QUEENSLAND AGRICULTURAL JOURNAL

Vol. XV. FEBRUARY, 1921. Part 2.

Agriculture.

FIGHTING DROUGHTS.

AN ANALYSIS AND SOME SUGGESTIONS.

By Cuthbert Potts, B.A., Principal of the Queensland Agricultural College.

To thinking men this is probably the most important problem facing Australia at the present time. The country has just passed through one of the most extensive and most protracted droughts ever experienced. Losses of live stock have been enormous. Production and reproduction have been lowered. Were these losses merely individual, the majority of us might look on with indifference; but these losses are not individual, they are national. Our national wealth is depleted by each drought and, in consequence, each and every individual in the community has to suffer.

There is no impossibility in devising some scheme whereby we could combat our droughts, but the problem is a national rather than an individual one. Unfortunately, now that the drought has broken, there may be a tendency to forget. During the drought many good resolutions were made to the effect that some preparation must be made to prevent them inflicting on us these enormous losses. We must not forget these good resolutions. Now is the time to organise; and this analysis of the problem is presented, trusting it may serve some useful purpose in maintaining a live interest in the subject. In the latter portion I offer a scheme for financing fodder conservation in the hope that the suggestions there contained may be of some value in assisting to solve the problem.

FUNDAMENTALS.

To begin with, it is necessary to examine our premises. A clear and accurate knowledge of these is essential in order to build solidly and so arrive at any solution of permanent value.

As a basis, it must be recognised that Australia lies in one of the great dry belts of the world. Australia's rainfall distribution and meteorology are comparatively simple, and a thorough study of Dr. Griffith Taylor's works should be made before any scheme for fighting droughts is propounded. With this cautionary advice, we will proceed to make a mere statement of certain salient points. These can be confirmed and amplified as desired.

1. The area of Australia is roughly 1,900,000,000 acres, and some two-thirds of this can be utilised. Probably 600,000,000 acres are suitable for stock only, while another 600,000,000 acres can be used for crops and stock; a small portion only being definitely agricultural. Thus the primary conclusion is, that Australia is and must remain a stock-raising country.

2. The rainfall is erratic, and droughts are constantly occurring. Mostly, these are local in effect but, occasionally, they are widespread.

3. Droughts are Nature's method of giving the land a rest. In our climatology, droughts take the place of the hard winters of Europe, North America, and Asia. Without such rest periods, Nature would run riot or decay. Droughts, then, should be looked on as beneficial and not as a curse (*see* J. J. Fletcher in "Science and Industry," vol. 2, August, 1920, p. 486). If at present we find them disastrous, it is merely because we have not taken them sufficiently into consideration in our pastoral and agricultural organisation. In colder climes the winter rest period is recognised and provided for. In our clime the oncoming drought is not considered, and is unprovided for. The fault is man's—not Nature's.

4. Perhaps it is the regularity of the winter rest periods in colder climes which has enabled agriculture to establish a proper system. Perhaps it is merely the slow accumulation of centuries of experience which has evolved the proper methods; perhaps it is combination of both of these; but neither of these features suits our conditions. Our droughts are not regular in their incidence; they are erratic, and, so far, we have no safe means of prediction. (This may be overcome as the result of careful meteorological investigation.) Further, we have no long period of experience from which to glean a proper working system. But the most important feature is, that we are, or should be, rapidly developing; and this introduces an important variable when successive droughts are placed in comparison.

Under these circumstances there obtains in Australian practice a large element of gamble. In any proposals for fighting droughts this element must be taken into consideration. The tendency towards gambling must be opposed, but it cannot be eradicated for years and years yet to come.

5. Couple the gambling element with the fact of our rapid development, and the natural outcome is that many are induced to start on the land with too little capital. This is not a bad feature, for we must grow, and we want all the grit and courage that lies behind such action. It is, however, a very real difficulty to be faced in any proposal put forward.

6. Whatever may be the final development, at present Australia is almost entirely dependent on pastoral and agricultural production for her annual national wealth. Any failure in this respect is a national calamity; any increased success spells national prosperity. Therefore, this drought problem is of as much interest to the cities as to the country.

7. Though Australia is a land of drought, it is also a rich land, yielding abundantly when rain falls. Further, the rainfall, which on the average is sparse over much of the land, is sporadically abundant. When abundant, the growth of grass and herbage and crops is superabundant; also, great floods occur. Of these two features, the flood waters appeal most to the popular eye. Hence we hear a great deal about water conservation and irrigation in times of drought, and but little about fodder conservation. But fodder conservation is undoubtedly the more important, as is indicated in the following analysis.

IRRIGATION COMPARED WITH FODDER CONSERVATION.

Let us consider irrigation first. To begin with, we have to recognise that Australia possesses no great range of snow-clad mountains. Therefore we are lacking Nature's provision for the conservation of water. When we wish to conserve water, we are compelled to fall back on great storage dams, such as that at Burren Juck or that proposed at Mitta Mitta, at the head waters of the Murray. Suitable sites for such dams are limited, because several essential conditions have to be complied with. First, the dam must be in a narrow outlet to a large flat valley, so that a comparatively small dam will impound a large quantity of water. Second, the rock structure at the dam site must be impervious to water, otherwise seepage round and under the dam would destroy its effectiveness. Third, the intake or catchment area must be so large that the rainfall received thereon shall be sufficient to fill the dam. The out-take from the dam must be strictly in accord with the average rainfall over the catchment area. Hence the size of the dam in relation to the area to be irrigated must be increased just in so far as the rainfall on the catchment area is more erratic. In other words, the more erratic the rainfall, the more difficult and expensive to establish storage dams for irrigation, even provided suitable dams sites can be found. On this account, water conservation for irrigation will be restricted to certain specially favoured areas—areas of small variability in rainfall. (*See* Dr. Griffith Taylor—"Australian Environment: Map of Rainfall Uniformity," p. 23.) In truth, the irrigable area of Australia will almost certainly lie mainly in the south-eastern quarter. At best it has been estimated (by Mr. Elwood Meade, I think) that the possible irrigable area of Australia will not exceed 6,000,000 acres.

This is only 1/200th part of the 1,200,000,000 acres which can be occupied, and but 1/100th part of the area definitely committed to grazing.

But there is another phase to the subject. Suppose that large irrigation settlements were established, could we expect that the irrigationists would grow fodder in large quantities for sale? I don't think so. If we assume that our major droughts hit us once in each five years, we have this position: For four out of the five years, fodder grown under irrigation could not hope to compete with that grown under natural rainfall conditions. Therefore, for four years the irrigationist would have to store his fodder, trusting to the higher prices in the fifth year to recoup him for his work and waiting. Some scheme of credit would be required whereby stored fodder would be accepted as security for a loan. But if such financial assistance were given to the irrigationist, why not extend it to the farmer working under natural rainfall conditions, and so obtain the conservation of fodder from the cheaper system of production?

In itself irrigation must play a big part in our national welfare, but we cannot expect irrigation to play any very large part in the solution of our drought problem, especially with reference to fodder conservation for live stock. Each irrigation settlement, as it is established, must be expected to evolve its own scheme of operation. Each settlement will engage in, say, fruitgrowing or dairying, or topping off lambs, or in some other type of agriculture which will yield a large annual return, so that when the drought comes, we must expect to find irrigationists fully occupied in their own work and in no way concerned in the production of fodder for starving stock.

FODDER CONSERVATION.

If the above argument is correct, we are forced back on to the second point—viz., that there is a superabundant growth of herbage, grass, and crops when the rainfall is good. When we remember that, in a good season, this growth extends over an area of some 1,200,000,000 acres, the enormous possibilities in fodder conservation are immediately evident. These possibilities far outweigh any conceivable possibilities under irrigation.

In making this statement, it is not contended that we could conserve anything like the full measure of our surplus growth in a good season, nor is it contended that it would pay to hand-feed the whole of our live stock during a drought period. Thus:—

First: The demand for labour to conserve much of the growth in the western country would be as sporadic as our seasons, and it could not be hoped that this demand could be satisfied.

Second: It is not necessary to attempt to feed the whole of the stock. In any drought we only lose a percentage of our live stock. The removal of this percentage by death relieves the land to such an extent that the remainder pull through. If, then, at the commencement of a drought, we hand-feed those stock which were well forward in condition, and those females which were heavily pregnant, we would, in effect, be removing from the land a sufficient number to so relieve the situation that the remainder would weather out the drought. Treated from this standpoint, there is every probability that fodder conservation and the hand-feeding of stock would pay.

Third: While fodder conservation in the western country may not be feasible, fodder production and conservation in the farming districts is possible. Further, stock water could generally be assured in the farming districts.

So far an attempt has been made to concentrate attention on what is undoubtedly the essential feature of this problem of drought resistance—viz., fodder conservation. This is the major factor in any endeavour to stabilise our production as against our variable rainfall.

Later, an attempt will be made to analyse the factors controlling fodder conservation; but, before proceeding, it is necessary to handle another phase of the matter—viz., railway communication.

It has been pointed out above that Australia lies in one of the great dry belts of the world; that droughts are always with us, but that, usually, they are limited in effect and local in their incidence; occasionally they are extended. Yet even in our worst droughts, some parts of the country are unaffected; some portion has an abundance of natural growth. Obviously, therefore, much loss could be avoided if our live stock could be readily and cheaply transported to where the feed exists. This means of meeting the problem has been so often and so ably advocated, that there is little need to go further. What is required is a network of railways through the back country, laid out with full consideration as to their strategic effect in combating droughts.

The conclusion that a proper system of railways would greatly assist in fighting our droughts, is easy to arrive at, but would they return a payable annual revenue? This raises another aspect to the whole problem—viz., the question of finance. It is necessary, therefore, to consider irrigation, stock water, stock railways, and fodder conservation from the financial standpoint before we can proceed with the discussion.

THE FINANCIAL ANALYSIS.

Irrigation.—When we build great storage dams for conserving water for irrigation we are making a provision whereby a free gift of Nature, our rainfall, is made more potently available. The original work is undertaken by Government, and the redemption and the annual cost of upkeep are recovered by a revaluation of the land served, together with annual water rates, &c.

Stock Water.—Conservation of water for stock purposes is very similar to that of conservation of water for irrigation, from the financial standpoint. It is an attempt to utilise more fully a free gift of Nature, our rainfall, whether surface or subterranean. In this regard much can be done by private enterprise, but where Government is asked for assistance, such assistance should be forthcoming, provided Government is fully protected as to recovery of the outlay by a direct lien on the area, or persons or stock served.

In the wide expanse of Australia's pastoral lands, however, there will be found some places which demand a provision for stock water, but which are so placed that private individuals will not undertake the work. Such places would lie on lines of transport or communication. Here Government would have to undertake the work, but it would be difficult to allocate any specific area or persons served. Therefore any direct charge for the recovery of the outlay would be difficult. Perhaps, in such cases, it were better for Government to make a gift of such works to the industry, recognising that a recovery will be made indirectly through the increased prosperity of that industry.

A Network of Railways through the back country for the purpose of easy and rapid and cheap transport of stock in times of drought is, in its essentials, another attempt to utilise more fully a second free gift of Nature—viz., our natural pasturage. This is a project justly undertaken by Government, but, as with irrigation, the area or industry or persons served should find the annual revenue. This network of railways has often been advocated, but without taking this point sufficiently into consideration. Instead, there has been rather a general feeling that such strategic lines of rail would be on a parallel with other railways; but they would not. An ordinary line of rails is built with the object of developing some district, it being anticipated that, as the district developed, so profits will be obtained from freights and fares. No such anticipation can be made with reference to the drought-fighting railways suggested. The revenue from such railways can only be expected during times of drought—times when the average stockman is looking for a concession in freights rather than anything else.

If this strategic system of railways is to be constructed it must be considered on the lines similar to those for an irrigation settlement—*i.e.*, those served must be charged with the redemption of the outlay, the interest on capital expenditure, the cost of annual upkeep, and the service rendered. This necessary annual revenue might be obtained by a direct charge tax on the area served, or a tax on the stockowners direct, or a per capita tax on the stock held.

The latter is considered the more equitable because it is likely to distribute the cost of upkeep in accord with the probable service to be rendered. Of course, if such an arrangement were arrived at, Government would have to undertake to transport stock in times of drought at some predetermined rate. Further, Government would have to undertake that, if the revenue from ordinary traffic more than covered the costs of operation for any year, such revenue would be deducted from the direct charge made on the stock owners.

In this respect it is interesting to note that about 1893 we carried in Australia 90,000,000 sheep and some 12,000,000 head of cattle. This was our maximum, but, with proper organisation, is there any reason why we should not reach or even exceed these numbers. But if we accept these numbers as a possible stock holding, then a direct tax of 3d. per head on sheep and 1s. per head on cattle (horses have not been taken into account) would yield an annual revenue of £1,725,000, an amount which should certainly be sufficient to finance any system of drought-fighting railways that might be suggested.

This matter of a stragetic system of railways for the purpose of combating droughts deserves every consideration, but it can only be approached from the standpoint of a direct charge on those served. As with irrigation, the Government may be expected to find the money for the construction, but the stockowners would have to find the greater portion of the annual revenue to cover upkeep and running charges.

Fodder Conservation.—With fodder conservation we immediately meet with distinct differences and in these differences we find our difficulties.

Fodder crops are *not* a free gift of Nature. *The production of fodder is largely the result of man's labour.* Hence the amount of fodder which may or may not be produced is dependent on conditions other than the natural rainfall, the quality of the soil, &c.

