedingly useful in enabling us to recognise plants naturally related, and thus probably having many properties in common. This is well seen in the process of grafting, where plants of the same family only unite and grow, and in the production of hybrids, which are the result of crossing one species with another. Hence the utility of being familiar with the affinities of plants and their arrangement into natural groups. In dealing with weeds, for instance, which, for our present purpose may be regarded as plants out of place, it is important to

know the families to which they belong, and thereby something of their characters—their peculiarities of growth and reproduction—in order the more effectually to adopt proper measures for their extermination.

3. *Vegetable Pathology.*—In spite of all our care and attention, sometimes indeed because of it, disease will appear in our orchards and vegetable gardens. And if it were only for coping successfully with disease, a knowledge of vegetable physiology, or the conditions of healthy growth, might be recommended, for in order to understand disease properly, which is a departure from the normal condition, you must understand health, the condition from which that departure has been made. There can be no question of the supreme importance to the fruit-grower of his being prepared to deal with the various diseases which threaten him. Our climate, which is so favorable to vegetable growth, is likewise pre-eminently suitable for the various forms of fungi which prey upon our fruit trees and fruit, and there is an absence of that continuous and excessive cold of other countries which tends to keep in check both insect and fungus pests.

This department of vegetable pathology is one which will be specially and practically attended to here. Not only have we specimens of the various diseases affecting fruit trees and fruit, which will be used for illustration, but any such will be treated in the gardens, and the best-known measures for their prevention or mitigation practically demonstrated, in conjunction with Mr. Neilson.

But in order to apply the remedy we must first study the disease. The Premier, on a recent occasion, referring to a serious disease of the body-politic, used language which is also very appropriate here. He said—"If we desire to effect a cure, the first thing is to ascertain the nature, the history, and the extent of the disease; and then, having done so, to apply the proper remedy, if it can be found." We seek to find out the cause of the disease, and having done so, to remove it, if possible, and thereby effect a cure.

In studying the fungi causing disease it is absolutely necessary to use the microscope, and therefore every one attending this school will be trained in the use of that instrument. I hope that the day is not far distant when every horticultural society will possess one for the use of its members, and I am pleased to be able to state that I was asked to choose a microscope for a horticultural society a short time ago, intended to be presented as a mark of respect to their energetic secretary.

Knowing the disease, which can often only be accurately revealed by the microscope, we are provided with the means in many cases of dealing with it. Great advances have been made in remedial measures within the last few years, and when the

dreaded potato disease has at last been successfully treated we are encouraged to experiment with other diseases, in order to discover a remedy. The day is now past when such inflictions are regarded as dispensations of Providence, something to be endured and not to be cured.

I have already referred to the fact that the whole subject of botany will be properly graduated, and the more advanced topics reserved for the latter part of the course. Among these will be included such subjects as the geographical distribution of plants, and the origin of cultivated plants. Such studies will be useful in showing the natural conditions under which certain kinds of plants grow, where they are likely to thrive here, and the kind of treatment most suitable to the peculiarities derived from their environment.

In the introduction and cultivation of new products this knowledge forms a valuable guide as to the best mode of treatment and management.

Conclusion.

I have thus endeavoured to show very briefly, but still I trust successfully, that scientific knowledge may be brought to bear on the art of horticulture with the happiest and most beneficial results, that such knowledge is a power not only to relieve the tedium and monotony of mere mechanical labour, but to invest it with an interest which it would not otherwise possess, to increase the charm of rural pursuits, to suggest improvements and modifications where otherwise dull routine would bear sway, and thus to produce the result which is, or ought to be, the reward of faithful and intelligent toil, a bountiful return of the fruits of the earth.

The Horticultural School is now about to be fairly launched on its career of usefulness, and may be likened to a noble ship about to set forth on what we all hope will be a prosperous voyage, commanded as it is by a veteran in the service. Carrying out the simile, I am sure the words of the poet express the feelings of us all on this auspicious occasion :—

Sail forth into the sea, O ship !
Through wind and wave, right onward steer ;
The moistened eye, the trembling lip,
Are not the signs of doubt or fear.
Sail on, nor fear to breast the sea !
Our hearts, our hopes, are all with thee ;
Our hearts, our hopes, our prayers, our tears,
Our faith triumphant o'er our fears,
Are all with thee, are all with thee.

OUR INDIGENOUS PLANTS IN RELATION TO HORTICULTURE.

By Baron von Mueller, K.C.M.G., M.D., F.R.S., etc.,
Government Botanist.

(*2nd September*, 1892.)

A free discourse was delivered by Baron von Mueller, initiatory to the lectures, given in the College of Horticulture at Burnley, on the 2nd September, 1892, at which address besides the students were also present D. Martin, Esq., the Secretary of the Agricultural Department, the Hon. Wm. Anderson, Joseph Harris, Esq., M.L.A., and several other distinguished ruralists and friends of theirs. Baron von Mueller commenced in some graceful wording to allude to the facilities, which in so enlightened a spirit the Government had offered through the Minister of Agriculture to incipient horticulturists under the principal care of the Superintendent of the Horticultural Gardens and through special teachers. He referred to the horticultural career as one of the happiest most prosperous and healthy in life under most circumstances; further he dwelt on the ease, with which rural pursuits also in this direction could be carried out in a winterless clime like ours, as compared to the difficulties to be overcome by the length and severity of the winters in the home-countries, indeed we here having almost two springs annually, the one ushered in by the first greening of the grass about Easter; the other commencing some months later, when the orchard-trees burst into bloom. The Baron referred further to the very ample scope of horticulture here, as from a so much vaster number of plants could here be selected for outdoor-culture than it was possible in the countries of our forefathers. Indeed, he said, in the milder regions of Victoria almost any plants of the globe might be reared except those of the equatorial zone, added to which was the blessing, that rural lands were obtainable in the cheapest of all possibilities. In the continuation of his remarks he pointed out the advantage, which studious horticulturists here had in becoming acquainted with the exact chemical contents of soils and of various manuring substances, the relative action of these, their respective adaptability to various forms of plant-life, and the accuracy with which the adequate nutrition could be offered in each instance.

The Baron exhibited in connexion with these observations various gypsum-preparations from extensive beds of this mineral, as prepared in a Melbourne-factory from material obtained near the south-coast of Australia and the Murray River. As a particular horticultural resource, almost latent, yet replete with deep local interests, he regarded the methodic gathering of our most ornamental plants for our own gardens, so that every Australian might become more intimately and extensively acquainted with the flora of his native land. He showed pressed dried specimens of some most gorgeous plants, particularly from extra-tropic Western Australia, which never had yet reached even any conservatory in Britain or elsewhere, among such plants of extraordinary beauty the *Verticordia oculata*, which as having its flowers embellished with minute feathers, reminding one of those of the smallest humming bird. He thought that the export trade of seeds of ornamental plants, indigenous to this part of the world, ought to assume dimensions more on a mercantile scale. He spoke of the 300 kinds of Australian Acacias, some of which were the main glory of the glasshouses in the first half of this century much more than now, he having greeted them himself as the harbingers of the spring throughout the earlier years of his life in European gardens.

In speaking of scenic culture here, he emphasized, how we were envied in the colder lands by being able to surround our dwellings with the grandeur of vegetation, which inspired some of the greatest of poets such as Byron and Goethe with rapturous effusions, when they beheld on a then difficult journey to Italy the laurel, the myrtle and the olive in their natural grandeur; but he pointed out, that, to this colony was not denied the magnificence of alpine scenery with its own charming vegetation, which for continental Australia exists only in Victoria and New South Wales. This brought Baron von Mueller to touch briefly on culinary garden-culture and the advantages, which our wide range of clime affords for it. He instanced, how the London-market was earliest in the season supplied with kitchen-vegetable and orchard-fruits from the Channel-Islands, and latest from the Scottish Highlands. The railways, he remarked, approached also here the Alps already, and we could have vegetables and fruits now brought to the metropolis from our sub-alpine valleys, after the supply from the lowlands had ceased for several weeks. This, he meant, was all the more significant, as the establishment of sub-alpine farms in our Snowy Mountains by Scotch Highlanders, Scandinavians and Swiss would enable the prospecting parties of miners much more to hold out in their searches, so that much of auriferous country in our Alps could be far better tested, if re-provisioning, all required to be done through pack-horses now, could be effected from near places in our highlands, so far as

turnips, cabbage, beans, carrots, barley, rye, oats, fowls, eggs and much other food is concerned, that can be raised even in coldest climes.

He directed attention finally to the facilities, with which water, without expenditure by mere gravitation was obtainable from the Alps, and how by diverting water of the rivulets or by slightly tapping natural reservoirs or reaches, new flow for irrigation could be secured,—mitigating thus by the least exertion and outlay the dangers of floods in the lowlands, and pointing out, that in the cooler regions also the invasion of all kinds of horticultural crops was least to be feared through destructive fungs and insects.

In conclusion Baron von Mueller congratulated the students on the splendid prospects before them, which circumspectness and experience of the rulers of the land had opened up; and he felt sure, that they would derive therefrom all the anticipated benefits in their own practical life, and would have cause ever to be grateful for the boons offered to them by this first Horticultural College established in the great Austral Land!

UNDEVELOPED SOURCES OF WEALTH.

By Joseph Harris, M.L.A.

(19*th May*, 1893.)

The paper I am now about to read to you is not of a sensational character; it will simply deal with a few subjects which I think deserving of attention, and may prove to be of some value either to yourselves or to others. The title of my paper may be given as "Undeveloped Sources of Wealth." I admit this to be a high-sounding and grandiloquent phrase, and may lead you to anticipate something much greater than will be realized by the time my paper is finished.

I have not discovered a speedy way of wiping out our National Debt, nor an instant method of at once giving employment to the thousands of idle men now in Melbourne; but I trust that what I say may have the effect of causing you and others to think how best we may add to the general wealth of the colony by growing those plants and trees, and manufacturing their products, which may be readily produced, and which at present we have to import from other places. The fact that our School of Horticulture is now full, that we have even more pupils than the Board originally intended taking, is a sign, I think, that our fellow colonists thoroughly recognise that it is absolutely necessary we should give more attention to the cultivation of the soil than we have done.

Owing partly to the fewness of our people as compared with older countries, to our distance from the great centres of population, and to the comparative high price of labour, our manufacturing industries have not been the universal success at one time anticipated, and on all hands it is recognised that to "mother earth" we must chiefly look for our permanent prosperity. Not only in these colonies, but in England, America, and elsewhere, considerable attention has been given of late to horticulture and agriculture.

Royal commissions and select committees have been inquiring how best to increase fertility of the land and restore prosperity to the tillers of the soil. Many of the leading statesmen of the mother country have taken a keen interest in this subject, such men as Gladstone, Lord Derby, Sir J. Lubbock, Jesse Collings, and Lord Sudely have spared time to devote to this matter. The latter gentleman a few years ago put his faith in horticulture into

practice by planting large areas of fruit trees ; 100 acres of strawberries, 60 acres of raspberries, a quarter of a million of black currants, nearly the same number of gooseberries were included in the 700 or 800 acres this gentleman devoted to fruit culture.

In America, about 30 miles from San Francisco, in the heart of one of the largest fruit-growing districts in the world, has recently been opened the Leland Stanford Jr. University of California, with a first endowment of £4,000,000. The endowment being ample no fees are necessary, the education being practically free. Students have only to arrange for board, clothes, and books. Belonging to the university there are about 40,000 acres of excellent land, about 1,100 of which are already in bearing as vineyards, a considerable tract being orchard land. Immediately surrounding the university buildings there are 8,000 acres of rich land ; upon this is already located one of the finest stock-breeding farms in America. Something like 1,000 acres of this tract will be planted as orchard, and about 100 acres will be used for illustrative horticultural work of various kinds ; 250 acres will be devoted to landscape gardening, and about 100 acres to botanical purposes. This is the first university in the world to elevate horticultural education to its true place of dignity among the arts and sciences by making it one of the leading features of the institution.

You are all aware that old England has its colleges of horticulture, and at the one at Swanley they take in lady students. The women's branch there has now been in existence about two years, and so far has been a success. These nurserymaids—not in the domestic but in the horticultural sense—are trained in fruit, flower, and vegetable culture. They are also taught jam and sauce making, and other kindred subjects. The last report of this college states that several applications had been received for women, both as head and single gardeners, and in one case to take entire charge of the conservatories and green-houses. This is what is occurring in crowded England, and may never occur here, and I only refer to the fact as indicating another outlet for female labour in a congested population. But I must refrain from saying more as to what is being done in other countries, but will come nearer home. Not only is our own Horticultural School full, but our agricultural colleges are always full, and to get admission to either Dookie or Longerenong application must be made months in advance. Greater facilities must be afforded our young people to learn both horticulture and agriculture, and I think some rudimentary instruction in these subjects should be given in some of our country schools.

The profession of horticulture is a noble one—no science more healthful or pleasurable. Agriculture and horticulture are, without doubt, the two most important industries under the sun,

inasmuch as they deal with the food supply of the whole world Horticulture may be considered the parent of agriculture in one sense, for it determines upon a small scale the value of those principles upon which a more extended cultivation of the soil depends. No art demands a wider range of natural and experimental knowledge than the practice of horticulture. Like many other sciences it is never learnt; there is always something fresh to be picked up, some new and improved method of culture, whereby quality and quantity are improved, some new variety of vegetable, fruit, plant, or tree to be tested. It is the most ancient of all industries. Shakspeare makes his grave-digger declare there are "no ancient gentlemen but gardeners," and since it was the calling of our first parent, so will the last man be dependent on the gardener's energies. No business combines so much of the *utile et dulce* as gardening. By the sweat of his face mankind is fed, by the taste he exhibits the earth is beautified.

Fortunately for our horticultural efforts we have in Victoria a fine genial climate and fertile soil, we can grow the currant of Greece, the olive of Italy, the lemon of Portugal, and the raisin of Spain as well in some parts as the countries I have mentioned—this is an indisputable fact. The gentlemen (leading grocers of the city) who acted as judges of dried fruits at our late Intercolonial Wine, Grain, and Fruit Exhibition stated that some of the Zante currants, muscatel raisins, and prunes were of the very highest order of merit, and a few samples even superior to any imported; this fact is very encouraging, and should lead, and no doubt will lead, to extensive areas being placed under these crops. Now, when we remember that we annually import some seven to eight million pounds weight of currants and raisins alone, we can see what an opening there is for the extensive cultivation of these fruits. In addition to these two kinds we import something like a million and a half pounds weight of other kinds of dried fruits, some of which, for instance, figs and prunes, can well be grown here. We also import considerable quantities of almonds, walnuts, and other nuts, and these we can grow in some part or other of the colony as well as in any part of the world. We Victorians are often boasting of the enormous wealth of our natural resources, but these resources must be developed and not permitted to lie dormant in the soil. Our farmers tell us that the growing of our great staple product, wheat, barely pays, and that a smaller yield, unless better prices were obtained, would mean disaster. We have yet a few million acres available for wheat-growing in the mallee, where land can be rolled, cleared, and ploughed at a very low cost, and our wheat yields will doubtless, unless serious droughts or other calamity ensue, increase annually for some years to come. My main object is to direct attention to a few plants and trees which are not ordinarily cultivated in the colony, but which may probably be

grown to advantage, not of course to the neglect of others which are known to be profitable, but as adjuncts, some perhaps at first experimentally only. To a lover of his profession, there is an immense amount of pleasure derivable from testing and experimenting upon new plants and novel industries. Nothing would be easier than to make up a list of exotic plants and trees which would grow in some part or other of the colony, but we are at once met with the high cost of production as compared with many other countries, and if we are to engage profitably with many of these it is inevitable that the price of our rural labour must be reduced.

I have no desire to be thought a "paper" gardener—one who can sit down and write fluently on subjects he has no real practical knowledge of. I have many a time smiled at letters and articles which have occasionally appeared in our public press recommending the cultivation of this plant or of that; scores, aye hundreds, of plants of economic value will grow with us, but the main question we have to deal with is, can they be successfully and profitably grown here? This is the crux of the whole thing; it is simply a matter of £ s. d.

I have seen the cultivation of the tea plant recommended. We all know this plant will grow well in numerous places—for the past dozen years I have had it flowering and seeding at Mount Martha; but to grow the plant to perfection, as I have seen it in the hilly districts of Ceylon, you must have a yearly rainfall of 90 to 120 inches, so that the warm, moist, and steamy atmosphere will force the growth of leaves, and even if our climate were ever so favorable we could not compete with Coolie labour at the miserable price at which it is paid. A few years ago it was thought that that valuable quinine plant, the cinchona, would pay to cultivate here, but although it will grow in many places our climate is too dry and variable for it to succeed. In the cinchona districts of Ceylon the temperature is exceedingly equable, varying a few degrees only in the year.

The conservatism of farmers and gardeners is proverbial, and a lot of drumming and drilling is required to get them to move out of the beaten paths they have been accustomed to, but we in this young country, with a fine climate and fruitful soil, must take every advantage of these, and cultivate any and every thing we can be assured will pay. The necessity for discovering every plant, fruit, and tree which will tend to increase our wealth from the soil, and expand our exports, never before existed to such an extent as now. All kinds of garden produce, and I may add farm produce as well, were never, I suppose, so cheap as at present, and I think if I can point out to you some plants and crops which can be profitably grown here—if I can set some of you thinking of what I say and recommend—I shall be pleased. Writers in

newspapers and others usually indulge too much in generalities; they, and all of us, know how absolutely necessary it is to get all we can from the soil, but they do not sufficiently indicate what we should grow—my intention is now to point out those crops I think should be tried.

Sugar Beet.

First and foremost among crops not grown here—and which I feel convinced would pay well to cultivate—is this most valuable root. It is about 30 years since the press of Melbourne and a few of our public men first directed attention to the importance of sugar beet. At that time cane sugar was the common staple article all over the world. Sugar produced from the beet root was very small; in fact, the industry was then only beginning to develop. In 1868 the total yield in all Europe of beet sugar was only 650,000 tons. In 1889–90 the yield in Europe alone was no less than 3,543,107 tons. California—with soil and climate similar to our own, but with a little less rainfall—is now, after considerable opposition from those connected with the established cane-sugar industry, growing the root largely. In 1890 3,250 tons of crystallized sugar were produced; but in the very next year (1891) this quantity increased to 10,350 tons from three factories, and two more factories were in course of building. In the whole of the states of America they are now manufacturing something like a million tons of this sugar annually. The production of cane sugar is gradually diminishing, the total yield for 1890 being, according to *Hayter*, 2,676,500 tons, or a trifle more than half the quantity made from beet. The wonderfully rapid increase in the production of beet sugar is, of course, owing to the large subsidies paid by Germany, France, Belgium, Russia, and other European countries. Some 20 or 25 years ago a commencement was made in this colony to grow this root and manufacture it into sugar. As far as the growing of the root and its conversion into sugar were concerned the experiment was successful, yet the enterprise came to grief, if I remember rightly the causes being want of sufficient capital, proper management, and the lack of the necessary scientific skill to make the venture a success. The quality of the article made was pronounced by experts to be equal to any imported.

The history of the attempt to start this novel industry in Victoria was graphically given at a meeting of the Royal Commission on Vegetable Products some half-dozen years ago by Mr. Murray Ross, a gentleman who had sufficient faith in the practicability and remunerativeness of sugar-beet growing and manufacturing the same to build, at a cost of some £50,000, that fine pile of buildings near the junction of the Gippsland and Mornington railways. This gentleman stated to the Commission

that he was willing to spend another £50,000 to complete the works. Whether he is still ready to spend this trifle of £50,000 I do not know. No possible doubt can exist as to the suitability of our climate for the growth of this plant, and we have any amount of land eminently adapted for it. The crop is very exhaustive to the soil, and cannot be grown successfully on the same ground year after year. Of course a deal depends on the richness and the natural constituents of the soil, but in ordinary cases—and this may be laid down as a rule—beet should only be grown once in three or four years on the same land. Mr. Pearson, our Government Agricultural Chemist, has experimented upon beet root; and in one of his reports he says—"It may be considered to all intents and purposes demonstrated that sufficiently rich beet can be grown in this colony. With properly-selected seed, with the improvements in the modes of cultivation which are the result of experience, there is practically no doubt that a yield of from 6,000 lbs. to 8,000 lbs. of sugar per acre per annum may be counted upon." Although the beet plant will grow in almost any kind of land, great attention must be given to the selection of those soils best adapted to its successful cultivation. It thrives best in a deep sandy loam or an argillaceous soil; peaty and also chalky soils are not suitable. It does well in light silicious ground if it be rich in humus or in manure. A purely clay land is unsuitable, being too cold, and the long tapering roots would not easily penetrate it; they would also be deficient in saccharine matter. The land should be well drained. Neither marshy land nor a dry sandy soil will yield a satisfactory crop. The presence of salt in the soil is very inimical to the production of sugar from this root. Monsieur Baruchson says that 1 per cent. of salt destroys 5 per cent. of sugar. Even close proximity to the sea, solar action on the portion above ground, the use of any manure impregnated with salt is a serious obstacle to success. So important a matter is this that some of the German manufacturers, when contracting with the growers of the root, stipulate that it shall not be grown on certain soils, and sometimes name the kind of manure which shall be used. Land which has already been cropped should be preferred to that newly cleared. The roots penetrate to a good depth if the soil is open and well pulverized, and newly-cleared land may contain some matter detrimental to the sugar-producing power of the beet.

I need hardly add that stony soils should be scrupulously avoided. From what I have said about the cultivation of the beet plant, you will see that more attention to soils is required than that necessary to grow potatoes, onions, or other roots. To renovate the soil impoverished by the beet, various manures are used. If farm-yard manure be used, it should be applied in the autumn, the land deeply ploughed, and in the spring, at seed time,

some artificial manure may be lightly ploughed in, sulphate of ammonia being considered one of the best fertilizers. All the leaves cut off at the time of digging up the roots, if not used for feeding cattle or sheep, as well as the refuse or waste substances made in the manufacturing, should be returned to the soil. The selection of seed saved from roots rich in sugar is very important, and large European manufacturers frequently provide the seed themselves, so as to insure the best quality being grown. Neither very large nor very small roots are best adapted for sugar purposes, those averaging between 2 lbs. and 3 lbs. are reckoned the best. They should have small tops, not necky, and those which grow almost entirely in the ground are the best. The harvesting and the manufacturing of the root into sugar are matters somewhat foreign to the object of my paper, and at present unnecessary for me to speak upon. I need hardly add that until the factories and machinery necessary to transform the beet root into sugar are ready, it would be madness for our farmers to rush off into beet-growing.

At the period I have already mentioned, when this industry was first started and failed, the necessity for extracting all we can from the soil did not exist to the same extent as at present. Now we are faced with the fact that thousands of our fellow men are wanting work, that numbers are leaving our shores for New Zealand, South Africa, West Australia, and other places; short-sighted persons may say, well, let them go, the better for those who remain. I say no, most emphatically ; these men are the very life-blood of the colony, and it is disastrous that we should lose them. Let us take steps to attract population rather than repel it. The growing of sugar beet or of any other crop will not afford instant relief, but I feel convinced that this industry would be of great benefit, and be a large factor in our national wealth. We consume between 50,000 and 60,000 tons of sugar annually. If this were to be grown here, it would mean the occupation of, say, 30,000 to 40,000 acres of land, and give employment to a large number of men, irrespective of those required in the factories. Our railway receipts would be largely increased by the conveyance of the roots to the factories, the transport of manures, and in other directions. Just now all the talk is about placing men on the land, but what are they to grow ? Our local markets for vegetables can easily be swamped. Several years must elapse before fruit trees come into full profit. Beet is an annual crop. A living no doubt could be made by combining several rural industries, such as poultry, pigs, bees, and other things, but it seems to me that in this beet industry we have the very thing which small holders could cultivate profitably. The proposal to place men on allotments of 10 acres each should be increased to say 15, a man could then grow a crop of beet of

5 acres every year, and the sale of his produce would be assured. Fairly good land should give a return of 20 tons of roots to the acre, the manufacturer would give, say, 15s. per ton placed in the railway trucks, so 5 acres at 20 tons to the acre would realize £75. The seed for these 5 acres would cost about 15s. per acre ; the manure, say, 40s. per acre ; and extras 5s.; or a total of £3 per acre, totalling for the 5 acres £15 ; this deducted from the money realized would leave a net income from the 5 acres of £60. The balance of the 15 acres would, of course, be used for growing potatoes and other vegetables, perhaps a little corn, a few fruits, fodder for their cow, horse, pigs, and fowls. In the cultivation of beet a quantity of light labour is required—earthing up, hoeing, and weeding—such work that children could engage in. The price of labour in the colony is fully one-third higher than it is in Germany, but against that drawback we have much cheaper land. There it runs about £3 per acre per annum ; here, with the exception of some extraordinarily fertile spots in the western district, it is very much less, infinitely less. Here we have a duty of £6 per ton on cane sugar and £12 per ton on beet sugar. This should be a sufficient set-off against the imported article.

The growing of our own sugar might possibly provoke hostility from those interested in cane-sugar refineries. I have not forgotten the injury done to those immense sugar refineries at Bristol and elsewhere in England by the development of the beet-sugar industry ; but while some harm to individuals might accrue here, should this replace cane sugar, I am convinced that very great national benefits would follow the cultivation of a plant so eminently adapted to the country. Accept if you please the advice given by Mr. Pearson, and send to the continent of Europe for some properly accredited gentleman of experience who would understand both the administration and the technical sides of the question.

I have not lost sight of the fact that the Gillies-Deakin Government offered a bonus of £100 for 20 tons of a good marketable quality sugar grown in the colony, said bonus available up to 30th June, 1895. This has not yet been applied for, nor will it ever be ; the sum offered is altogether too small, and the required quantity of sugar too small also. I am not by any means a fervent advocate of the bonus system ; with the one exception, perhaps, that of the butter bonus, which, no doubt, has been successful, the other bonuses offered have been either partial or total failures.

Will not some of our enterprising men take this subject up, but should private enterprise fail, then it might be worth while our Government and Parliament considering the propriety of offering something substantial, say, £5,000 for the first 500 tons of beet

sugar grown in the colony. I hope that beet-sugar production will not much longer be with us a dream of the future, but that it will speedily become a well-developed source of wealth.

Fibre Plants.

Spasmodic attempts have been made from time to time to grow fibre plants here, but, although flax and hemp will in some parts of the colony do as well as in any part of the world, we can point to no results of which to be proud. Mr. Guilfoyle, Director of our Botanic Gardens, has on several occasions exhibited splendid collections of fibres, which, although very interesting from a scientific point of view, were not of much use to the practical man who might be anxious to cultivate for profit. To be of any real service a few acres of each should be grown, an account of the cost of the same to be kept, and then the value of the fibre produced estimated; but even this would be difficult, different fibres require different treatment and machinery.

The three principal fibres are flax, hemp, and jute; the latter we may abandon all thought of growing; our climate is too cold, the plants producing jute will only thrive in a warm and humid climate.

Of flax (*Linum usitatissimum*) we had last year, according to *Hayter*, the prodigious area of thirteen acres under this crop, producing 15 cwt. of fibre and 267 bushels of linseed. In the same year we imported 373,392 gallons of linseed oil, valued at £44,000. Surely in the flax we have a plant we should be able to grow enough of to supply our own requirements at any rate. Now, what is the reason it is not cultivated in quantity? We have in many parts of the colony the very soil and climate most suitablef or it; we have also among us plenty of men who have grown it in Ireland and in Scotland, and who know all about its culture, and also some who understand the manufacturing the fibre, and the expressing the oil from the seed. Mr. Miller, the rope manufacturer, informs me that his firm is prepared to purchase pretty well any quantity of fibre for manufacturing into cordage and twine purposes, and that if they could buy plenty of flax they had all the necessary appliances for making canvas, and that with a little extra outlay they would be able to manufacture other linen goods. *Hayter* says that last year we imported fibres to the value of £67,050, and this independent of jute and cocoa-nut fibre, which we cannot produce here. I am informed that in Gippsland a few farmers have grown this last season a few patches of flax, and have been well pleased at the result. One farmer particularly has gone to some expense in getting machinery to prepare the plant for market, and intends to go extensively into the cultivation of flax next season. The only obstacle I can see in the way to a profitable cultivation of this valuable plant is the high price of

labour compared to that in other countries. The greatest flax-producing countries in Europe are Russia, Italy, France, and Belgium, and in each of these countries the cost of labour is very low. But in some of the states of America immense quantities of flax are grown; in three states alone as much as nearly 7,000,000 bushels of flax seed were grown in one recent year. I have no record of what the rate of wages is in Iowa, Dakota, and Kansas, the three states I allude to, but it will be very much higher than on the European continent, although probably less than what has been ruling here.

Steeping, or water-retting, is done by immersing the flax in a stream or pool of water. Sometimes the flax is spread out thinly on the ground and exposed to the decomposing influence of dew and rain; this is what is known as dew-retting. But these means of separating the fibre are largely superseded now by the so-called dry process, resulting in a gain of both strength and quantity. The use of chemicals and the application of steam for the purpose of freeing the fibre from the woody matter have resulted in a great saving of time over the old-fashioned methods.

Hemp is cultivated nearly all over the world. At our Horticultural Gardens was grown this last season a patch of splendid hemp, and I have no doubt that it, like flax, would succeed in many parts of the colony.

The New Zealand flax (*Phormium tenax*) is a valuable plant to have in any garden. Possibly it may pay to cultivate in some parts of Victoria. In New Zealand a considerable trade is done in its fibre. The plant will grow almost anywhere, thriving best, like most other plants, in fairly rich soil.