Allowing for seasonal variations, it can be taken that the amount of fodder which the farmers aim at producing is largely determined by the probable profits they may get. Farmers will not willingly over-produce, as they know that by so doing they are likely to glut the market, and thus be forced to sell their produce at a loss on their year's operations.

If farmers were organised so that they directed their efforts towards the growing of crops in quantities in true relative proportion to the annual demand, and, if many of the farmers were in such a strong financial position that they could afford to hold their produce over from the time of plenty in the full-growing season until the time of shortage in the non-growing period, gluts in the market would be largely avoided but beyond this there would be a fairly safe guarantee that a truly full annual supply would be produced.

But, in actual practice, we find little combination amongst farmers, hence glutted markets do occur. The least consideration, however, will indicate that such gluts are not due to the production of any annual surplus of fodder; they are due to the seasonal surplus which results because most farmers are so placed, financially, that they are compelled to sell their produce in the flush of the growing season. Selling on a glutted market implies the probability of selling at a loss on the cost of production; therefore, the existing conditions insist that, on the average, there shall be an under rather than an over production in any one year.

To emphasise this we might take lucerne as an example. This crop usually falls to an unprofitable price (from the producer's standpoint) during the summer but recovers to a fair payable price during the winter. The whole year, however, finds no surplus. Maize is another crop which is peculiarly subject to these seasonal fluctuations of value. Prices for maize at the time of the full harvest are generally so low that those farmers who are compelled to sell find that they have produced at a loss. The natural result is that they restrict their operations. Therefore, though Australia, and Queensland in particular, is eminently suited for the production of maize, we do not normally grow a sufficiency of this crop to meet our own year's requirements.

The conditions appertaining to the production and marketing of the above crops (and there are many other crops similarly conditioned) invite a system of speculation. Therefore, it is not surprising to find that city merchants are buying up on the low seasonal market and holding for the higher off-season market. The operations of these speculators are certainly of some value in so far as such operations have a tendency to hold up prices on a glutted market. But with reference to fodder conservation these speculative operations are most disastrous. Obviously, the security for the speculator lies in an under production for any one year, while the necessity for fodder conservation is an over production in every good year.

Consideration of this point is fundamental to the success of any organised scheme for fodder conservation. The farmer must be induced to grow a real annual surplus, and he can only be persuaded to do this by ensuring that his work will be sufficiently profitable.

Passing from the farmer to the stockmen, we have the former as a producer and the latter as a consumer. Thus, with regard to fodder conservation, we have a problem which is governed by the ordinary laws of supply and demand.

If the stockowners were well organised, and created a definite and consistent demand for fodder (not the unthinking periodic demand now caused by our droughts), the farmers could and would supply up to the limit of profitable production. In such a definite division between consumer and producer we would have a strictly commercial arrangement, wherein the stockowners as a body had replaced the existing speculating merchants. This move would be of undoubted value, because the element of time would be introduced. The stockowners would aim at a gradual accumulation of fodder over a number of years; they would be demanding an annual surplus of production in good years, which surplus they could only hope to obtain by making the transaction profitable to the producing farmer. Our speculating merchants, on the other hand, have no such ultimate objectives. They merely aim at the greatest profits in the shortest time, and, automatically, they are against the full production in any one year, let alone a surplus production in, say, four out of five years.

If it were possible to organise such a strictly commercial arrangement between the stockowners, on the one hand, and the producers of fodder, on the other hand, there would be no necessity or right to fall back on the Government for assistance; but it is more than doubtful if any such organisation could be sufficiently perfected to render it workable. The element of distributed management enters too largely into the industries of both stock-raising and farming. Further, on many properties we have no clear distinction between the two sections—*i.e.*, we have many farms where both farming and stock work are carried on conjointly. Thus there is every indication that this important problem of fodder conservation must be solved along some lines of co-operation, and in this regard Government assistance is both justifiable and necessary.

Briefly, fodder conservation resolves itself into the following basic elements:—

1. We have a section committed to farming operations only. This section could and would produce a large surplus of fodder in good seasons provided it were demonstrated that such production would be profitable. For future argument, call this group Section A.
2. We have another section who are carrying on both farming and stock-raising on the same property. These men also require to conserve fodder for their own stock as against possible droughts. Let us call these Section B.
3. We have those who are engaged in pastoral work only—that is, men who are so placed that it is practically impossible for them to conserve fodder for their own use, yet who will require fodder in times of drought. We will call these Section C.

Combined, these three sections form the greatest element in our primary production, and their united efforts constitute the greatest factor in the production of our annual national wealth. The disturbing factor is the drought.

In good seasons, Section A could produce an annual surplus of fodder, but does not do so because there is no provision made to finance him over the period of "waiting."

Section C knows it will require surplus fodder in times of drought, but, largely because of lack of organisation, it makes no provision to see that such surplus is conserved.

Section B is a growing element, and is interested in the problems of both other sections. It is this element which is likely to force the whole problem on to co-operative lines.

SUMMARY.

Just here it might be of advantage to make a brief summary of the foregoing arguments.

Water Conservation and Irrigation is justly undertaken by the Government. It is a justifiable attempt made by the nation to obtain a better service from a free gift of Nature—*i.e.*, from our rainfall. In Australia such undertakings belong to the Government rather than to the individual, because the peculiar nature of our climatology and physiography renders a large initial outlay necessary. In such projects, the Government recovers by a direct charge on the area served, *i.e.*, by annual water rates, &c.

Water Conservation for Stock Purposes, whether by dams or wells or bores, is quite similar to irrigation in so far as it is an attempt to obtain a better service from a free gift of Nature. In this case, however, private enterprise can do much. But if the Government is asked for assistance, such assistance should be forthcoming, the Government recouping itself by a direct charge on the area or persons or stock served. This is strictly in accord with the practice for irrigation settlements.

A Network of Railways Strategically Placed for the Rapid Transport of Stock in Times of Drought.—Here, again, we have an endeavour to utilise more fully a free gift of Nature—viz., our natural pasturage. This matter is entirely similar to that of irrigation. A large initial outlay is necessary for construction; the Government must undertake the work and be recouped by a direct charge on those served.

Such a network of lines could not be expected to pay, in the commercial sense of earning an adequate annual revenue to cover interest and working expenses; but such railways would be to the pastoral industry what water would be to an irrigation settlement—it would render stock-raising more certain and more profitable, but not quite in the same degree. Therefore, if such a net of railways were built, there must result a direct charge on the pastoral industry for at least a portion of the annual revenue required. Another portion must be borne by the Government on behalf of the general community, who will benefit by the increased prosperity of the pastoral industry. Of course, if such railways earn any commercial revenue, the charge against the pastoral industry should be reduced by that amount, and, with time, this reduction may be large or even complete.

Fodder Conservation is quite different from any of the above, because we have now to consider what is the result of man's labour, rather than the better utilisation of a free gift of Nature. This section of the problem is governed by the laws of supply and demand, and it cannot be expected that there will be any regular or sufficient supply of fodder except in so far as it is made profitable for the farmer to produce it. Exactly the same argument applies to the production of fodder on an irrigation settlement except that, in this latter case, the cost of production is more expensive than under conditions of natural rainfall. Therefore, we cannot hope that irrigation settlements will play any considerable part in this problem of fodder conservation.

Were it possible to thoroughly organise both the suppliers of fodder (the farmers) and the consumers of fodder (the stockmen), this whole problem would become a purely commercial transaction which would adjust itself without Government assistance. But, in rural work, such thorough organisation is quite improbable of attainment, for the simple reason that both farming and grazing are extensive in their operations and are committed to distributed and independent management as opposed to manufacturing, where the tendency is towards concentration of effort and centralised control and management. Therefore, and chiefly because agriculture means so much to our whole community with regard to the production of our annual national wealth, it is incumbent on the Government to intervene. In this case, however, the Government cannot act as for irrigation, or for stock water, or for stock railways. Instead, the Government must direct its efforts towards establishing some system of co-operation between the two big sections of our primary production, recognising, with regard to fodder conservation, that the stockowner is the consumer and the farmer is the producer.

Before proceeding to outline a tentative scheme for financing fodder conservation, it is necessary to refer to several other points which are well illustrated in Dr. Griffith Taylor's works on "Australian Environment" and "Australian Meteorology." From these works it will be fully recognised that the area for the possible growth of fodder crops is restricted, more or less, to the south-eastern quarter of the continent and to an area paralleling fairly closely our eastern seaboard. Also, that much of the area suitable for the production of stock is not suitable for the production of crops.

Again, the more southern areas are subject to winter rains and, consequently, are more suited for the production of wheat and oats, both of which can be converted into a permanent hay crop which can be transported over long distances without deterioration. From well south and extending up the eastern coast to the north of Brisbane, we can grow lucerne which also can be converted into one of the very best of hays, again possible of transport over big distances without deterioration. But going further north, much of the growth will be on the summer rainfall, and will include such summer crops as Sudan grass, Japanese millet, panicum, maize, and sorghum. Many of these crops can be converted into hay and so are capable of transport over long distances, but much of this produce would be better converted into silage, which is perishable as soon as it is removed from the silo or the stack.

Therefore, while it may be better to transport the fodder to the stock in the south-east of the continent, it is more than probable that the stock will have to be transported to the fodder in our northern areas.

This point may not be of great importance at the present juncture, but it will undoubtedly have a modifying effect on any completed scheme for fodder conservation.

FODDER CONSERVATION.

We are now in a position to discuss some of the features of a scheme for fodder conservation.

In times of drought it is the stockowners who are chiefly concerned. It is the live stock industry which is liable to the big losses, and it is from this industry that there arises a sudden and large demand for fodder. In times of drought the farmer is not so largely concerned. For him, his loss is merely the year's operations. For the stockmen it is different, because the losses threatened are for more than a year's operations. Each animal takes more than a year to develop. Thus it is natural to find that most of the schemes for fodder conservation up to the present have been propounded by the graziers.

Some of these schemes advocate direct action by the Government in the direction of buying up fodder and the establishment of great fodder conservation dumps.

Other schemes advocate direct action by the graziers for the creation of their own fodder reserves. There are still other suggestions midway between the above—that is, schemes asking for Government assistance to a grazier's fodder conservation fund.

In the best of these schemes ample provision is made to protect the Government against loss, but in no case have I found the farmer, the producer of the fodder, taken fully into consideration. Because of this, it is doubtful if any of the schemes for fodder conservation, so far suggested, could hope to succeed.

Let me take a scheme recently published in the "Sydney Morning Herald." It is quoted as one of the best, and as one of the most practical. The scheme is as follows:—

1. That the graziers should subscribe to a fund for the purpose of purchasing fodder in times of plenty, which fodder is to be held against the oncoming drought.
2. That the Government should supplement the above fund £1 for £1.
3. The total sum aimed at for each year to be £1,000,000. This sum to be placed under the management of three thoroughly practical and reliable men for the purpose of purchasing fodder, which fodder is to be stored at points specially selected with reference to easy and rapid transport.
4. The farmers to be paid a fair price and to be circularised so as to enable them to produce a sufficiency of material. The delivery of the fodder to be taken a few months after stacking and on being passed after examination by an expert.
5. Each grazier subscribing to the fund to have a prior lien on a quantity of fodder, I take it, in proportion to his subscription.

There are other conditions incidental to the scheme, but which have no bearing on the present discussion.

[TO BE CONTINUED.]

"THE CULTURE OF TEMPERATE FRUITS IN QUEENSLAND."

BY ALBERT H. BENSON, M.R.A.C., Director of Fruit Culture, Queensland.

For some years after fruit-growing became one of the staple industries of Queensland, the attention of orchardists was, at least in the tropical and semi-tropical parts of the State, mainly centred on citrus fruits such as oranges, lemons, citrons, shaddocks, mandarins, together with custard apples, mangoes, guavas, granadillas, bananas, passion fruit, &c. Almost the whole of the literature on fruit-growing was confined to advice as to the treatment of such fruits. Gradually, however, it was found that, in certain districts, particularly on the Darling Downs, the fruits of temperate climates could be produced in as great perfection as in cold countries. Amongst these may be mentioned apples, pears, plums, peaches, apricots, quinces, nectarines, figs, walnuts, quinces, pecan nuts, cherries, strawberries, and many others.

It is the latter fruits that the author has exhaustively and clearly dealt with in the hundred and nineteen pages which are entirely devoted to them, commencing with a description of the districts suitable for their cultivation in respect to climate, soils, rainfall, &c. Directions are given for the selection of an orchard site; the preparation of the land in the matters of breaking-up, subsoiling, drainage; laying out the orchard; planting the trees; their subsequent cultivation; propagation by various means such as from seed, cuttings, budding and grafting; irrigation, manuring, and subsequent treatment for the destruction of insect pests, fungoid disease, &c.; and the different treatment of each variety of fruit tree, nuts, and berries.

Nor has the market garden been overlooked, several pages being devoted to the cultivation of most of the culinary vegetables, followed by copious notes on insecticides and fungicides. This book should be in the hands of all fruitgrowers and market gardeners, and can be obtained from the Department of Agriculture and Stock; price, two shillings.

Poultry.

REPORT ON EGG-LAYING COMPETITION, QUEENSLAND AGRICULTURAL COLLEGE, DECEMBER, 1920.