The Esparto Grass (*Stipa tenacissima*)

is one of the most valuable fibre plants in the world, and is imported into England at the rate of 140,000 to 150,000 tons annually. It is a native of Spain, Portugal, and North Africa. It grows on the poorest of soils where no other vegetation is produced. A drawback to the cultivation of this plant is the fact that it takes many years to establish, and from twelve to fifteen years before fit for harvesting. It will then produce 6 to 8 tons to the acre, value £5 to £7 per ton. The late Dr. Schomburg was fortunate in raising, some twenty years ago, a large number of plants of this grass, but at this moment I am not aware of what has become of them. Our Mr. Bosisto also succeeded in importing this plant some few years since, and I must make inquiry as to how it is succeeding with him. Mr. Noble, paper manufacturer, says the New Zealand tussock grass is as good as esparto, and probably our own tussock grass, so plentiful in many parts of the colony, may be equally valuable.

The Ramee,

or glass-cloth plant (*Boehmeria nivea*), will do fairly well with us in many places, but at present can only be recommended experimentally. A plantation made by Mr. Fuller at Cheltenham some years ago resulted in failure. The plant wants thorough shelter from cold winds and frosts. The fibre is very strong and valuable, realizing from £30 up to sometimes £100 per ton. I observe that Fiji has gone into growing ramee largely.

The Sunflower,

with its large handsome smiling face, is being grown in immense areas in Russia, Germany, and other European States, and would probably pay well to cultivate in Victoria. On good land the yield should be 50 bushels of seed to the acre, and a bushel of seed should yield 1 gallon of oil. Haldane says the oil is of great value, and is employed for table purposes, lamps, painting (especially for greens and blues). It makes excellent soap of great softness. When travelling in Switzerland and Germany two or three years ago I observed the words liberally placarded at all the railway stations "Zunflower Zweep." For some time I could not imagine what this meant, when presently a ray of intelligence flashed across my dull intellect that "Zunflower Zweep" just meant Sunflower Soap, and so it proved to be. As a lubricant it is most excellent; as a drying oil nearly equal to linseed; quite equal to olive oil for salads and other domestic purposes, in fact, seems to be superseding olive oil. The seed, shelled and ground, makes very fine sweet flour for bread, and is also a valuable food, of course in its whole state, for poultry. The seed, roasted and ground, is a substitute for coffee; the seeds also make demulcent and soothing emulsions. No flowers yield more honey; they also give a fine yellow dye. The pith may be used in surgery instead of moxa; the oil is used for cloth-dressing; the leaves are excellent fodder, either fresh or dry; the marc, or refuse after expressing the oil, is superior to linseed cake for fattening cattle and poultry. By treating the stem like flax a very fine fibre is produced, nearly as fine as silk. So you see every part of the plant is of value—the flower, the seed, the leaves, and the stem, while a valuable potash is made from the stem and leaves. As you already know, the sunflower is an annual plant. It is a gross feeder, and does best in a rich calcareous soil; one of the best manures for it is old mortar. The impoverishment of the soil by its culture can be remedied greatly by burning the stalks and spreading the ashes over the soil, and of course the land could be kept in good heart by a liberal use of bone-dust, blood manure, guano, or other artificial fertilizers.

There are several varieties of sunflower, the white-seeded one producing the most oil, while many cultivators on the continent prefer a dwarf species (*Helianthus indicus*) as being the most profitable for general cultivation. It is stated that wheat grows better when succeeding a crop of sunflower. I have had inquiries as to how the seed should be extracted from the head or disc. When the seeds are shining and ripe the plant may be either pulled from the ground or cut with a sickle. The discs are cut from the stem and the seeds rubbed out with any suitable instrument, such as that used for rubbing out maize.

Other Vegetable Oils.

Time will not permit to more than just mention olive, castor, colza, and other oil-producing plants which grow well here. The olive, as you all know, does well in numerous parts of the colony, and excellent samples of oil have been exhibited at our various shows and exhibitions for very many years past, but, as I stated before, the sunflower, which gives a return in as many months as the olive does in years, and which appears to yield a product as valuable as the latter, may possibly in time supersede it. One advantage the olive has over the sunflower, inasmuch as the latter requires special soil and manuring, while the olive will live nearly for ever, and requires little attention in the way of pruning and dressing, it will also grow in a great variety of soils, wet marshy land being alone inimical to it. An Italian saying is, "If you wish to leave your children a lasting inheritance, plant an olive tree." De Candolle puts the average age of the olive at 700 years. The castor oil plant does well enough here, in some parts of South Australia is quite a weed; but we cannot expect to compete with India and its cheap labour in the production of castor oil. I have little faith also in our being able to produce economically rape or colza oil. But there is one other valuable oil plant which I think may prove profitable—it is the earth-nut (*Arachis hypogœa*). I have only seen this singular annual plant in two or three places. At the Horticultural Gardens at Richmond it does well. The crop is a most profitable one, producing in a good year as much as 100 bushels (25 to 32 lbs. to the bushel) to the acre. The seeds contain 42 to 50 per cent. of oil; after they are cleaned, decorticated, crushed, and pressed by cold pressure, 1 bushel of seed will yield a gallon of the finest oil, very clear, and of a pale-straw colour; it is then frequently sold in Europe for olive oil. It makes an excellent lamp oil. It is also used for dressing cloth, and for lubricating watches and other delicate machinery. An inferior quality of oil is made by the seeds or cake remaining after the first pressing being ground finely, heated, and pressed again; this

is largely used by soap manufacturers. After the oil is expressed, the cake is given to cattle, being particularly rich in flesh formers, of sweet taste, and agreeable flavour. Cattle are fond of the stems of the plant, so nothing need be wasted. These earth, or pea-nuts as they are commonly called here, are, when fresh, very rich and delicious, very different to the rancid trash frequently found in Melbourne. Most people who have been accustomed to consume them fresh much prefer them to any other kind of nut. The seeds roasted and bruised in a mortar and made into cakes are an excellent substitute for cocoa, and when parched and beaten with sugar make an excellent sweetmeat. This valuable and humble little plant has lately been placed to a novel use, the oil it produces, under the name of "Arachide," is extensively used in some parts of Europe in the manufacture of margarine; from a report I have seen, the trade done in this oil for this purpose is kept very secret. When fresh, the oil is perfectly wholesome, and it will keep for a long time without getting rancid.

The plant requires a warm situation to thrive in, and a deep rich soil is the best for it. Sir Ferdinand von Mueller says that in the southern United States alone the annual value of the crop is upwards of half-a-million sterling. It is also largely cultivated in the south of France and Spain, in parts of Africa, and many other parts of the globe.

Flower-farming for Perfumes.

The time will come when this industry will in Victoria become of great importance. Very many of the flowers which provide the material for perfumes grow well with us—the rose, lavender, jasmine, mignonette, sweet-scented geraniums, and a host of other plants do as well with us as in any part of the world, while some others, such as the boronia, the acacia or wattle, and the sweet-scented pittosporum probably thrive better. Mr. Piesse, of the celebrated firm of Piesse and Lubin, of Paris, when visiting our Great Exhibition of 1880, and after travelling through a considerable portion of the colony, drew our attention to the great advantages we possessed in climate and soil for the successful cultivation of numerous scent-producing plants. He strongly urged us to give this matter our thoughtful consideration, feeling confident it would be a *bonâ fide* and remunerative method of augmenting personal incomes, and would contribute greatly to the general prosperity of the colony. The profits at first may not be large, but the attempts at new industries would afford employment to a number of young people, teach them habits of industry, and in the course of time develop into an important item of our exports.

I know of no industry so delightful, so healthful, as this. A valuable object-lesson in this line is to be found at the Government Scent Farm at Dunolly, where, under the enthusiastic superintendence of Mr. Mellon, a great variety of plants and bulbs are grown expressly for perfume purposes.

In establishing a flower farm for perfumery purposes we must bear in mind that one great essential to pecuniary success is the ability to obtain cheap labour, such as women and children may afford; it would never pay to give 6s. or 7s. per day to collect orange blossom or jasmine flowers. It would also be a mistake to attempt to cultivate too many kinds of scent plants; only those specially adapted to the soil, situation, and climate should be selected. It is a well-known fact that these factors influence in a great degree the delicacy and fragrance of many flowers. The lavender and peppermint grown at Mitcham, in England, yield oils which far excel in value those of France or other countries. The greatest flower farms in the world are those lying on the shores of the Mediterranean, commencing near Nice on to Cannes, which is 20 miles, and from Grasse to the sea, 10 miles; but for considerable distances beyond these inland places flower farming is carried on. Here grow the jasmine, the tuberose, the rose, and other plants as we grow cabbages, onions, or potatoes. Labour is abundant and cheap, men getting about $2\frac{1}{2}$ francs per day; these of course do all the heavy work of the fields while women and children gather the blossoms and attend to hoeing and other light work, the former being paid from a franc to a franc and a quarter per day. In this colony of Victoria you enter a homestead of golden grain, there in France one of lavender sheaves; here of butter and cheese, there of olive oil and of violet butter; here vats of wine, there of orange flower and rose water. Now, while our sparse population and higher-priced labour may prevent our entering into successful competition with England, France, Italy, and other places in the cultivation of some of our commoner scent-producing plants, we are able to grow, as I stated before, some kinds infinitely better than any other country. Mr. Bosisto and some other chemists have after repeated trials succeeded in extracting what may perhaps be considered the most exquisite of all scents—I mean the *Boronia megastigma*. Now, if this can be profitably done, I have no hesitation in saying it would shortly become the most highly prized of all scents in Paris or London; the plant luxuriates in the poor sandy peaty soils of some parts of Brighton, Cheltenham, and numerous other districts, while I have also seen it doing equally well in the richer loams of more inland places. I am no great advocate for company forming, but it seems to me that there is a legitimate field for a number of persons to join together and form a company for the express purpose of growing perfume plants. Soil, situation, and climate would of course have

first to be considered, while proximity to population, so that women and children may be procurable, must not be left out of calculation.

Sericulture.

It must be something like 30 years since an enterprising Italian gentleman started near Lilydale a mulberry plantation on a somewhat pretentious scale, but it came to grief. If I remember rightly, Signor Martelli had not sufficient capital to keep the thing going, and at that period most of us were too busily engaged making money in other directions to tempt speculation in the slower art of silk growing. Since then several attempts have been made by Mrs. Bladen Neill, Mrs. Timbrell, and other ladies to establish this industry—Corowa, Albury (N.S.W.), Northcote, and other places were selected, but from some cause or other no good or lasting results have been achieved. I observed only two or three months since that another attempt was to be made, and I wish the "Women Silk Growers' Association" (I think this was the name) every success. New Zealand has been planting mulberries extensively at her agricultural farms at Whangarei, the idea being to give employment to the Industrial Schools children. This is an industry which, above all others, requires the aid of women and children, and this only for a short period in the year; but it seems to me it should prove a paying one, provided always the persons engaged know how the worms should be managed and the silk manufactured; like everything else, the necessary knowledge and attention is required to make the thing profitable.

Numerous plants afford food for the silkworm—the ailantus, the bombax, the ricinus, the maclura, or Osage orange, the Indian plum, and others; but by far and away the chief is the mulberry, of which there are several varieties. The best appears to be *morus multicaulis*, or moretti; but in Europe they have kinds which are specially adapted for certain situations. The white mulberry, upon which the worms chiefly feed, will grow almost anywhere, provided the soil is fairly good and the site sheltered from high winds. The trees soon arrive at an age fit for the leaves being stripped.

My friend Mr. Bosisto has drawn my attention to what came under his observation when travelling in Spain a few years ago, and which I think is not generally known. I quote his words:—"I noticed in the districts of Murcia and Miranda the *morus alba* growing in clumps and rows on lands belonging to the villagers; on inquiry I became acquainted with a novel industry, viz., the making of silken gut from silkworms fed on the mulberry leaves. This industry is carried on by villagers entirely in this part of Spain, and a trade is done to the extent of some thousands of

pounds sterling. This silken gut resembles very much catgut, but is finer in appearance; it is employed as strings for the guitar in Spain, but throughout Europe is used chiefly for the ends of fishing lines, on which to fix the hook. I had some difficulty in finding out the process of manufacture, and the following may not be quite complete :—When the worm is well developed and showing signs of spinning its cocoon, it is at once removed from the feeding tray and put alive into strong vinegar; in this it is kept for about fourteen days, the head and tail are then removed and the double entrail is pulled out between two fingers of each hand to its utmost stretch, forming two strings, each generally measuring from 9 to 15 inches, according to the size of the silk-worm; these are repickled for a time, they are afterwards rounded in a similar fashion to that of a leathern shoe lace; another process follows—in order to neutralize the acid absorbed they are then dried, and the process is complete."

Specimens of Victorian silk have been sent on various occasions to Europe, and extremely favorable reports have been received—of equal commercial value to those of any country, and so on.

Baron von Mueller informs us as to the profits of sericulture elsewhere. He quotes a fact from California, according to which £700 was the clear gain from $3\frac{1}{2}$ acres of mulberries, the working expenses being £93. In this country, California, this industry is assuming enormous dimensions, since 1870 between 7,000,000 and 8,000,000 mulberry trees having been planted. The Commissioner of the United States for Agriculture estimates that an acre should support 700 to 1,000 mulberry trees, producing, when four years old, 5,000 lbs. of leaves fit for food. On this quantity of leaves can be reared 140,000 worms, from which over a net profit of from £80 to £240 per acre may be obtained by one person only. Mr. C. Brody, of Sydney, thinks the probable proceeds of silk culture to range from £60 to £150 per acre. The discrepancies in these calculations arise from difference in cost of labour, soil, attention, climate, and so on.

Medicinal Plants.

The cultivation of these may be regarded as a very minor industry; still, as we import a great number, either in a natural or prepared state, there is no reason why we should not cultivate those which readily grow here. I may mention camomile, sarsaparilla, phytolacca, rhubarb, tansey, broom, and numerous others. Liquorice does as well with us as anywhere. In a spot in my old garden at South Yarra it was rampant, a perfect weed, and it seemed almost impossible to keep it within bounds. It delights in a deep sandy loam. The roots are fit to use in about

three years after planting, and are easily manufactured into the liquorice of commerce. We import annually 50,000 to 60,000 lbs. weight, of a value of upwards of £2,000. There is an import duty of 2d. per lb.

To any one thinking of embarking in the culture of medicinal plants, or, in fact, the culture of any plant not in common cultivation, I would urge him to procure a copy of Baron von Mueller's valuable work entitled "Select Plants for Industrial Culture," price 5s., to be had at the Government Printing Office, and should be purchaseable at our principal booksellers.

Dye Plants.

Out of the numerous plants used for dyeing I can hardly point to one I think would pay us to cultivate. Indigo, woad, turmeric, safflower, madder, sapan-wood, in fact the bulk of plants used for this purpose, come chiefly from India, and, even supposing our climate was suitable, we could not compete with the cheap labour of that country. The late curator of the Adelaide Botanic Gardens, Dr. Schomburg, who was an enthusiast in experimental cultivation, had got together a fine collection of dye plants and dyes, numbering about 70 objects, but at this moment I do not remember that he was sanguine of the successful and profitable cultivation of but a very few.

The Caper Plant (*Capparis spinosa*)

has not, I think, been grown anywhere in the colony with a view to profit, and yet it does well in numerous places, and there is little doubt but that we could grow it as well as Southern Spain, from whence our chief supplies are sent. As a pickle the flower-buds of the caper are in great esteem everywhere. The buds are gathered by children, then thrown into a cask containing as much salt and vinegar as is sufficient to cover them, and as the supply of capers increases more vinegar is added. This runs on for, say, six months, when the caper season closes. The casks are then emptied and the buds sorted according to their size and colour, the smallest and greenest being considered the best. They are then put into smaller casks of fresh vinegar for commerce, and in this state will keep for five or six years. The caper plant is propagated from seeds, from cuttings of the stems, and also from pieces of the root. It must have a warm aspect, delights in dry or even rocky situations, and positively refuses to grow in wet land. In my old garden at South Yarra we grew it merely as an ornamental plant, but winter frosts generally damaged it considerably. It required a higher and drier place than the margin of a swamp.

Tanning Materials.

Amongst plants producing tanning materials, next in importance to our native acacias may be placed the tanning sumach (*Rhus coriara*), a native of those countries bordering on the Mediterranean; of easy cultivation, well suited for dry soils, I am convinced it would thrive in numerous parts of the colony, and be a profitable plant to grow. Some few years since I obtained from Europe, through a Melbourne seedsman, a quantity of seed of this, which grew well, but ultimately the plants languished and died, solely, I found out afterwards, through the soil being too rich and the situation too damp. The importation into England of this sumach, chiefly from Sicily, is enormous, 12,000 to 18,000 tons being the usual annual quantity. The price of Sicilian sumach is from 15s. to 16s. 6d. per cwt., that imported from Spain is not so valuable. The parts used are the leaves and young twigs. These are gathered two or three times in the summer, then dried and ground or crushed, when they are ready for packing. Plants raised from seed take longer to mature than those raised from cuttings or suckers, and it is generally four or five years ere they are fit for cropping, whereas plants from cuttings or suckers are ready for stripping in the second year. The plant lives for ten to fifteen years, and an acre of plants at their prime produces about a ton of leaves.

Sumach is also used for dyeing, the leaves are principally used for yellow and black, and the roots give a red dye.

Venetian sumach is the product of *Rhus cotinus*, and contains about 20 per cent. of tannin; it imparts a light colour to leather and considerable firmness; the leather is soft and friable. The leaves yield a yellow dye, called in commerce "Young Fustic."

Rhus vernicifera is the celebrated "Lacquer-tree" of Japan, a small tree which yields a vegetable wax. By making wounds in the tree the juice is collected, placed in tubs, then an infusion of galls and iron is added, and after some other manipulation the beautiful jet-black varnish is produced. The tree which produces what is commonly known as "Japan Vegetable Wax" is *Rhus succedanea*, and was, I think, first introduced into Victoria some 30 years ago from Japan, by Mr. G. W. Rusden, a gentleman well known to many of us. It does well here, is a strikingly handsome small tree, and should be planted largely for scenic effect. It is the berries of this plant which produces the wax which is chiefly used for manufacturing candles and vestas. I have mentioned these two last plants not with any idea of recommending them to be cultivated for economic purposes, but having mentioned *Rhus coriara* and *cotinus* I could hardly refrain from just referring to two plants considered of so much importance in their own country, Japan.

I cannot leave this subject without alluding to the plant introduced from America some few years ago, and which was reputed to be so valuable for tanning purposes. I refer to the "Canaigre" (*Rumex hymenosepalum*) one of the dock or sorrel family, a plant said to yield 20 to 40 per cent. of tannic acid. I have grown this at Mornington, but not with pronounced success, the soil being probably too poor and the situation too cold. Further north considerable success has resulted in the cultivation of this plant, and it will likely become a considerable source of wealth.

The Cork Oak (*Quercus suber*)

is a tree which thrives well in many parts of the colony. In the Fitzroy Gardens, Botanic Gardens, Macedon State Nursery, and in many private gardens throughout Victoria, are to be found isolated specimens of this useful tree. On account of the length of time one has to wait before any return comes in, it is not a tree we could recommend to our selectors and farmers to plant, but surely we have among us a number of landed and wealthy proprietors to whom immediate revenue would not be so necessary, and who would, by planting a few hundred acres of the tree in question, be not only exhibiting a kind of patriotism—a love for his country—but would at the same time insure, if not to himself, to his heirs, a valuable property. Mr. Hayter informs us that in 1890 and 1891 we imported cork in its natural and also cut state to the value of £46,000. The demand for cork is fast increasing, being now used for purposes which twenty years ago would never have been dreamt of. Those new substitutes for oil-cloth called kamptulicon and linoleum are manufactured from cork and caoutchouc. We also find that cork dust makes excellent packing for fruit for exportation. Thousands of tons are used in various parts of the world of the rough cork bark for making artificial rock-work. With what excellent effect has it been used in the Aquarium at the Exhibition Building. The cork tree is a native of the south of Europe and the northern part of Africa. I have also seen it growing abundantly, apparently wild, in Tuscany, and there it seemed to be doing well on rocky sidelands where there was very little depth of soil; it thrives best in a granite or schistose soil. It may be multiplied by seeds or by grafting on to the common evergreen or Holly Oak (*Quercus Ilex*), which seeds most abundantly. Probably trees so raised would not be so good as those raised from seed sown in the place where they are to remain. I have imported these acorns from England, but although freshly gathered at the time of shipment, none of them grew. If packed in moss or sand and despatched by one of the fastest boats they should carry all right.

I have already alluded to the length of time before the tree is fit to strip for its bark; this somewhat depends on the climate;

in Algeria and Southern Spain the trees are fit for barking before those grown in colder climes; fifteen to twenty years is the usual time before they are ready, and then in from eight to twelve years the trees may be rebarked, and this process can be renewed for 150 years or more. I need hardly say that the inner layer, or what is called the "mother bark," must not be injured, or the tree will fail to renew its bark, or perhaps may die. Napoleon III. did incalculable good by planting along the coast of the Bay of Biscay miles of this valuable tree, thereby draining a large tract of swampy and unhealthy country, making it a place fit to live in, and also causing it ultimately to become a source of profit.

The Valonia Oak (*Quercus Ægilops*)

is a singularly beautiful and most valuable tree, a native of Southern Europe, from whence enormous quantities of the commercial article called "Valonia" is exported to England. "Valonia" is the cups of the acorns produced by this tree. Although it is some time since this tree was first introduced into the colony, and attention drawn to its great value by Sir Ferdinand von Mueller and others, it is still scarce.

Mr. Cunnack, of Castlemaine, and Mr. Wm. Lawrence, of South Yarra, have imported both plants and seeds of this oak, and I think it would well pay some of our enterprising Melbourne nurserymen to get out large quantities of both; a ready sale would be found among numerous gentlemen interested in tanning and the leather trade. There are some trees already seeding in the colony, and it is to be hoped that every acorn will be collected and sown. The tree is not a rapid grower, it is growing very slowly with me near the coast; but further north, and in warmer districts, the growth is more rapid. I may just add that the value of "Valonia" consists in its giving a rich bloom to leather, as well as hardening it and making it less permeable to water.

Fruit-growing for Export.

It is not my intention to more than just allude to this industry. There are gentlemen infinitely better qualified to speak on this most important subject than I, besides the matter is of too great moment to be dealt with in this paper. For the past two or three years we have been shipping to England considerable quantities of apples, a few pears, and other fruits. The results have varied, but there is no question that those growers and shippers who have carefully selected fine, sound, and good sized fruit, and have properly packed it, have been rewarded with excellent account sales, while others, less careful in the selection and the packing, have had most unsatisfactory returns, and serve them right too. Properly done, there is an immense future in the exportation of apples to England, and probably to many continental towns, to India, perhaps to Canada by the new route, and other places.

In selecting the kinds of apples and pears with a view of exportation, the greatest care must be taken in planting only those which have been proved to carry well, and which can be placed on the London market at just the proper time, when they are pretty sure of commanding a ready sale. Reports have from time to time appeared in the newspapers as to the most suitable kinds, methods of packing, &c.; besides, Mr. Neilson and many of our leading fruit-growers, who have shipped fruit successfully, would, I am sure, cheerfully impart any desired information.

We can hardly expect to be able to export to Europe what are known as soft fruits—plums, tomatoes, and other kinds have been tried in one or two instances, but success was not achieved. One of the most perishable of fruits is the strawberry, and yet it is constantly shipped from America to England. At a recent date the steamer *Majestic* conveyed from New York to Liverpool 147 crates of strawberries and thirteen cases of tomatoes; both on being opened were found exceptionally good and fine, and realized good prices, the shipment being pronounced a success. I need hardly say that the steamer was specially fitted up with refrigerating rooms. I allude to this more particularly to illustrate what can really be done with proper packing, careful handling, and suitable means of transport.

I have no hesitation in saying that considerable loss is occasioned to our fruit-growers by the rough and careless handling the fruit is subjected to at the hands of railway porters, carters, and others. Stringent measures should be taken to prevent loss from this source; men, after being cautioned, should be fined or penalized in some way or other. An industry yet quite in its infancy is the canning, the bottling, and the drying of fruits; very great possibilities are here before us, and I feel convinced that presently great developments will take place in these directions.

The Vine.

The culture of the vine, whether for wine making or for the production of raisins and currants, is as yet only in its infancy with us, time alone will develop the immense possibilities there are in the colony for our wines. Some persons think that in a little while the wine industry may mean more wealth to us than even wheat-growing. A late visitor to our colony, Mr. Burgoyne, says this is pre-eminently a wine-making country, and that we are as well able to make good wines as any other community in the world. He was struck with the remarkable advantages our grape growers possessed, not only with regard to soil and climate, but the configuration of the country also, as compared with the assistance nature offers to the vignerons of France along the banks of the Rhine and Moselle. Mr. Burgoyne is, as you know, a leading wine merchant of London, and a gentleman

whose opinions can be relied upon. During his recent visit here, he not only purchased large quantities of wine, but also invested a considerable sum of money in buying a vine-yard in one of the northern parts of the colony. As a temperance man, not a teetotaller, I would like to see much more wine consumed and less ardent spirits; the former would, I am convinced, tend to reduce drunkenness, and, consequently, the misery caused—every facility should be afforded by the State to the wine-grower and the wine-seller. France drinks 30 gallons of wine each per annum; we hardly a gallon. There it means £40,000,000 per annum, giving employment to two or three million persons. California yields 20,000,000 gallons of wine annually, Victoria only 2,000,000 gallons. I know that we are now making fair progress in the direction of vine planting, but we have a lot of leeway to make up to get abreast of California—a country whose wines are generally much inferior to those produced here.

Sauces and Pickles.

What is there to prevent our making nearly all these within our own borders. Why should we import yearly nearly £20,000 worth of these articles? It seems to me a reflection on our enterprise that we do not, with perhaps a few exceptions, manufacture everything needed in this line.

Cider.

From sauces to cider is a jump, but often on reading the market reports, and when I saw the price of apples quoted so low, I have wondered the growers did not make them into cider. Nearly every year, just at mid-season, when they are most plentiful, we are told that, with the exception of the very best fruit, apples do not pay to send to market, they are given to pigs and cows; but frequently I have seen them lie rotting on the ground, not paying to pick up. The quantity of cider imported into the colony is so small as hardly worth mentioning, but I am quite convinced that in apple districts it would pay well for one or more persons to start the manufacturing of this most wholesome and refreshing beverage; there are plenty of west country people who would be only too glad to have the opportunity of indulging in what may be termed their native liquor. I am well aware that to make first-class cider, apples of any description will not do, special varieties are required; at the same time, a very good wholesome drink can be made from the gleanings of a general orchard.

Farm Seeds.

We import annually from £30,000 to £40,000 worth of seeds of various kinds, a good portion of which is grass, clover, and canary seed. The latter seems to have gone out of cultivation

altogether, for Hayter, in his *Victorian Year-Book* for 1892, puts down the area as nil, and yet I have seen fine crops of this a few years ago in the Drysdale district. Mustard is another crop which seems dwindling to nothing, last year showing only 2 acres as against 30 to 40 two or three years ago. How is this? Our Melbourne seedsmen almost invariably prefer their stocks of rye grass and cocksfoot from New Zealand to seeds grown in our own colony; and why? Because it is cleaner, better dressed, freer from sorrel, and other weed seeds. Is this not a reflection upon our own farmers, that they do not keep their fields clean, and so be able to produce a good marketable article? At present I do not think we could successfully compete with Belgium, Holland, and other places in Europe in the production of clovers, lucerne, and a few other grasses, but I feel assured we import large quantities of seeds which should be produced on our own soil.

Insect Pests.

It would be a source of wealth to the colony were we to keep in subjection these pests which play such havoc in very many of our gardens. It would be almost impossible to estimate, even approximately, the loss we suffer from the ravages of codlin moth, pear, and cherry slug, and a host of other pests. By drastic measures we have stamped out phylloxera from our vineyards; we should do our best to subdue those pests which ravage our gardens. A most important thing it is to know the best means to be taken to attain this end, and I hope our Government will lose no time in introducing and passing a measure dealing with these scourges, which, like the rabbit pest, will, the longer they remain undealt with, be all the more difficult and expensive to eradicate. Fortunately for us, I think that terrible plague the "Hessian fly" has not yet appeared in our fields, but our neighbours in New Zealand suffered very severely in some localities last season; in one district as great a loss as 50 per cent. was experienced.

Colonial Woods.

The value of our colonial timber seems to be getting more appreciated than formerly. Reiser's process of seasoning will cause a revolution in the method of dealing with them, and it is quite on the cards that by-and-by we shall be exporting to England and other places some of the best of our hardwoods. Our display at the recently opened Imperial Institute should cause some inquiries to be made. We have been hiding our light under a bushel. I believe a demand will spring up for our blackwood redgum, and many of our high coloured and best woods for cabinet-making and other purposes. May we not possess in our forests a very valuable asset—a wealth as yet quite undeveloped?

MANURES AND MANURING.

By A. N. Pearson.

Under the title of "Orchard Manuring" a lecture was recently given at the Government Horticultural School, Burnley, by Mr. A. N. Pearson, the Government Agricultural Chemist. Although the lecture had reference mainly to the special requirements of orchardists, yet it dealt in so concise and comprehensive a manner with the whole question of manuring generally that it will doubtless be of use and interest to agriculturists of all sections. The following is the substance of the lecture :—

All living things must feed. This is as true of plants as of animals. But upon what do plants feed? We might, perhaps, obtain an answer to this question if we were to find out what a plant is made of. If we take any piece of a plant—green grass, for instance, or the leaves of a tree, or a piece of wood, and heat it in a dish or shovel over the fire, we see the first thing that happens is the escape of steam. This shows that the plant contains water. After having dried off all the water, if we heat the plant still further we find it catches fire and a large portion of it burns away. But we find it will not all burn away, there is a small portion left behind which we call ash. Thus, by this rough analysis, we find plants to be made up of three different kinds of matter—first, of matter dissipated on drying, which is mostly water; second, matter dissipated on burning ; and third, ash or matter not dissipated on burning. Of these three kinds of substance the first is far and away the greatest in quantity. On an average we may say that plants contain about 72 parts of water in 100 ; some plants, such as turnips and cabbages, may contain as much as 92 parts in 100. Of the matter dissipated on burning we may say that there would be on an average about 26 parts in 100, and of the ash about 2 parts.

Were we to adopt a finer method of analysis we could find out what the matter dissipated on burning was made of, and what the ash was made of. We should find that in the former there was carbon, which is the black stuff we see in charcoal ; nitrogen, which is the principal gas in the air we breathe ; and the elements

of water, namely, oxygen and hydrogen. In the ash we should find oxide of iron, lime, magnesia, potash, soda, phosphoric acid, sulphuric acid, chlorine, and silica. These various substances would on the average be present somewhat in the proportions set down as follows :—

AVERAGE COMPOSITION OF PLANTS.

		Parts in 100,000.
Matter dissipated on drying, consisting almost wholly of water		72,000
Matter dissipated on burning, consisting of—		
Carbon	11,000	
Nitrogen	750	
Elements of water (oxygen and hydrogen)	14,250	
		26,000
Matter left behind after burning (ash), consisting of—		
Oxide of iron	20	
Lime	300	
Magnesia	125	
Potash	550	
Soda	70	
Phosphoric acid	270	
Sulphuric acid	80	
Chlorine	85	
Silica	500	
		2,000
		100,000

Now, where does a plant obtain these different substances, where can it find the food with which to supply them? Are they obtainable from the soil? Let us see what the soil contains. Were we to put a sample of soil through the same process of rough analysis as we did the plant, namely, by drying and then burning it, we should get similar results; it would give off steam,

showing the presence of water; it would blacken and catch flame, showing the presence of carbon and other matters dissipated on burning; and there would be left behind a quantity of matter, namely, the ash, which would not be dissipated by burning. But we should observe an obvious difference between the plants and the soil, for whereas in the plants the greater proportion consisted of water and the least proportion was the ash or earthy substance; in the soil it is the other way about, the ash or earthy substance greatly preponderating. We shall, in fact, find an average soil to contain something like the following :—

AVERAGE COMPOSITION OF SOILS.

	Parts in 100,000.	
Water		10,000
Burnable matter, commonly called humus ...		8,000
(Consisting of carbon, the elements of water, and nitrogen, the nitrogen amounting to	200)	
Earthy substance or ash, consisting of—		
Alumina	1,000	
Oxide of iron	3,500	
Lime	350	
Magnesia	250	
Potash	200	
Soda	150	
Phosphoric acid	100	
Sulphuric acid	150	
Chlorine	10	
Carbonic acid	300	
Soluble silica	250	
Insoluble silica and sand ...	75,740	
		82,000
		100,000

From this list we see that there is everything in the soil that there is in the plant. Yet we may not from this fact conclude

that the plant gets all it requires from the soil. We could, however, set the matter at rest by making different kinds of artificial soil—as has been done by various experimenters—and trying to grow plants in them. We might take pure quartz sand, wash it in strong boiling acid, and, having obtained it perfectly clean and dry, mix it in different ways with the substances shown in the above list; in one pot, for instance, we might put all the above substances, in another we might put all except the humus, in another all except the nitrogen, in another all except the oxide of iron, and so on all through the list. By such an experiment we should discover that a plant obtained from the soil all its foods except one; that one exception is the carbon. This substance the plant obtains from the air. We burn fuel, and the carbon of the fuel goes into the air in the form of gas. Men and beasts, when they breathe, exhale the carbon of their bodies in the form of gas into the air. Plants absorb this carbon from the air; it goes to form wood, and grass, and grain, thus being converted into the fuel and food of man, from which the carbon again passes into the air, and so again forms the food of plants, and thus again and perpetually passes through the same cycle. With this solitary exception, however, the plant gets all its food from the soil. The greatest bulk of these foods consists, as we said, of water; 72 per cent. of water, removable by drying, and $14\frac{1}{4}$ per cent. of the elements of water, removable by burning, making a total of over 86 per cent. of water. Considering that a plant consists mostly of water, and that this has to be obtained from the soil, it will be readily understood how the magnitude of a crop is strictly limited by the rainfall or by the amount of water used in irrigating. Water is the chief food of plants, and no amount of manuring can ever make up for lack of water.

But the water being provided for and the carbon obtained, as we see, from the atmosphere, let us turn our attention to those other constituents of the plant which are found on burning to remain behind as ash; and let us consider at the same time the nitrogen which disappears on burning. The list is rather a long one:—Nitrogen, oxide of iron, lime, magnesia, potash, soda, phosphoric acid, sulphuric acid, silica. These things the plant obtains from the soil. Now, supposing a soil does not contain all these things, or contains some of them only in very small quantity, shall we have to put them into the soil in the form of manure? That depends upon whether the plant needs them all or not. It does not follow that, because a plant takes substances into it, those substances are essential to the well-being of the plant; they may be neither helpful nor hurtful to it. We might carry out a series of experiments with artificial soils made by mixing substances with pure quartz sand in the manner we have already

described, and in this way we could find out which of the substances was necessary to the well-being of plants. By a series of such experiments we should find that the nitrogen and all the substances in the ash except the silica were absolutely necessary; if even one of these was left out of the artificial soil the young plant would grow only so long as the food originally contained in the seed lasted; after that was used up the plant would cease to grow, or if it put forth new leaves it would be by absorbing the substance of the old ones; it would not increase in weight or size. This would occur in the case of the omission of any of the substances excepting the iron. The omission of the iron would cause a somewhat different appearance. The plant would grow to a considerable extent, even after it had used up all the food originally contained in the seed, but it would be white and colourless, and would ere long perish. From such experiments we should obtain results which would show us that all the above substances except the silica must be presented to the plant through the soil, and if the soil does not contain sufficient of them they must be supplied in the form of manure.

Shall we then have to arrange for the supply of these nine plant foods to the soil? If we have to do this then the art of manuring may become a somewhat complicated business. But fortunately the matter is very much simplified for us by the fact that some of these plant foods are already contained in all natural soils in practically inexhaustible quantities. Take, for instance, the oxide of iron: An ordinary crop would remove from an acre of land about 2 lbs. of this substance, but the amount naturally present in an acre of average soil 2 feet deep is from 50 to 250 tons. Take, again, the sulphuric acid: An ordinary crop would remove 9 lbs. or 10 lbs. of this substance from an acre, but the amount naturally contained in an acre of soil 2 feet deep is from 3 to 10 tons—sufficient to last for several centuries. But take, however, the case of nitrogen: The amount of this substance removed from the soil by an average crop is 80 lbs. per acre. Now, I have known many soils which have not contained more than $2\frac{1}{4}$ tons of nitrogen in an acre 2 feet deep; and this, drawn upon at the rate of 80 lbs. a year, would be wholly exhausted in 70 years. But many years before it became exhausted the crops grown on such a soil, unless the nitrogen were replenished from some other source, would cease to be profitable—in fact, it may be taken as a general rule that unless the nitrogen in a soil exceed 5 tons per acre 2 feet deep crops cannot be grown profitably without manuring.

If we glance over the list of substances which enter into the composition of plants we find that those essential substances which it absorbs from the soil in greatest quantity are nitrogen, potash, lime, and phosphoric acid; and of these four substances

many soils contain so small a store that they quickly become so far exhausted as to cease to yield profitable returns. Of these four substances it is, generally speaking, the phosphoric acid that begins to fail first, for most soils contain much more nitrogen and potash than they do phosphoric acid; then the nitrogen begins to fail, and finally the potash and lime. Some soils may also perhaps fail in magnesia, though I have not yet had such brought under my notice. But the four substances—nitrogen, potash, phosphoric acid, and lime—are the four plant foods about which we have chiefly to concern ourselves in manuring. But we may reduce the list still further, for we cannot give phosphoric acid to the soil without at the same time giving lime, for any substances we may use for supplying phosphoric acid to the soil invariably contain the phosphoric acid combined with lime. Thus, then, our list is reduced to three—namely, nitrogen, phosphoric acid, and potash; and these are the three plant foods to which we may practically confine our attention in manuring.

But how are we to know that we shall have to apply any or all of these plant foods to our particular soil? Our soil may be naturally rich enough in these plant foods, or at least in one or two of them. We may find this out in most cases by means of a chemical analysis of the soil; there are cases in which a chemical analysis does not give all the information one wants, but it will at least show us if the soil is poor in plant foods. If the chemical analysis show us that the soil is poor in any particular plant food then we may make up our minds at once that we shall have to supply that plant food. But there is another way of finding out which of the three plant foods a soil requires to have given to it. I refer to the system of trial or test plots in the field, which during the last few years I have so often advocated. Suppose we have a series of plots laid out according to the following plan:—

Plot 1. Nitrogen, phosphoric acid, and potash; light dressing.
Plot 2. Do.; medium dressing.
Plot 3. No manure.
Plot 4. Nitrogen, phosphoric, and potash; heavy dressing.
Plot 5. Same as Plot 2, but without nitrogen.
Plot 6. Do., but without phosphoric acid.
Plot 7. Do., but without potash.
Plot 8. No manure.

Plot 3 receives no manure; Plot 2, alongside of it, receives a mixture of the three plant foods; this mixture it is customary to call a complete manure. Now, if Plot 2 gives us a better yield than Plot 3, we shall know that the soil needs to have some

plant food given to it. But how shall we know what quantity to give? This we find out in the following way:—On Plot 1 we give a light dressing of the complete manure, on Plot 2 we give twice as much as on Plot 1, and on Plot 4 we give three times as much as on Plot 1. Now, suppose Plot 3, without manure, gives us at the rate of 60 bushels of fruit per acre, and Plot 1, with the light dressing of manure, gives us 90 bushels, we shall then know that 30 bushels per acre increase has resulted from the light dressing of manure. If again from Plot 2 we get 120 bushels per acre, we shall see that twice the dressing of manure has given twice the increase of crop, namely, 60 bushels. Therefore, the money spent in the medium dressing has given just as profitable a return as that spent in the light dressing. Naturally, then, we should think it desirable to give not less than the medium dressing. Now, suppose that on Plot 4 we get a yield of 150 bushels, we should likewise see that the heavy dressing was just as profitable as the medium dressing. Suppose, however, we obtain from this plot only the same as from Plot 2, then we should conclude that the increase of manure over and above what was given on Plot 2 was simply waste, and if we got a result intermediate between these two we should reason that the most profitable quantity of manure was somewhat between the medium and the heavy dressing.

Thus far, however, we shall not have learnt whether our soil needs all the three plant foods, or only one or two of them. How are we to find this out? How, for instance, must we find out if the soil needs nitrogen? Some people might suppose we should do this simply enough by putting just nitrogen on one plot and comparing the yield of that plot with the yield from the unmanured plot. But this plan would not answer at all, for suppose the soil needed potash and phosphoric acid as well as nitrogen, then no amount of nitrogen added by itself would give us an adequate increase of crop. In such case, indeed, by disturbing the balance of growth, it might result in a decrease of crop. We should have to supply the phosphoric acid and potash to one plot, and then to another plot the phosphoric acid and potash together with the nitrogen. This is arranged in the case of Plots 2 and 5 of the above plan. Now, if Plot 2 with the nitrogen gives us an increased yield of 60 bushels of fruit, and Plot 5 without the nitrogen gives us an increase of only 10 or 20 bushels, we learn at once that the soil needs nitrogen manuring, though perhaps not the whole of the dressing given in Plot 2. Similarly Plots 6 and 7 tell us about the phosphoric acid and the potash.

Let me here quote from some actual results of these test plots as applied to fruit trees by Mr. Ewers, of Childers, on his raspberry plantation. The test was made upon some young raspberry bushes in their third season; and striking as were the results

gained, we may expect that they would have been still more striking with older vines. The following were the results :—

RETURNS FROM TEST PLOTS ON THREE-YEAR-OLD RASPBERRIES BY MR. EWERS, CHILDERS, 1892–3.

—	Weight of Raspberries per Acre.	Estimated Weight of New Canes for Next Season.*
	lbs.	oz. per plot.
Plot 1. Complete manure, light dressing ...	2,700	43
Plot 2. Complete manure, medium dressing	3,000	54
Plot 3. No manure	2,050	36½
Plot 4. Complete manure, heavy dressing ...	3,500	62
Plot 5. Same as Plot 2, but no nitrogen ...	2,275	35
Plot 6. Same as Plot 2, no phosphoric acid	2,750	45
Plot 7. Same as Plot 2, no potash ...	2,850	47
Plot 8. No manure	2,000	49
Plot 9. Same as Plot 2, but nitrogen given as nitrate of soda	2,900	62
Plot 10. Same as Plot 2, but twice as much potash	3,300	65

* The weight of the new canes was estimated by measuring their length and thickness; by multiplying these together the cubical contents were approximately ascertained, and from this the weight was readily calculated.

Compare the yields from Plots 1, 2, 3, and 4. The increased yields on Plots 1, 2, and 4 are 650 lbs., 950 lbs., and 1,450 lbs. Plot 1 is a little high relatively to the others, but such irregularities often occur if we take only one series of plots or only one season's yield. If the increase in that plot had been only 500 lbs. then the series would have been perfectly regular, and would have convinced us that this soil would bear the heaviest dressing of manure with profit. Now compare Plot 5 with Plots 2 and 3. The increase on Plot 5 without nitrogen is only 225 lbs., as compared with 950 lbs. with nitrogen. We should, therefore, reason that this soil needed all, or nearly all, the nitrogen given in Plot 2; and, indeed, if we refer to the second column of figures, showing the weights of the new canes which will bear fruit in the coming season we shall see that the growth of new canes, without nitrogen, was even a little less than without any manure at all. Now let us compare Plots 6 and 7 with the unmanured Plot 8. If we were to judge from the yield of fruit alone we should form the idea that a great portion of the phosphoric acid and potash given in plot 2 could be dispensed with; but if we turn to the weight of the new canes we shall see that without the phosphoric acid or potash the growth was even slightly less than with no manure at all.

Having, by some method, found out what plant foods our soil requires, the next point to be considered is where to get these

plant foods. Where are we to buy our nitrogen, phosphoric acid, and potash? If you were to go to a manure dealer and say you wanted a ton of nitrogen, he would probably stare at you; he would not know what you meant. In the Melbourne market the principal source of nitrogen as a plant food is sulphate of ammonia, which is obtainable at the gas company's office for £12 10s. a ton. Ammonia exists in coal gas as it first comes from the retorts, and must be removed before the gas is fit for consumption. It is removed by passing the gas through sulphuric acid, which absorbs and combines with the ammonia, forming the crystalline salt known as sulphate of ammonia. Ammonia consists of nitrogen to the extent of over 82 per cent., and sulphate of ammonia contains 21 per cent. of nitrogen. Now, from these figures we can ascertain the money value of nitrogen. If sulphate of ammonia, containing 21 per cent. of nitrogen, sells at £12 10s. per ton, then the nitrogen must be worth close on £60 per ton. But the simplest method of reckoning its value is to consider what would be the price of a material containing only 1 per cent. of nitrogen. Thus, sulphate of ammonia containing, as it does, 21 per cent. of nitrogen is sold at £12 10s. per ton, therefore a substance containing only 1 per cent. would be worth close on 12s. per ton. Thus we calculate the money values of manures according to the value of 1 per cent. of the essential ingredients per ton. So if we have presented to us a substance containing $8\frac{1}{2}$ per cent. of readily soluble nitrogen, we know that it must be worth eight and a half times 12s., that is to say, £5 per ton. Another source of nitrogen is nitrate of soda. This contains only 16 per cent. of nitrogen, and its value, according to what we have already seen, would be sixteen times 12s., that is to say, £9 12s. per ton. But, as a matter of fact, it is never sold in Melbourne for less than £18, that is to say, nearly twice its value.* In Europe, with its cold winters, the nitrogen in nitrate of soda is more quickly taken up by fruit trees and by root crops than the nitrogen of sulphate of ammonia; but I have tried the two in comparison with each other five or six times on fruit trees and root crops in this country, and find that this superiority does not exist here; in fact, if anything, the nitrogen in the sulphate of ammonia gives the better results. We do not, therefore, need to use nitrate of soda here. But there are also other sources of nitrogen, as shown in the table at the end of this lecture.

It will be seen from this table that nitrogen is obtainable in sulphate of ammonia, nitrate of soda, dried blood, dried offal, and also mixed with other things in dried night-soil, farm and stable manure, and compost heaps, and in smaller quantities in dried fish, some kinds of guanos, and bone dusts and meals.

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* Since the above statement was made it has been offered at £12 10s. per ton.

I would recommend a careful study of the above list. It gives a statement in brief of all the sources of nitrogen, phosphoric acid, and potash—the three principal plant foods; and it presents the prices at which these various manures are now sold in Melbourne as compared with their real value.* It shows that there are at present three really cheap manures offered, namely, dried blood, real value about £4 10s., offered at £2 10s. to £3 10s.; concentrated superphosphate, real value £21, offered at £13 7s. 6d.; and highly concentrated potash sulphate, real value £14 10s., offered at £12. These are the cheapest sources of nitrogen, phosphoric acid, and potash taken singly. In addition to these are some cheap mixed manures, such as dried night-soil, worth about £2 to £3, offered at £1 to £1 15s. per ton; some samples of bone dust and offal dust also are offered at a low price. On the other hand, there are some manures which are constantly sold at prices above their intrinsic value. This is nearly always the case with special mixtures. Speaking generally, however, manure prices in Victoria are low as compared with other countries; and the wide-awake cultivator who takes pains to look well into the manure market can make some very advantageous purchases.

To show what may be done in this respect, let us take a simple illustration. Suppose a man wanted to manure his orchard or vineyard, he buys, we will suppose, a mixed manure, which is sold to him under the name of "orchard manure," at £14 per ton. He is told to put on half-a-ton to the acre. This costs him £7 per acre, together with freight. On sending this to be analyzed he finds that the half-ton of manure consists of 4 cwt. nitrate of soda, at 18s., £3 12s.; 5 cwt. superphosphate, 16 per cent., at 9s., £2 5s.; 1 cwt. potash chloride, 62 per cent., at 20s., £1; total, £6 17s. It is a good manure, and produces a very good effect, and, considering the ingredients of which it is mixed, the charge for mixing has been only 6s. a ton, which is no great thing. This half-ton of manure will have given 72 lbs. of nitrogen, 90 lbs. of phosphoric acid, and 70 lbs. of potash to the acre of soil, and this will have cost him £7, exclusive of freight.

Now, let us see what this man might do in the way of cheaper purchases. He now, we will suppose, buys his nitrogen as blood manure, which contains 9 per cent. nitrogen, and for which he pays £3 per ton. The nitrogen contained in blood manure being not quite so soluble as nitrate of soda nitrogen, he buys a little more of it. But as the blood manure contains also a little phosphoric acid and potash, he needs to buy somewhat less superphosphate and potash salt. He makes his mixture as follows:—8 cwt. blood manure, containing 88 lbs. nitrogen, 9 lbs. phosphoric

* Since the delivery of this lecture the prices in some cases have considerably altered. See note at bottom of the "List of Plant-food Suppliers" at the end of this lecture.

acid, 6 lbs. potash, at 3s., £1 4s.; 1⅗ cwt. concentrated superphosphate, 45 per cent., containing 81 lbs. phosphoric acid, at 13s. 4½d., £1 1s. 4½d.; 1$\frac{1}{10}$ cwt., potash sulphate, 54 per cent., containing 66 lbs. potash, at 12s., 13s. 2½d.; cost of mixing, 3s. 5d.; total, £3 2s. By this arrangement he gets the same amount of plant food for £3 2s. an acre that he did in the former case by paying £7. And further, suppose that he had applied the test plots to his soil, and had found it to be naturally rich enough in potash, he could knock off the 13s. 2½d. for potash salt.

But suppose he were to buy dried night-soil containing 3 per cent. nitrogen, 3½ per cent. phosphoric acid, and 2½ per cent. potash. This substance being not quite so soluble as in the blood manure and superphosphate mixture, he would require a larger quantity. Suppose he bought this at £1 15s. per ton, and used it at the rate of 1½ tons per acre he would then be getting as follows:—1½ tons dried night-soil, containing 100 lbs. nitrogen, 118 lbs. phosphoric acid, and 83 lbs. potash, at £1 15s., £2 12s. 6d. Thus for 30s. an acre he would have got the same result as he did in the first instance for £7; but the cost of carriage and spreading on the land would have been three times as great.

This question of cost of carriage is a very important one, and leads one to consider the advantage of concentrated manures. Take, for instance, the potash manures. Suppose we wish to buy a ton of potash. We may buy it in the form of kainit at £4 10s. To buy a ton of potash in this form we should have to pay £36, and the freight on 8 tons of material. But if we were to buy it in the form of highly concentrated sulphate of potash, containing 53 per cent. potash, we should have to pay only £22 16s., and the freight on 1 ton 18 cwt. The same in regard to superphosphate. If we wanted to buy a ton of soluble phosphoric acid we might do it by purchasing a low grade superphosphate, containing 16 per cent. phosphoric acid, and selling at £7 10s.*; in this form we should pay for a ton of phosphoric acid £47, and freight on 6¼ tons of material. But if we were to buy it in the form of concentrated superphosphate, containing 45 per cent., and sold at £13 7s. 6d. we should have to pay only £29 14s. 6d., and freight on 2⅔ tons material. The cultivator who is a good business man will readily see the advantage of these concentrated manures.

Speaking of concentrated manures naturally leads us to consider the most bulky and least concentrated of all these plant-food suppliers, namely, farm-yard and stable manure. This manure varies in value, reckoned according to average market prices of plant food, at from 3s. 6d. up to 11s. a ton. Its average

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* But see note at bottom of table at the end of this lecture.

value may be taken at about 7s., delivered on the land. If it cannot be obtained delivered on the ground at that price, it is almost certainly cheaper to buy the plant foods from other sources. You will see that farm-yard manure contains less phosphoric acid than it does nitrogen and potash, therefore in using this manure on average soils, such as the orchard soils 20 miles round Melbourne, it should be supplemented with superphosphate. To obtain from average farm-yard manure the same result as we could from the mixtures above described we should have to use it as follows :—10 tons per acre stable manure, containing 100 lbs. nitrogen, 60 lbs. phosphoric acid, 100 lbs. potash, at 7s., £3 10s.; and 4-5th cwt. concentrated superphosphate, containing 36 lbs. phosphoric acid, at 13s. 4½d., 10s. 8d.; total, £4 0s. 8d.

Let us place these different methods of obtaining the same result side by side and compare the cost :—1. Special orchard manure mixture, cost £7 per acre. 2. Stable manure and superphosphates mixed, cost £4 per acre. 3. Blood manure, concentrated superphosphate and potash salt, cost £3 2s. per acre. 4. Dried night-soil, cost £1 10s. per acre. No. 3 of the above methods has the advantage of the others, namely, that its composition is just what you like to make it, and you can make it to be just what the soil requires. In all the other cases you may be paying for material which the soil does not require. If the soil does not require potash, you cannot leave the potash out of the stable manure or the night-soil. No. 4, however, is so cheap that even if the potash it contains is not required still you get the value of the money in other plant foods. The only objection to this last-mentioned manure is the odour, but this is by no means so strong as in the undried night-soil ; and the disease germs which might have been contained in it have been destroyed by heat.

The extreme variability of manures, as shown by the table at the end of this lecture, will indicate the advisability of always buying them according to the results of analysis. There are no respectable manure merchants who will not sell on these terms. Buying without analysis is worse than buying a pig in a poke, for if the pig be not worth the money given the loss is no great thing, but if the manure be not what the soil requires the loss is one affecting a whole season's yield from every acre of ground that has been manured.

One word more before leaving the subject of stable and farm-yard manure. It is often said that these small concentrated manures will not have the same mechanical effect on the soil that the bulky farm-yard manure has. This is true, but where such an effect is required it can always be obtained by green manuring. And by green manuring with peas or beans the soil not only becomes broken up and rendered lighter and more porous, but the peas and beans, like all leguminous crops, indirectly cause the soil

to be enriched in nitrogen, so that they save the cost of supplying nitrogen in the manure. This effect is shown in the following illustration, which is engraved from a photograph taken by Professor Dr. Wagner, of Darmstadt, in Germany. The illustration speaks for itself, and needs no explanation.

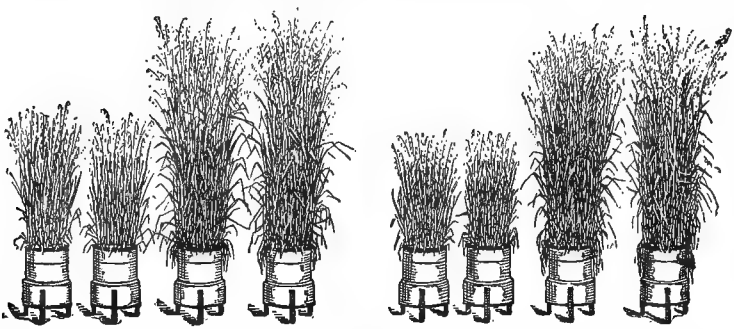


FIG. 19

Manured with phosphoric acid and potash.

Manured with phosphoric acid, potash, and nitrogen; the nitrogen being given as nitrate of soda.

Manured with phosphoric acid and potash. In the previous season mustard was grown in these pots and afterwards dug in as green manuring.

Manured with phosphoric acid and potash. In the previous season vetches were grown in these pots and afterwards dug in as green manuring.

Suppose then that we adopt this plan of green manuring with peas or beans, we need only manure the ground with superphosphate and potash salt, sow the peas or beans, and plough them in at blossoming time. Our expenses would then run as follows:—$1\frac{3}{4}$ cwt. concentrated superphosphate at 13s. $4\frac{1}{2}$d., £1 3s. 5d.; $1\frac{1}{8}$ cwt. potash salt, at 12s., 13s. 6d.; peas or bean seed, 4s.; total, £2 0s. 11d. This is one of the cheapest and most beneficial methods of manuring the soil, and is especially to be recommended at distances from Melbourne, where the freight on manure is heavy.

On the whole, it may be said that manure prices in Victoria are low as compared with other countries, and the wide-awake cultivator who looks well into the manure market can make some very advantageous purchases. This cheapness of manure is not owing to the great quantity of manure in the market, but to the small demand for it. A great deal of manure is exported from Victoria; it may be that more is exported than is used within the colony. This is not because Victorian soils do not need manure. There is no country in the world that is covered with rich first-class soils. The majority of soils in all extensive countries are

poor ones, and Victoria is no exception to this rule. I suppose that amongst the hundreds of soils which I have examined at least three-quarters of them have been what we should call third-class soils; and the really first-class soils could be almost counted on one's fingers. Victoria at present is looking for a return of prosperity to its agricultural exports. What are we, then, to say to the fact that perhaps the greater portion of the plant food which ought to be used for the growth of this agricultural export is allowed to be sent out of the country to feed the agriculture of other lands?

But, it is said, will manuring pay? We are too poor; we cannot afford to manure. In answer, one has to say that, not only will cultivation with rational manuring pay, but it is only when one begins to manure that in the majority of cases cultivation becomes a profitable business. It is cultivating without manuring that does not pay. Only when people study their soils and supply the crops with plant food in accordance with the requirements of the soils will the mass of them be able to rise from a hand-and-mouth existence up to competence and comfort.

Now, to show you in conclusion what may be done by manuring, let us turn again to the case of Mr. Ewer's test plots in his raspberry plantation at Childers. The results of these plots are here reproduced from the first part of the lecture:—

RETURNS FROM TESTS ON THREE-YEAR-OLD RASPBERRIES BY MR. EWERS, CHILDERS, 1892–3.

—	Weight of Raspberries per Acre.	Estimated Weight of New Canes for Next Season.*
	lbs.	oz. per plot.
Plot 1. Complete manure, light dressing	2,700	43
Plot 2. Complete manure, medium dressing	3,000	54
Plot 3. No manure	2,050	36½
Plot 4. Complete manure, heavy dressing	3,500	62
Plot 5. Same as Plot 2, but no nitrogen...	2,275	35
Plot 6. Same as Plot 2, but no phosphoric acid	2,750	45
Plot 7. Same as Plot 2, but no potash ...	2,850	47
Plot 8. No manure	2,000	49
Plot 9. Same as Plot 2, but nitrogen given as nitrate of soda	2,900	62
Plot 10. Same as Plot 2, but twice as much potash	3,300	65

The weight of the new canes was estimated by measuring their length and thickness; by multiplying these together the cubical contents were approximately ascertained, and from this the weight was readily calculated

Plot 4 was manured with 105 lbs. soluble nitrogen, 105 lbs. soluble phosphoric acid, and 105 lbs. soluble potash. This could be obtained by the following mixture :—11 cwt. dried blood, containing 120 lbs. nitrogen, 12 lbs. phosphoric acid, 8 lbs. potash, at 3s., £1 13s.; 1⅞ cwt. concentrated superphosphate, containing 97 lbs. phosphoric acid, 13s. 4½d., £1 5s. 1d.; 1⅞ cwt. concentrated potash salt, containing 99½ lbs. potash, at 12s., £1 2s. 6d.—£4 0s. 7d.; freight and application, 10s.; total cost of manuring, £4 10s. 7d. Now compare the yield of 3,500 lbs. of raspberries per acre obtained from Plot 4 with the yield of 2,050 lbs. obtained from Plot 3 without manure. There was an increase of 1,450 lbs. of raspberries due to the manuring. The profit of the transaction was as follows:—Increased yield per acre, 1,450 lbs. raspberries, sold at 2½d., £15 12s.; cost of manure, £4 10s. 7d.; increased profit due to manuring, £10 11s. 5d. Or compare Plot 10 with Plot 8, which shows a similar profitable result with somewhat less outlay. Fruit takes out of the soil much more potash than nitrogen and phosphoric acid. Thus, for instance :—

150 cases of—	Would remove from the Soil—		
	Nitrogen.	Phosphoric Acid.	Potash.
	lbs.	lbs.	lbs.
Apples	3¾	2½	6⅜
Pears	3½	4¼	15
Cherries	6	4¾	15
Plums	7½	4¼	17
Gooseberries	4½	7¾	14
Strawberries	10¼	5½	8½

It will be surmised from this that a good result might be obtained by increasing the allowance of potash in the manure and decreasing the nitrogen and phosphoric acid. This was done on Plot 10. The nitrogen and phosphoric acid were only two-thirds

of that given on Plot 4, but the potash was half as much again. This would be given by the following mixture :—

$7\frac{1}{3}$ cwt. dried blood	£1	2	0
$1\frac{1}{2}$ cwt. cont. superphosphate ...	0	16	8
$2\frac{7}{8}$ cwt. potash salt	1	14	6
	£3	13	2
Freight and cost of application ...	0	6	10
Total cost of manure ...	£4	0	0
1,300 lbs. increased yield of raspberries, at $2\frac{1}{2}$d.	£13	10	10
Cost of manure	4	0	0
Increased profit per acre ...	£9	10	10

If the nitrogen were supplied by green manuring with peas, the results would doubtless be still better.