The weather conditions for the month have been extremely trying for the birds. Daily throughout the period the shade temperature has been in close proximity to 100 degrees. During the last week temperatures of 104 degrees, 107 degrees, 108 degrees, and 110 degrees were registered in the shade on the College poultry plant. This trying weather has caused a big drop in the egg yield. Broodiness has been very troublesome, and three pens in the light groups had three birds apiece in the broody coops at the one time. There are a few odd birds dropping feathers, these being White Leghorns that have been troublesome with broodiness. There have been six deaths during December, viz.—N. A. Singer's C., L. G. Innes's E. (both ovarian disorders), H. Chaille, Mrs. R. Hodge, E. F. Dennis's A., and T. Gaydon's F. died from heat apoplexy. There were 15 birds requiring attention owing to the excessive heat on the 28th, when the shade temperature on the poultry plant registered 110 degrees. Lavish watering of the pens had to be resorted to in order to give the birds a little comfort. Several nights during the month were extremely close, and very heavy breathing was quite audible whilst walking past the pens. The following are the individual records:—

Competitors.	Breed.	Dec.	Total.
	LIGHT BREEDS.		
*G. Trapp	White Leghorns ...	133	1,179
*Haden Poultry Farm	Do.	129	1,173
*O. W. J. Whitman	Do.	121	1,156
*J. D. Newton	Do.	130	1,130
*J. M. Manson	Do.	118	1,128
Geo. Lawson	Do.	126	1,127
*Quinn's Post Poultry Farm	Do.	133	1,124
*J. J. Davies	Do.	122	1,120
*N. A. Singer	Do.	134	1,108
*Dr. E. C. Jennings	Do.	136	1,107
*W. Becker	Do.	130	1,104
*L. G. Innes	Do.	124	1,086
*E. A. Smith	Do.	135	1,070
*T. Fanning	Do.	147	1,070
Mrs. R. Hodge	Do.	126	1,066
*G. Williams	Do.	128	1,063
*J. H. Jones	Do.	125	1,060
*H. Fraser	Do.	121	1,054
*W. and G. W. Hindes	Do.	106	1,045
*Mrs. L. Anderson	Do.	127	1,037
B. Chester	Do.	129	1,029
*S. McPherson	Do.	102	1,022

EGG-LAYING COMPETITION—*continued.*

Competitors.	Breed.	Dec.	Total.
LIGHT BREEDS—*continued.*			
*Thos. Taylor	White Leghorns ...	131	1,009
S L. Grenier	Do.	117	1,009
*Mrs. L. Henderson	Do.	124	1,004
*Range Poultry Farm	Do.	107	984
Thos. Eyre	Do.	102	978
*S. W. Rooney	Do.	81	958
B. Chester	Do.	112	935
Avondale Poultry Farm	Do.	97	925
H. P. Clarke	Do.	100	905
W. Morrissey	Do.	82	901
R. C. J. Turner	Do.	93	896
C. Langbecker	Do.	119	895
S. Chapman	Do.	123	892
C. M. Pickering	Do.	108	868
H. A. Mason	Do.	109	854
W. D. Evans	Do.	101	846
C. H. Towers	Do.	80	845
A. J. Andersson	Do.	82	818
C. A. Goos	Do.	116	816
Miss E. M. Ellis	Do. Pen with	drawn	583
HEAVY BREEDS.			
*R. Burns	Black Orpingtons ...	124	1,149
*E. F. Dennis	Do.	114	1,142
*A. Shanks	Do.	110	1,126
*R. Holmes	Do.	101	1,123
*E. Morris	Do.	108	1,077
*A. Gaydon	Do.	105	1,074
*D. Fulton	Do.	87	1,067
*W. Smith	Do.	93	1,025
H. M. Chaille	Do.	96	1,018
*J. A. Cornwell	Do.	128	1,017
*A. E. Walters	Do.	99	1,013
*E. Oakes	Do.	109	1,002
*T. Hindley	Do.	102	975
J. E. Smith	Do.	78	952
Parisian Poultry Farm	Do.	113	952
*R. B. Sparrow	Do.	101	951
Mrs. G. H. Kettle	Do.	95	937
R. C. Cole	Do.	96	918
G. Muir	Do.	82	902
*E. Stephenson	Do.	81	851
*J. E. Ferguson	Chinese Langshans ...	75	847
*Nobby Poultry Farm	Black Orpingtons ...	81	847
G. Flugge	Do.	91	743
Total	...	7,035	64,607

* Indicates that the hen is being single tested.

DETAILS OF SINGLE HEN PENS.

Competitors.	A.	B.	C	D.	E.	F.	Total.
LIGHT BREEDS.							
G. Trapp	20[illegible]	196	209	186	201	181	1,179
Haden Poultry Farm	218	165	217	205	180	188	1,173
O. W. J. Whitman	185	181	213	194	173	210	1,156
J. Newton	216	180	194	139	197	204	1,130
J. M. Manson	179	198	205	190	181	175	1,128
Quinn's Post Poultry Farm	209	194	192	184	163	182	1,124
J. J. Davies	198	189	188	186	185	174	1,120
N. A. Singer	189	169	185	212	182	171	1,108
Dr. E. C. Jennings	157	210	173	171	185	211	1,107
W. Becker	193	187	203	183	159	179	1,104
L. G. Innes	187	178	190	200	206	175	1,086
E. A. Smith	180	157	195	175	178	185	1,070
T. Fanning	91	192	188	196	205	198	1,070
G. Williams	171	180	181	175	202	154	1,063
J. H. Jones	177	174	182	190	184	153	1,060
H. Fraser	147	179	190	187	184	167	1,054
W. and G. W. Hindes	169	181	149	188	174	184	1,045
Mrs. L. Anderson	200	186	185	165	151	150	1,037
B. Chester	178	151	182	169	177	172	1,029
S. McPherson	201	202	91	127	211	180	1,022
Thos. Taylor	193	176	139	183	160	158	1,009
Mrs. Henderson	150	165	177	161	187	164	1,004
Range Poultry Farm	120	165	176	196	158	169	984
S. W. Rooney	140	136	183	144	176	179	958
HEAVY BREEDS.							
R. Burns	190	176	222	171	202	188	1,149
E. F. Dennis	206	178	175	208	176	199	1,142
A. Shanks	162	194	174	221	155	220	1,126
R. Holmes	174	199	192	179	198	181	1,123
E. Morris	182	185	191	147	187	185	1,077
A. Gaydon	183	221	181	155	139	195	1,074
D. Fulton	184	187	172	194	92	238	1,067
W. Smith	110	213	188	181	171	162	1,025
J. Cornwell	173	196	177	120	159	192	1,017
A. E. Walters	156	170	156	187	147	197	1,013
E. Oakes	152	204	169	94	189	194	1,002
T. Hindley	179	196	162	174	123	141	975
R. B. Sparrow	177	107	178	156	146	187	951
E. Stephenson	168	133	159	150	125	116	851
J. E. Ferguson	108	149	110	135	191	154	847
Nobby Poultry Farm	160	221	83	224	139	20	847

CUTHBERT POTTS,
Principal.

THE DWARF COCONUT.

With reference to our article on the dwarf coconut, published in the December issue of the Journal, we are indebted to Mr. Charles Booth, Stadium, Mitchell, for the information that several excellent specimens, which bear prolifically every year, having a length of trunk of about 9 feet (inches ? Ed.) are to be found in the village of Kerepuna, in the Central Division of Papua. The nuts are retailed by the owners at 1s. per nut for seed. They have quite a good thickness of kernel and are of a bright orange colour. Mr. Booth added that he had never heard of any of the seed planted coming to anything, but made the experiment of planting several of the nuts, but they all "missed."

Tropical Industries.

THE QUEENSLAND SUGAR INDUSTRY.

The "Queensland Sugar Journal," which always gives to those interested in the sugar industry and in other matters connected with agriculture very useful information on these subjects, publishes the following *resumé* of the past year's work in the various sugar districts:—

"The 1920 sugar season is now practically at an end, and the figures of the Government Statistician and those of the General Superintendent of Sugar Experiment Stations practically agree in estimating the output at something over 163,000 tons of raw sugar. This is slightly better than the yield for the previous year; but very far short of the 1917 figures, which reached 307,714 tons. It has to be remembered, however, that the past season's crop has suffered under several disabilities of a very severe nature. In the first place, the drought of 1918-19 broke at too late a date in most of the districts to admit of anything like normal growth in the cane; also, the blighting influence of the restricted price of sugar since the war commenced, together with heavy losses both from cyclone and frost, were all operating against the success of the crop just harvested. Happily, the rain came in time to afford material relief in most districts, and the crop was distinctly better than was anticipated a few months ago. Had plantings been larger, or in other words had the relief in prices come in 1919 instead of well into 1920, there would have been a still better result, notwithstanding the dry weather. Most of these disabilities have been removed, and the prospects are just now brighter than they have been for a number of years past.

"The Secretary of the Australian Sugar Producers' Association, Mr. G. H. Pritchard, returned just before Christmas from one of his periodical visits to the Northern sugar districts. At every place visited—and his tour covered the whole of the areas from Mossman down to the Herbert River—the crops were looking exceedingly well, and the prospect in all cases was that the sugar production for 1921 will show a very substantial increase on that of the season just closed. It was evident that every effort is being made on the part of individual farmers towards implementing as far as may lie within their power, the promise made by the delegation which waited on the Prime Minister early last year, that, in view of the increased price offered for their sugar, they would endeavour to secure larger crops next year, in order fully to supply the sugar requirements of the Commonwealth. We may confidently anticipate, that should no unforeseen adverse circumstances arise, there will be a very largely enhanced tonnage of sugar available by the close of the year now current. Arrangements are being made at all the mills of the Colonial Sugar Refining Company to enlarge the supply of cane available; and as a further evidence of confidence in the future of the industry, it may be noted that the Mulgrave Central Mill Company have decided to spend £130,000 in improving their mill and in extending the area from which its cane supplies are drawn. To give effect to this, an adjustment of areas has been agreed to amongst the suppliers to the Hambledon and Mulgrave Mills, with a view of shortening the haulage where possible, and so facilitating the harvesting operations. Other mills have various improvements and additions in hand; and it may be assumed that the annual overhaul both of mills and tramlines will this year be unusually thorough, in order to avoid as far as possible the risk of breakdown or other delays.

"Mr. Pritchard found also that in all the districts visited, farmers were doing their best towards acquiring the latest labour-saving implements; and it is a feature worth mentioning that Queensland is by no means behind other cane-growing countries of the world in the invention and use of cane planting and cultivating machinery. Indeed, we are distinctly in the van in these matters, as inquiries from various directions concerning apparatus in use here have sufficiently proved. It was also made evident that where the cane farmer is able to finance the proposition, he is in very many instances strongly disposed towards the purchase of farm tractors. We are safe in asserting that, in spite of all the adverse conditions of the past few years, there are at present far more tractors in use in the Northern canefields than in any similar area devoted to other crops within the State, and probably also one might go further and say—within the Commonwealth. Numerous demonstrations have been given by the agents of various farm tractors, and there are some half-dozen makes of tractor now in practical use, and being thoroughly tested out as to their adaptability to the work of the canegrower. It may be said that as a rule, the users of these tractors speak very highly of the value of mechanical power as against horse teams in the field.

"Another noticeable and altogether satisfactory feature coming under Mr. Pritchard's notice wherever he went, was the desire of the growers to use fertilisers in improving the tonnage and richness of their cane, together with other up-to-date methods which have proved themselves in the experience of the different districts. The element of quality in determining the commercial value of the cane is more fully recognised than hitherto; and apart from the seasonal influences at work, it has been noticeable during the past year that varieties of cane are becoming increasingly popular, not so much on account of heavy tonnage as of the c.c.s. content. In the Mossman particularly, this year, the results thus attained have been specially good; and attention to this phase of their business cannot but prove highly advantageous both to the grower and to the industry in general.

"On the whole, notwithstanding a number of unfortunate exceptions, the season has passed with considerably less in the way of labour troubles than we have been accustomed to in recent years. Labour has everywhere been plentiful, and men, returning year after year to take advantage of the highly favourable terms offered them in Queensland canefields, are not as a rule disposed to waste their time and opportunities by senseless strikes over minor details. At the same time, especially towards the close of the season, the burning of cane has been far too general. Of course, in some instances, this is done with permission, in order to facilitate operations; but there have been a number of instances where cane has been burned contrary both to the wishes and to the financial interests of the grower. In these cases the object has been all too apparent in the demands immediately afterwards made for extra cutting rates considerably in excess of the award which makes full provision for crops in any sense abnormal, such as those on loggy or stony ground, or where the cane has become badly tangled. Unfortunately this practice on the part of the cutters has become far too common in the North; and unless means are found of minimising the evil, it will inevitably prove an ever increasing source of mischief all round.

"Mr. Pritchard emphasised the improved tone and happier outlook of cane farmers in all the districts visited, though in view of losses suffered in the past, and the unjustifiable holding down of prices since 1914, there is manifest a feeling that the price now paid for raw sugar is not in any sense to be regarded as excessive. As already shown, it has been sufficient to greatly encourage cane production; and provided the labour factor in the industry can be induced to take a reasonable view of what, after all, are mutual interests, there is every reason for a hopeful view of the industry. In spite of all drawbacks, and many cases of individual hardship, the past season has been such as to materially assist many of the growers; and with anything like favourable weather conditions from now on, there should be a very substantial backing within the next twelve months to our earnest wish for all our readers that they may enjoy the blessing of A HAPPY NEW YEAR."

THE NORTHERN AND CENTRAL SUGAR DISTRICTS.

The General Superintendent of the Bureau of Sugar Experiment Stations has received the following report from the Field Assistant, Mr. J. C. Murray:—

"Throughout the month cane areas at Babinda, Gordonvale, Hambledon, and Bundaberg have been visited.