I am unfortunately unable to quote more instances from my experiments in fruit manuring. But I have dozens of similar returns from my experiments with cereals, hay, peas, beans, roots, and potatoes; and there is no question about manuring being profitable when carried out in a business-like way. Indeed it is as I have already said, that, except in a few fortunate cases of naturally rich soils, agriculture cannot be carried on as a highly profitable business except with the liberal use of plant foods.

There is only one further matter remaining to be considered, and that is in regard to the mode of applying the manures to the soil. In manuring fruit trees it is advisable that the manures should get down to a considerable depth. To this end the solubility of the manures must be considered. The most soluble manures are the nitrogen salts—sulphate of ammonia and nitrate of soda —the potash salts, and the superphosphates. Next to these come dried blood and dried night-soil. Farm-yard manure is partly soluble and partly insoluble; some of the insoluble gets very slowly converted into the soluble kind, but a portion of it becomes finally so fixed as to be of little use to plants. Bone meal is readily made use of by plants having roots near the

surface, but it only very slowly reaches deep roots. The same remark applies probably to Thomas phosphate. Coarse bone dust is so slowly dissolved that when placed in the surface soil it is of scarcely any use to deep-rooted plants. And bone ash, bone black, and mineral phosphates are of all manures the least soluble, and, therefore, of the least use in orchards. In this connexion I may mention a new and very promising mode of manuring fruit trees, namely, that of putting the manure into holes 2 or $2\frac{1}{2}$ feet deep around each tree, there being from 1 to 4 such holes to each tree according to size, and the holes being put down in different places each year. By this method the manure gets at once to the roots, and it does not cause that growth of weeds which results from surface manuring.

In laying out an orchard it is a good plan to dig the holes for the trees wide and deep, say, from 2 to $3\frac{1}{2}$ feet deep, and to place at the bottom of each hole from 3 to 8 lbs. of coarse bone dust. Before returning the soil to the hole it should be mixed with from 2 lbs. to 5 lbs. of fine bone dust, and the upper foot or 18 inches should be mixed with about 4 lbs. to 10 lbs. of dried blood. This amount of manure will generally serve until the trees come into bearing. After that a complete dressing of manure, according to the requirements of each soil, should be given each year, the amount being spread in a circle of from 2 feet to 6 feet radius around each tree, and dug or ploughed in.

In conclusion, I would emphasize what I have already said in regard to the necessity and importance of rational manuring. Amongst the many benefits which agriculture has gained from science is a knowledge of the nature and action of plant foods. Fifty years ago nothing certain was known on this subject beyond the fact that increased crops were sometimes obtained by putting certain things, chiefly farm-yard manure, into the soil. Now, the reason why these things cause an increase of crop has been ascertained, the composition of manures and the action of each ingredient has been studied, and the nature and requirements of different soils have been to a great extent investigated ; and it has become possible, by applying in a business-like way the knowledge so gained, to obtain the largest crops at the least possible cost. Thus the sphere of profitable cultivation has been considerably widened. I have in lectures and published reports on several occasions shown from my own experiments in the field what results it was possible to obtain. And I would now urge cultivators in their own interests, and in the interests of the country, to endeavour to obtain similar results for themselves. Complete success may not attend their first efforts, but let them try again until they succeed. And if they will consult me in their efforts, it will give me pleasure to assist them when possible with counsel and advice.

LIST OF PLANT-FOOD SUPPLIERS.

—			Containing—	Real Value of 1 per cent.	Real Value per Ton.	Price at which Sold.
MAINLY NITROGENOUS.						
Nitrogen only		Sulphate of ammonia ..	21 per cent. nitrogen	12s.	£12 10s.	£12 10s.
		Nitrate of soda ..	16 ,, ,, ...	11s. 6d.	£9 2s.	£18 (now £12 10s., see note below)
Nitrogen preponderating, but containing also phos. acid and potash		Dried blood	8—14 ,, ,, ...	10s.	£4 9s. to £8	£2 10s. to £4 10s.
			¾—1½ ,, phos. acid. ..	5s. 6d.		
			½—¾ ,, potash ..	4s.		
		Dried offal	5—8 ,, nitrogen ..	9s. 6d.	£3 to £6	—
			2½—5 ,, phos. acid ..	5s.		
			¼—1¼ ,, potash ..	4s.		
		Some dried night-soil ..	4½—5½ ,, nitrogen ..	9s. 6d.	£3 to £3 12s.	£1 15s.
			2—2½ ,, phos. acid ..	5s.		
			1¾—2 ,, potash ..	5s.		
MAINLY PHOSPHORIC.						
Phosphoric acid only	Phos. acid difficultly soluble	Bone ash	37—45 per cent. phos. acid ..	4s. to 4s. 6d.	£7 8s. to £9 14s.	—
		Bone char	30—40 ,, ,, ..	4s.	£6 to £8	£4 to £6
		Mineral phosphates ..	4—40 ,, ,, ..	3s.	12s. to £6	—
		Some guanos	8—30 ,, ,, ..	4s. 6d.	£1 16s. to £6 15s.	£6 5s.
		Thomas phosphate ..	17—24 ,, ,, ..	5s. 6d.	£4 13s. 6d. to £6 12s.	£4 10s.
	Phos. acid readily soluble	Superphosphates made by adding sulphuric acid to bone ash, bone char, mineral phosphates, and some guanos	12—20 ,, ,, ..	7s. to 8s.	£4 4s. to £8	£6 10s. to £9
		Concentrated superphosphate, made by removing extraneous matter from the above	44—50 ,, ,, ..	8s. 6d.	£18 10s. to £21 5s.	£13 10s.

Phos. acid preponderating, but containing also nitrogen and sometimes potash	Phos. acid difficultly soluble	Bone dust	15—26 per cent. phos. acid	4s. 6d.	£4 to £7 10s.	£5 to £6
			1½— 4 ,, nitrogen	9s.		
		Bone meal	1½— 4 ,, phos. acid	5s. 6d.	£4 15s. to £9	£6 10s. to £7 10s.
			1½— 4 ,, nitrogen	10s.		
		Bone and offal dust	11—16 ,, phos. acid	4s. 9d.	£3 5s. to £6 2s.	£4 10s. to £5 10s.
			2½— 5 ,, nitrogen	9s. 3d.		
		Some guanos	8—20 ,, phos. acid	5s.	£3 8s. to £10	£4 10s. to £9
			2 - 9 ,, nitrogen	10s. 6d.		
			2— 3 ,, potash	4s.		
		Dried fish	6—15 ,, phos. acid	4s. 6d.	£3 10s. to £7 7s.	—
			6—10 ,, nitrogen	9s.		
	Phos. acid readily soluble	Superphosphates made by adding sulphuric acid to any of the above five	8—16 ,, phos. acid	8s.	£4 to £9 8s.	£6 10s. to £14
			1½— 6 ,, nitrogen	10s.		
			MAINLY POTASSIC.			
Potash only		Kainit	12½ per cent. potash	5s.	£3 10s.	£4 10s.
		Concentrated potash chloride	52 ,, ,,	5s. 6d.	£14 6s.	£12 10s.
		Highly concentrated potash chloride	62 ,, ,,	5s. 6d.	£17	£20 (now £13, see note below)
		Highly concentrated potash sulphate	53 ,, ,,	5s. 6d.	£14 11s.	£14
Potash and nitrogen		Saltpetre (nitrate of potash)	35 ,, ,,	5s. 6d.	£17	£22 10s.
			13 ,, nitrogen	11s. 6d.		
			COMPLETE MIXTURES.			
Nitrogen, phosphoric acid, and potash in even proportions		Various mixtures of any of the above, sold as "Cereal Manure," "Orchard Manure," Fison's, &c., &c.	5—9 per cent. nitrogen	12s.	£7 10s. to £11 10s.	£9 10s. to £15
			5—9 ,, phos. acid	8s.		
			5—9 ,, potash	5s. 6d.		
		Same as above, but made with highly concentrated material	9—12 ,, nitrogen	12s.	£16 to £22 10s.	£24
			13—26 ,, phos. acid	8s. 6d.		
			18—34 ,, potash	5s. 6d.		
		Some dried night-soil	1½— 3½ per cent. nitrogen	9s. 6d.	£1 9s. to £3 8s.	£1 to £1 15s.
			1½— 4 ,, phos. acid	5s.		
			1½— 3 ,, potash	5s.		
		Farm-yard and stable manure	3-10—13-20 per cent. nitrogen	8s. to 10s.	3s. 6d. to 11s.	—
			3-20—2-5 ,, phos. acid	4s. to 5s.		
			3-10—7-10 ,, potash	3s. to 4s.		
		Compost heap, made of decayed vegetable matter, such as rotten wood, kitchen refuse, road sweepings, forest gleanings, and other rubbish			1s. to 3s. 6d.	—

NOTE.—It will be understood that the market prices of manures are constantly changing. Since the above table was prepared, nitrate of soda has been offered at £12 10s., bone dust at £4 10s., ordinary superphosphate at £5 5s., and highly concentrated potash chloride at £13 per ton.

ECONOMIC ENTOMOLOGY:

SOME ADVANTAGES TO BE DERIVED FROM ITS STUDY.

By C. French, F.L.S., F.R.H.S., Government Entomologist.

(14*th July*, 1893.)

The subject on which I have, by request, ventured to address you this afternoon is one that, in the present state of affairs in Victoria, would appear to be appropriate, inasmuch as we are embarking in the cultivation of our rural industries to such an extent as to cause us to hope that prosperity may return to us, and that the prognostications of our pessimists and "crest-droopers" may not be realized.

When I allude to the large areas that, during the last few years, have been taken up for the cultivation of grain, wine, and fruit, it will at once strike those of us who were fortunate enough to have listened to Mr. West's splendid lecture that we have only as yet touched the fringe of our great natural resources. To talk of over-production in either grain, wine, or fruit is only to expose our little weaknesses and want of knowledge on the subject.

It is not my intention to deal further with such matters; still, some allusion, as above, to these growing industries may not be out of place.

In the early days of fruit-growing in the colony, when our late venerable friends T. C. Cole, R. Watmaugh, Murdoch, and a few others led the way, they had comparatively little to contend with, at least in the shape of pests, either insect or fungus. But since the wholesale destruction of the valuable insectivorous birds, the extensive importations of trees and plants from foreign countries, and from other causes, the grower at the present time finds himself confronted with insect and other foes both numerous and formidable.

Again, with the extension of the orchard and farming area into thickly-timbered districts, native insects, formerly confined to indigenous plants, have thought fit to attack our imported trees, these latter being, I suspect, more palatable to them than many of our native gums, wattles, &c.

The destruction of our valuable auxiliaries—the insect-destroying birds—has, without a doubt, been the cause of an enormous increase in the number of noxious insects, all and sundry, and nothing could have been more suicidal than for us to have allowed this destruction to continue as it has done.

To every dark cloud, however, we are told there is a silver lining, and this we hope will be the case in the matter of the future protection of our insectivorous birds; and owing to the persistent efforts of the Field Naturalists' Club, supported by the Zoological Society, together with my own humble efforts in the same direction, this has been taken in hand by the Governments of the day, the result being that many of our best birds are permanently protected throughout the year.

As to the causes leading to such a wholesale slaughter of these birds I have little to say, but if I were to express my feelings on the subject I fear it would be much more impressive than edifying to you. I feel, however, that, to put it mildly, a deal of the destruction has been caused through a want of knowledge of the subject, and this is where I consider that an acquaintance both practical as well as scientific with economic entomology, coupled with ornithology, is absolutely indispensable to those engaged in our great rural industries.

Within the present century, at least according to Kirby and Spence in their delightful volumes on entomology, one of the principal causes of the little attention paid to entomology in England has been the ridicule and almost, we may say, contempt which have by the ignorant and unthinking been lavished upon those who ventured to preach any of the advantages to be gained by a study of such matters; but in a comparatively few years things in this respect have vastly changed, and we have but to look to America with its splendidly equipped entomological institutions, and as their systems are being followed by Europe and the colonies also, they are thus leading the way in such eminently useful work.

Great naval and military commanders have told us how that to be fully acquainted with the habits or movements of an enemy is to assist them materially in the annihilation of the latter, and so it is with ourselves in connexion with a knowledge of insect life in all its interesting though oft-times very destructive bearings. We must be able to follow the practice of a physician or surgeon, viz., to diagnose where such is required, and, having found out the true cause and seat of the disease, then proceed to apply, if possible, the remedy.

Supposing, for example, that a young man—and it is for such that this little discourse has been prepared—who is tired of the apparently dazzling but very temporary pleasures of city life, wishes to go on to the land and commence an independent business of his own, say, as an orchardist. He will first of all consult some good authority as to the best situation to commence operations. Having made up his mind, he will naturally wish to know more about that which he is about to undertake. He will, if convenient, obtain suitable books, attend practical lectures

bearing upon the subject in which he has ventured. He will prepare himself for his newly-imposed task by seeking for practical information from all and every available source. His evenings, when not otherwise taken up, should be spent in the study of such subjects as the chemistry of soils, rotation of crops, seasons, and diseases of all kinds. Lastly, he should, if possible, provide himself with a good powerful lens, supposing he cannot yet afford a microscope, and this, together with his note-book, should be his constant pocket companions ; he may then commence his study, during his leisure hours of economic entomology.

My young friends will perhaps say—"Oh ! this advice may be all very well, but what time will a man have left after having spent his day in the field or orchard, and what inclination will he have, being tired, for either literary work or for the study of entomology ?" My reply is, that to the man who is intellectually and studiously inclined nothing hardly is impossible.

In the room to-day, brought here for your inspection, are some of the most beautiful illustrations of insects and their life-histories that have ever been done in Australia. These illustrations, mark you, have been prepared by my young friend, C. C. Brittlebank, in after hours—often after having followed the plough from daylight till dark. No light work on such land as that at Pentland Hills, I can assure you. If you require information on these subjects read Smiles' "*Life of a Scotch Naturalist*" or "*Lives of the Earlier Lancashire Botanists.*" These works ought to be possessed by every student, having been written when there was no such thing known to the toiler as eight hours work, eight hours recreation, and eight hours rest. So you see, that without wishing to deprive you of your share of athletic sports, you can spend your spare time profitably, both for yourself and probably for others also.

With the microscope—and very useful instruments of this kind may now be purchased at a cheap rate—there is to be derived endless pleasure. I allude to pleasure combined with profit.

I do not mean that our embryo orchardist should, by the study of the above subjects, neglect for a moment his necessary duties. I well recollect my early horticultural training, when we used, after the day's work was finished, around the fire at night, and in the season, either do much of our grafting, label-making, writing, &c., &c., with our instructor by our side; and who would, that is, when we thought proper to behave ourselves, read to us from such works as *Paxton's Dictionary, Loudon's Encyclopædia*, and others of the grand old works which, even in modern times, we cannot afford to despise. Thus many a pleasant and instructive evening was passed by those learning the business.

The competitive system of giving prizes for the best essays and collections, prepared by permission of the Department, and assisted,

by your instructors, should be the means of greatly stimulating this feeling of emulation amongst the students. In Part I. of my new book I have given some brief instructions for the collecting of insects and the preservation of the same; and, if anything further bearing upon the subject be required at any time, it can be had for the asking.

Our young man may now be supposed, with the aid of a few pounds in cash, a fair stock of common sense, diligence, and a set of garden appliances, including a good spray-pump, to have made a fair start. His trees have been well selected from advice supplied, probably by either our friend, Mr. Neilson, or other experts. The chemist, we will suppose, has been asked to furnish some particulars as to the soil and its constituent parts, and the work may be fairly said to have commenced.

The trees thrive well and show signs of permanency, when lo! our young friend detects something wrong with his trees, which are either looking sickly or display signs which, to the practised eye, are not to be mistaken, of some pest more or less insidious in its attacks upon the tree. What is best to be done? Having thought the matter over, he determines to seek advice either from his books or from those whom a paternal Government have appointed for such work. He sends down specimens, obtains the necessary information, and all appears to be well. It is here where a practical knowledge of these diseases makes itself apparent. He discovers, for example, that his peach trees are covered with little brown insects with longish antennæ (or horns), with two projections sticking out from near the extremity of the body. Now the person who does not know, or has not read anything about the nature and habits of this pest, often says to himself—"Ah! I have heard somewhere of Paris green. I will give my tree a good dose, and so surprise our little brown friends." He gets the London purple or Paris green and sprays his trees; the result being that he finds the aphides there as usual, and not in the least disconcerted by what he considers his remarkably ingenious device for their destruction. Why and how is this? I will endeavour to tell you.

The aphides, as well as the very large family of so-called plant-bugs, are wholly suctorial in their habits, that is, they have a rostrum or beak with which they pierce the bark, and through which the sap of the tree is sucked out. It will thus be seen that such useful preparations as the arsenical compounds are next to useless against the above-mentioned insects, as their "beaks" are thus far below the reach of such applications.

The man who has studied the habits of these creatures for himself knows this much, and proceeds to destroy the hordes of little insects by spraying with a liquid that will kill by coming into contact with them. (I need hardly tell you what to use, as

this has been done in Part I. of my Handbook, and also in Part II., the latter being now in the hands of the binder.) You will thus see that by making a study of the subject you can save a deal of useless experiment, and devote the time which you would have spent therewith in a more profitable direction.

We will suppose the aphides on the branches to have been all disposed of—no easy matter, I can assure you—when lo ! next morning we find countless numbers swarming up the stems of the tree. Then the man who neither reads nor observes for himself would doubtless say—"Why, those that I sprayed yesterday have recovered from the effects of the spraying, and are as lively as ever again." But the careful observer will examine with his lens the parts of the tree sprayed with proper material, and thus satisfy himself as to the efficacy or otherwise of his attempts to destroy them, and, if successful, he would look over the tree for further indications of their presence.

The trained man knows that the insects are on the roots, where they hybernate, as well as on the tops. He at once concludes that he should first strike at the "root" of the disease. Whereas the man who knows nothing of the subject, and probably cares little either, proceeds to lament and predict the destruction of all orchards, and not infrequently winds up by chopping out his trees. This man, then, probably returns to the city again to seek employment likely in some menial position, where he thinks, as did the historical London tallow-chandler, "that the profits, though slow, are sure."

When one goes on the land, whether it is for the purpose of growing anything, from wool to special products, he will find that there are leisure moments which may be profitably spent in the interesting and useful study of economic entomology. Laying aside the many marvellous and wonderful provisions which nature has provided even the simplest of insects with a means of maintenance, the study is both useful, intellectual, and delightful. We will suppose that a grower comes across an insect eating the epidermis, or outer skin, from the foliage of his fruit trees, and thereby admitting the direct rays of the sun at a time when such may not be desirable. If he has a well-trained eye, and knows anything of the subject, he will naturally think to himself, well, I will poison these leaves, and when the insects eat the tissue of the leaves they will all be destroyed. He gets out his sprayer, gives the trees a good spraying, and finds in a few hours his caterpillars dead under the trees. His knowledge that the leaves have been eaten by insects which are not suctorial therefore proves to be of practical use to him.

As an example of "how not to do it," we will take the case of a grower (I have seen many) who, whilst either digging, planting, or ploughing, keeps his gun near to his hands. Ask

him why he carries his gun, and he will probably tell you that he has it to shoot the magpies (*Gymnorhina*) which destroy his crops. It possibly has never struck him that our common bush magpie, although it will occasionally eat a little grain, also grapes, is one of the most valuable of our native birds. It follows the plough and spadesman, picking up the grubs as they are turned out of the ground, and is the faithful friend and companion of the ploughman.

Our old friend, the laughing-jackass (*Dacelo gigas*), also comes in for his share of abuse and persecution from the ignorant. I have seen many of these birds shot just because they happened to be perching on some high tree near an orchard. Surely this must be something worse than ignorance on the part of those holding such an opinion. Still many of these contemptible pot-shotters might, if the matter of the economy of the bird was properly explained to them, be induced to see the error of their ways, or by a little gentle persuasion, as the following anecdote will show, be compelled to either do so, or pay dearly for the luxury of killing:—A few months since two very fine specimens of the native turkey or bustard (*Choriotis Australis*) made their appearance in a certain district; and after the proclamation to protect the turkey "all the year round" issued by the Commissioner of Customs at the request of myself, and kindly supported and forwarded by Mr. Martin, Secretary for Agriculture. Here was a chance for the so-called sportsmen. Away they went, and brought back in triumph (which was, however, short lived) the two identical turkeys which they had shot as expected. All appeared to be going along smoothly until they chanced to meet the local policeman, who promptly summoned them to the court, and they were fined £5 each for shooting the protected turkeys, together with costs and the confiscation of the birds, which were probably eaten and enjoyed by the policeman and his family.

Most of us recollect the serious outbreak of phylloxera that occurred in the Geelong district, and for which we were wholly unprepared. Although I am one of those who believe in the efficacy of the action taken by the Government of the day in suppressing this fearful scourge, I think, however, that if we had been better acquainted with the pest, and the remedies which in Europe and America have been tried, but with only, it is true, partial success, we might have thought twice before resorting to such extreme, though very necessary, measures. We now know something of the aerial as well as of the root forms of this wonderful little insect, and this knowledge has enabled those situated in the great wine districts of Europe and elsewhere to bring into use the various means which have been tried for its eradication.

When the great scourge of locusts took place in Africa, and later on in America, Cyprus, and even in our own southern colonies, and, although the plague is of ancient origin, little was hitherto known of its life-history. Nowadays, however, the inhabitants of these hot countries have been able, by a patient and exhaustive study of these terrible insects, in many instances to be partially successful in coping with what would appear to have been a singularly hopeless task. It was found that there were two special periods at which they could be successfully attacked, viz., when in the egg stage; and, secondly, when in the newly-hatched or "hopping" stage; the former being accomplished by the collecting of the eggs, the authorities paying the collectors so much per bushel for same. The second plan consists in driving the young locusts, which were found by observation to be travelling always in the one direction. (I have had a rough sketch made of the latter plan from a photograph taken by a friend who took part in the locust destruction in Algeria. This plate I have brought for your inspection.) When the young locusts are hatched they travel for a few days in a circle, and after they have obtained sufficient strength they commence their onward march in one direction. During this march they eat up every living plant which they can manage to digest. They have a wonderful appetite, and when in the winged state will devastate the whole vegetation of a country in no time.

The screens as shown in the sketch, also in the model, often extend for a hundred or more miles over mountains and rivers; and where labour is of little value the number of locusts destroyed by means of these screens is simply beyond all attempt at calculation.

In Australia, however, I am afraid that until the interior becomes more settled, and owing also to the comparatively high price of labour, an attack on the locusts on such an extensive scale as in the countries before mentioned would be well nigh impossible.

At present we know a good deal concerning the life-history of these pests, and, partly for the purpose of refuting a statement that our Department of Agriculture were too late in taking action, I obtained freshly-deposited eggs and had them hatched artificially. After making allowance for difference in temperature, &c., I found that we had nearly two months in which to attack them before they assumed the winged stages. These experiments, which I undertook principally for the defence of the Department, and partly for my own information, conclusively disproved the assertion that the Department had been dilatory in the matter, and also proved that it had done its best to induce the settlers to band together for the destruction of this terrible enemy.

Before closing my few remarks about the locusts, it may interest you to know that for some time past I have been trying to find time for the preparation of an illustrated treatise on this important subject. Owing to pressure of work, however, I have not yet been able to get it ready. The coloured plates are ready, specimens of which are here to-day for your inspection; and in this connexion I may be allowed to point out some of the difficulties under which one labours when preparing books of this kind. The notes are got ready, and you place them before you on your table, when lo! a knock is heard, and a visitor is announced; or else you are besieged with letters asking for information on matters all and sundry. I would here like to commend to my youthful hearers the excellent practice of replying to all letters, if at all possible, on the same day as that on which they are received. I mention this as some of you may at a future time hold a similar position to that held by our experts at the present time. If you are at literary work correspondence should not, if possible, be allowed to accumulate. It is a bad practice, as a grower when he writes for your advice is no doubt anxiously awaiting the reply to his request for information. Reply at once. The matter is then off your mind, and you are ready for the next day and the work required of you.

In the early part of last year I received several caterpillars of the "Celery Vine Moth" (*Chærocampa celerio*). In some instances they were described to me as "horrid things with horns on their heads" (the so-called horn is fixed at the other end), and that when handled they "would 'spit' and fly back." I was anxious, of course, to interview this "monster," when to my astonishment it proved to be the larva of the beautiful Hawk moth, which you will find figured in Plate XIX., page 108, of Part II. of my new book on insect pests, an advance copy of which I have obtained to show you this afternoon. If these persons had taken the trouble to place one of these caterpillars in a box and fed it with freshly gathered vine leaves, they would have been able to trace the insect from the grub to the pupa, and from thence to the perfect insect. This would have been very little trouble, and from that time they would have had a practical acquaintance with the habits and life-history of one of the worst caterpillar pests of the vine.

How often has it happened that a traveller who, by stress of weather or from other causes, has had to refrain from accomplishing that for which he had left home, and has had to pass many a weary hour at some country hotel, and who has had a bitter experience, that is, if he be an intellectual person, in walking about doing nothing? Whereas had he been a naturalist his spare time could have been agreeably and profitably spent in observing and collecting some of the insects or plants of the district. As to

those who know how to spend their leisure profitably and intellectually at the same time, more especially in the delightful study of nature and her handiwork, the feeling becomes one of intense pleasure. You have also the feeling that you are not only adding to the store of your own knowledge, but in all probability making observations which may be of use to some one else, and that some one will in all probability be the grower.

Kirby, one of the most delightful and practical of our great English writers on entomology, remarks "that entomology is unquestionably the best fitted for thus disciplining the youthful mind, and simply from these circumstances, that its objects have life and are gifted with surprising instinct admirably calculated to attract youthful attention, and are to be met with everywhere." "It is not meant to undervalue the good effects of the study of botany or mineralogy, but it is self-evident that nothing inanimate can excite such interest in the mind of a young person as beings endowed with vitality, exercising their powers and faculties in so singular a way, which, as Reaumur says, are not only alive themselves but confer animation upon the leaves, fruits, and flowers that they inhabit, which every walk offers to view, and on which new observations may be made without end." "Besides these advantages no study affords a fairer opportunity of leading the young mind by a natural and pleasing path to the great truths of religion, and of impressing it with the most lively ideas of the power, wisdom, and greatness of the Creator."

We have thus said a little, only a little to be sure, concerning the use of entomology in enabling one to know something about insects that are destructive to crops, but there is another aspect of the question, and that is the advantages to be gained in being able to tell a destructive insect from a beneficial one.

Take for example our little ladybird (*Leis conformis*) which, when in the larval state, is so destructive to aphides all and sundry. It is no uncommon occurrence for growers, I mean those who have not taken the trouble to think or read for themselves, to send me these useful little insects as something to be dreaded, and asking to be supplied with an effective remedy. Again, I have seen people shaking these, their best friends in the insect line, on to a cloth and destroying them wholesale. Surely this must be for the want of knowing better, as a very cursory glance over any aphis-infested tree will disclose the presence of numerous ugly-looking grub-like forms busy devouring the aphides in a wholesale and voracious manner.

Then there are the *Hemorobidæ*, or lace-wings, which, in the larval state, like wolves in a sheep-fold, make great havoc amongst the aphides. I must refer you to Part II. of my book for a more lengthy description of these two valuable "insect helps" to the

fruit-grower. In France, we are told, boys are employed to prevent the birds, chiefly sparrows, from destroying these useful little insects.

The *Syrphidæ*, flies whose larvæ are armed with a singular mandible furnished like a trident with three points with which they transfix their prey. These grubs are most destructive to aphides of all kinds. (On Fig. 9 of the chart which I show you to-day you will see the larvæ in the act of killing an aphis.)

A large group of *Hymenoptera*, wasp-like insects, are most merciless destroyers of insects, especially amongst the *Lepidoptera*, that is, butterflies and moths. They do not, however, confine, by any means, their attacks to members of this large order of insects, as even the destructive *Cecidomyia*, or Hessian fly, has its enemies in certain minute species of a genus closely allied to *Ichneumonidæ*. In Europe no less than three species of these little flies are known to render us valuable help in destroying the larvæ of this dread scourge of the wheat-grower.

In Victoria we have a number of beetles, especially amongst the carabidæ, which, both in the larval and perfect state, destroy vast quantities of grubs which affect our cereal crops, grass, lands, lawns, &c. I had one of these, our largest species (*Hyperion Schrœtteri*) alive to show you how he would demolish either a grub or a moth. Unfortunately, however, for me at least, an unfriendly rat got into the box, the lid of which I had incautiously left off, and in the morning nothing but a few fragments were left on which I could ponder as to the wrong principle of counting one's chickens before they are hatched.

Spiders also, at least most of them, are very useful animals, more especially as they are destructive to boring insects, also those which hybernate under the bark of our native trees. One (*Vocconia*) which we know by the common name of tarantula, which it is not, being a perfect glutton, as the piles of insect débris, *i.e.*, wing-cases, &c., will show.

The tale has been told of gallant officers who were fearless in the face of an enemy, but would feel very uneasy in the immediate presence of a huge spider, and although they are useful we must be careful, as many of them bite sharply, and a few kinds are also venomous.

The economy of some of our much despised hornets, more especially of the genera *Sphex*, *Pompilius*, and other large kinds, which we know principally by their orange-yellow bodies, often banded with black, and some of us by having felt their formidable sting, is well worth the trouble which it would entail in watching some of their peculiar habits, and as destroyers of grubs (above ground), centipedes, scorpions, cicadæ, &c., they have few equals.

It would take hours for me to give you even a brief account of the many advantages to be gained by a study of economic insects, as the subject is not only interesting and useful, but also well nigh endless. I can, however, promise you that should the Department so desire it, and your instructors think fit to ask for another discourse on these lines, I will be most willing to place my humble efforts at your disposal.

As the days are now short, and the daylight is fast passing away, I must conclude by saying that to be successful we must be practical as well as energetic, always willing to learn from those who are willing to impart their knowledge to those requiring it, and never "setting ourselves up" as knowing everything, as we can learn something from the humblest. In these days of bustle, turmoil, and keen competition, it behoves every one of us to be on the alert, and the grower who is able to discriminate between his insect enemies and friends must surely have a better chance than those who know nothing of the subject. As for botany, what shall I say of it? Nothing further than to remark that the same rule which applies to the use of a study of entomology will apply, as our friends Baron von Mueller and Mr. McAlpine can tell you better than I can, to botany; not forgetting chemistry, which is probably the most valuable of all the applied sciences. If I were asked whether I would prefer the study of botany to that of entomology, I feel sure, from previous experiences, I should reply that I would prefer to study both. Do not, when you have gained a little scientific knowledge, look with a superior sort of air upon the practical orchardist, as he, having better chances often of observation in orchards than you may have, will be able to teach you many a practical lesson which may serve you in good stead. The time is upon us when we must use our heads as well as our hands, and the end of all this will probably be, as the great Darwin has told us, the survival of the fittest.

GLIMPSES OF SOME BRITISH BOTANICAL GARDENS AND THEIR CONSERVATORIES.

By W. R. Guilfoyle, F.L.S., Director Melbourne Botanic Gardens.*

(11*th August*, 1893.)

Having been granted a holiday by the Government some three years ago for the purpose of visiting Europe, I made the best use of the opportunities thus afforded me of seeing the principal gardens and parks, public and private, of Italy, Switzerland, Germany, France, Belgium, and the United Kingdom.

During my travels I saw so much in the way of gardening and horticulture that was really interesting and useful to me that I devoted my time almost entirely to wandering from one garden or park to another, until I had fairly exhausted my holiday.

It may truly be said that Britain itself is a garden from one end to the other, so beautiful in the simplicity of nature and so frequent, so extensive and so well cared for, are the private parks, gardens, and ornamental grounds of the wealthy classes, and so liberally are the places of public resort and recreation endowed. In dealing with the subject "Some British Botanical Gardens and their Conservatories," I have endeavoured to describe, as concisely as possible, the principal points of interest in five of the most instructive of these scientific institutions, referring also to some of the rare and beautiful plants they contain.

I had the advantage of seeing the Royal Botanic Gardens of Kew under favorable circumstances, and, although to them must fairly be conceded the pride of place, as being the finest in existence as scientific gardens, I cannot agree that they possess any strikingly picturesque natural features or that they contain many examples of high-class landscape art, in fact, they were never intended as such; they are what might be termed a botanical map of the world.

* The lecture was illustrated by coloured drawings (life size) of the following plants:—*Nelumbium speciosum* (lotus lily), *Nepenthes* (pitcher plant), *Sarracenia* (side-saddle plant), *Anthurium* (flamingo flower), *Brownea macrophylla*, *Musa coccinea* (scarlet banana), *Rafflesia Arnoldi* (root flower), and *Raoulia eximia* (New Zealand vegetable sheep).

The Kew Gardens and Arboretum contain the largest collection of living and dried plants known, obtained from every clime, and afford facilities for the study of the science of botany and horticulture which no other institution of the kind has been able to eclipse, if even to approach. The cost of keeping them up amounts to upwards of £25,000 per year.

Of course to give a detailed description of all the subjects of striking interest in these gardens would take up far more time than could be possibly devoted to them, even in a fairly comprehensive lecture ; indeed, it would necessitate many visits to Kew before the enormous amount of material therein accumulated and classified could be even superficially grasped. Nevertheless there are certain features which, from their importance and bearing on botanical science generally, call for more than a mere passing remark; I allude to the various conservatories and the museums of economic botany. The palm house of Kew, one of the finest and largest in the world, is 362 feet long, 100 feet wide, and 66 feet in height, having wings 50 feet wide and 30 feet high. The central part of this great conservatory is encircled by a gallery 33 feet from the ground, and ascended by spiral staircases. Visitors are thus enabled to view from above the canopy of rich and varied tropical leafage which arches over the pathways and obscures the roof. The glass (about 45,000 square feet) is slightly tinged with green, to obviate the scorching effect of direct sunlight. The magnificent collection of palms, for the cultivation of which the house was primarily intended, comprises some hundreds of kinds, but mingled with them, towering high or fighting for existence below, there is a variety of other tropical vegetation which is marvellous to the beholder.

On a lawn to the north of the palm house is a T-shaped house of various temperature, consisting of a central area, occupied by the great "*Victoria Regia*, or Royal Water Lily," from South America ; two lateral wings, one for economic plants and one for temperate and tropical orchids ; a back wing, used as a tropical stove ; a compartment for begonias and Gesneraceæ, and for Cape heaths, fig-marigolds, &c.

No less than 1,400 species of orchids are growing in the Kew conservatories, and of the most showy kinds there are perhaps eight or ten specimens of each. The most recent enumeration of the number of species known, to say nothing of mere varieties or hybrids, is said by Sir Joseph Hooker to be upwards of 5,000.

A succulent house, 200 feet long and 30 feet wide, is mainly devoted to those plants of warm and arid countries which are characterized either by excessive succulence or by the converse condition of extreme dryness and rigidity. The plants in this

house, as is the case in the temperate and tropical fern houses, are all arranged in groups, closely allied, and the more important ones are the cactuses or "Indian figs," euphorbias, bromelias, dasylirions, dracænas, beaucarneas, yuccas, aloes, agaves, crassulas, rocheas, sempervivum or "house leeks," echeverias, mammillarias, opuntias, and cereus. Among the latter was the celebrated *Cereus giganteus* (called by the Mexicans "suwarrow"), which in the Rocky Mountains imparts a singular aspect to the scenery; its enormous tall stems, 50 to 60 feet in height, with diameter of about 2 feet, having the appearance of telegraph posts.

In one of the tropical stoves I saw for the first time a young plant of the double cocoa-nut palm, or "coco-de-mer" (*Lodoicea sechellarum*), the fruits of which, found floating about the sea prior to the discovery of the Seychelles Islands, in 1743, puzzled so many botanists, and gave rise to many absurd and fabulous tales.

One of the tropical houses is devoted to the great group of *Aroideæ* and *Marantaceæ*, the latter order showing all the principal kinds of ginger and arrowroot; the *Cyclanthaceæ*, embracing the closely allied *Pandanus*, "screw pine" or vacona, from Mauritius, and of which sugar bags or sacks are made; also the pepper tribe, *Piperaceæ*. Among the aroids, which abound chiefly in tropical swamps and humid forests, were many splendid anthuriums or "flamingo flower," *Dieffenbachias* or "Dumb-cane," with their spotted leafage, and the *Colocasia antiquorum* or "taro," so well known and valued as an esculent in the islands of the Pacific. The great aroid, *Amorphophallus titanum*, which flowered at Kew three years ago, is a native of Sumatra. It is a herbaceous plant of gigantic proportions, and of its kind eclipses all others. The spadix of the flower is 5 feet high, and the spathe 3 feet in diameter. The divided blade of the leaf covers an area of 45 feet in circumference. Among the peppers (*Piper*) was the "kava" plant of Fiji, from which is prepared a stimulating beverage. The root of this plant is chewed by young boys or girls, and the juice thus extracted, together with the pulp, and water poured on, is placed in a bowl, and after straining through a piece of "tappa" (cloth made of the bast of *Brousonettia papyrifera* or "paper mulberry"), is drunk with avidity by the chiefs and others assembled.

One of the greatest boons to botanical students is the three museums, and I cannot do better than to quote the words of Sir Joseph Hooker (the late director of the gardens), as given in a handbook:—

"The object of these museums is to show the practical applications of botanical science. They teach us to appreciate the

general relations of the vegetable world to man. We learn from them the sources of the innumerable products furnished by the vegetable kingdom for our use and convenience, whether as articles of food, of construction, and application in the arts of medicine, &c."

Museum No. 1 contains the collections illustrative of the products, &c., of the dicotyledonous and gymnospermous divisions. The arrangement is eminently practical, the contents being systematically arranged, numbered, and labelled. The building itself is a plain brick one, of three floors, and was opened to the public in 1857. It is filled with glazed cases, each of which contains specimens of raw and manufactured products of the vegetable kingdom, consisting of food, medicine, articles of manufacture, and woods used in construction, &c.

In this museum, also, are specimens in every stage of growth of that most singular plant, *Welwitschia mirabilis*, discovered by Dr. Welwitsch, in South-western Africa, about half way between the equator and the Cape, in 1859; and to quote Sir J. Hooker's description of it—"Has a dwarf woody trunk, seldom rising more than a few inches above the ground, with a diameter often of several feet, and a single pair of leaves, usually torn to ribbons, which spring from the margin of the trunk, and persist through the life-time of the plant, which it is estimated may reach 100 years. It is related botanically to the pines and firs *Coniferæ*, and is remarkable as presenting—associated with the simplest type of structure in its vegetable organs—a more complex form of flower than we find elsewhere in the group."

Another most extraordinary vegetable production, *Rafflesia Arnoldi*—a plant said to be impossible to cultivate—is represented by a wax model, presented by the Royal Horticultural Society of London. The *Rafflesia Arnoldi* is the largest flower in existence, is destitute of true stem or stalk and leaves, and in its natural state weighs from 12 to 15 pounds, while it is capable of holding twelve pints of water. It was discovered by a Dr. Arnold in the interior of Sumatra.

In another glazed case is a specimen of the balsam bog plant (*Azorella cæspitosa*), from the Falkland Islands, forming huge, hard, and hemispherical hillocks, often 2 to 4 feet in height, and which, in some respects, at first sight is not unlike the sheep plants of the mountains of New Zealand (*Raoulia mammilaris* and *R. eximia*), called so from their compact large tufts, resembling that animal when seen at a short distance. The Raoulia, which is also shown in the museum, is, like the former, a huge conglomerate mass of diminutive flowers, but it belongs to the composite order, while the azorella is of the *Umbelliferæ*. The contents of Museum No. 2 comprise the products of the palm, grass, lily, mushroom, and sea-weed families.

Museum No. 3 contains a large collection of timber, the woods of Europe, British India, Natal, Cape of Good Hope, British Guiana, Trinidad, Canada, Queensland, New South Wales, Victoria, Tasmania, and New Zealand.

An afternoon at Oxford was well spent in the Botanic Garden, which is situated on the banks of the Cherwell. The garden is only a few acres in extent, but contains some wonderfully fine specimens of rare and beautiful trees, besides which it is famous in the annals of botany and horticulture as being the oldest of the British Botanic Gardens (founded in 1632), and the place where several eminent botanists studied and brought to light many interesting facts connected with science. Jacob Bobart was the first director, Tradescant succeeded him, and, later, Sherard formed the medicinal garden and herbarium. Drs. Sibthorp and Daubeny were also professors of botany here. John Evelyn was a constant visitor between the years 1654 and 1675, for the purpose of attending lectures in the School of Medicine, and spent most of his time in the Physic Garden, which is still in existence. Baxter, 78 years ago, planted the large *Sophora Japonica*, or "pagoda tree," near the arch gateway, opposite the Magdalen College, and this tree measured 11ft. 3in., circumference of stem, 5 feet from the ground. There are some noble examples of ash. *Fraxinus excelsior* ("common European ash"), *F. pubescens* ("American red ash"), and *F. Ornus* ("manna ash"), the latter 45 feet high and 6 feet round. A copper beech measured 11ft. 6in. in girth, and another variety of *Fagus sylvatica*, called *F. asplenifolia*, was also a magnificent tree. *Pyrus aria* ("the white beam tree"), *P. sorbus* or "service tree," and *P. intermedia*, 35 to 40 feet high, was, at the time of my visit, a perfect picture, its branches bending to the grass with the weight of scarlet fruit. Among other interesting fine specimens must be mentioned *Corylus colurna* ("Constantinople frizzled hazel or filbert"), 30 feet high and 5ft. 7in. in girth, *Prunus cocomilia* ("the Calabrian prune"), which yields a bark considered a specific for fevers in Calabria, and the flowers of which have a perfume resembling that of the heliotrope. On the banks of the Cherwell some of the trees are of huge proportions. Several *Populus alba* ("white or silver poplar") averaged 14ft. 5in. in circumference 5 feet from the base; *Populus fustigiata*, or "upright poplar," 11 feet; *Planera aquatica* (the "planer tree" of Southern United States) measured 12ft. 1in. in circumference. Many elms, too, near Christchurch meadows are of enormous size; but in the Magdalen Grove, at the back of the College, are two elms, one 26ft. 8in. in girth, and was 125 to 130 feet high; the other I found to be 21ft. 6in., and was quite as tall.

A great treat was a day spent at Chatsworth, seat of the Duke of Devonshire, one of the oldest and most celebrated gardens in England; in fact, it is a private botanic garden. It was here that *Amherstia nobilis* from the Burmese Empire, and one of the most gorgeous flowering trees in existence, was first brought under cultivation ; indeed, a conservatory which cost more than £1,000 was specially built for this plant alone. Three hundred years ago gardening was known at Chatsworth, and it was interesting to observe the various styles of the art, which are still preserved and kept up from the stiff formal Oriental, Italian, and Dutch to the present or so-called modern or natural landscape system. To attempt a description of the many beauties to be met with in the outer grounds of Chatsworth—the lovely lakes, lawns, charming endless vistas, glades, and dells, huge artificial rockeries so skilfully arranged as to deceive even an expert as to whether they were not natural formations—would occupy more time than could be given to them just now. I will therefore briefly refer to the contents of the glass structures, which cover some acres of ground. The Victoria Regia house contains, besides the great water lily itself, which is grown in a tank 36 feet in diameter, numerous choice aquatic plants, amongst which is a fine plant of *Euryale ferox*, of the East Indies, which before the Royal water-lily was the noblest water plant known. The *Nymphæas* are largely grown, and amongst them were *Nymphæa gigantea* and *N. cærulea*, the blue water lilies ; *N. Devoniensis*, with brilliant crimson flowers, the sweetly-scented *N. Daubenyana*, and the sacred lotus lily or rose of the Nile (*Nelumbium speciosum*), with leaves standing up parasol-like above the large rosy-pink flowers. The are many orchid houses, and several are devoted to kinds requiring special treatment. One of these houses contains a magnificent collection of cattleyas, principally Brazilian—some of them with flowers 7 inches across, and amongst other orchids, hanging in baskets from the roof, were some rare odontoglossums, phalænopsis or moth orchids, and oncidiums, all American. Another conservatory was filled with special Brazilian, Mexican, and British Columbian species requiring cool treatment—a matter which only within the past few years has occupied the serious attention of orchid cultivators, it having been discovered that many tropical species thrive better by more free circulation of air.

A dracæna and croton house was crowded almost to excess with the most beautiful kinds of the variegated forms of these plants, striped or blotched with every imaginable colour, and they were the more interesting to me as I myself was the discoverer of some of them many years ago during a cruise of H.M.S. *Challenger*.

There is also a house of Cape heaths, one of camellias, of Indian azaleas, and an orangery, besides grape houses, &c.

But the large conservatory has long been considered one of the chief attractions of Chatsworth; in fact, before the erection of the great palm house at Kew it ranked foremost in the world as a plant house, and even now is without a rival in many respects. It contains tropical rarities which in point of cultivation and size are not met with elsewhere. The abundant space which the lofty and capacious house affords admits of the vegetation it contains growing as luxuriantly as in the tropics, and well might it be said that one can readily imagine one's self in the midst of a rich tropical jungle or forest.

Growing not in plots or tubs, but in a deep, rich well-drained soil, magestic cocoa-nut, date, ceroxylon, kentia, sabal, talipot, and other palms, tower up to almost their natural heights—some of them the result of 50 years' growth—and overshadow with their weighty ample foliage their less pretentious but powerful neighbours, tree ferns, panax, aralia, cordyline, zamias, and cycas. The great bananas (*Musa superba* and *M. Ensete*), of Abyssinia, vie, in their magnificent groups of broad massive leafage, with their allies the strelitzias of Africa, and singular urana or traveller's tree of Madagascar, whilst bread fruit, jack fruit, anona or "sweet sop," avocado pear, spondias or "vi apple," mangoes, mangosteen (king of fruits), diospyros or "persimmon," liche, longan, papaw apple, durian, Bengal quince, jujube, and a host of other fruit trees of the temperate and torrid zones are in their element, and, struggling for space amidst pandanus, mangroves, banyan, cinnamon, and nutmeg trees, ixoras, jonesias, browneas, and scores of others remarkable either for the brilliancy, beauty, or singularity of their flowers, or the grandeur of their foliage. An exuberant undergrowth of many kinds of dwarf ferns—arum, begonia, piper, tradescantia, maranta, billbergia, caladium, and like vegetation fills every available space, and up the pillars that support the vast roof, as also the stems of the taller trees, gay and brilliant flowering climbers find their way to the glass and partly obscure it. Glorious effects are produced in this large conservatory by massing a number of specimens of any particularly strong kind of plant together—*Musa coccinea*, for instance, from Cochin China, five or six in a group, with pale-green whorls of broad leafage, and dazzling scarlet bracts, lent a charm to a jungle of reeds, bamboos, and alpinias. And such delicious tints of colour as are produced by a combination of the well-known cissus discolor, yellow allamandas, numerous dipladenias, thunbergias, clematis, and aristolochias, festooning drooping boughs, binding them together or wrestling with noble philodendrous pothos and monsteria, can be better imagined than described.

The Botanic Garden of Edinburgh, which is under the directorship of Professor Balfour, is 27½ acres in extent, but

there is also an arboretum of 60 acres, in which trees and the larger shrubs are classified in groups arranged on the grass. Both garden and arboretum contain magnificent collections of plants, and afford every facility for the study of botany. The Botanical Museum in the upper part of the garden is much patronized by the public. The specimens therein are arranged on glass-covered tables and in cases, some for carpological or fruit specimens, grouped according to their relationship. One case contained the plants of Scripture, another fossil plants, and many other miscellaneous articles and products of the vegetable world. Structural, morphological, and physiological botany are taught and simplified or made easy by models in wax, and by living or preserved plants. One of the most interesting and useful collections in this museum to the student of botany is the papier-maché models of flowers, in some instances nine or ten times their natural size, which illustrate the various orders of plants.

A series of the principal genera of each order, beginning with the *Ranunculaceæ*, or order of the butter-cups or ranunculi, clematis, &c., and ending with the *Gramineæ* or grass family, are so neatly and beautifully made as to be capable of being taken to pieces, as one would dissect the flowers themselves, to ascertain their parts and relationship. The fungi or mushroom order, is also well illustrated by models as well as by specimens preserved in alcohol, whilst the *Algæ*, or sea weeds, and lower forms still of vegetable life, are represented.

The garden is greatly to be admired for the excellent manner in which it is arranged, not only as a scientific repository but for its pretty little lawns, vistas, and background of foliage, the winding pathways through shrubberies, its old interesting trees, and for the splendid outlook over Edinburgh from the arboretum in front of Inverleith House (known as the Old Mansion House), which is the residence of the director.

The class ground within the garden proper contains only herbaceous plants and annuals (similar to the one at Kew), which are arranged in botanical sequence in long narrow beds, according to Hooker and Bentham's *Genera Plantarum*, for the information of students. The rock garden is not an artistic design, being simply a terraced slope, ascended by steps, and containing several thousand square or triangular compartments for alpine and dwarf herbaceous plants, besides small shrubs, amongst which several New Zealand species were flourishing ; nevertheless it demonstrated how such plants, with attention and a knowledge of their habits, may be cultivated with perfect success. A semicircular pond in the centre of the ground was filled with aquatic weeds and the more showy water-lilies. The pine tribe scattered over the garden and arboretum numbers some 300 species. No fewer than 70 distinct forms of the English holly (*Ilex aquifolium*), variegated and green, are

grouped in a large bed, and at the time of my visit were laden with berries—mostly scarlet, but many of them golden yellow.

The glass-houses teem with a rich and varied tropical and semi-tropical vegetation, but it would of course be a work of supererogation to recount the names of the thousands of species contained in this excellent institution.

The Dublin Botanic Gardens—or, as they are called, the Royal Botanic Gardens—are situated in the suburb of Glasnevin, on the Tolka River, about 3 miles north of the metropolis. The general contour of the gardens being of an undulating character, has enabled the designers of it to make much of little more than 40 acres, and the work has been very artistically planned.

As the visitor strolls along the sweeping walks or over the well-kept turfy expanses, broken by clumps of green and variegated hollies, maples, rhododendrons, laurels, and numerous individuals of British and foreign timber trees, the scenery is everywhere varied, interesting, and delightful. The ever-flowing Tolka stream, with its emerald-green banks studded with silvery-leaved willows (*Salix venenata* and *S. regalis*) and drooping reeds and bamboos, is a factor in the landscape which adds a great charm to the surroundings.

Dotted about the lawns are some glorious examples of golden-leaved yew trees and copper-coloured beeches. These light up the dark background of firs and other trees outside the grounds. Trees with coloured foliage well blended with the greenery of a landscape often afford more pleasing effects than the most fantastic beds or borders of flowers that the gardener can design.

A prominent feature is the rock garden, which is well stocked with luxuriantly growing alpine vegetation, ferns in suitable positions, rare wild flowers from the highlands of Europe, bog plants in great variety growing in peat beds at the base of rocky recesses where moisture is obtainable.

This rockery is so artistically made that in many places it creates the impression that the native rock has cropped up through the turf in the natural way. Orchids and pitcher plants are largely grown in houses specially provided for them, and the collections of these embrace nearly all of the best kinds known in cultivation. But to any person taking an interest in quaint forms and the anomalous development of plant life, so varied and extraordinary, there is in the collection of North American sarracenias alone quite a study. They number about ten species and many hybrid varieties. The plant is called "side-saddle flower," or "trumpet leaf." The flowers themselves are of no great beauty, but the highly-coloured pitcher-like blades—often mistaken for flowers—are in reality the leaves in a distorted condition. The real pitcher plants are the nepenthes, of which the giant species (*N. Rajah*), found a few years ago at Kina Balu, a mountain in

Borneo, is the finest yet discovered. Mr. Burbidge informs us that he found the plant in large clumps, having stems 5 or 6 feet in height with very broad massive leaves and pitchers or urns capable of holding two or three pints of water. Besides this species there are some 25 or 30 others, of which *Mastersiana*, a hybrid variety, and *Rafflesiana*, from Singapore, are the handsomest. The palm house contains 90 species of well-grown palms, some of which tower up to the roof, which is more than 60 feet high. There too are perhaps the finest specimens in cultivation in Britain of those noble trees—the *Browneas grandiceps* and *coccinea* from Venezuela and New Granada. The former was furnished with between 30 and 40 gorgeous flower heads of bright clear rosy pink colour, and borne in dense clusters at the extremities of the short young shoots from the main stem, contrasted charmingly with the dark pinnate leaves of 3 feet in length. The *Brownea coccinea*, which flowers somewhat later, and of which I also saw specimens at Kew and at Chatsworth, produces dazzling vermilion tassels of bloom from out of the bark of the stem and branches, and which, before expansion, resembles small marbles, whilst the leaves in a young state are of a rich bronzy hue. Two other beautiful plants, rare in cultivation, attracted my attention—*Jonesia asoca* (*Saraca*) and *Butea frondosa*—which like the browneas first alluded to, the *Poinciana regia* or gold moha tree, the *Amherstia*, and many other of the more gorgeous flowering trees and shrubs of the tropics, belong to the order *Leguminosæ* or pod-bearing tribe. A curvilinear range of glass, called the New Holland house, is filled with our eucalypts, numbering some 70 or 80 species, numerous acacias, epácrids, the araucarias, dammaras, callitris, and a host of Australian plants too numerous to mention. The vegetation of New Zealand is fairly represented in the open borders. The *Phormium tenax* or "New Zealand flax," veronicas, pittosporums, &c., do well with little shelter. I may say that, as a picturesque botanical garden, that of Glasnevin has few rivals, and the visitor to Ireland who omits seeing it will have missed a treat which few other places can offer all the year round.

Having briefly described these various scientific institutions, it may be asked what British conservatories and operations connected therewith have to do with matters of the kind here, seeing that they are applied in most instances under very distinct climatic conditions. The conservatory system, so called, is almost as necessary here as in Britain, owing to the variable nature of our climate; and, therefore, any garden worthy of the name should have the material aid of shelter and warmth thereby afforded.

Visitors from the Antipodes are usually amazed at the plants to be seen luxuriating in the open air in these southern climes, and which in some continental and British gardens it is

absolutely necessary to grow in pots or tubs under glass. It would be well in my opinion for our young men, anxious as many of them are to keep abreast with the onward march of horticulture, to be actively in touch with the most approved methods of cultivation adopted by experienced growers at home, as well as in the colonies. Thus they would learn how to increase and successfully grow valued plants, many, perhaps, of economic importance, from warmer or colder latitudes for test purposes or acclimatisation here. I would add, in conclusion, that intelligent application to the study of so useful and pleasing a profession as that of horticulture would most surely merit and should insure success ; and if, as is so truly necessary, forethought and observation be practised, afterthought, with all its possible miseries, would be avoided. Our climate and soil, generally speaking, being favorable for the cultivation of almost anything, the opportunities afforded by tuition in this and other institutions of the kind, also through our increasingly liberal land laws, should enable our young men to become not only owners of flourishing gardens, but horticulturists in the truest sense, and second to none in the world.

VICTORIAN LAND IN ITS RELATION TO CULTURAL EFFORT.

By Ambrose C. Neate.

(*8th September*, 1893.)

It is not, I would assume, too much to expect in a large island-continent such as Australia that its rapidly increasing population will aim of necessity to secure its sustenance food, clothing, shelter, &c., from or by means of the soil to a far greater extent than is at present attempted. That the culture of the soil will be extended in a remarkable manner needs no forecast, seeing—as is apparent to all observers—the present depression is forcing our sons to think of the country, with the view of fitting and settling themselves upon it, as intelligent workers who intend to test the powers which God has given them of transforming many a wilderness into a garden.

In time to come people will look back with gratitude to the men, both in and out of our Parliaments, who by their wisdom in schemes for village settlements, labour colonies, &c., induced a large part of our population to become rural in its habits, independent in spirit, and more truly healthful in both body and mind.

It may be asked by a young farming man, say, in one of the home counties, "Is Victoria capable of yielding the varied products needful for man and beast?" From some of us who know something of facts not entertained by thoughtless or mere casual observers, the answer would be given, "Undoubtedly; although it is but fair to add that in comparison with America, having its soil almost inexhaustibly rich, by reason of the enormous accumulation of leaf mould throughout its forest areas, our own land is seen to some extent at a disadvantage." I have not visited very much of the country "from the Murray to the sea," so might very fittingly ask to sit at the feet of some of our pioneers, who know so much of its worth—far more than I can hope to arrive at. I would, however, remark that the success attained in the western and other districts in the yield of root crops, grains, fruits, &c., prove that it can be almost indefinitely extended.

The accompanying table may offer a suggestive idea or so to a young intending culturist :—

Quality.	Suited for—	Improved by—	Other remarks.
1.—Sandy loam, clay base	Nursery, garden flowers, lawns, vegetables, fruit trees	Bone-dust, lime, phosphates, river-bank soil, vegetable decay	As seen on the south side of River Yarra.
2.—Red friable and dark loams, clay base	All garden produce, fruit trees, farm crops, &c.	As in No. 1, except river-bank soil	Such are found in Gippsland, &c., also Flemington, Heidelberg, and Goulburn Valley.
3.—Heavy loam, clay base, black, heavy, and strong soils	Fruit trees, vegetables (much stirring for root crops)	Sand, lime, bone-dust, vegetable decay	As at Box Hill, Doncaster, Barrabool Hills, and also freely north side of Yarra.
4.—Limestone and marl, sometimes clay base	Vines, fruit trees (if clay below), brassica family, beans, &c.	Same as for No. 1, except bone-dust and lime	As at Geelong, Western Port, &c., western district near coast.
5.—Yellow clay and heavy retentive soils generally	When improved fruit trees, as pears, apples, corn, &c.	Lime, sand, wood ash, vegetable decay	Special need of drainage, exposure to sun, &c.
6.—Sandy and very light soils, wanting in substance	Vegetables and quick-growing succulent crops generally	Lime, bone-dust, heavy loam and clay, also river-bank and other good soils	As near sea coasts and much on south side of River Yarra.