"BABINDA.

"The cane returns from Babinda this year have surprised even the most optimistic of six months ago. The mill has been going in full swing since the beginning of the season, and there does not seem much chance of finishing before the end of January. Good density and tonnage per acre have been a gratifying feature this crushing, and judging by the flourishing appearance of the young plant cane, and the areas planted, the next season should be a record one for Babinda. Everywhere the farmers are busy, either cultivating or clearing and burning off. A good deal of new land is being reclaimed from the scrub out the Russell River way, where the soil is exceptionally rich and should pay the farmers well for the heavy work required to clear the dense undergrowth and big trees. The land on the river and at Moolibah is a heavy deep loam, very rich in vegetable matter and free to a great extent from the acidity that usually prevails in soils that have been growing cane for any length of time.

"Badila grows exceptionally well here, and many farms look a picture. Cane pests up to the present are not giving the growers any trouble, although they are present in patches. With regard to the latter, there has lately been an emergence in the North, and in some places the beetles are numerous, but whether it is from the fact that the Moolibah and Russell River soils have abundant organic matter, or from other causes, very little damage has been done by these pests.

"Immediately round Babinda the growers are actively cultivating, and, in addition to Badila, Green Goru (24 B) is making a good showing. It is probable, though, that canes like Q. 855, Hybrid No. 1, Q. 813, and D. 1135 would also be worth planting on these areas more extensively than is being done at present.

"Most of the areas in the vicinity of the mill are small, but Dr. Knowles is preparing to plant between 300 and 400 acres. Considering the expense of clearing and burning, &c., he is to be commended for his enterprise. This gentleman also takes an active interest in the latest methods of cultivation, fertilising, and variety experiment. In fact, the interest taken by the rank and file of the growers in scientific agriculture is one of the most pleasing features in the North, and the result is noticeable wherever one goes, in farm innovations and different experiments being carried out on a small scale.

"With regard to noxious weeds, summer grass causes the hoe to be frequently used. No other grasses, indigenous or introduced, are giving much trouble. There is a general feeling amongst the growers that the borer pest has been greatly checked by the parasite flies recently released by Dr. Illingworth. From observations made there is every reason to believe this is so.

"In contrast with other places visited farther South, the leaf of the cane in the Babinda district is healthy, and gumming was not found. Keeping this before them, the growers, if they wish the healthy state to continue, require to exercise care in plant selection, and carefully supervise planting, if done by hired labour.

"GORDONVALE.

"The prospects for the industry are very bright at Gordonvale. The farmers have rich soil to work on, and it is fairly easy to cultivate and drain. The milling accommodation and the tramline are adequate so far, and general satisfaction prevails as the result of this year's run. Next year a record crop is expected. Badila is the staple cane growing, and the strike of plant cane is very satisfactory. The grub pest is a considerable problem, and in addition to using arsenic the growers are endeavouring, where possible, to change their varieties, using more highly resistant canes like D. 1135 on the more badly infested fields. Good results with regard to poisoning are being obtained with carbon bisulphide. Up to the present the commercial application of this chemical has been the difficulty, but a Mr. Dawson of Gordonvale, has invented and tried a machine which seems to be expeditious and economical in this respect. Any growers wishing to get particulars of this implement could get in touch with this gentleman by writing direct to him, or through the secretary of the local Farmers' Union.

"Besides Badila and D. 1135, Clark's Seedling and Malagache are making a good showing, although, on some of the older farms, a good deal of mottling is present in the H.Q. 426. This may be due to a variety of causes, but still, when next the farmers are planting they should endeavour to select cane that has a healthy leaf, and where stem is free from cracks and small roots.

"The careful selection and continuous changing of plants is a matter all farmers ought to concentrate on. It will pay them handsomely.

"A considerable amount of liming is being done on the Gordonvale farms. This is a good feature. More green manuring could also be gone on with, especially on some of the higher lands. Blood and bone manure is being used as a fertilizer by numbers of the farmers, with good result. Patches of poor soil are evident at intervals on some of the plantations, but it is likely these are due to lack of drainage and a consequent souring of the affected patches. The draining and livening of such as these, and the planting of a quickly growing cane with a good root system, such as Q. 813, would perhaps help the farmer over the difficulty. Otherwise an analysis would determine for him the artificial manures he would require to bring it up to standard.

"The cultivation done by farmers is of good standard, although some growers could be more careful in working the young plant crop. The best implement is one that creates a good tilth, but has no tendency to invert the soil particles or displace the young roots. The 'Bottom King' is a useful implement for a farmer to possess, also the 'King cultivator.' Mechanical traction is coming into vogue a good deal in all the Northern districts, being a considerable saving in horse flesh to the farmer.

"HAMBLEDON.

"Milling operations were still in progress at Hambledon, and a number of the growers had fair quantities of cane to get in. The farmers right through have had a very satisfactory run and expect a still larger crushing next season. As the seasons progress, more scientific farming is being gone in for in the way of studying fertilizers; the most efficient farming machinery, and soil conditions generally are being given careful consideration by the growers. A considerable amount of liming and green manuring has been done in the last twelve months, and in addition to this great activity is at present noticeable in connection with the combating of the grub pest. Arsenic is being used freely, in some cases up to as high as 200 lb. weight to the acre. Growers, however, ought not to take the treatment of some of the badly-infested Cairns soil as an absolute guide, and for ordinary purposes it is not necessary to apply more than 60 lb. per acre.

"With regard to the behaviour of varieties, Badila is still the most satisfactory from the farmers' point of view.

"Mr. Walker, of Hambledon, has a small quantity of 'Pompey,' recently introduced by the C.S.R. Company, and, judging by its healthy, erect appearance and vigorous stool, it should be a cane worth looking after.

"Clark's Seedling is giving satisfactory returns, but appears to do better on the loams than the volcanic soils, ratooning poorly on the latter. This cane, if not carefully selected, will probably become very poor in a few years, owing to its susceptibility to attack by disease through the medium of the leaves. Good selection and rotation of crops will go a long way towards keeping this cane up to standard.

"After a crop that has been diseased is taken off, sometimes the bacteria that was the cause of this disease remains in the soil. That is why it is a good idea to fallow after a poor crop, if disease has been the cause of the poverty, or plant some immune crop, such as cowpea or Mauritius bean. D. 1135 is still being planted in considerable quantities, and being a highly-resistant cane to ordinary parasitic attack, is a useful variety to plant on grub and borer-infested areas.

"BUNDABERG (Woongarra and Barolin).

"Since last visiting these areas splendid rains have fallen, and the plant crop looks well. Many of the farmers are busy ploughing, preparatory to an early start at the planting, while a considerable amount of labour is being employed in the field keeping down the weed growth. The chances for next year are very good, provided an ordinary amount of rain falls. The borer is not quite so numerous as three months ago, although there will probably be another outbreak about next May. It is likely the moths are now flying, although none have been observed. This is difficult, seeing that they mostly move at night and bide in the foliage during the day time. The farmers on these areas are doing more green manuring than hitherto. This is a good feature, especially in view of the fact that grubs are numerous in places, and the more vegetable matter in the soil, when these parasites are present, the better.

"With regard to varieties, Badila, 1900, H.Q. 426, and D. 1135 are making good headway. A variety known as Shahjahanpur recently distributed from the station has made good headway, and some grown by Mr. McCrackin, of Rubyana, has outstripped in growth all the other canes. This variety is a vigorous striker, with a good root system, stools well, and grows in an erect manner. It has a good sugar content and is highly resistant to frosts. From a farmer's point of view, the little of this variety they have is worth keeping and replanting.

"The weather has been hot here this last week, baking the soil and making it unpleasant for the men to work, as many go barefooted while hoeing. Boots are very unsuitable for working in a red volcanic soil, and the evolution of a suitable foot-covering for farm labourers would be a boon in the hot weather. A fair amount of mechanical traction is in evidence, more especially the 'Caterpillar' type.

"The farmers are at present well supplied with water and grass, and live stock and leguminous crops look well."

COPRA DRYING.

As is generally known, the object of copra-drying is to get rid of the water from the coconut, or, at least, as much of it as will prevent the formation of mould and the consequent deterioration and loss of oil.

When the lighter parts of the oil are lost, the remainder is of inferior quality, oleac acid is formed, and the oil becomes rancid.

Mr. W. E. Shoobridge, chairman of the Saaz Patent Drying Process Co. Ltd., of Hobart, Tasmania, who passed through Port Moresby on the Morinda to Samarai, and who will be returning by that vessel, claims that his company's process fulfils perfectly the conditions of drying copra at a low temperature under perfect control, to a degree, and, therefore, can be adjusted to the exact temperature to evaporate moisture, and not to volatise the oil, leaving the copra so dry and cool that it will not absorb moisture and therefore will maintain its quality and quantity. Mr. Shoobridge carries samples of copra in his pocket which he says were dried by his process six years ago. They are of a pure white colour, are of good odour, and certainly impress one as being more appetising than some of the samples we have seen arriving in Port.

Briefly, the Saaz process consists in passing the air over steam pipes and then being driven through the machine by a blast fan, and, where necessary, in hot damp air, to be passed first over brine pipes to condense some of the moisture before being heated by the steam pipes. The copra is laid out on broad bands of wire netting, passing round rollers, and driven by link belt chains. Several floors can be placed one over the other. There are five floors, each section containing 3,000 superficial feet of drying surface.

For handling it is proposed that the nuts should first be cut clean in halves by a thin circular saw, the halves passed under a jet of water to wash them clean, then placed on an elevator and taken up to the floors and placed face down. In about eight hours the nuts are sufficiently dried to leave the shell and can be easily taken out, and the five floors placed on the lower one and the four top floors be reloaded. It is estimated that from 2 to 2½ tons of copra can be dried in each section in each twenty-four hours. An analysis of the copra dried under this process showed moisture 5.30, oil 67.10, and oleac acid .263. The copra was dry and would not show an oil-mark when pressed on absorbent paper, but when raised to a temperature of 104 deg. F., showed a distinct oil-mark and at 180 deg. the oil was running freely from it. On being exposed to damp air for a week it had rather lost than gained moisture. No oil was lost in the drying, and it retained its full flavour.—"Papuan Courier."

Forestry.

DESTROYING THE BITTER BARK TREE.

In reply to an inquiry as to the eradication of bitter bark, by Mr. B. Henicke, of Mount Larcom, the Government Botanist (Mr. C. T. White) has replied as follows:—

Bitter bark (*Alstonia constricta*), which suckers so freely, might be poisoned with an arsenical solution like other standing timber.

Standing trees might be "frilled" by making a succession of downward axe cuts right round the tree into the sapwood and each cut overlapping the other so as to leave no unsevered bark or sapwood for the conveyance of food-containing sap for the tree. The solution should now be freely poured into the frill with a watering-can (without a rose) or old teapot or kettle.

Bitter bark suckers freely, and the eradication of sucker growths in paddocks or cultivation areas is more difficult; the suckers might be cut down, however, and a solution painted over the cut stump with a brush or swab. They also, of course, can be grubbed out, and constant grubbing will exhaust the old roots eventually; an arsenical solution poured round the grubbed plant would no doubt be effective, but would poison the ground for some time for all other plants.

A suitable solution is—Arsenic, 1 lb.; washing soda, 3 lb. (or caustic soda, 2 lb.); water, 4 gallons. The soda is necessary to help the arsenic dissolve, and Mr. G. B. Burrowes, Assistant Inspector of Agriculture in New South Wales, recommends the addition of whiting, because the whiting dries white and shows which trees or plants have already been treated. If ordinary washing soda is used, boiling will be found necessary to bring about complete solubility, but, if caustic soda, the heat generated does away with the necessity of boiling.

It may be worth mentioning, perhaps, that the bark of *Alstonia constricta* is a useful tonic, and is official in the British Pharmacopœia, but the demand is very limited. A solution has been used, I believe, with some success as a tick wash.

Dairying.

THE INFLUENCE OF BARLEY ON THE MILK SECRETION OF COWS.

Amongst the standard feeds for horses, cattle, sheep, and pigs in the United States of America, barley is much in evidence, and is frequently used as a part of the grain ration for dairy cattle and poultry. Some dairy farmers have a prejudice against the use of this cereal for milch cows, who believe that it has a tendency to dry up the cows, but the nutritive effect of the cereal, and its high value for stockfeeding, are otherwise generally recognised by farmers. As to its influence on the milk secretion of cows in the United States University dairy herd, this has been studied during the past few years, and the results are thus summed up in the following pages by Messrs. F. W. Woll, head of the Animal Husbandry Division of the College of Agriculture, Berkeley, California, and E. C. Voorhies, of the same division:—

EXPERIMENTS WITH GRADE HOLSTEIN.

In taking up this question for study, it was decided to feed barley as the sole concentrate to a good type of a dairy cow for several lactation periods, in addition to alfalfa hay or alfalfa and silage. The plan was to feed barley heavily during this time, up to the limit of the cow's acceptance, so as to secure as conclusive evidence as possible with regard to the cumulative effect of this cereal and this method of feeding on the milk flow. The cow selected for this experiment, a grade Holstein named Hannah, had been in the University dairy herd for a year previous to the trial. She was purchased by the University in July, 1913, was about four years old at that time, and weighed slightly over 1,200 lb. She dropped a bull calf on 16th July, shortly after her arrival in the herd. Hannah is a strong, healthy animal; she has always been in the best of health and condition while in the herd, and has repeatedly been placed on experiments which did not interfere with that here outlined. Her feed record for the year prior to the barley feeding is complete up to 1st January, 1914, so far as kinds of feeds are concerned. Since that time, the amounts of feed eaten are known for her as well as all other cows in the University dairy herd.