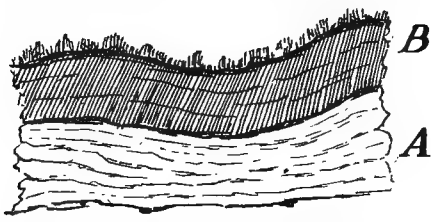
NOTE.—All (1 to 6) greatly improved by stable or farm-yard manure.

The task of manuring sandy land with clay, and *vice versâ*, is one which would well repay a grower, for, in the first case, the free working which the sand insures and the added strength given by the clay to the poor baseless sand should prove the value of intelligent thought in this respect. Such is frequently done in Britain, and should be arranged here more generally than now. Mr. Guilfoyle has very greatly improved some intractable and almost unworkable land by the use of sand freely applied in parts of the Melbourne Botanic Gardens. Moreover, I feel assured that besides the changeful effect on the soil the sand freely used as a dressing *re* vines affected with *Phylloxera vastatrix* would be likely to prove helpful, seeing that the disease is stated not to attack vines growing on sandy land. It would be interesting if this statement could be confirmed by tests made at various centres.

The trenching in of clay to poor Caulfield sand, as suggested by the writer to a friend who was about to make a garden, was adopted with good results in growth as affecting apple, pear, and other fruit trees. In this connexion, I would point to the pronounced

success which has attended the tropical groupings originated and completed by Mr. Guilfoyle near the large conservatory in the Botanic Gardens, where he took particular care to introduce an artificial clay base, thus :—

EXAMPLE OF SOIL WITH CLAY BASE.



A CLAY. B LOAM.

The true culturist must act on the same principle as the wise man does, who, being the owner of a horse, feeds him well to insure good and cheerful service. The soil will respond like a living creature to a little generosity on the part of its owner in the way of manure, restoring those constituents taken off or exhausted by continual cropping. There are men who try a little "economy" by starving the land, leaving some other people a cruel inheritance later on, discreditable to the first and ruinous to the second.

The advantage of securing classified locations for the various plants to succeed best in is of course a well-understood matter with the practised grower, who would be almost sure to act somewhat as shown in the accompanying table :—

Position.	Suitability.	Added Note.
1.—Undulating land ..	Preferable for gardens generally—flowers, fruits, vegetables, farm crops, &c.	Interchangeable to some extent, according to depth of soil, drainage, water supply, &c.
2.—Hill-sides, north and west aspects principally	Best adapted for vines, fruits, as apricots, peach, plum, orange, lemon, and strawberry	
3.—Rich valleys and semi-flat country	Well adapted for farm and garden produce, root crops, red and black currant, gooseberry, &c.	

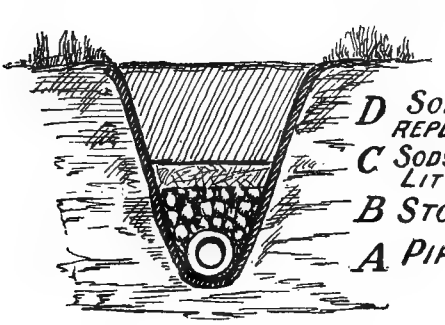
The astonishing success which has followed the well-directed efforts of the Messrs. Chaffey at Mildura, and those of the pioneers of the Goulburn Valley districts, goes to prove the value of rightly-conceived plans, combined with irrigation, as affecting

the fruit industry, and is a testimony to the sturdiness, both of the culturists and the soil they have so skilfully wrested from obscurity.

They have done much with water in the way of reducing soils, whose latent strength would never have been available in any other way, to a state wherein the tender rootlets of both tree and herb could secure their proper sustenance, but is not a word of caution needful? To some I feel sure there is danger not in using too little but too much water. Were fruit trees lovers of much moisture, as are willows, then the case would be very different.

It needs but little in the way of argument after all that practical men have written and done to make plain the need in some form or other, when a young man takes upon himself to aim at becoming a successful tiller of the soil. In some positions he may dispense with artificial drainage, but not necessarily so because his block is on a hill-side; it may be the more necessary on that account. There are of course many ways of carrying off the soakage:—(1) The open trench; (2) the same half-filled with stones topped by soil; (3) the trench and drain pipe styles combined thus:—

EXAMPLE OF APPROVED DRAIN.



This is without doubt the best and most reliable of drains.

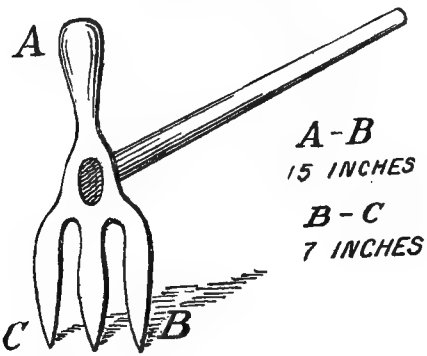
Some people who are but little suited to bring even a small area into a state of culture err by taking—say, for them—the enormous quantity of 200 or more acres (much of it very poor and sour) in various parts of the colony. They "ring" and burn the trees, and distress all lovers of the beautiful by the mischief effected, and do not in any way compensate for it by actual culture or other real improvement. And they are at last worn out and dispirited, poverty-struck and old, with a feeling that their way at least of rural living did not yield those pleasures about which poets have sung and artists delighted to portray. It behoves

every one living by the soil to do as is the practice with the onion-growers of the Portarlington district, cultivate every available inch of the block, and not waste time—"the warp of life"—in holding too much land or becoming in any other way partners in that well-known but scarcely successful firm of Messrs. Grasp-all and Lose-all.

Surely 40 acres of good land, in a well-watered position, and systematically used, should be a fair thing for a good man to manage, defined by a recent correspondent of one of our Victorian newspapers as laid out thus:—10 acres, homestead, orchard, poultry, cow-yard, &c.; 10 acres to grow field peas, potatoes, &c., as food for pigs, poultry, cattle, &c.; 20 acres set apart for grazing of cows and horses.

There are of course very many labour-saving tools, which in the hands of our "coming men" will help them materially to reduce their holdings to a state of tillage. Those in the agricultural section are very numerous and mostly valuable, but it seems to me for small selections the "Planet Junior" hand-plough, drill, hoe, rake, and seeding apparatus combined gives a hard-working fellow, whose soil is friable, a means of conquering his work in very much less time than usual. In the vegetable and fruit garden of the Government House the gardener (Mr. J. D. Allen) finds it most serviceable. There is another instrument of splendid value for a good variety of work in a garden, farm, or orchard of the style of a pick (say, 6 lbs. in weight), made to order of my late and very much respected father. It is shaped thus:—

The Mattock.



I well remember one of his men exclaiming when at work on the Barrabool Hills—"Bedad, here is a clod which has not been turned up since Adam was a boy," but a mattock such as this

would have made short work of the "clod" and stiff soil generally if it had at that time been available. For trenching, levelling, and turning up obstinate soil to the action of the sun there is nothing like it.

The future grower in these southern lands must, if he would be a successful one, pay a great deal of attention to the details of his work. Life in the country is scarcely a sufficient reason for either slovenliness in dress or duty. Of course there will not be the prim habit of the shopman, but a free and easy manner will no doubt assert itself, and his dress will be in accord with his surroundings. There are several things he should know apart from his directly horticultural training. Some young men are, of course, very observant, and probably have their parents and former school tutors to thank for the free use they make of their note-books. I would assume that a young man, to be able to get his living from the soil, requires a full equipment of knowledge of all that can be learned, with the time at his disposal, of the three branches, viz., botany, gardening, and farming, and I am given to understand by Mr. Neilson that some of the students here are candidates also for a term at Dookie (the Government Farm). This principle is evidently sound, and it will be well if the students can in every instance become apt learners in the ways named. Boys and young men need a quiver full of arrows to hit the mark, as well in drawing, carpentering, and general building, also to practise special lines of culture, all to afford auxiliary force, and give him a sure living, and a balance besides to carry forward for a rainy day.

The earnest student will be likely to spend his evenings in studying the books and other cultural publications with a view to help himself onward; and he will, I trust, avoid that prodigal attention to sport which was so thoughtfully referred to by Mr. J. West, of Mooroopna, at a meeting of the Chamber of Rural Industries, on 31st August, when he said—"However we might shut our eyes to the fact, the surplus energy of the young people was running in the direction of sport. . . . If the matter were not watched it would have a most serious effect in crowding out that stability which had hitherto existed in the Anglo-Saxon character." Of course we know Mr. West is right, and that his word of caution is well timed.

There can be no doubt that the young land-owner, in order to succeed, will have to act upon Samuel Budgett's maxim, "Push, Tact, and Principle," and withal must be very much of an enthusiast, who is always learning.

Let me offer a few closing thoughts regarding such an one:—

(*a*) How could he better spend his holidays than to take a trip to Mildura or the Goulburn Valley fruit and irrigation districts? He could there have a chat with

and see the labours of successful growers, and away on other occasions to the western and other interesting lands under culture.

(*b*) He will not be likely to place dependence on only one or two leading items of produce, "not have all his apples in one basket." He will have, and needs to have, a variety, and, besides, will not fail to supplement his earnings by stock, the fowl-yard, &c.

(*c*) No doubt he will be on the alert *re* industrial plants, especially after a visit to the Economic Museum, Botanic Gardens; will grow them experimentally at first, but will be quite sure of his market, asking "Can I find a buyer in the colony or out of it?" If an affirmative answer comes to hand these plants will, no doubt, in a supplementary way yield him much and profitable satisfaction.

(*d*) How about his settling in life? (You may well ask if this properly belongs to my subject.) Let him be patient; his selection will teach him that. Will she help him? Perhaps so, and after all, prove more enthusiastic than himself; and thus cause the exclamation of many years ago by a Highton labourer, about the knowing rooster's opinion of his mistress, to come true in her case also :—

> "He crowed aloud, did Chanticleer,
> The missus, she is master here!"

Women's rights, you observe, may even be practised in a rural kind of way and place, but they cannot be more effectually exerted than by the mother bringing up her children (of course with the primary help of the father) to love a country life with its usually pleasing associations.

Note.—The address was accompanied by several drawings, among which were—

(1) A charcoal kiln, internal form.
(2) A charcoal kiln, external form.
(3) The Cranberry (*Oxycoccus palustris*).
(4) The Whortleberry (*Vaccinium myrtillus*).

These were intended to illustrate some auxiliary sources of revenue.

THE COMMERCIAL ASPECT OF BEE-KEEPING.

By L. T. Chambers, Bee-keepers' Supply Association.

(*8th December*, 1893.)

Bee-keeping, like many other pursuits, may be limited to a small area, as is usually the case in amateur work, or extended to a large area, partaking of the nature of an adjunct to other pursuits, or becoming the sole occupation or employment of an individual as a means of obtaining a living. In a recent lecture given by Mr. Ellery before this association, we had a concise study of the economy of the beehive, and we need not now do more than glance over the points then brought under your notice.

Our subject to-day deals with the concrete value of bee-keeping. The money there is in it. The possibilities of turning knowledge and labour into hard cash. This, sir, is the question that is exercising our minds very much at the present time. And it is my pleasure at this opportunity to supply a pointer in the direction of one source of profit to the individual and the State. I desire to speak with all due caution only of facts which are fully known and proved, and which, as a bee-keeper for ten years past, I am thoroughly conversant with.

There are three points to be considered in our subject to-day, and these three points really resolve into two. They are these—The source of supply, that is, the prospective crop to be gathered; the workers, that is, the bees; and the superintending power, that is, the man. Given assurance of the prospective crop, the development and proper management of the bees lies within the power and direction of the prime factor, the man.

Good superintendence presupposes good workmen and good methods. Still, I desire to dwell upon this point awhile, to show how much depends upon careful selection, even in the matter of breeding a bee. We find exactly the same conditions present and under control as in the case of sheep, cattle, trees, or vegetables. To suppose that "a bee is a bee," and therefore all bees are of equal value as workers, would be quite as great a mistake as to assume the same of a horse, or possibly a man. There is a wonderful variation of character and ability in the apiary, as a little careful investigation will soon prove.

Before, however, saying anything in the direction of the crop and the possibilities of gathering it, I should like to say a word or two about the man—the present or prospective bee-keeper.

While we are on sure ground in pointing to variation in character as exhibited in the bees, we are equally on sure ground in dealing with variation in the character of men.

We cannot blind ourselves to the fact that the elements of success or otherwise in any direction lie rather in the man than in his surroundings. I say this because of a very general but erroneous opinion that "bees work for nothing, and board themselves," therefore easily reached profits are available. This, sir, is not so. Nature is not so prodigal in any direction. Bee-keeping, with money to be got out of it, must result from applied knowledge and industry. When these are united there is little fear but the profits—and good profits—for labour expended are to be reaped; but let not the careless or slipshod expect much from the beehive.

The first factor named—the crop—is one which claims our especial and careful attention, because we at once must look at comparative values, and our relation to other parts of the world producing a like crop.

We begin sadly to know the relative value of wheat-growing and the cost of production compared to other wheat-producing countries. And so all along the line our first consideration is, the relation we bear to other parts of the world which can produce a like article to that we desire to produce. The question arises—Can we produce honey in quality and quantity equal or superior to other parts of the world, or are we upon a lower standard? We ask this question because, if there is money in bee-keeping and profit to the State—that money must be won from an outside market—an aim less than this is not worth striving for.

The possibilities of comparison which lie within reach must for the present be confined to figures which reach us from the United States, from whence we draw our inspiration of the entire subject as now presented on commercial lines—the production and consumption of honey as an article of food having grown enormously during the past twenty years. In *Langstroth Honey Bee*, recently revised by Dadant and Son, we find some comparative figures given at page 404:—"We have no official statistics of the honey crop of the United States, but the following extract from *The American Bee Journal* (1886) will give an idea of the immensity of our honey resources, considering the comparatively small area of this country now occupied by apiarists:—'The Californian *Grocer* says that the crop of 1885 was about 1,250,000 lbs. The foreign export from San Francisco during the year was approximately 8,800 cases. The shipments last year by rail were 360,000 lbs. from San Francisco and 910,000 lbs. from Los Angelos, including both comb and extracted. We notice that another Californian paper estimates the crop of 1885 at

2,000,000 lbs., and the crop of the United States for 1885 was put down at 26,000,000 lbs. We do not think these figures are quite large enough, though it was an exceedingly poor crop ; but former years have given still better results. Through the courtesy of Mr. N. W. McLain, of the U.S. Apicultural Station, we have received the following statistics from *The Resources of California*, 1881:—The honey shipped from Ventura County, California, during 1880 amounted to 1,050,000 lbs. The Pacific Coast Steamship Company, of San Diego, shipped 1,191,800 lbs. of honey from that county in the same year. The crop of the five lower counties in California that year was estimated by several parties at over 3,000,000 lbs. According to a report of S. D. Stone, Clèrk of Merchants' Exchange, of San Francisco, the actual amount of honey shipped to that city from different parts of California in the sixteen months ending 1st May, 1881, was 4,340,400 lbs., equal to 217 car loads. *One hundred tons of honey*, in one lot, was shipped during the same year from Los Angelos to Europe, on the French barque *Papillon*. This had been *all* purchased from the Los Angelos apiarists;' " and on page 406 the revisers give their own averages of honey for a period of twenty years as 50 lbs. per hive. They say that, "with proper management, at least 50 lbs. of surplus honey may be obtained from each colony that is wintered in good condition. This is not a 'guess' estimate, it is the average of our crops during a period of over twenty years, in different localities. Such an average may appear small to experienced bee-keepers, but we think it large enough when we consider that we have very few linden trees in our neighbourhood." It may be stated that Chas. Dadant and Son have been in the honey-producing business for many years, and are practical apiarists, owning and managing about 1,000 colonies of bees, and these, of course, under the very best management.

Here, therefore, we have a clear basis of comparison, 50 lbs. of honey per hive, resulting from best appliances and management. Can we equal or surpass it, or do we fall short of it? And, before that question is answered, let us glance for a while at our sources of supply. The present dealers in honey have an idiotic method of naming prime honey as "garden honey." It may be that this arose in the past as a distinguishing brand to differentiate it from what was then known as " bush honey," which was gathered from hollow trees and logs in a rough and uncleanly manner. However, as little of such honey now reaches us, the term " garden honey," to express by name a sample upon which more care has been taken, need no longer be used. We may assure ourselves that the amount of honey gathered from garden flowers is a very insignificant quantity, of varying flavour, and not worth taking into consideration in reviewing our sources of

supply. Briefly said, therefore, our chief source of supply is from the various species of eucalyptus trees. Lacking these, the supply is of small amount, unless we name white clover, which, in some cool and moist localities, yields a crop of excellent honey. In fact, white clover honey may be classified as the best of honey—finest in flavour procurable the world over.

The various species of eucalyptus trees are all honey producers, but bearing a rather intermittent supply. So far as bee-keepers have investigated this matter, they have been unable to supply exact data of the blossoming of the different species. A rule-of-thumb way of stating the case has been adopted in the past, which gives alternate years as good and bad, so far as the honey supply is concerned—that is one year giving a fair to a good supply, and the following year a poor supply, or none at all. This method of computation is anything but reliable; but still there is a foundation of fact in it, not discoverable in Victoria only, but in other parts of the world as well. A good season is usually followed by a poor one, while a poor one is usually regarded as a guarantee for a better one to follow. This may, however, not be borne out; there are many intermediate results between poor and good. So far as I know, no one has been able to more than guess at the conditions which produce a good supply of honey, whether past or present rainfall, or present conditions of atmosphere and weather. Abundant blossoms by no means guarantee abundant honey. Certain conditions of weather increase or decrease the yield. A warm moist atmosphere, such as is experienced prior to a thunderstorm, usually guarantees a good flow of honey. Speaking in general terms, the eucalyptus blooms bi-annually. The tree which blooms this year will not probably bloom next year, but will during the second year develop its seed pods. However, one tree may blossom this year and its neighbour the next, and we frequently find that one part of a tree will blossom one year and the other portion the following, and at times we find the disparity separated by a few months only. It will be seen that to a large extent the prospective honey crop is an unknown quantity; but yet the careful and investigating bee-keeper may gather information ahead by carefully noting the forming and advancing blossom buds of the trees around. And given an abundance of flowers, the probability is that during their continuance of bloom the weather will be favorable to the secretion of nectar. There is still another point of variation to be noted in the eucalypt. Most forest trees are regular in their time of blooming, but not so the eucalyptus family. The bass-wood of America, which produces the largest crop of forest honey, opens its flowers at a regular month and day, and the flow of honey from it ranges from three days to twenty or more, so that the bee-keeper knows his preparations must be complete to

secure that crop at a given date ; but our trees may blossom any time from October till June, and are altogether irregular and subject to conditions which do not appear on the surface.

This extended time of honey supply is a decided gain, and, with good management, a large crop may be gathered. With a large surrounding forest of honey-producing trees, keeping a continuous bloom for months, the apiarist is placed in a much more reliable situation than in the case of the one who knows his crop is limited to a few days, with all the possibility of broken and unfavorable weather.

In choosing a locality for an apiary, it is well to obtain one that possesses a good variety of timber. This insures a longer and more continuous supply than a position which has but little variety.

The quality of the honey from the different species is very various, but of that I will speak later on.

The box tribe, which is so extensively scattered throughout the colony, stands at the head of our forest trees as a source of supply. The red, yellow, grey, and white box trees all bear abundant crops of excellent honey. The redgum, which grows on water-courses, gives a heavy crop, usually every other season, but at times breaking away from that rule. The various species usually denominated whitegum are all likewise good producers. The messmate, black butt, silver top, mountain ash, stringybark, and a host of others, known by common bush names, supply sources of honey—some good, some inferior.

It will be clearly seen that in this colony at least we have many thousands of miles of honey-producing forest, giving a long-continued flow of honey, such as is not enjoyed by other climates which are not so mild or temperate as ours. In addition to the large forest trees, there are, of course, a host of smaller growth—banksias, hakea, acacias, &c., and thousands of flowering shrubs herbs, and grasses, many of which yield honey abundantly.

Although much of our forest timber has been ruthlessly wasted, there remains many thousands of square miles yet untouched, or comparatively so. There is, therefore, abundant room for development in this direction.

There is no necessity in this colony, as in colder climates, to make special preparations for long months of winter. In fact, in most parts the bees are able to fly and gather sustenance during our so-called winter months. In most parts of the States, except in Southern California, it is necessary to pack away all hives of bees in cellars, that they may maintain an even temperature of about 40° Fahr. There they remain for five months, due regard being given to their food supply ; yet, notwithstanding these precautions, very many are annually lost. This is a matter which gives us no concern here, entails no labour, or causes any loss.

We may now return to consider and compare the figures of Dadant and Son with those which are obtainable here, and see if their stated yearly average of 50 lbs. per hive is or can be exceeded here. I find also that Dr. Miller, an extensive apiarist, of Marengo, Ill., in an article written in September this year, says of another bee-keeper, who reports an average of 75 lbs. per colony—"spring count"—for eight years, "This makes some of us green with envy."

"Spring count" means the total gathering to be credited to the original number of hives of bees that began work in the spring, before swarming. So that it will be seen that, if the increase by swarming were only 50 per cent., the average of 50 lbs. per colony would have only been gained. We may, therefore, take these figures as being reliable, and, if anything, a full statement of the case. Southern California, which nearly approaches our own climate, produces by far the greatest amount of any of the States. Her supply is chiefly drawn from a dwarf bush known as sage-bush, of which there are several varieties. The crop is, however, a very uncertain one. In 1886 California produced a crop of 9,000,000 lbs., but since that year has not raised more than 2,000,000 to 3,000,000 lbs. in any year.

We get a peep at Californian prospects in page 129, "*Gleanings in Bee Culture*," as under:—

"Some time ago one of your honey reporters stated that the crop of 1892 was not a failure in California, because they 'had already received twelve car-loads of honey.' It is very evident that this firm does not appreciate the honey resources of California. In a good year twelve cars could be loaded within a radius of ten miles of my apiary! San Diego Co. in a good year will produce 2,500,000 lbs. of honey, and not exert herself beyond her strength. This is 125 car-loads of 20,000 lbs. each. In 1886 the firm of Surr and Winchester bought of the crop of San Diego Co. over 2,000,000 lbs. There were other buyers, too, and many producers shipped direct to San Francisco. Thus it will be seen that Surr and Winchester alone had of San Diego Co. honey 100 car-loads of 20,000 lbs. each. In 1887 they still held it, and they made money by so doing, for 1887 was a very poor honey year. You mentioned it in '*Gleanings*,' but I think you gave no name of the parties who held the honey. Yes, we are waiting for a good crop, and we have been waiting for nearly seven long years! But we are in the hands of an all-wise Providence, who knows much better what we ought to have than we do ourselves. In the excellent season of 1883 the honey crop of Hancock County, Illinois, was estimated at about 200,000 lbs., which made an average of less than half a pound per acre. Thirty-six thousand pounds of this was our own crop, and the county did not contain one-tenth of the bees that could have

been kept profitably on it. Yet, at this low rate, the crop of Illinois alone, with the same percentage of bees, would have been 15,000,000 lbs. We cannot form an adequate idea of the enormous amount of honey which is wasted from the lack of bees to harvest it."

We know by such statements as these that, although we may hear of Californian crops of honey being immense, such crops only come very occasionally, and our supply of honey is more regular, and more to be relied upon. This fact, therefore, stands out clearly. We have in this colony a source of wealth in the shape of a natural crop, which yearly goes to waste through need of gathering and marketing. We can get a glimpse at it by comparison. We now have a few bee-keepers of experience who wholly devote themselves to the business of honey gathering, and we know the probabilities and possibilities of the pursuit. We know that, with good management, 100 colonies of bees will collect 5 tons of honey in a season, and in some parts double that amount. What of the thousands of square miles of unoccupied country, where hardly a bee is to be seen?

Some few months ago, as secretary of the Bee-keepers' Association, I issued a circular to all our bee-keepers of note, asking information under the head of supply and cost of gathering. I have here some 20 answers from bee-keepers owning 2,000 hives of bees, and living in different part of the colony. In answer to the question of yearly average gathered per hive, a considerable variation exists, corresponding to the locality, but it is worthy of note that those who are engaged in bee-keeping pure and simple, and who have, therefore, made a choice of locality, show a very large average, far exceeding the average of Dadant and Son, who possess many years' more experience in manipulation and management, and of those who simply make bee-keeping an adjunct, show that their averages are fully up to and past the 50 lbs. average. Two hundred hives of bees, with a 50 lbs. average, means 5 tons of honey, with a spot value of £20 to £25 a ton. This represents the working capacity of one beekeeper, any increase in honey not greatly adding to the labour, so that a greater gathering would add to the profit of that labour without greatly adding to its cost. It would simply mean that the bee-keeper would have to skip round a little more and possibly get up earlier.

What does it cost to produce a ton of honey may be only answered by careful computation of several seasons' work; but enough has been said to show that a living may be made by bee-keeping embracing seven or eight months' work only, and the probabilities are that a good living and something over may be obtained.

For a small outlay of capital and labour, I know of no pursuit which gives so speedy a return. So far, we have reviewed one-half of the subject—that of production. The other half

needs equal attention; with a large crop available, what are we going to do with it? To make it profitable to the whole community, as well as to the individual, we must exchange it for foreign money, and begin to get a stream running out of the colony, opening the way for a still larger output, that others may engage in the production. We may have some difficulty in opening up trade—some opposition, some prejudice; but looking at a fair sample of our honey, can we have any fear about finding a market for it at its value side by side with other like products of other parts of the world?

We may feel assured that we need only a well-regulated and persistent effort to find and secure outside markets for this valuable product which we have at command.

I have spoken of variation in quality of honey. This is very marked all the world over.

Before the introduction of the movable frame hive and the honey extractor little was known of this subject, as the contents of a hive were allowed to remain till a given time and then removed, the whole being mixed. Now, however, the bee-keeper is enabled to see the various qualities of honey as they are brought in, note their sources, and separate one from another.

While some honey is excellent, and needs no recommendation, other is objectionable in flavour and appearance, and as an article of food has nothing to recommend it.

A colony of bees gathering honey from various sources during the spring and summer will bring in very varying qualities. It would be poor policy to reduce these to an average sample where it is possible to grade them.

The bee-keeper may, however, classify his crops as they come in, and set aside any honey from objectionable sources, so that it does not contaminate the whole.

Referring to the labour entailed, and the conditions necessary to success in bee-keeping, I can only say, as said at the beginning of my subject, the profits lie in the man. His capital must largely consist of knowledge, but such knowledge will rapidly be gained where there is an enthusiasm in the subject.

While the work is not laborious, it needs constant attention, and during the spring months long hours, but this is more than compensated for by the ease of other times. There are many men who, although physically incapacitated from the hard labour of a country life, may find profitable employment in bee-keeping as a source of living, or as an adjunct to something else.

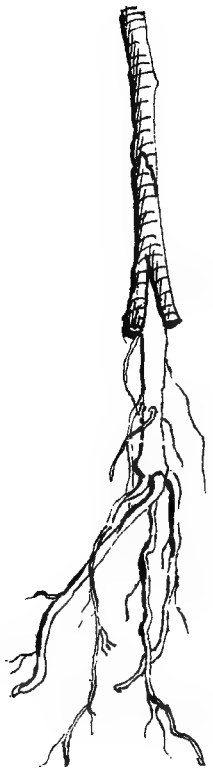


FIG. 1.

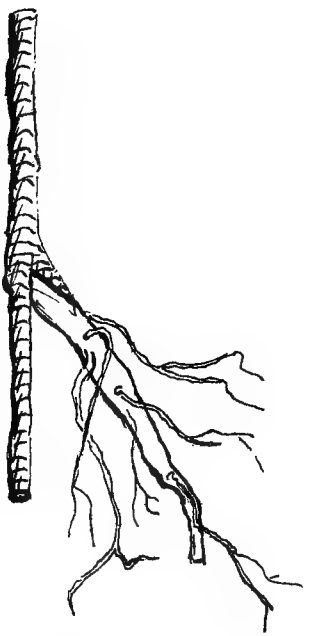


FIG. 2.

APPENDIX.

PRIZE ESSAYS BY STUDENT A. E. BENNETT.

THE PLUM (*Prunus Domestica*)

Is a naturalized English fruit, but its original country is supposed to be Asia Minor.

The genus *prunus* belongs to the extensive natural order Rosaceæ.

The plum is a deciduous tree, attaining the height of 15 or 20 feet, and forming a moderately spreading head.

Plums are amongst the hardiest of all stone fruits, and the crop is one of the most remunerative if the season be at all favorable.

Uses.

The fruit is used for dessert, cooking, drying, tinning, and bottling purposes.

A wine is also made occasionally from plums.

In some parts of Europe there is distilled from the fruit an excellent spirit. The leaves of the plum are also largely used to adulturate tea.

Its wood is valuable for turning and in the manufacture of musical instruments.

Propagation.

The best plum trees are obtained by grafting and budding on seedlings or cuttings of Mussell, Julien, Myrabolan, or Cherry Plum.

A French variety of the latter is now being extensively used as a stock. The plum has been worked on apricot and almond roots, but this practice is invariably not successful in some soils. In layering the varieties used are the Mussel and Julien, which are also extensively used as stocks.

It is possible to root-graft the plum, but it is not often practised.

The two diagrams (Figs. 1 and 2) show the most successful modes of treatment—seedlings raised from the Common Plum, the Blue Gage, &c.

For dwarfing the seedlings of the Mirabelle are chiefly employed.

Some sorts reproduce themselves nearly true from seed, such as the Green Gage.

The seed of the plum may be sown when taken from the fruit, or it may be buried in sand in the autumn or early spring.

Suckers are frequently used, but should be avoided if possible in consequence of sending up numerous suckers.

Plum stocks are used in some nurseries in large numbers for peaches, nectarines, and apricots.

The time for budding the plum, January ; and grafting from July and August—just before the sap begins to flow.

Figs. 3 and 4 show modes of working.

The varieties given in the list below strike freely from cuttings :—

French Cherry Plum, Common Cherry Plum, Common Yellow Cherry Plum ; Mussel and Julien do well from layers.

Culture.

In preparing the ground for the cultivation of the plum it should be thoroughly trenched to a depth at least from 15 inches to 18 inches. Deep ploughing is, however, the most general method of preparing the ground for large orchards—say, 10 to 18 inches or more. The time for ploughing is between spring and autumn.

The trees are generally planted from 18 to 20 feet apart.

The depth to which the young plum tree should be planted should not be more than it was grown in the nursery.

The roots should be well spread out, and covered over by fine soil.

The month of June is a favorable season for planting.

One-year-old trees are by some preferred, but the trees should not be more than two years.

The modes of cultivating the soil are by various instruments, such as the plough, disc harrows, hoe, &c.

Many growers have found common salt one of the best fertilizers for the plum, as it promotes its health and general appearance ; but lime, bone dust, blood manure, superphosphate, and farm-yard manure are the most generally used.

Varieties of Plum used for—

Dessert.

Early Rivers
Early Orleans
Reiné Victoria
Magnum Bonum
Angelina Burdett
De Montfort
Diamond
Prince Englebert
Kirk's
Washington
Reiné Claude de Bavay
Coe's Golden Drop
Green Gage
Blue Superb
Belle de Septembre
Coe's Late Red
Pond's Seedling.

FIG. 3.

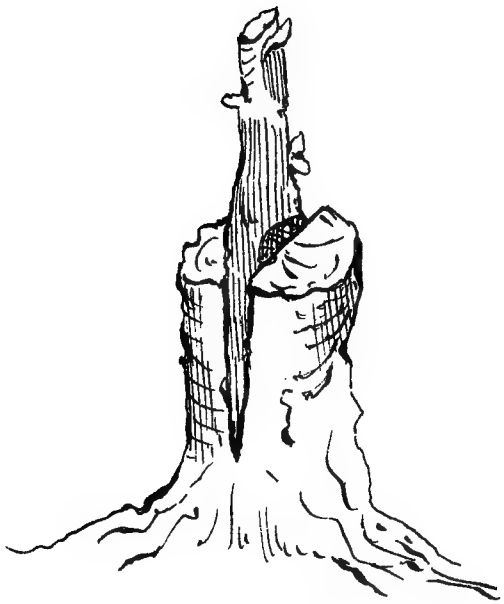


FIG. 4.

Cooking.

Early Orleans	Germain Prune
Diamond	White Magnum Bonum
Belle de Septembre	Green Gage
Coe's Late Red	Guthrie's Late Green.
Pond's Seedling	

Marketing.

Early Rivers	Green Gage
Early Orleans	Magnum Bonum
De Montfort	Coe's Golden Drop
Angelina Burdett	Blue Superb
Diamond	Belle de Septembre
Prince Englebert	Coe's Late Red
Washington	Pond's Seedling
Kirk's	Reiné Claude de Bavay.
Reiné Victoria	

Drying.

Angelina Burdett	Fellemberg
De Montfort	D'Agen
Prince Englebert	French Prune
Coe's Golden Drop	German Prune
Early Rivers	Ickworth's Imperatrice
Early Orleans	Washington
Kirk's	Reiné Victoria
Coe's Late Red	Belle de Septembre
Reiné Claude de Bavay	Blue Superb.

The most important varieties operated upon at the college are—

McLoughlin, of which 4 lbs. green produce 1 lb. dried, is of excellent quality, both before and after drying.

Washington, of which 4 lbs. green produce 1 lb. dry, also ranks as one of first merit, both before and after drying. It does not keep its colour so well when dried as some of the other varieties, but makes a good dessert prune.

Of Mirabelle von Flowtow's Gelbe Frübbe Quetsche, $3\frac{1}{4}$ lbs. green make 1 lb. dried. Its quality is excellent before and after drying, and it is a most superior light-coloured dessert prune, resembling very much Coe's Golden Drop, only it comes in about six or eight weeks earlier.

Kirk's, Reiné Victoria, Purple Gage, Diamond, and De Montfort also give very good results.

The best varieties for—

Tinning.

Coe's Golden Drop	Mirabelle von Flowtow's
Green Gage	Denyer's Victoria
Yellow Magnum Bonum	Ickworth's Imperatrice.

Bottling.

Ickworth's Imperatrice	Denyer's Victoria
Coe's Golden Drop	Mirabelle von Flowtow's
Yellow Magnum Bonum	Green Gage.

Soils and Aspect.

The plum will grow well in nearly every part of this colony, but it only bears its finest fruit on loamy soils, say 15 to 18 inches deep, resting on a clay subsoil, provided the subsoil is open and properly drained. The ground should be well trenched or deeply ploughed previous to planting, to keep the roots as near the surface as possible.

It adapts itself to almost any aspect, but it does best in a north-western one. If planted in an eastern aspect it does not do so well, because if there has been a frost in the night the rising sun thaws it on the leaves too quickly; but when planted in a north-west aspect the atmosphere gets warmer about it more gradually.

Pruning.

In the first year when the tree has pushed out young shoots rub off all but the three or four top ones, and allow them to grow to form the crown or head.

If the tree has been pinched in the nursery and these three or four shoots have been formed cut them back to three or four buds from the base, and then when they have grown in the spring rub off all shoots that it may not be found necessary to retain for the future formation of the tree. In the following year it will have made a considerable length of wood, which should be cut back, leaving five or six buds according to the length of the stock.

In the third year after planting allow an increased growth until the tree begins to fruit, which would be about the third and fourth year.

A good deal of unnecessary winter pruning of young trees can be avoided if a judicious system of summer pruning be practised.

Mode of Bearing.

All the varieties of plums produce their fruit on the small natural spurs along the stems of the bearing shoots of one, two, or more years' growth.

Owing to the plum being one of the hardiest of fruit trees, open standard culture is generally practised.

It requires little or no pruning after the fourth year beyond that of thinning out crowded wood or taking away decayed or broken branches, and this should be done during the autumn months as soon as the leaves have fallen. The ordinary way of pruning is to cut off two-thirds of last season's wood and leave one-third.

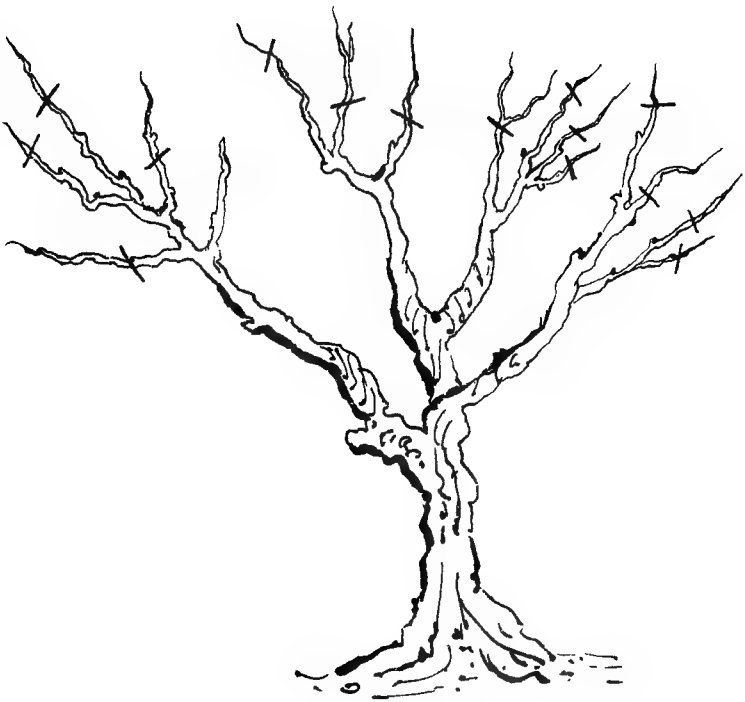


FIG. 5.

Old trees that have become barren can be renovated by cutting them pretty severely, and covering the wounds with paint made of red lead and oil, and giving them a good top-dressing of farm-yard manure.

Fig. 5 show mode of pruning and shape.

Injurious Insects and Diseases.

red spider (tetranychus telareus).

This pest is one of the principal enemies of the plum, and by allowing it to remain on the tree it gives the leaves a rusty-brown unhealthy appearance, and causes them to shed much earlier than the natural period.

Prevention and Remedies.

Never allow stones, logs, or rubbish to collect or exist in an orchard.

A very good emulsion is made from kerosene—say, 1 part to 25 parts of water; use when the leaves are off the tree.

Sulphur has been found a very good preventive.

Tobacco water is a very effective remedy against this insect, and may be sprayed on the tree when the fruit is off.

Soft soap and Gishurst's compound are also very good remedies.

When spraying use the spray in an upward direction, as the mites are mostly on the under part of the leaves; they should be sprayed on with considerable force.

As many leaves as possible which are badly attacked by the spider should be shaken off into a sheet and burnt.

Painting the stems of the trees with a hard brush, using slaked lime and sulphur mixed for the purpose, is a prevention.

cherry slug (selandria cerasi).

This insect is most destructive in the larva state. It resembles a small dark-greenish slimy caterpillar, and infests the leaves of plum and other trees, destroying them by gnawing the epidermis off the upper portion, and leaving the skeleton and the lower portions of the leaves untouched.

About the second week in November it is to be seen on the trees.

Prevention and Remedies.

We find the best time to tackle this slug is before the fruit becomes far advanced, and not when the tree is in bloom.

Dusting the tree with sand kills the slug, but it does not destroy the eggs.

Hellebore powder—at the rate of 1 to 1½ oz. to the gallon of water, and spraying the tree—is found the most effective remedy for the prevention of this pest.

THE PLUM CURCULIO (CONOTRACHELUS NENUPHAR, HERBST).

The female curculio makes a small hole in the fruit with her proboscis, and there deposits her eggs; after this she gnaws a crescent-shaped slit around and partially under the eggs.

Remedies recommended.

To 1 lb. of whale-oil soap add 4 ozs. of flour of sulphur, to half-a-peck of quicklime add 4 gallons of water, and stir well together; add to this mixture, say, 4 gallons of strong tobacco water.

If no rain falls for three weeks after spraying, one application will be sufficient.

PUCCINIA PRUNI (same order as rust in wheat): OR PEACH-PLUM LEAF-RUST.

Remedy.

Ammoniacal solution of carbonate of copper, as a spray—5 ozs. of copper; first spraying after blooming or when the old wood is in leaf.

PODOSPHÆRA OXYACANTHA: POWDERY MILDEW, FOUND BOTH ON THE CHERRY AND PLUM.

It belongs to the group of true moulds known as the *Erysipheæ*.

Remedy.

The Bordeaux mixture and the ammoniacal solution of carbonate of copper.

MONILIA FRUCTIGENA (as shown in 1, Fig. No. 6): PLUM-ROT OF THE FRUIT.

Prevention.

Burning all diseased fruit, which destroys the spores.

PHYLLOSTICTA DESTRUENS: SHOT-HOLE OF THE PLUM (ANOTHER NAME—SEPTORIA PRUNI.)

Both these fungi riddle the leaves with holes (as shown in 3, Fig. No. 6).

Preventions and Remedies.

All fallen leaves should be destroyed.

Dressings of sulphate of iron, either applied in solution or solid form.

Improved form of Bordeaux mixture:—Bluestone, 13⅓ ozs.; lime, 13⅓ ozs.; treacle, 13⅓ ozs.; water, 15 gallons.

EXOASCUS PRUNI: BLADDER OR POCKET PLUM.

This disease is due to a fungus, and attacks the young plums just as they are beginning to swell. 2, Fig. 6, shows the diseased plum.

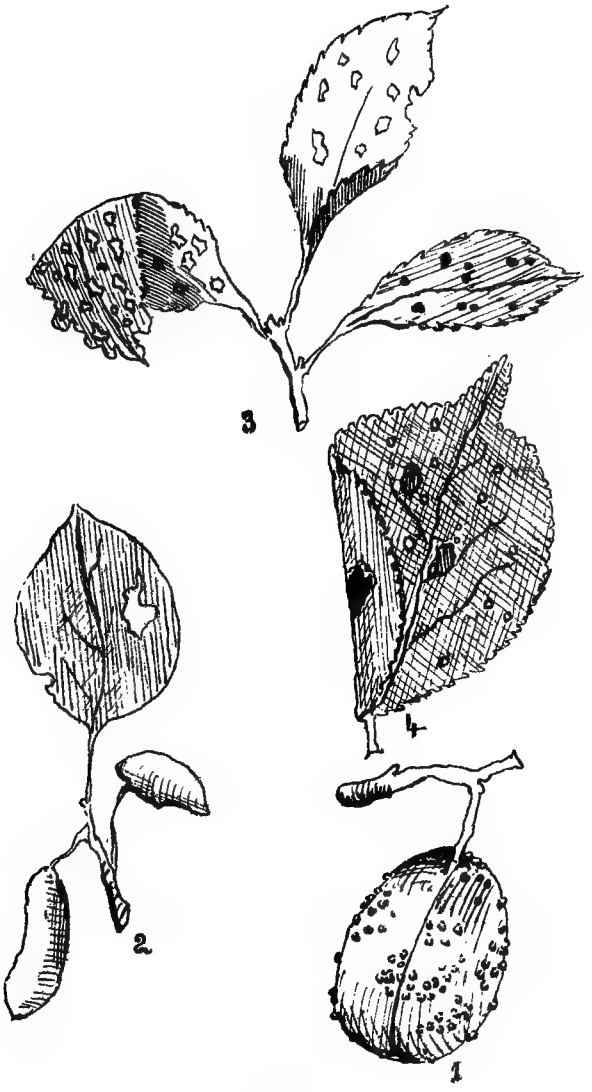


FIG. 6.

POLYSTIGMA RUBRUM: RED SPOT ON THE PLUM LEAF.

Formula for IXL.:—Unslacked lime, 40 lbs.; sulphur, 20 lbs.; rock salt, 16 lbs.; diluted to 60 gallons of water. This is good for a spray for the red spot, as shown in 4, Fig. 6.

Varieties classed as Prunes.

1. SKIN DARK. A. FREE PRUNES—FLESH SEPARATING FROM THE STONE.

D'Agen, or French Prune	Lafayette.
Autumn Compôte	Mitchelson's
Early Rivers	Red Magnum Bonum
Fotheringham	German Prune.
Fellemberg, or Italian Prune	

B. CLING PRUNES—FLESH ADHERING TO THE STONE.

Prince Englebert	Nouvelle de Dorelle
Pond's Seedling	Ickworth's Imperatrice
Standard of England	Bonnet d'Eveque.

2. SKIN PALE IMPERIAL PRUNES. A. FREE IMPERIALS.

Oullin's Golden Gage	St. Martin's Quetsche.
St. Etienne	

2B. CLING IMPERIAL—FLESH ADHERING TO THE STONE.

Coe's Golden Drop	Jefferson
Downton Imperatrice	White Magnum Bonum.
Guthrie's Late Green	

Besides the list given before the following, although not claimed under the heading of prunes, make very fine dried fruit, as was proved during last season at the gardens :—

Denyer's Victoria	De Montfort
Washington	Isabella
McLoughlin	Reiné Victoria
Diamond	Purple Gage
Perdrigon Violet Hâtive	Kirk's.
Denbigh	

Ornamental Varieties.

COMMON ENGLISH SLOE, OR BLACKTHORN.

Prunus spinosa.—This being an ornamental tree in shrubby plantations, we find that the branches are more thorny than the common damson, and the fruit is nearly round, quite black, but covered with a thick blue bloom. In spring the tree is a perfect cloud of white bloom.

Sinensis alba (Fl. Pl.)—It is noted for having fine double white flowers.

Double-flowering Sloe.—It is a large shrub; its height is found to average from 10 to 12 feet, with quite slender shoots and leaves, but it is thickly sprinkled every spring with the prettiest little double white blossoms, being about as large as a sixpence, resembling the Banksia rose. It is one of the greatest favourites among Chinese and Japanese—those unbounded flower-loving people.

Prunus Pisardi.—The beauty of this tree is that the leaves are of a dark-red colour. When in flower it bears a small white blossom, and also bears fruit.

Sinensis rosa (Fl. Pl.)—Double-blossomed plum.

MONTHLY ESSAYS.

MAY.

The month of May is invariably admitted to be the grandest time of the year by both artist, poet, and horticulturalist, on account of the lovely autumn tints that meet the eye at every turn.

The brown, red, and yellow leaves of the English trees stand out prominently in front of our noble native gum-tree. Visitors to the gardens cannot pass the pavilion without admiring the beautiful patch of Virginian creeper, the leaves of which are just now turning to a dark-red tint.

On entering the nursery the visitor or student cannot help stopping to admire a very fine specimen of the persimmon tree (native of Japan) shedding its leaves, and leaving the golden fruit to ripen later on.

This month is one of the most important for the student, as planting is now being carried on, and every opportunity is afforded him to see the preparation of the soil, which must be well broken up by spade work. It is also most important to have the fertilizers properly mixed with the soil before planting time.

The fertilizers most frequently used are bone dust, superphosphate, and blood manure. It should be remembered not to use too much of the latter, on account of its burning nature.

Pruning keeps many of the students busy. The plum is the first to be operated upon, but it does not require much pruning if the tree has had a summer pruning.

The pruning is effected by cutting out the superfluous branches where they cross each other, and keeping the tree in proper shape, &c.

A new student has to be very careful when pruning not to cut off the fruit spurs.

Whenever a limb is pruned the surface of the wound should be neatly smoothed over, and should be covered with paint made of red lead and oil.

Cherries, apricots, peaches, nectarines, quinces, pears, and apples are pruned this month, which gives the students plenty of work both for hands and mind.

It requires considerable practice to properly prune gooseberries. It is a good plan to cut all stray and crossing branches out, and leave the centre open. By this method the grower can gather his crop in much less time.

Currants are also pruned this month.

The first appearance of the woolly aphis (*Schizoneura lanigera*) gives extra work. The mode we adopt to get rid of the pest is to apply the following mixture :—Soft soap and tobacco water mixed, rubbed on to the branches of the tree with a hard brush. This gives good results.

Digging in the rose borders and hoeing up the weeds in the flower garden provide occupation for some.

Picking some of the late apples and stowing them in the fruit-room has to be attended to.

During this month cuttings of geranium, fuchsia, &c., are put in. The cuttings are best planted in the autumn, because the sap is descending and the earth is still warm ; therefore rooting commences quickly.

In choosing a cutting a young firm wood grown in the summer is the best.

The end of the cutting should be made quite smooth close under a joint with a sharp knife, as a clean cut heals quickly and a jagged wound slowly.

Collecting capsicums is a tedious occupation, their fumes being very trying to the eyes.

Grubbing trees in the old orchard gives the students plenty of work, also enables them to look for the borer.

Levelling the ground with one of the scoops is exciting work, this being done by horse power.

Trenching in the nursery and sowing seeds keep some busy.

The draw hoe this month is brought into play for scraping the weeds off the paths.

Weeding and raking up leaves are necessaries of the garden, and have to be attended to.

Collecting tomato seed is an interesting occupation. The fruit of the tomato must be of the best and largest, and perfectly ripe.

The pulp is abstracted through a coarse bit of canvas, and the seeds are then laid on pieces of paper to dry.

Trimming the boxthorn hedges provides plenty of work for some, while others are engaged lifting rooted cuttings of vines and wheeling manure.

The soil is kept in good order by the use of the plough, which is used in the lower orchard, and also the hoe; burning rubbish is also carried on this month.

To trim the edges of a buffalo-grass border, the student requires to have a steady hand and eye.

Mr. Joseph Harris, M.L.A., gave a lecture this month on "Undeveloped Sources of Wealth," which was attended by many of the public, and was very instructive as well as interesting to the students.

JUNE.

Pruning during this month keeps us very busy. The gooseberries, dwarf apples, and pears are by this time well on the road to being finished.

Trenching gives a lot of work in the orchard. The word trenching means moving the whole of the soil to the depth of 2 feet or more. Fig. 2 shows mode of working.

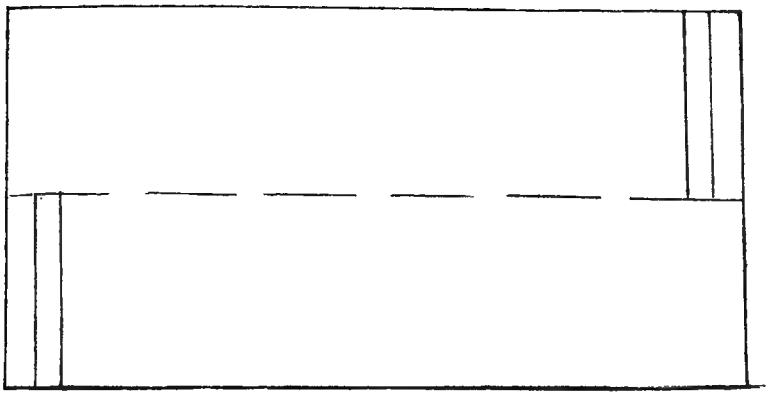
Collecting strawberry runners and planting them in rows for distribution occupies the students to their advantage. Cutting down chrysanthemums and collecting tomato seed also give employment, and some are engaged trenching in the nursery, and putting up seed potatoes for distribution. Instructions are given in ploughing in the lower orchard with the new American plough, and the students are also shown this month how to lay drain-pipes. Collecting the maize off the experimental plots and putting up American agricultural seeds for distribution make things a bit busy.

Mr. A. N. Pearson gave a very interesting lecture entitled "Manures and Manuring," which was attended by many of the public and students.

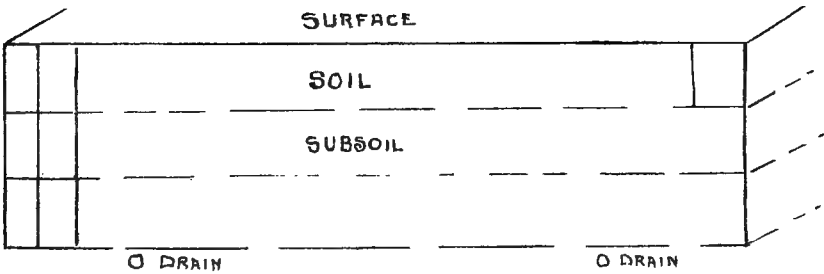
JULY.

This month also keeps us very busy in pruning the pear and apricot.

The students are kept busy collecting codlin moths. The bandages of old bagging are now taken off the stems of the trees, where they have been for about two or three months. The best bandages are, perhaps, those made from old (not rotten) bagging, cut into strips of, say, 4 or 5 inches wide.



PLAN.



LONGITUDINAL SECTION

FIG. 2.

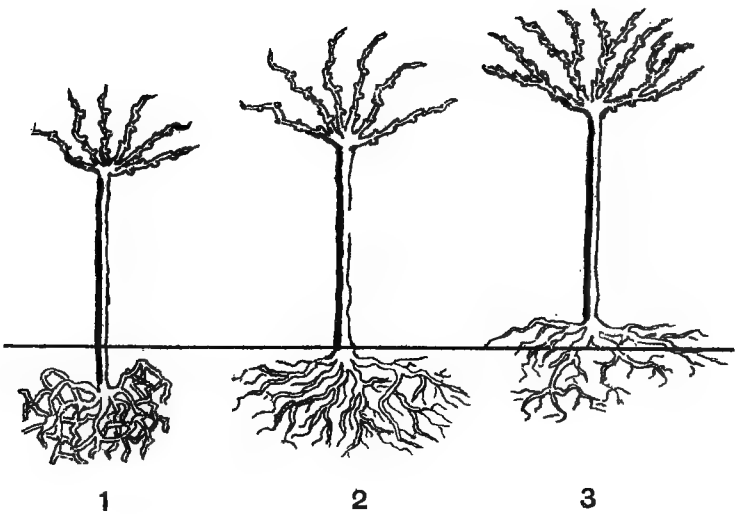


FIG. 3.

These bands should be carefully removed, and the grubs destroyed at least once every week. The average amount collected from one tree is 90 to 100.

Scraping off the loose bark with a three-cornered hoe is another good plan, and also painting the stems with a mixture of cow-dung, lime, and sulphur. This preparation fills up any cracks, and prevents the moths from depositing their eggs.

Spraying the aphis on the peaches gives us plenty to do, the mixture used being soft soap and tobacco water. The IXL and new Bordeaux mixtures are found to be very effective. A dull day is generally chosen for spraying.

Root pruning is started this month. Cutting Cape weeds in lower orchard also gives extra work.

On wet days we are occupied in the pavilion making wooden labels, &c.

Planting trees in the new nursery gives us plenty to do, the trees being apples, cherries, plums, pears, nuts, and a new American wine berry.

Re-planting roses in the flower border, and writing labels for same, keep some of the students busily occupied. The roses are planted 2ft. 6in. apart, and consist of 70 varieties. The following are some of the best:—Tea-scented, Noisette, Rev. T. C. Cole, L'Ideale, Marechal Niel, Cloth of Gold.

Mr. C. French, F.R.H.S., wrote a very interesting lecture on "Entomology," which was read by Mr. McAlpine, the Horticultural Board being present, also many of the public and students.

AUGUST.

Planting trees in the orchard this month provides the students with occupation and useful knowledge.

Fig. 3.—1 shows bad planting, the roots twisted, and the soil piled up the stem like a cone. 2 shows good planting in drained land, the roots spread out evenly just within the ground, and the surface covered with litter of manure. 3 shows the tree planted almost on the surface in wet or low-lying ground, the soil for covering the roots being taken from between the trees, and mulching with manure—thus another illustration of bad planting.

It is always as well when planting to shorten long roots and cut off broken ends smoothly. The soil should be firmly pressed about them by carefully treading—not ramming—the soil hard.

Fertilizers used when planting are bone dust, superphosphate, and blood manure. When the tree has been planted cut back all the branches to within 2 or 3 inches of the stem of the tree.

Dwarf apples and pears are now being pruned. The sowing of tomatoes and egg and chili seed in the hot frame in pots requires our best attention. The following list contains those best grown :—

Tomato.—Mikado, Mayflower, Ponderosa, The Peach, Volunteer, Optimus, Sutton's A1, Acme, Trophy, President Garfield, Keye's Early Prolific, Green Gage.

Egg Plant.—Black Pekin, Dwarf Purple, Long White.

Chili.—Coral Red, Tom Thumb, Spanish Mammoth, Long Red, Golden Dwarf, Birdseye. There are also many grown at the college not given in the above list.

We are instructed in "root-grafting" this month. One of the main objects is to see that the scion and root is properly united. Figs. 5 and 6 show the most successful modes of treatment.

To keep the scion and root in position we bind them with thin strips of calico.

Digging in the orchard between the trees is now being proceeded with, and keeps the students well employed.

Planting potatoes in the lower orchard occupies us for some time. The following list gives a few of the best varieties of potato :—

Crimson Beauty	St. Patrick
Red King	Sutton's Early Flourball
Seedling Kidney	Tasmanian Red
Sutton's Magnum Bonum	Vanguard
Stowbridge Glory	Peach Blow, &c.

Weeding and hoeing keep one and all busy. Cutting and trimming boxthorn hedge and planting vines give plenty to do.

Mr. A. C. Neate gave a very instructive lecture this month entitled "Victorian Soils and Cultivation." It was attended by the Horticultural Board and students and a good gathering of the general public.

SEPTEMBER.

This month is one of the most interesting to the students who are now instructed how to make "grafting wax." This is a mixture of beeswax, tallow, and resin in equal quantities, and half the quantity of lard.

These ingredients are slowly melted over a fire in a tin dish, and well plastered on paper of good substance, which is cut into narrow strips, and is used for wrapping around the graft in place of the old-fashioned clay ball.

Sowing peas, carrots, lettuce, onions, and beet keep us all well employed.

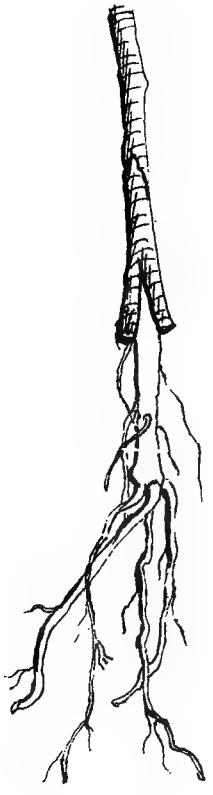


FIG. 5.

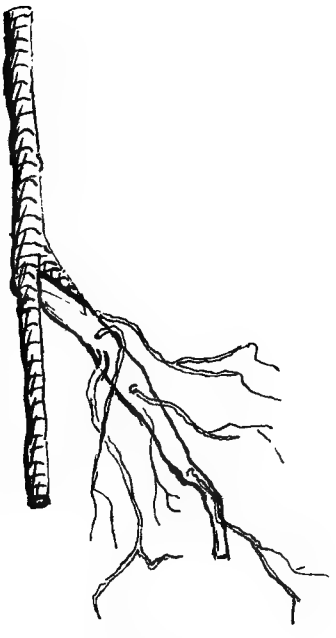


FIG. 6.