The milk yielded by the cow was weighed throughout the lactation period, and weekly composite samples of the milk were taken and tested for total solids and butter-fat. The effect of the grain feeding on the body condition and the general health of the cow was also carefully noted. Table I shows the production and the feed consumed by this cow during five consecutive lactation periods, 1913-18. During the middle three years, 1914-17, she was fed barley as a sole concentrate, and during the first and the last year of the trial mixtures of common grain feeds, the roughage fed throughout the trial being alfalfa hay or green alfalfa, and Indian corn or sorghum silage.

TABLE IA.

PRODUCTION OF HANNAH, 1913-18.

Year	Dates of calving	Days in milk	Lbs. milk	Lbs. butterfat	Per cent butterfat	Ave. body weight lbs.	Character of grain feed
1913-14	July 16, 1913	274	8,246.2	269.11	3.27	1,231	Mixed
1914-15	May 27, 1914	350	12,806.1	432.77	3.37	1,276	Barley
1915-16	June 30, 1915	308	11,859.5	373.11	3.15	1,349	Barley
1916-17	June 14, 1916	323	9,605.4	315.74	3.29	1,439	Barley
1917-18	July 23, 1917	317	9,535.5	325.06	3.41	1,445	Mixed

TABLE IB.

FEED CONSUMPTION BY HANNAH PER LACTATION PERIOD, IN LBS.

Feeds	1913–14*	1914–15	1915–16	1916–17	1917–18	Average 1914–17 (barley only)
Alfalfa hay	..	4,674	4,551	5,482	4,931	..
Alfalfa, green	..	6,836	5,331	2,378	855	..
Indian corn, green	..	317	359	..	195	..
Indian corn, silage	..	1,570	6,537	6,564	8,591	..
Sorghum silage	..	3,437	..	..	1,587	..
Sudan grass silage	..	..	..	650	..	..
Barley	..	3,059	2,917	2,350	483	..
Wheat bran	..	..	..	..	292	..
Oats	..	..	..	..	24	..
Cocoanut meal	..	..	..	..	336	..
Dried beet pulp	..	..	..	..	1,015	..
Cotton seed meal	..	..	..	..	46	..
Total concentrates	..	3,059	2,917	2,350	2,917	2,775
Average daily grain	..	8.7	9.5	7.3	6.9	8.5
Feed units, roughage	..	4,177	4,156	4,283	4,308	4,205
Feed units, concentrates	..	3,059	2,917	2,350	2,197	2,775
Total feed units	..	7,236	7,073	6,633	6,505	6,980

The table shows the dates of freshening during the progress of the experiment; days in milk for each lactation period; production of milk and butter-fat, with average per cent. of fat, body weight, and feed consumed. It will be seen that Hannah's production during the first lactation period on barley was increased by about 4,560 lb. of milk and 164 lb. of butter-fat over that of the preceding period—an increase of 55 per cent. and 61 per cent., for milk and butter-fat respectively. This increase was, of course, primarily due to the heavy grain feeding practised during this year. Up to March, 1914, Hannah received rough feeds only, alfalfa hay and corn silage, to which a daily allowance of 5 lb. of mixed grain feeds (barley, oats, linseed meal, and cocoanut meal) was added after 5th March. During the greater portion of the first year of barley feeding, on the other hand, she received 10 lb. of barley daily, and 7 to 8 lb. during the last four months of the lactation period. While she was offered and ate as much as 15 lb. of barley daily for a few weeks during the following lactation period, it was found that 10 lb. a day was ordinarily her limit, and this amount was rarely exceeded even at the flush of her production when she produced over 2 lb. of butter-fat daily. She remained in milk considerably longer this lactation period than during the preceding year, viz., 350 days, and her body weight was, on the average, 45 lb. heavier during the barley feeding than while on mixed grain the preceding period.

During the following two lactation periods the feeding of barley as exclusive grain feed was continued; the amount of milk produced during these two periods was somewhat lower than during the preceding year, but considerably above the yield for the mixed grain period, and the same holds true also for the production of butter-fat during these periods. If the average production by the cow during the three lactation periods when she was fed barley as sole concentrate be compared with the corresponding averages for the preceding and the following periods when mixed grain was fed, it will be found that her milk production during the barley periods was 2,533 lb., or 28.5 per cent., higher than when she was fed mixed grain, and her average production of butter-fat was increased by 75 lb., or 25.3 per cent. Her lactation periods during 1914-17 were thirty-one days (10 per cent.) longer, on the average, than during the mixed grain feeding, and she weighed an average of 29 lb. heavier during the intermediate periods than when fed mixed grain rations.

The average yields of butter-fat by the cow for each day in milk during the five lactation periods, 1913-18, were .98, 1.23, 1.21, .98, and 1.03 lb., the average for the barley period being 1.14 lb., which is 13 per cent. above the average for the mixed grain period. Since the amount of grain and roughage eaten during the first lactation period, 1913-14, is not known, no definite comparison can be made between the feed consumption and the dairy production of the cow during the five-year period. However, as grain was fed only during the latter part of the first lactation period,

* Amounts of feed eaten known only during latter half of lactation period; fed alfalfa (green or hay), corn silage and concentrates (barley, oats, bran, linseed meal, cocoanut meal, in varying mixtures) during the year.

the amount of mixed grain eaten, and the total or daily feed consumption must have been considerably lower this period than during the first year of barley feeding. The average amount of barley eaten daily for the period 1914-17 was 8.5 lb., against 6.9 lb. of mixed grain the following year. The average number of feed units in the barley rations was 6,980, or 7.3 per cent. above that furnished in the last mixed grain period, 1917-18. It seems evident, therefore, that the increase in production during the barley periods, as compared with the yields on mixed grain feeding, came largely as a result of the heavier rations fed, especially of grain, during the barley periods.

There is nothing in the results obtained on the experiment with this cow that would indicate that an exclusive or even a heavy, long-continued feeding of barley has any deleterious influence on the milk secretion of the cow; on the contrary, the production was greatly increased on barley feeding; her lactation periods were about a month longer, on the average; she weighed heavier when fed barley than when receiving mixed-grain rations, and she was in perfect health and maintained an excellent appetite throughout the whole feeding period. The effect of the exclusive barley feeding was therefore beneficial in every respect.

* The explanation of the belief of some farmers that the feeding of barley tends to dry up milch cows is probably to be sought in the fact that such a result has frequently come when cows have been turned out on barley stubble, or fed coarse barley hay only, with no additional feed. The amount of feed they are thus able to obtain, especially on stubble pasture, is not, as a rule, likely to furnish sufficient nutriment for the maintenance of a fair dairy production, and a decrease in the milk flow naturally results, along with a gradual drying up of the cows. The barley is blamed, while it is the system of feeding that is responsible for the result observed. Milch cows producing a good mess of milk cannot be expected to pick up sufficient feed to maintain their production on barley stubble alone, but fed alfalfa hay in addition, or better still, alfalfa and some succulent feed, like silage or roots, they will give good returns for the feed that they find in the stubble field.

In view of the results and discussions presented in the preceding, there is every reason to utilise barley for feeding dairy cows when it is not needed for human food and whenever its price is not too high in comparison with other concentrates to make it an economical stock feed.

PAPER FROM BAGASSE.

A FORMOSAN ENTERPRISE.

In Formosa they have succeeded in establishing a successful paper-making industry, with bagasse as the raw material.

In 1915 they turned their attention to the utilisation of bagasse, which up to that time was exclusively used for fuel, as a material for paper, and having been convinced of the promising future of the bagasse paper industry as well as the many advantages of a process operated as a subsidiary industry of sugar manufacturing, they carried the scheme into execution, investing a considerable amount of capital in it.

Regarding the encouraging prospects which this industry had in store, there is no room for the slightest doubt. In Java and in America, also, interested parties are making extensive studies of the subject. For example, Messrs. Fluto & Co., of New York, some time ago created a special department in their office for its study, and are now making various investigations in conjunction with many problems relative to sugar-making.

In conclusion, it may be of interest to add that well-made bagasse paper possesses several valuable qualities. It is far more durable and more nearly water and moisture proof than papers made from other materials. The results of the scientific and practical tests conducted clearly show that the bagasse paper proved twice as moisture-proof without the application of any treatment for this purpose as ordinary wrapping paper made in Japan proper. These admirable characteristics of bagasse paper are natural qualities, and when advantageously employed will greatly extend its uses beyond wrapping and printing purposes.—"The South African Sugar Journal."

* It is believed by some farmers that feeding smutty barley will tend to dry up milch cows. There is, however, no definite evidence to this effect, although the danger of feeding considerable amounts of smutty grain to any kind of stock, and especially to pregnant females, is generally recognised.

Entomology.

CANE GRUB INVESTIGATION.

The General Superintendent of the Bureau of Sugar Experiment Station has received the following report upon Cane Grub Investigations, from the Entomologist, Dr. J. F. Illingworth:—

Splendid rains have fallen during the past month, and conditions could not be better for crops. Naturally, the days are somewhat oppressive in summer in this humid climate, but it is just what the cane requires; one can fairly see it grow. If we escape a cyclone, there is every promise that the cut next season will be a top-notcher.

Cane beetles began emerging on 18th November here, yet I am pleased to report that they have not appeared in excessive numbers. Fortunately, the Muscardine fungus and other natural agencies destroyed the vast majority of the grubs on the Greenhills Estate last season; hence there is a marked decrease in the number of beetles that came out, particularly in the fields that have been regularly infested.

Considerable attention has been given, during the past month, to a study of the biology of cane beetles in general, particularly their mating habits, egg-laying, &c. As is probably well known, the grey-backs are only one, though the most serious, of the numerous species of beetles that deposit their eggs in cane land. Hence, our investigation naturally covers all important pests of sugar-cane.

EMERGENCE OF CANE BEETLES IN THE CAIRNS DISTRICT.

It was about five days after the soaking rains beginning on 12th November that we found the first grey-backs on the feeding trees. Yet the height of the flight was not reached until about the end of the month, following the heavy downpour of 25th-27th November. *Lepidiota frenchi* began to appear immediately following the latter rain at Gordonvale, and by 10th December this species was out in considerable numbers, especially in the areas where they were troublesome last season. As is well known, this species has a two-years' life cycle, and the heavy emergences of the beetles occur in the even years—1916, 1918, 1920. *Lepidiota rothei* emerged somewhat later, for I found the first specimens mating on low bushes at dusk on the evening of 13th December.

On the other hand, *Anomala australasiae* and *Anoplognathus boisduvali* emerged in considerable numbers, following the first rains. The *Anomala* is rather peculiar in its habit of feeding on the flowers of the lantana. The fragrance which these beetles often give off is probably due to the nectar that they absorb from the flowers. The Christmas beetle (*A. boisduvali*) is very partial to blue and poplar gums; it is seldom that one finds them on other feeding trees.

The grey-backs usually go to the Moreton Bay ash, wattles, figs, bloodwood, blue gum, and even the new growth of the ti-tree and apple (*Careya*). We have made the interesting discovery that it is the custom of these beetles to feed for a brief period—a day or so—on the cane leaves, before flying away to other feeding grounds. Banana plants in the cane areas are also invariably considerably eaten.

BEETLE EMERGENCE HEAVY AT MOSSMAN.

This was once a region seriously devastated by beetles, but fortunately during the last decade the district has suffered little from these pests. Recent reports, however, state that the beetles have appeared in great numbers, which is not encouraging, yet I hope they will confine their activities to the uncultivated areas.

MATING HABITS OF *LEPIDIOTA ALBOHIRTA*.

Heretofore, we have had no definite knowledge of the mating habits of this species, due largely to the fact that the beetles favour large, tall trees, hence are too far up for easy observation. The mating activities of *L. frenchi* and *L. rothei*, on the other hand, are easily observed, for when they emerge at dusk they fly to low bushes, and even copulate while hanging on wire fences or any other available objects. The males in these species invariably slide backwards and hang head downwards, as soon as connection is secured; here they hang perfectly motionless and rigid for about half an hour, when they separate and begin feeding.