The following varieties are some of the best grown :—

Peas.—Early Dwarf Prolific Sugar, Wm. Hurst, Duke of Albany, Early Marrowfat.

Carrots.—James' Scarlet, James' Intermediate, Long Red Surrey.

Lettuce.—Buttercup, Neapolitan Cabbage, Cabbage Lettuce.

Onion.—Brown Globe, Brown Spanish, Golden Globe.

Beet.—Carter's Perfection.

Lifting dahlias and chrysanthemums in the nursery is now proceeded with, and is interesting work.

The students have an opportunity of seeing the mixing of manures by Mr. Pearson.

The following are some of the mixtures :—

2·14 cwt. to the acre, sulphate of ammonia.
$3\frac{3}{4}$ cwt. to the acre, Albert's P.K.N.
$2\frac{1}{4}$ cwt. to the acre, sulphate of ammonia.
2 cwt. to the acre, Albert's concentrated superphos.
2 cwt. to the acre, potash salt.
20 tons to the acre, stable manure.

In some of the plots the trees are not to receive any manure until they come into bearing.

Spraying, hoeing, and digging in the orchard are now being carried on.

Planting fruit trees on Pearson's experimental plots gives the students an opportunity of learning how to mix the fertilizers with the soil.

Pansy seeds are now set in the nursery.

A very interesting experiment to kill the weeds in the footpaths is now being tried.

The following mixture is used :—

Arsenic	...	...	1 lb.
Caustic soda	...	...	1 lb.

The two ingredients are put into a wooden tub, and boiling water poured on, keeping the mixture well stirred until dissolved after which 100 gallons of water are added. This is then poured on the paths with a watering pot, and we hope the experiment will be a great success.

Mowing the lawns with a mower in front of the pavilion keeps some of us busy.

Mr. W. R. Guilfoyle, F.L.S., delivered an interesting lecture entitled "Glimpses of some British Botanical Gardens and their Conservatories," the Horticultural Board being present, besides many of the general public and students.

OCTOBER.

The work of this month is mainly tying up vines and thinning out the laterals and stripping plum stocks of their leaves to prepare the stocks for budding ; and cutting up Cape weeds in the lower orchard. The last is a very necessary operation, as the weed has got a good hold in the ground and takes away a lot of plant food from the fruit trees.

Hoeing and digging around the flower borders give us plenty of employment. Ploughing in the orchard and disbudding peach trees are now being carried on.

The planting of melons and vegetable marrows gives the students plenty to do.

The following are the names of some of the principal varieties grown :—

Rock Melon.—Emerald Gem.

Cucumbers.—Noa's Forcing.

Water Melon.—Kolb Gem, Cuban Queen, The Boss, Mr. Phenicy.

Vegetable Marrows.—Long Green, Long White, Long Cream, Custard, Penny Bid, also Turk's Cap, Gregory Sugar Pumpkin, Dilpassant, Mammoth Chili, Ironbark Pumpkin.

Collecting oranges and shaddocks from under the trees is one of the necessaries of the orchard.

A very interesting lecture was given by Mr. R. L. J. Ellery on "Bee Culture." The Horticultural Board, students, and a good number of the general public attended.

NOVEMBER.

This month is most interesting and instructive to the students.

Setting lobelias around the pavilion occupies some of us.

Thinning out the laterals of the vine has to be carefully attended to. A new cultivator has just been introduced into our college called the "planet junior," and it is found most useful ; it is easily worked, and may be used as a seed drill, wheel hoe, and rake.

Tying up raspberries in the lower orchard has to be seen to.

Some of the students are planting out tomatoes in the nursery and mulching them with manure.

The list of varieties grown is given under the heading of work in the month of August.

Mulching is nothing more than covering the ground about the stems of plants with coarse straw or litter, which, by preventing

evaporation, keeps the soil from becoming dry, and maintains it in that moist and equable condition of temperature most favorable to the requirements of young roots.

Planting tree dahlias and ornamental beet around the flower borders is now being proceeded with.

Summer pruning the peach and the pear gives the students plenty to occupy their hands and mind.

When a tree has arrived at the age of three or more years, summer pruning is not required so much.

Mixing manures for fruit trees in the orchard is now being attended to.

The students are kept busy fighting the pear and cherry slug (*Selandria cerasi*). This little destructive insect is easily seen with the naked eye when in the larva state; it is a small dark-greenish slimy caterpillar, found on the leaves of the pear, cherry, and other trees, which they injure very much by gnawing the epidermis off the upper portion of the leaves and leaving the under side untouched.

Dusting the infested trees with dry sand will kill the slug, but not its eggs.

Spraying the trees with a mixture of soft soap and water also kills the slug, but not its eggs. The proportions used are 2 ozs. to a gallon of water.

Hellebore powder—at the rate of 1 lb. to 20 gallons of water, and sprayed on the tree—is found to be the most effective remedy for the prevention of this pest.

Ploughing in the orchard with the aid of the horse, and hoeing, digging, and weeding give some of the students occupation.

Planting egg and chili plants is now being attended to.

Mowing grass on the lawns with a scythe and planting seed of the sugar beet and beans in the lower orchard give us plenty to do.

Beans are now being set, the distance apart of the rows being 2 feet.

The list given below enumerates some of the best grown :—Emperor William, Canadian Wonder, Golden Waxpod, Ne Plus Ultra, &c.

Thinning out onions in the lower orchard gives work to the students.

Rooted chrysanthemums are now being planted in the nursery. The following are some of the best grown :—Sunset, Mrs. H. Cannell, Lady St. Clair, Gold, Sunflower, Lady Lawrence. There are a great many more varieties, but too numerous to mention.

Mr. McAlpine's experimental wheat plots look very well. Mr. Greenlaw has got the looking after them.

Cutting dead-wood out of oranges gives us work.

DECEMBER.

The flower garden looks very well this month in spite of the great heat (80 degrees in the shade), and one cannot help seeing a very fine specimen of the *Grevillea robusta*, order Proteaceæ, which just now is in bloom in the gardens.

Budding apple trees is started this month. There are five points to be remembered in budding—

1. The sap must be free.
2. The root action good.
3. The work done cleanly.
4. The binding not too tight.
5. The stock or stem not cut back the same season.

The students this month are occupied in disbudding peaches.

Planting dahlias in the nursery is now going on. The best sorts are—Zulu, Mr. A. W. Tait, Yellow Pet, Sunshine, Empress of India, and many other varieties too numerous to mention.

The cherry slug is now getting troublesome, and has to be kept under by constant spraying with hellebore mixture.

Hoeing up weeds in the medicinal plots has to be attended to.

We started picking fruit this month—gooseberries, currants, and plums. The varieties of plums are Red Cherry Plum and St. Etienne.

Meteorological instruments have been carefully attended to during the year, and the rainfall has been unusually heavy.

Mr. L. T. Chambers gave a very interesting lecture on "Bee Culture," which was well attended by the public, the Horticultural Board and students also being present.

The students are now looking forward to their usual Christmas holidays, and are working with a will to tidy up the grounds.

ESSAY ON TRIP TO DUNOLLY SCENT FARM, 1893.

The second annual trip of the students of the Horticultural College, Burnley, to the Government Scent Farm took place on the 23rd November, 1893; some of them, taking advantage of the exceptionally fine weather, left Melbourne by the 12.5 p.m. train. The run to Castlemaine passes through Keilor Plains and Sunbury, where the vineyards were looking their best, the dark-green foliage being very pleasing to the eye.

On the right a very noticeable mansion—the country home of Sir William Clarke—stands out prominently and, with its beautiful artificial lake and well-kept park-like grounds, adds much to the beauty of the landscape.

We journeyed on through Macedon, which gave us the impression of being a charming resort for summer visitors.

Numerous residences are dotted about, and we got a glimpse of the vice-regal residence high up on the mount.

Kyneton, our next halting place, is a town of considerable note, being the centre of a large agricultural district.

Malmsbury is next passed, and one cannot help noticing its reservoir. The country is undulating, and many acres seem to be under crop.

After passing two or three stations we reached Castlemaine at 4 p.m., where some of us broke the journey to look round this formerly famous gold-mining centre.

We were fortunate in having an introduction to Mr. Max Pincus, chemist, who received us in the kindest manner, and showed us round the town, pointing out the most interesting sights.

The town is still mainly supported by the gold mines. The streets are wide, and laid out at right angles as in Melbourne.

The market buildings add to the appearance of the city, and another important building is the post-office, which has a handsome clock with mechanical process for self-lighting it at night.

The buildings of the Supreme Court, gold offices, and Treasury are of good design.

We visited the monument erected by the citizens to the memory of the explorers Burke, Wills, and King. It occupies a fine position, and bears an inscription commemorating the exploits of the explorers in crossing the continent from Melbourne to the Gulf of Carpentaria. The leader, Mr. Burke, was a resident of Castlemaine prior to accepting the command of the expedition.

The churches, of which there are many, occupy good positions, being mostly erected on high ground. There are two State schools.

The School of Mines and gaol are built in prominent positions.

The city seems to be in advance of many others of the same population, being lighted by electricity.

Time being short we paid but a hurried visit to the benevolent asylum, where we chatted with the resident doctor. The building is of Gothic design, and with its many gables, mullioned windows, and terraces might be taken for an old Tudor mansion.

The park, which comprises about 70 acres, has a sheet of water, a fountain, a fern grove, and a collection of choice shrubs and trees.

(Figure 2 shows view taken from the botanical-gardens, the benevolent asylum in the distance.)

The chimes of the post-office clock striking 8 reminded us that we must hasten to the train that was to carry us to our destination—Maryborough—and after taking leave of the doctor we hastened by moonlight to the station, where we were glad to find the members of the Horticultural Board, including our lecturer, Professor McAlpine, and other visitors interested in the scent industry.

A two hours' run landed us at Maryborough, and we were glad to reach comfortable quarters for the night.

This brought the first day to a close.

Saturday morning being fine, some of the students rose early to see what changes had taken place since their last visit; but as the train to Dunolly left at 6 a.m. we had to hasten. The new law courts, which were then unfinished, are now completed, and the building adds to the appearance of the town.

On our walk to the station we noticed a very fine specimen of Magnolia.

On reaching the station our party consisted of members of the Horticultural Board, Professor McAlpine, Mr. Max Pincus, Mr. J. N. Caire, Mr. McFarlane, Mr. Ogle, Mr. Churchill, and the students.

The railway trip to Dunolly occupied about one hour.

The country passed through seems good for agricultural purposes, as we noticed several fine vineyards and farms all looking well. On reaching Dunolly we were received by the mayor, J. Desmond, Esq., J.P., Mr. Morris, and many of the leading councillors and citizens. A pleasant walk through the principal streets soon brought us to our hotel, where a sumptuous breakfast awaited us, to which we all did ample justice.

The mayor now escorted us round the township, pointing out and explaining anything especially interesting.

We first visited the reservoir, which is a fine sheet of pure water, and continued our walk along the banks, and passed the Roman Catholic Church, which is built on an elevated position, and is of modern design; in contrast to which, on our right, is seen an old digger's hut.

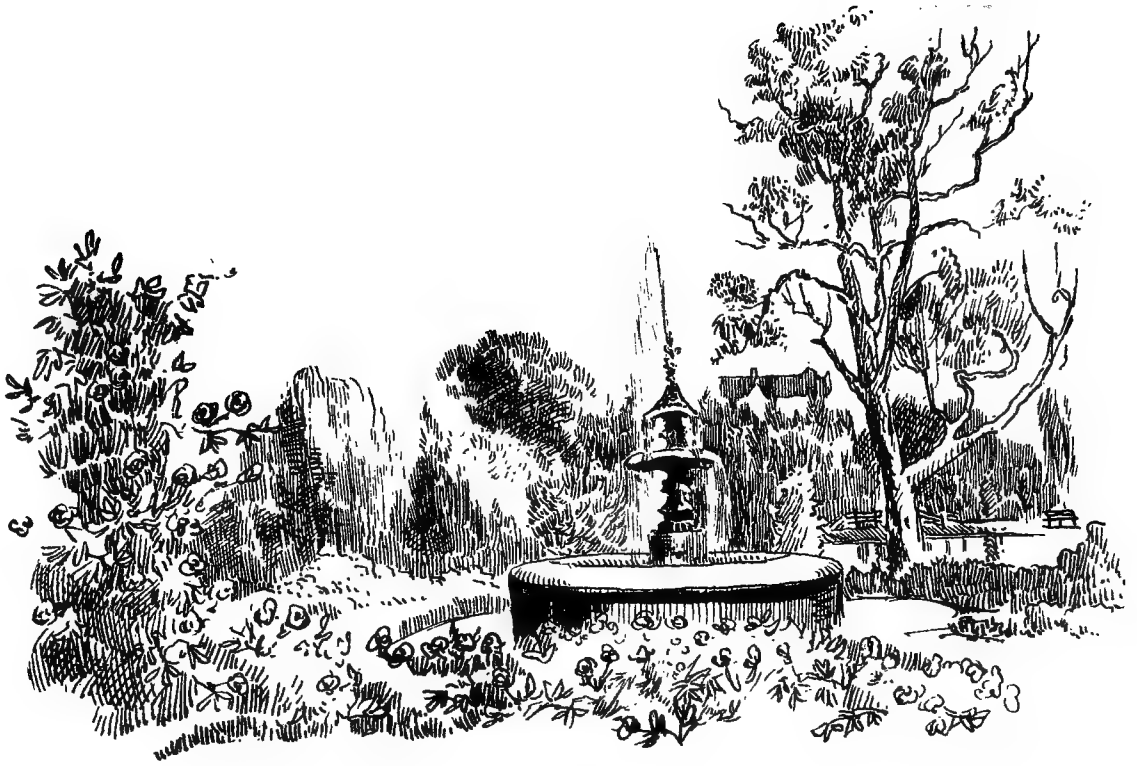
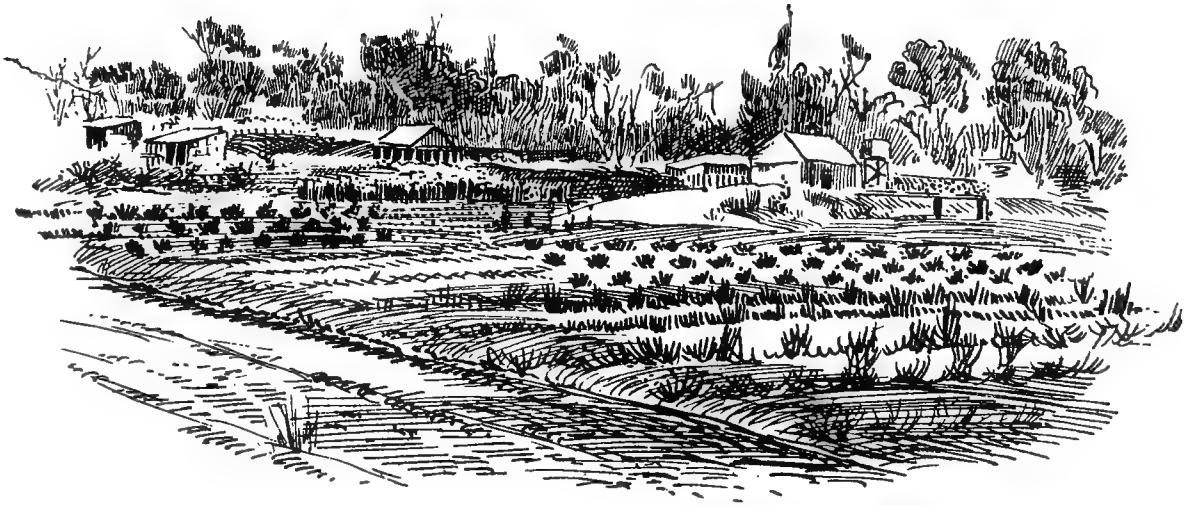


FIG. 2.



We passed the residence of Mr. Tatchell, and noticed a fine crop of strawberries of The Captain variety.

The public gardens (which are well kept) were next visited; and they contain some fine specimens of the Portugal laurel (*Cerasis lusitanica*) growing in great luxuriance.

We were then escorted to the town hall by the mayor, and shown the concert hall and other fine rooms. The building is of modern structure and of good design, and adds greatly to the architectural beauty of the town. Mr. Caire, photographer (who accompanied us through our trip here), succeeded in taking a view of the exterior of the building.

It was now time to take our departure to our destination—the Scent Farm; and we mustered in the main street, where we found the drag (kindly lent by Mr. Morris, ex-mayor) awaiting us. The students were soon all seated, and, after three cheers and waving of hats, a good start was made.

The post-office was considered worthy of a place in this essay, and while the students were settling themselves in the drag a snapshot was taken.

The road to the farm is about 7 miles, and is generally fairly good, but owing to the recent floods it was much cut up, and it was as much as we could do to keep our seats. A few new homesteads were passed, with some amount of cultivation around them. The perfume from the Eucalyptus was very strong and refreshing. After about two hours' driving we came in sight of the Scent Farm, where we saw the Australian ensign floating in the breeze in honour of our visit.

The director, Mr. Mellon, was awaiting our arrival, and gave us a hearty welcome. He showed us round the farm, describing things of interest. We inspected a bed of over 3,000 cuttings of the true Lavender (*Lavandula vera*), and close by was the cassie (*Acacia Farnesiana*), the scent from which plant closely resembles that of the wattle blossom. We were shown a new variety of fig, which Mr. Mellon told us has good qualities for drying, containing sugar and salt in proper proportions, and known as the Belona Fig.

We next passed the tuberose (*Polianthes tuberosa*), which grows well. The plants have to be three years old before they are of any use. The double varieties give most perfume. Violets (*Viola odorata*) grow well, and produce a valuable perfume. A very fine bed of lavender is passed (*Lavandula spica*).

The lavender is planted about 5 feet apart, and we were told that it grows wild on the Alps.

Lavandula Stœchas, we are informed, is extensively used for perfuming soap. We were shown a fine bed of Boronia, and told that the perfume retains its strength longer when the trees are well cut down after the flowering season.

The scent of the jonquil (*Narcissus jonquilla*) is abstracted by the enfleurage process.

The perfume of the Geranium of Africa is much stronger than that of the Geranium of Rose.

We next passed a fine bed of fennel, and a small plant Mr. Mellon calls serpolet, which produces a rich and pleasant smelling oil.

Some fine plants of rosemary (*Rosmarinus officinalis*) were seen, which forms the basis of Eau de Cologne; also beds of peppermint.

We were shown varieties of the Seville Orange, this being the kind best adapted for producing the oil of Neroli, a valuable essential oil largely used in the manufacture of perfumes.

The plants at the farm are all arranged in rows running due north and south, so as to obtain full benefit from the sunshine.

We were told that this is of importance, as on the influence of the sun depends in a great measure the quality of the essential oil obtainable from the plant. We noticed some fine-looking shrubs of the Sweet Verbena, also the *Eucalyptus citriodora*, and the Rose de Grass (*Rosa centifolia*), which valuable plant produces the Attar of Roses.

We inspected the beds of wallflower, tansy, and mint, which grow wild on the Alps. Their perfume is used for scenting soap. We were then taken to the distillery, where we were shown three stills at work. One of 300 gallons cost £80; one of 50 gallons £30; and one of 20 gallons £5, all of which answer admirably.

The director informed us he considers that a still of 30 to 50 gallons capacity will be sufficient for small farms growing only one sort of plants. Figure 5 shows a still, in the working of which we were instructed. The stills are fitted with a false inside, and this is tightly packed with flowers, and then filled with water. They are then ready for working, and all that is needed is to fire up beneath them. The most important point is to know how to regulate the fires.

If roses are being distilled, some alum and salt must be put with them.

When being emptied, the top of the still is swung round to open it, and the false inside hoisted out by means of tackle, thus saving a great amount of labour.

We were told a separate still for each perfume is not absolutely needed, as by using sulphuric acid or oil of vitriol, 1 part to 20 of water, the stills are easily and perfectly cleansed.

A move was made to the store-rooms, where the extracts in course of preparation are kept; here we were shown the fat used to absorb the scent. Mutton, beef, and pork fats are used in

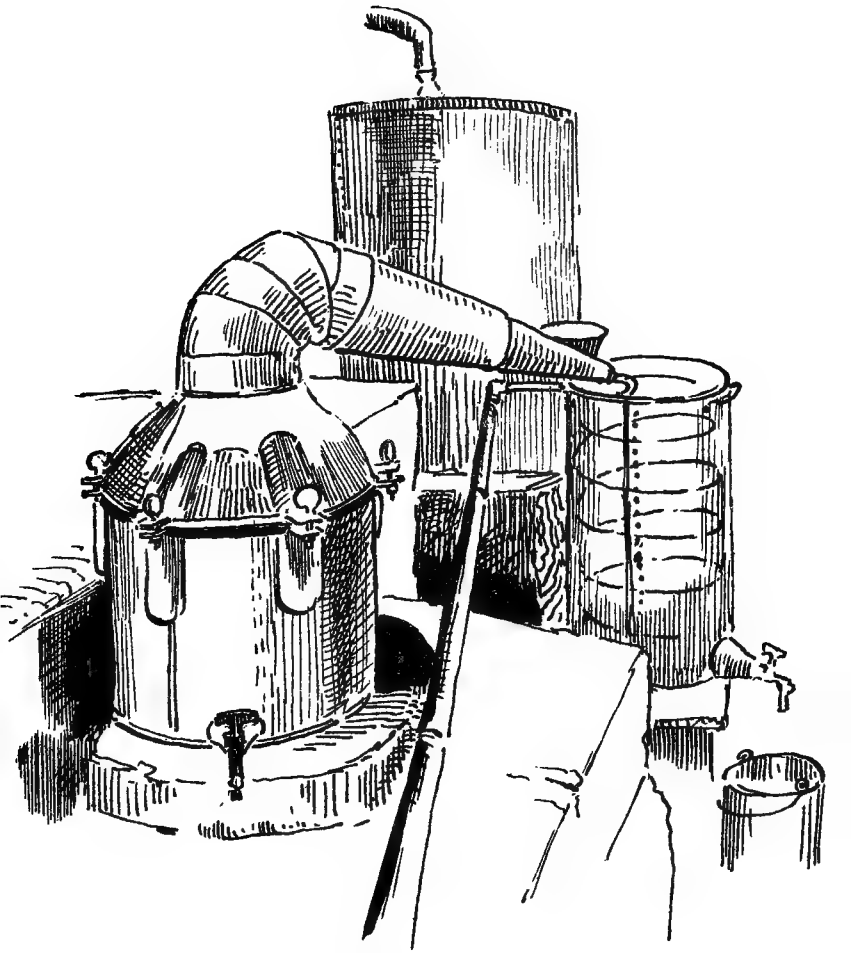


FIG. 5.

equal quantities, prepared by boiling, adding 2 ounces of alum and a handful of salt to 20 pounds of fat. The mixture is then passed through a sieve to free it from all impurities.

This process has to be repeated, when it is ready to be stored away for use.

This fat, after being treated with spirit, retains some amount of odour, and is useful for pomatum.

Mr. Mellon now described the processes for extracting the scent.

The Fat or Enfleurage Process.

The flowers are gathered, and are placed upon a layer of pure lard, a quarter of an inch in thickness, spread over a sheet of glass about 2 feet square, which is framed in wood, and forms a kind of tray.

These trays, sometimes 40 or 50 together, are then piled one upon another. The flowers are changed every 12, 18, or 24 hours, according to circumstances, and the process is thus continued until the lard is sufficiently charged with perfume.

The fat has the property of absorbing the perfume from the flowers, and is then treated with spirits of wine, which has the power of taking the scent from the fat.

We were informed that jasmine and tuberose are frequently charged as often as 50 times before the lard is considered to be sufficiently impregnated.

Another process is by macerating the flowers in oil, after which they are put under a press to extract all the oil and perfume, and this oil is treated with spirit of wine in the same manner as the fat.

Another process is by saturating calico in oil, and allowing the oil to drop from it for a few minutes; then place the calico in a tray similar to the enfleurage process, but with a wire gauze bottom instead of glass. The flowers are changed from time to time. When the oil is mixed with the scent it is pressed, and the calico washed in spirit.

Oil of peanuts is the best for the purpose, but olive oil can be used.

The temperature has a great effect on the time taken for these processes. A warm atmosphere quickens the extraction, but the production is not so good as in cooler weather, so that the longer the time taken the better the scent.

Mr. Mellon informed us that he can teach any ordinary intelligent person the knowledge of the work required in the cultivation of the plants. The majority of the scent-producing plants grow with very little trouble and attention.

The extraction of the scent needs care, but a knowledge of the process is easily acquired.

The following is a list of plants grown on the farm, and the modes of abstracting the scent were explained :—

Wattle (*Acacia Farnesiana*)	...	Enfleurage.
Boronia (*Boronia megastigma*)	...	,,
,, (,, *polygalifolia*)	...	,,
Tuberose (*Polianthes tuberosa*)	...	,,
Mignonette (*Reseda odorata*)	...	,,
Violet (*Viola odorata*) ...	...	,,
Jonquil (*Narcissus jonquilla*)	...	,,
Juniper (*Juniperus communis*)	...	Distillation.
Wordwood (*Artemisia absinthium*)	...	,,
Ironbark (*Eucalyptus Leucoxylon*)	...	,,
Lemon-scented Gum (*Eucalyptus citriodora*)	...	,,
Bouvardia.		
Orange (*Citrus cergamia*)	...	Distillation.
,, (,, *bergamia*)	...	,,
Lavender (*Lavandula vera*)	...	,,
,, (,, *spica*)	...	,,
,, (,, *decussata*)	...	,,
,, (,, *Stœchas*)	...	,,
Pennyroyal (*Mentha Puleguim*)	...	,,
Peppermint (,, *piperita*)	...	,,
Fennel (*Fœniculum capillaceum*)	...	,,
Rosemary (*Rosmarinus officinalis*)	...	,,
Geranium (*Pelargonium odoratissimum*)	...	,,
,, (,, *capitatum*)	...	,,
Anis (*Pimpinella Anisum*)	...	,,
Wild Thyme.		
Celery.		
Lilium eximium.		

We then went into the laboratory, where we saw a splendid collection of Eucalyptus oils and other perfumes—*Eucalyptus globulus*, *amygdalina*, *rostrata*, *Stuartiana*, &c., and also some different extracts from the flowers.

Mr. Mellon now proposed that we should devote our time and attention to a most excellent luncheon which awaited us.

Mr. Martin, the Secretary for Agriculture, occupied the chair, the mayor sitting on his right.

Among the guests we noticed Councillors Ritchie, J.P., Daly, J.P., J. Russell, the town clerk, and Dr. Russell.

Mr. Tatchell, the member for the district, only made his appearance at the close of the repast, his parliamentary duties keeping him away.

After the usual loyal toasts had been drunk, Parliament was proposed by the Chairman, coupled with the name of Mr. J. Harris, M.L.A.

In responding, Mr. Harris said he regretted the duty had not fallen into better hands. The speech from beginning to finish was practical, and in his usual happy and humorous style, and the applause was great throughout.

The next toast proposed by the Chairman was the Dunolly Borough Council, coupled with the name of Mr. Desmond, the mayor. The Chairman remarked that most townships had some object of interest to take visitors to. He was glad Dunolly was proud of its Scent Farm, so ably managed by Mr. Mellon.

The mayor, in responding, apologized for the absence of the member for the district, Mr. Tatchell, and delivered a very able speech, bearing mostly on local matters.

Mr. Ritchie next proposed success to the Scent Farm, coupled with the name of Mr. Mellon. It had been a very up-hill undertaking to face, but, under Mr. Mellon's able management, had been a great success.

In responding, Mr. Mellon was received with great applause, and gave a very interesting account of the Scent Farm from its commencement, and the future prospects of the industry, which he painted in glowing colours. If we could produce the essential oils in sufficient quantities a European market is waiting at remunerative prices.

Dr. Cookson proposed the Horticultural Board, coupled with the name of Mr. Draper.

Mr. Draper thanked the guests for the way they had drunk the toast. The members were proud to visit the Scent Farm. He always thought highly of the district, and was, like Mr. Harris, anxious to know the financial results of the Scent Farm.

Mr. Lang proposed the Press. He indorsed the remarks of Mr. Harris and Mr. Draper, and hoped the industry would prove a financial success, which would add greatly to the prosperity of the colony.

Mr. Williamson (of the *Express*), Mr. Carruthers (of the *Gladstone Gazette*), and Mr. McFarlane (*Leader*) briefly responded.

One of the senior students had the honour of proposing the health of their instructor, Professor McAlpine, which was done in a few appropriate remarks. The toast was enthusiastically drunk, with musical honours.

Mr. McAlpine, in responding, said he was taken quite aback for once in his life. He highly appreciated the kindly feeling shown by one of the students in proposing his health in such a spontaneous manner. He had great pleasure in proposing the health of their worthy Chairman, Mr. Martin, who had always taken a great interest in the Dunolly Scent Farm.

The mayor spoke in the highest terms of the valuable services rendered by Mr. Martin to make the Dunolly Scent Farm a success.

The Chairman, on rising to reply, was loudly applauded. He endeavoured his best to develop the resources of the country. From the first he had taken a great interest in the success of the Scent Farm, and would have liked to see a village settlement attached to the farm, in which case the children of the settlers could be profitably employed during the busy season.

Mr. Caire now grouped the party, and succeeded in taking a very admirable photograph.

Other smaller groups were then taken by one of the students of the college, which have turned out very satisfactory—one representing the students seated in the drag on their return journey to catch the 5-o'clock train.

The usual cheers and waving of hats were given in honour of the trip, and the outing will long be remembered by all as most instructive and enjoyable.

By Authority: Robt. S. Brain, Government Printer, Melbourne.