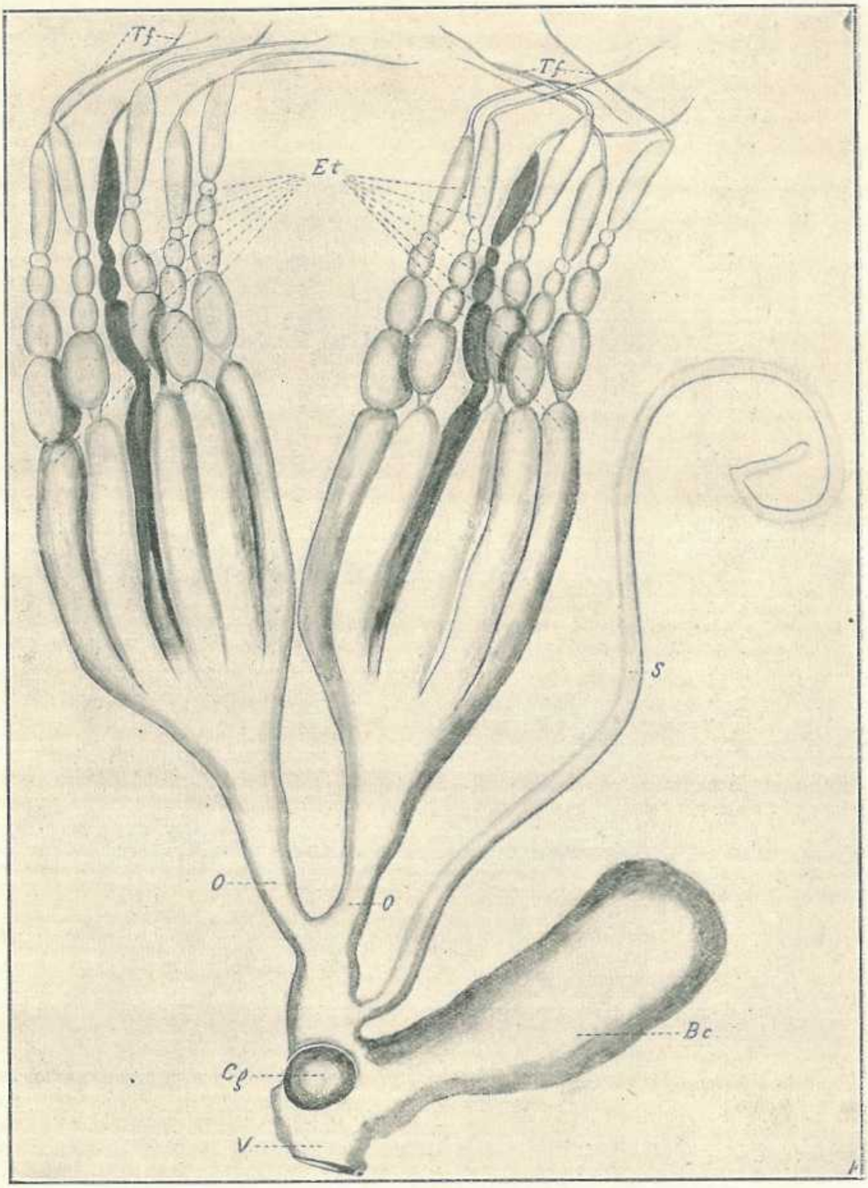

PLATE 9.—(FIG. 1) REPRODUCTIVE ORGANS OF FEMALE (*Lepidiota albohirta*) WATERHOUSE, X 5.

(Taken from beetle 3 days after emerging.)

Bc. Bursa copulatrix. *Cg.* Cement gland. *Et.* Egg tubes. *O.* Oviduct. *S.* Spermatheca *Tf.* Terminal filaments. *V.* Vagina.

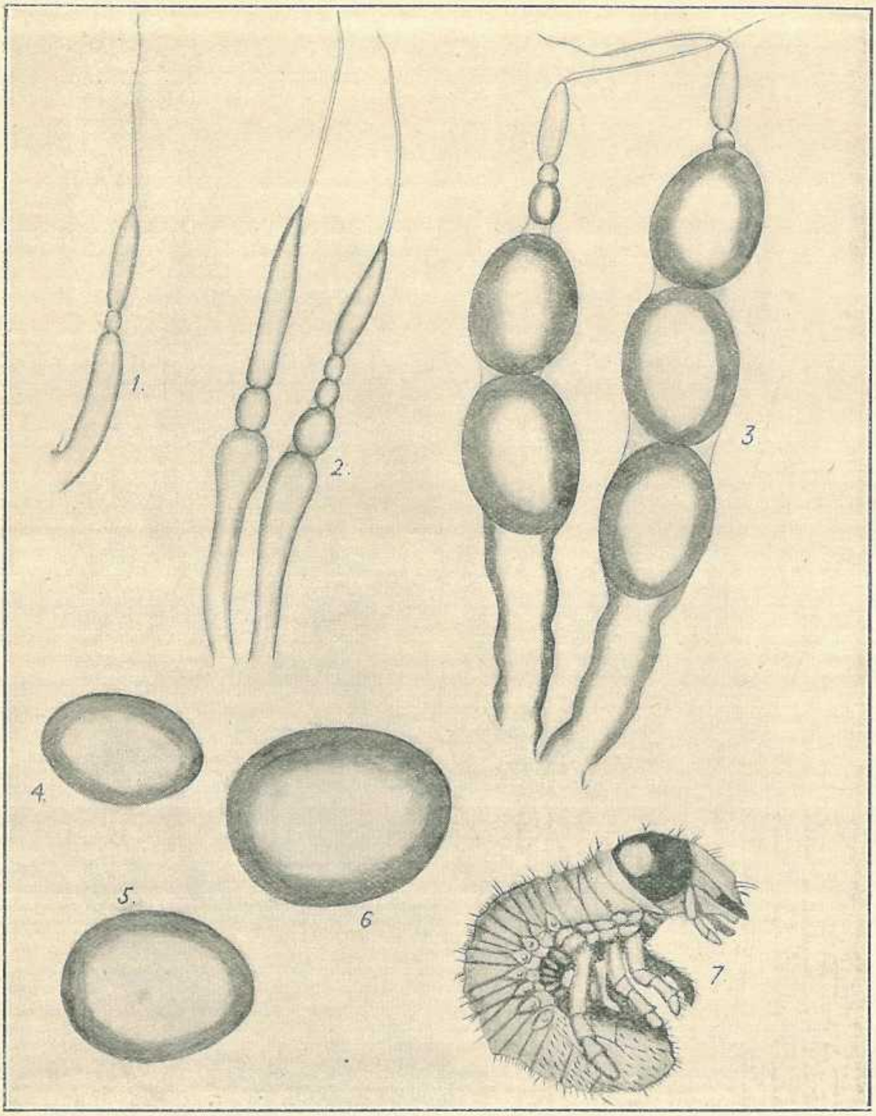

PLATE 10.—(FIG. 2) STAGES IN DEVELOPMENT OF *Lepidiota albohirta*, WATERHOUSE.

1. Egg tube from beetle before emerging.
2. Egg tubes from beetle shortly after emerging.
3. Egg tubes from beetle a fortnight after emerging, when ready to oviposit.
4. Newly-laid egg.
5. Egg taken from soil one week after laying.
6. Egg taken from soil two weeks after laying; ready to hatch.
7. Newly-hatched grub.

(All drawings magnified 5 diameters.)

This year we were fortunate in finding grey-backs on low trees near the laboratory, and observations between 7 and 8 p.m. disclosed that their mating habits did not differ materially from the other species of *Lepidiota*. It is interesting, however, to record that we have now demonstrated that all of these beetles copulate repeatedly during the period that the eggs are developing; I have even taken mating pairs when the abdomen of the female was packed full of ripe eggs, ready to oviposit. Furthermore, the males go from one female to another, as I have repeatedly observed. I have also made similar observations on the polygamous habits of the other species of *Lepidiota*.

FEEDING HABITS OF *LEPIDIOTA FRENCHI*.

This species, unlike the grey-back, apparently feeds very little during the period that the eggs are developing. Dissections of copulating beetles invariably showed the intestines empty, even when the eggs were almost fully developed. This is in marked contrast to the grey-backs, which are always packed full, from end to end, during the whole period that they are on the wing.

The fact that *frenchi* is able to develop eggs with very little, or possibly even no food, helps to explain their damage to cane far removed from any possible feeding trees. In such cases, when the beetles emerge in great numbers, they hang up on the wire fences to copulate, and are so numerous that one could gather them by the bucket-full. Here they have no opportunity to feed, and apparently go back into the ground, emerging on successive evenings to copulate, until the eggs are ready to lay. Where feeding trees were available, we have found these beetles on Moreton Bay ash, bloodwood, blue gum, and guava; but in no case was there much evidence of feeding. Then, too, when we confined the beetles in cages, they scarcely touched the leaves provided fresh each day. Furthermore, beetles placed in cages with no food oviposited as usual. The adults are able to endure this period of starvation because the grubs store up greater quantities of fat, before hibernating, than is the case with the grey-backs.

GRUB PARASITES ABUNDANT AT GREENHILLS.

As I have mentioned in former reports, the males of the *Campsomeris* wasps continue abundant, flying over the surface of the soil of the infested areas. Since we found that the males and females were in about equal numbers, when we were breeding these useful insects, we naturally conclude that every male above ground has a mate below—searching out the grubs. This is certainly encouraging; though no grey-back grubs are available at this season, there are several other destructive species, *i.e.*, those having a two years' life cycle. These will tide the wasps over until the *albohirta* grubs develop for a month or so; then the wasps will probably have all that they can do.

DESTRUCTION OF FEEDING TREES.

In the area that we cleared last year, bordering the fields on the Greenhills Estate, many suckers had grown up; to save brushing these off, I was fortunate in being able to destroy the foliage by a grassfire soon after the beetles emerged. Undoubtedly by this method some of the beetles were consumed, and it certainly is the most rapid and easy method of ridding the area of leaves on which the beetles might feed. I was pleased to see that another grub-infested area near Gordonvale has been treated in the same way very effectively. It certainly saves a tremendous amount of labour, which would be required to brush over areas that had been previously cut.

BEETLE BORER PARASITES.

Recent observations at Babinda have extended materially the known area where these friendly insects are active; undoubtedly they will soon extend to every portion of that district.

In casting about for an explanation of the remarkable success of these Tachinids at Babinda, when they have apparently failed to become permanently established in other centres, even where far greater numbers of the flies were liberated, I have come to the conclusion that the Babinda success is due solely to the fact that standover cane was available for the flies to breed in during the season that the fields were normally bare. These flies have a life cycle of about five weeks, so if they can find no borers in standing cane for that length of time, they must naturally die out. The exigencies of the case at Babinda make it impossible to harvest all of the crop, so there are inevitably a few fields throughout the district that must stand over uncut. This condition has proved a blessing in disguise, for it has been worth fully £25,000 to the district the past season, in the reduction in borer injury. Let me urge then that some small areas throughout the district here and there be left until such time that the ratoons begin to make cane again. In this way I am satisfied that the parasites will remain permanently established in spite of their natural enemies, for their rate of multiplication is tremendous—each female being capable of producing 500 or more during her life; and with a life cycle of only five weeks, one can easily estimate by geometrical ratio that the results would be so enormous that in a year they would be unthinkable. I am now satisfied that this is the main factor in maintaining the parasites permanently in any district, and it should be observed especially at the time that the first flies are liberated.

At Mossman, where the flies became so well established, they were at first liberated in the mill nursery, where much of the cane stood over during the period that other cane was cut. From this centre they have gradually become distributed in plants to every part of the district. Now that they are established they find sufficient standover cane to pass successfully the trying period when cane is usually milled.

LINEAR BUGS (*PHÆNACANTHA AUSTRALICA*).

I have called attention to the relation of these bugs to diseases of various sorts on cane leaves, but a most remarkable instance of this came to my notice on a Mulgrave River farm recently. Old ratoon cane, which was swarming with these bugs, was burned preparatory to cutting, hence many of the insects were driven across the headland into a field of young plant cane; they only extended into this about ten rows from the headland, but the leaves soon became badly blighted with tip wither, a disease which begins at the margins of the leaf and gradually extends downward; the affected portions of the blade dry up and leave a brown demarcation separating it sharply from the green midrib, which succumbs more slowly, dying backward from the tip. It was very evident that the bugs were the direct cause of this trouble, for the disease was worst in the portion of the field where the bugs were most numerous, and none of the leaves showed any trace of the disease further back in the field where there were no bugs.

THE VALUE OF SCIENTIFIC RESEARCH.

(*Extracted from Report No. 2 of the State Advisory Council of Science and Industry of South Australia.*)

THE WHEAT PESTS PROBLEM.

It is now well recognised that scientific research is of great money value, but it is not often that successful practical results follow so quickly upon research as in the recent campaign against the insect pests in the vast quantities of wheat which, owing to the war, accumulated in Australia. In this campaign South Australia played a very important part.

In the early stages of the weevil plague, at the instance of Mr. G. G. Nicholls, manager of the South Australian Wheat Scheme, a Wheat Weevil Committee was appointed, consisting of Dr. W. A. Hargreaves, Director of the South Australian Department of Chemistry (chairman), Mr. G. G. Nicholls, Mr. W. J. Spafford (Superintendent of Experimental Work, Department of Agriculture), Mr. A. M. Lea (entomologist to the S.A. Museum), Mr. E. A. Badcock (manager, S.A. Farmers' Co-operative Union, Limited), and Mr. J. T. Jackett (miller). Subsequently Mr. D. C. Winterbottom (Supervisor of Weevil Department in S.A. Wheat Scheme) was added to the committee.

The work of scientific research on the subject was taken up by the Department of Chemistry, and from experiments conducted in the laboratory of that department three practical systems of treatment were devised. These, when put into use by the Wheat Boards in the States of South Australia, Victoria, and Western Australia, resulted in saving wheat worth at least £1,500,000, besides giving very valuable knowledge on the whole problem of stored wheat which will be of service in the future.

This estimate of monetary value is an approximation. It is, however, based on the observation that the actual weevil damage was at least reduced to one-half of what it would otherwise have been. Senator Russell, chairman of the Australian Wheat Board, announced on 10th January of this year that the actual weevil damage done to the wheat purchased by the British Government during the time it was held after purchase and before shipment had been assessed at 2,200,000 bushels, and that the British Government had agreed to pay the Australian Wheat Board the sum of £522,000 to cover this loss. This was based on the contract rate of 4s. 9d. per bushel. The amount paid for losses can be taken as a low estimate of the value of the wheat saved for the British Government. During the three years 1915-16, 1916-17, 1917-18 the Commonwealth production of wheat was 404,000,000 bushels, of which South Australia contributed 98,000,000 and Victoria 136,000,000 bushels. The British Government contract was for 112,000,000 bushels, of which South Australia supplied 36,000,000 and Victoria 40,000,000 bushels, so that in round figures the British Government took about one-quarter of the Commonwealth output, and this entailed about one-third of the output of South Australia and Victoria. The savings to each of the States of South Australia and Victoria can be taken, then, to be at least an equal amount to that saved for the British Government. Hence, we arrive at the conservative estimate of £1,500,000 worth of wheat saved from destruction as the result of scientific research.

The following figures may help to demonstrate the extent of the undertaking as it affected South Australia, where the wheat had to be safeguarded from mice, weevils, &c.:—

The crop carried over from 1917-18 and in stacks was 42,000,000 bushels. The 1918 crop was 26,000,000 bushels, making a total of 68,000,000 bushels on hand. During the twelve months following only about 11,000,000 bushels were disposed of, leaving nearly 57,000,000 bushels to be carried over to 1918-19. The 1919 crop was over 20,000,000 bushels, and left no less than 77,000,000 bushels to be guarded.

Some idea of the magnitude of the work can also be gained from the following remarks made by Mr. B. A. Love, who was the Australian Commissioner for the Royal Commission of Food Supplies in London:—

"The cleaning, sterilising, and handling that had to be undertaken in Australia in connection with the wheat was without doubt the largest campaign of its sort that the world has ever had to undertake. When one considers the enormous amount of labour and the handling involved to enable the vast quantities to be cleaned, sterilised, and made fit for shipment it was truly colossal. In looking back over the work, I think we can be proud of the results of our labours. It is nice to feel, considering the enormous amount of thought and worry put into the task, that it was successful in results, efficiency, and cost. The gassing campaign without doubt saved an enormous amount of money, and enabled vast quantities of wheat to be held over until they could be treated."

The methods recommended by the Wheat Weevil Committee as the result of the scientific research carried out by the Department of Chemistry were the following:—

1. *Cleanliness.*—The weevil was recognised as a pest which was fostered by careless and dirty conditions. Cleanliness in the collection, transport, and storage of the wheat was, therefore, advocated. In storage the chief problem was to prevent contamination of the stacks from without. Hence the following precautions were enjoined:—Absolutely clean stacking sites, impervious insect-proof floors, thorough cleaning up of old stacking sites, and gutters filled with water, oil, or molasses placed around the base of the stacks to prevent access of crawling weevils. Stacks were either enclosed in hessian and then limewashed, or, wherever practicable, entirely enclosed in malthoid sheds. The malthoid sheds, first tried at the suggestion of Mr. A. M. Lea, a member of the Wheat Weevil Committee, proved the most successful.

2. *Gas Treatment.*—The use of poison gas for the extermination of vermin is by no means a new idea, and as far back as 1890, gas plants were used in South Australia for the purpose of suffocating rabbits in their burrows by means of air deprived of its free oxygen by being passed through a fire. During the mouse plague of 1916-17, Dr. Hargreaves had suggested the use of a gas-producer plant for providing large quantities of cheap gas for the extermination of mice; and in the middle of 1917, Mr. Saunders, of Clutterbuck Bros., of Adelaide, experimented with producer gas as a means of destroying weevils; but these initial experiments were unsatisfactory, because the treatment was not continued nearly long enough. Carbon dioxide compressed in cylinders had been advocated in 1898 by Noel Paton, and in 1911, 1912, and 1913 by Barnes and Grove, but their methods were prohibitive on account of cost. It was not until the time factor was shown to be an important one, by experiments with weevils in closed bottles, carried out in January, 1918, by Mr. Spafford, a member of the committee, that gas treatment was found effective.

Mr. D. C. Winterbottom, Chemist in the Department of Chemistry, was transferred to the South Australian Wheat Scheme as officer supervising weevil destruction, and he installed the first gas plant in Australia. It was a decided success. Subsequently other plants were installed by him in South Australia and Victoria, and similar plants were used in Western Australia. The operation of these gas plants in South Australia was placed in the hands of Messrs. S. D. Shield and E. A. Pengelly, research chemists of the Department of Chemistry, and in Victoria the plants were in charge of Mr. P. J. Thompson, of the Melbourne University.

The method employed was as follows:—The stacked grain was entirely enclosed in sheds covered with malthoid or similar material made as nearly air tight as possible. Then air freed from free oxygen by being passed through a furnace similar to that of a gas producer, but producing carbon dioxide instead of carbon monoxide, was blown into the shed for three or four weeks to asphyxiate the insects. Many large stacks were thus successfully treated. In one case the stack contained 200,000 bags of wheat.

3. *Heat Treatment.*—In the cleaning and shipment of the weevilly wheat, heat treatment to a temperature of 140 degrees or 150 degrees Fahrenheit was found to be the most effective method of checking further outbreak of weevil. Soon after research was commenced in August, 1917, Mr. Winterbottom found that this would probably be a successful method, and experiments were made to see the effects of heat treatment on the wheat. It was proved that the flour and bread making properties were not impaired. A machine was invented in the Department of Chemistry and erected at Port Adelaide, which killed all the insects passed through it without damaging the wheat. This was the first successful heat treatment plant in Australia.

Professor Lefroy was working on behalf of the British Commission in Sydney, and he investigated a large number of devices for destroying weevils, including a number of heat treatment machines designed by different inventors. He finally adopted the Poole and Steele machine. At first this machine was not successful, but Dr. Hargreaves was able, as a result of experience gained by the research experiments, to suggest at a conference in Sydney in March, 1918, certain modifications which resulted in the successful working of the machine, which was then adopted by the British Commission.

The effects of this successful end to the investigations will be more far-reaching than they appear at first sight. Not only can the saving of the wheat stored during the war, which would otherwise have been destroyed by insect pests, be directly credited to scientific research, but the results obtained have demonstrated the practical value of the methods used. These methods can be used in future, so that the total money value of the research is beyond assessment.

HOW SUGAR AIDS LONGEVITY.

"It is not always possible," says a correspondent in our contemporary, "The Confectioners' Union," "to follow scientists in their alleged discoveries of wonderful things in these days to practical conclusion. Recently we alluded to a scientist who claims to have invented a food for hens enabling them to lay eggs that will be self-preserving. In connection, however, with sugar generally, we note that Professor Metchnikoff has been discoursing on a discovery of his that certainly ought to give a great boom to the consumption of confectionery. Stripped of technicalities, this discovery means simply that senility in human beings is the result of certain poisons set up by bacteria, and the effect of these is to injure the liver, brain, and especially the arteries. Now it is contended that none of these poisons can be produced by any kind of sugar, and by the use of large quantities of sugar we understand that life can be very greatly prolonged, other things, of course, being equal. The sugar, it is declared, feeds the healthy bacteria and enables them to destroy those that are deadly.

"We remember that some years ago at Salzburg there was a grand conclave of savants on food science, and thereat it was laid down as an ascertained fact that sugar formed the best of all heart foods. It was demonstrated that it gave strength and steadiness to that organ and staved off disease. All along it has been well known, although not often cited so, that the great dietetic value of sugar lies not in its force-giving properties alone, but also in its most valuable antiseptic virtues. It is not so very long since sugar was regarded to a great extent as simply a nice heat-giver, but inquiries of a close analytical character have at last demonstrated that sugar is very much more than that, and that is why army rations of sugar have been very largely increased. Sugar, in a word, has been pronounced a veritable food; and it really is a preservative to the tissues of the consumers, helping to purify the whole system. Decidedly, it adds to natural force, a thing important in these days of strenuous life, and it helps to keep the heart in thorough working order as probably nothing else can do. Now we are assured that it arrests old age —a thing we can quite understand."—"The Indian Scientific Agriculturist," Nov., 1920. (4 Rupees per annum.)

Science.

EMANALOGY.

BY ARTHUR MORRY, Architect-Surveyor to the Department of Agriculture and Stock.

What is Emanalogy?* The word cannot be found in any standard dictionary, nor is it in daily use. It is a word coined by the writer to express a new development of what is believed to be an old science, based on the fact that every object in Nature, whether animate or inanimate, sends out emanations which are attracted through the machine, human or otherwise, fitted to respond, just as wireless messages are despatched and received.

Some things known to the ancients have been lost to us, such as the glass of Venice, the rust-proof metal of India, and other things might be mentioned as some of the lost Arts. We still wonder how the pyramids of Egypt and the druid columns of Stonehenge were erected. In the Arts and Industries, family secrets have been passed on until in time a break has occurred and the secret has been lost. There is reason to believe that the ancients knew something of and practised what we now call the science of Emanalogy; but, whether they understood the natural laws which governed it is a matter for speculation, though there is some evidence in favour of that view, or whether they simply practised it as many do to-day on discovering that they possessed a faculty which some others did not possess, and which they were able to put to some practical use. Jacob appeared to know something about its laws, when he placed the striped rods in the drinking troughs of the cattle, for he expected that the emanations from those rods were likely to produce the effect he desired. At a later date it was looked upon as a great mystery, and was attributed to supernatural agencies coupled with psychology and psychometry, and those known to possess the faculty were ostracised and made to suffer severe penalties. It took Galileo a long time to convince the philosophers of his day that the earth really did revolve round the sun, and so, in this enlightened age, there are scientists and philosophers who refuse to believe that some of the everyday occurrences of our lives—such as those produced by the use of the divining rod—are governed by laws which can be explained by the physical sciences.

The use of what is called the divining rod (for want of a better name) in the search for water and minerals is regarded by some as quackery and charlatanism, because those who use it say they cannot give any explanation of the phenomena, and because, too, they are often lacking in even an elementary knowledge of science. Why, it is asked, cannot anyone take hold of a forked twig and produce results? Why are some people supposed to possess this faculty and not others? May it not be asked, in reply, why it is that some people are superior to others mentally and physically in every sphere of life? In the same way is it not possible for some to be naturally endowed with a greater magnetic force than others? Very delicate experiments in the various branches of physical science have shown that all bodies, animate or inanimate, are susceptible of magnetism and send out magnetic emanations, which are attracted at distance limits not yet determined.

The several forms of electricity, terrestrial magnetism, and electro-magnetism probably all contribute in some way to the production of these phenomena, by discharging emanations the intensity of which is governed by laws known to physical scientists. The human body in some cases constitutes a magnetic machine which responds to the attractive force of magnetic emanations with which it is in contact. "It is possible to discover the law of magnetic intensity by comparing the vibrations accomplished by the same needle during the same time at different distances from the magnet, because, like every known force which emanates from a centre, this law is not affected by the intervention of any substance between the magnet and the needle unless that substance is itself subject to magnetism." Thus it is that in using the forked instrument of wood or metal for the detection of any substance, fluid or solid, it will continue to dip in response to the attractive force of the emanations, notwithstanding the intervention of other substances, until the positive intensity is exhausted, when it stops, but on being brought in contact again with the magnet it actively responds to the negative force until exhausted. By the use of suitable agents it is possible to detect emanations from great depths or from long distances on the surface, notwithstanding the fact that similar substances intervene.

* Emanalogy is a scientific word meaning emanation; that is, the act of flowing forth from a fountain head or origin, from any source, substance, or body, as effluvium, efflex, &c.—Ed. Q.A.J.

For example, several streams or beds of fresh or salt water may be located, one below the other, at great depths, and the thickness of the beds determined, also the nature or character of the matrix containing the water. Several beds of sandstone, shale, or other minerals may be detected in proper sequence, and their thickness and approximate composition ascertained. A dolomitic limestone can be detected and qualitatively analysed, though it be hidden from view hundreds of feet below the surface. The same with basalt or any other rock—not only its distance from the surface, but its component elements can be ascertained.

A glass of water may be drawn from the town supply and distinguished quite easily from another, drawn from a rainwater tank. The height of the reservoir where the former is stored, and a qualitative analysis of its mineral contents may be also determined. Any object may be hidden from view in any accessible place, and its position discovered; depths of soil may be measured; the drainage of swamps facilitated; in fact, there is hardly any limit to the uses to which it can be put.

There are several instruments in use for detecting the presence of water or minerals, but none so far will accomplish any of the above. A co-worker in this interesting work has constructed an instrument, rather crude at present, but which proves the theory of magnetic emanations, and with further improvements will no doubt become a very useful instrument to geologists and others engaged in research work, for by an extension of the same it is possible for wonderful results to be achieved, even by persons devoid of magnetic force.

It can hardly be believed that the means only recently discovered of accomplishing the above are of a simple character, free from complications, though it necessarily requires great concentration during the operation, or mistakes will occur; nor is it claimed that absolute accuracy can be secured as yet, in the absence of scientifically constructed instruments, but before long it will be quite possible—indeed it may almost be said to be so now—for an emanalogical survey of any area to be made, showing the position, width, depth, and direction of all underground streams, fresh and salt, and for the nature of the rocks below the surface to be stated, even some thousands of feet in depth. These are most important matters, and naturally will not be accepted by many, but the writer's experiments, more especially those of recent date, are based on known scientific laws which he has learned to apply during a long professional career, and which gives him the courage to express his convictions in the face of criticism and ridicule.

The science of geology has wonderful fascinations which could be made even more attractive if combined with the study of emanalogy.

RAISING RHUBARB FROM SEED.

Rhubarb has a large appetite, and wants planting in soil that has been well worked and heavily manured. Trench the bed you intend to grow it in, and add plenty of manure to the lower part. This can hardly be overdone. The plants should be set out about 3 feet between them every way. There is one thing that is very important in rhubarb culture, and that is not to pick a stalk from a plant the first year. There are two crops as a rule—one in the early spring, and another in the autumn. If after the plants get established—that is, the second year—you wish to have an early crop you must leave the autumn crop alone, and let it die down. The second season you will have as much as you want. A bed will last years with liberal manuring, and then some of the old shoots may be taken up and divided with a spade and replanted to form a new bed. This new bed must be treated the same as the first, and not pulled the first season. That is the culture for both the winter sorts and the spring variety.—"Producers' Review."

EXPERIMENTS IN CANE PLANTING.

In a report of different experiments in cane planting conducted in the island of St. Croix, West Indies, it was found that over an average of eight plots, cane grown from first ratoon plants gave an average of 54.8 tons per acre, as against 41.8 tons for plant cane cuttings, and 34.3 from those obtained from second ratoons. The variation, however, was greater in the case of the ratoon cuttings, namely, from 38.8 tons to 52.2; whereas in the case of plots derived from plant crops, the highest tonnage was 45.3, and the lowest 35.6 tons, being a difference of only 9.7 tons, as against a difference of 13.4 tons where first ratoons were used.—"South African Sugar Journal."

General Notes.

THE MANUFACTURE AND USE OF PEANUT BUTTER.

That peanuts thrive and produce heavy crops wherever grown in Queensland has been long ago proved. The market for the bulk of this produce is not within the State, there being no factory established in it for utilising the nuts by the production of oil or peanut butter. It is possible that few farmers in Queensland have every heard of such a product. From an exhaustive pamphlet on the subject, issued by the United States Department of Agriculture (Circular 128, Sept., 1920), we obtain much interesting information on the manufacture of this product, which might in time be one of the payable products of this State.

We are told in the said circular, that the production of peanut butter has, in recent years, developed to large proportions, as evidenced by the fact that one manufacturer alone produced about 6,000,000 lb. in 1919, and there are dozens of large factories, and hundreds of smaller ones. All told, peanut butter is probably the most important peanut product manufactured in the United States. The peanuts used in making this butter in 1919 probably totalled six or eight million bushels. In the early days of its manufacture peanut butter was sold largely as a food for invalids, but it soon outgrew this limited use. Now it is considered a standard luncheon delicacy, especially in the making of sandwiches, though it is used in various other ways.

FOOD VALUE OF PEANUT BUTTER.

Peanut butter is a wholesome and highly nutritious food, having a much greater food value than round steak. The following are the analyses of peanut butter and steak:—

Peanut Butter.—Water, 2.1 per cent.; protein, 29.3 per cent.; fat, 46.5 per cent.; carbohydrates, 17.1 per cent.; ash, 5 per cent.; fuel value, 2,825 calories per pound.

Round Steak.—Water, 65.5 per cent.; protein, 19.8 per cent.; fat, 13.6 per cent.; carbohydrates, none; ash, 1.1 per cent.; fuel value, 950 calories per pound.

These figures show that peanut butter contains one and a-half times as much protein, more than three times as much fat, nearly five times as much ash, and three times as much fuel value as round steak. In addition to this, peanut butter contains 17.1 of carbohydrates, while steak contains none. Pound for pound, peanut butter has a much greater food value than steak, though it sells for a lower price.

In dealing with the commercial manufacture of this butter, a full description is given of the necessary machinery needed and of the processes in connection with the manufacture on a large scale.

HOME MANUFACTURE OF PEANUT BUTTER.

From what has been said about the commercial manufacture of peanut butter, it is evident that the process is very simple. Usually nothing is taken from the peanuts except the germs and red skins, and nothing is added except a small quantity of salt. Many persons have the idea that peanut butter consists of ground peanuts mixed with oil. As shelled peanuts contain from 13 to 50 per cent. of oil, depending on the variety, it would be unnecessary to add oil. The only difference between ground peanuts and peanut butter is in the fineness of the particles.

A cheap wholesome peanut butter can be made at home by means of an ordinary meat grinder. Raw unshelled or raw shelled peanuts can be bought from dealers and roasted in the oven at home, or peanuts that have been roasted can be obtained. When roasting peanuts in the oven care should be taken to prevent burning. The nuts should be stirred from time to time in order to get a uniform roast. Greater care is necessary in roasting shelled than unshelled nuts, as the former are more easily scorched. By examining the peanuts from time to time during the process the desired degree of roasting can be given.

When unshelled peanuts are used they should be roasted in the shell and cooled. After cooling they should be shelled and blanched. The blanching can be accomplished by rubbing the meats over a wire-bottom screen. This rubbing removes the red skins and loosens the germs. If the screen has holes of the proper size the germs can be sifted out. The meats can be readily cleaned by pouring them from one vessel to another in the open, where the wind will blow out the skins.

After the meats are cleaned they are ready for grinding. The salt may be added before or after grinding. A good type of meat grinder is satisfactory for grinding the peanut meats provided the burrs are not worn. The finest burrs should be used and the machine should be set to grind the meats as fine as possible. If the butter is not fine enough after running it through the machine once, it should be put through again. When salt is not added to the nuts before grinding them it is advisable to add it to the paste before the second grinding.

In order to be sure of a good grade of peanut butter it is best to make it often rather than to make a supply which will last for several months. When made at home the actual cost of peanut butter is much less than the price paid in the stores; in fact, it should not exceed 15 or 20 cents a pound, which is a very low price for a product of such high food value.

The pamphlet concludes with the uses of peanut butter in cookery.

OF INTEREST TO RUBBER PLANTERS.

WHAT EVERY PLANTER OUGHT TO KNOW.

BY FRED KNOCKER, F.Z.S.

(Author of *Hevea Braziliensis* in British Malaya).

From "The Planters' Chronicle," Madras.

A SIMPLE LESSON ON THE PHYSIOLOGY OF HEVEA BRAZILIENSIS.

(*Continued from January issue*).

In the first instance water is taken into the tree by its roots, the reason for this being the very patent fact that before any food can be assimilated by the plant it must be in a state of solution. So is nitrogen, phosphorus, sulphur, potassium, and such-like introduced into the stem from the soil, *viâ* the roots. There is, however, one very essential element of plant food that cannot be passed in through the roots—to wit, carbon. Speaking at random, I believe, about half a cubic foot of carbonic acid gas goes to 1,000 cubic feet of air. That is not much; but is the rubber tree's opportunity. By the aid of the green corpuscles of the leaves (known as chlorophyll) acted upon by the sunlight the carbon dioxide (CO_2)—*i.e.*, carbonic acid—on entering the leaf is decomposed, the carbon absorbed by the plant and the oxygen restored to the atmosphere. This absorbed carbon is combined with the water taken in by the roots, but a goodly portion of the water escapes by the leaves, naturally far more at night. This overflow, as it were, is not wasted, as we are all well aware. It falls to the ground to be again used by the roots in absorbing the chemicals from the soil. It will be at once perceived that evaporation relies largely upon existing conditions, the principal factor being the amount of light—*i.e.*, the greater the light the greater the transpiration. From this fact follows the highly important one that, by what may be considered a process of suction, the leaves themselves supplement the root pressure from below in inducing the sap to flow upwards. Again, it follows that the more active the transpiration the more rapid the sap circulation. Think what this means in the light of our present knowledge: the heavier your rubber tree's foliage the greater the evaporation—the darker the shade of the green colouring of the leaves the greater the absorption of carbon. Yet still we cannot grasp the intrinsic value of these facts without a little more learning. So let us hark back to the stem and analyse our next household word—bark.

What is commonly regarded as bark is the dead outside tissues of the cork (epidermis); but accepting the word in a wider sense then it can be made to include all those layers external to the cambium, more appropriately named the cortex. I do not believe there is a planter in the whole of Malaya to whom it is necessary to explain that the cambium is the active formative part of a tree immediately underlying the inner bark and separating it from the wood. Likewise, that the cambium gives rise internally to the wood and externally to the inner bark, otherwise known as the *phloem* or *liber*, and which, in the Para rubber tree, is celebrated for its laticiferous vessels. Outside the liber is the middle bark known scientifically as the *phelloderm*, also latex-bearing. Then you get a layer of cork, and with this cork goes another formative tissue often called the cork *cambium* but more correctly named the *phellogen*. Differing from the true cambium, however, it has the power of reproducing laterally. In that connection it often aids opportunely the healing of not-too-serious tapping wounds.

There is just one other thing to note in the physiology of the cortex, and that is the cross layers of tissue which unite the middle bark with the pith by piercing the intervening layers, and which in consequence are known as the *medullary rays*—the "silver grain" of the cabinet-maker. From a rubber planter's point of view the importance of these rays are liable to be under-estimated, but to become familiarised with their true functional value we must now pick up the broken thread of the green leaf's story.

We have seen how transpiration is effected by means of the sap rising from the roots, and we have seen how carbon is taken in from the atmosphere through the medium of carbon dioxide. We left the carbon, so to speak, in the leaf combining with the water taken in by the roots. The chemical formula for water is universally known as H_2O; and bearing this in mind the reader at once perceives that the net result of this combination of carbon and water must be the formation of carbo-hydrates—*i.e.*, sugars and starch cellulose. These elements go to form an elaborated sap which is conducted down the outside of the stem and circulated by bast fibres composing the liber or inner bark. From the liber this elaborated sap is distributed in a lateral direction throughout the inner layers of the stem by means of the medullary rays (*vide et supra*).

Now, with no more than an iota of imagination, it can be readily understood how the prolificness of the laticiferous vessels and an expeditious and satisfactory bark renewal is dependable on the ever active co-operation of all these separate elements and processes. And it would appear, also, that, if cultivation is to be done at all to *Hevea braziliensis*, it should be concentrated on the development of the root and leaf systems. Granted both are largely dependent on existing natural conditions and environment, there is still much that the planter can do to help on nature with the good work. On the other hand it is self-evident that there has been a good deal done in the past that would never have been done at all if illumined by the light of the knowledge we have just acquired; and there still remains much being done to-day contrary to the laws instituted by nature for the creation of all that is best for the Para rubber tree, thereby handicapping her own powerful system for the production of healthy and vigorous trees. Take a walk round the *tote* and think it over.

Putting aside the fact that the latex-yielding proclivities of individual trees must vary in ratio to the degree of perfection attained by their root and leaf systems, it is equally apparent that the latex productivity of every tree is controlled by the varying activity of its transpiration—varying, that is, as we have seen, according to the supply of light and moisture. Hence, you get the heaviest yields any time during wet weather; but you get the heaviest yields from a combination of wet weather and the period of fully-matured and most luxuriant foliation. This period, speaking generally for Malaya, is in the month of January and thereabouts, when the rainy season drawing to a close allows of an increasing number of bright days interspersed with showers, and the trees have completely matured their annual equipment of new foliage.

So we are brought right back to the text of our article: "Bark Renewal" and "the Origin of Latex"; and the reader may like to reperuse Dr. Bobilioff's remarks in the light of his newly acquired knowledge. Peradventure, like the author, whilst not actually disagreeing with the learned doctor and allowing for the obvious misnomer of the title "Origin of Latex," he might feel inclined to pensively remark:—"Why all this experimental fuss to produce results which could be foreseen and were physically incapable of being otherwise?"

THE LESSON IN ABSTRACT.

Medulla (Lat. = the interior part) or Pith (Anglo-Saxon pitha, marrow): The dry and colourless axis, or centre, of the stem. It is surrounded by a layer of air vessels called the Medullary sheath.

Duraman (Lat. durus, hard) or Heart-wood: The outer, hard layers of wood, generally, more or less, darkly coloured, and constituting a "back bone" to the tree.

Alburnum (Lat. albus, white) or Sapwood: The outer layers of wood, pale in colour and composed of air-carrying vessels and sap-distributing fibres which pass the current of sap, taken in by the roots, upwards to the leaves.

Xylem (Gr. xylon, wood) or the Wood: The whole of the central part of the tree exterior to the medullary sheath—*i.e.*, the duramen and the alburnum.

Cambium (Lat. cambio, to change): The formative layer between the wood and the cortex out of which new wood and new inner-bark are formed.

Phloem (Gr. phoios, the inner bark of trees), Liber (Lat., inner bark) or Inner Bark: The inner layer of the cortex composed of vessels, soft bast, and bast fibres, the latter of which act as sap circulators of the elaborated sap brought down from the leaves.

Phelloderm (Gr. phellos, cork; derma, skin): The middle layer of the cortex which also contains laticiferous vessels.

Phellogen (Gr. phellos, cork; gennao, to produce), or Cork Cambium: The formative tissue from which the layer of cork is continually increased in thickness, and which by producing tissue laterally effectively covers over the renewed tissues of inner-bark formed by the cambium after tapping.

Cork: The outer layer of the cortex, the outside tissues of which exposed to the atmosphere become dead and eventually peel off under the expanding influence of the growth of the stem.

Epidermis (Gr. epi, upon; dermis, the skin): The dead outside tissues of the cork (*q.v.*) commonly called "bark."

Cortex (Lat. bark): The whole of the outside layers of the stem exterior to the cambium.

Medullary rays: The transverse layers of tissue uniting the pith with the middle bark (phelloderm), their function being to distribute the elaborated sap passing down the liber (*q.v.*) through the inner parts of the stem.

Transpiration: The process by which the superfluous water ascending the tree from the roots is exhaled through the leaf in the form of a vapour, thus forcing the roots to maintain a perpetual and efficient supply of sap circulating through the fibres of the sap-wood (*q.v.*).

Chlorophyll (Gr. chloros, green; phyllon, a leaf): The green colouring matter of the leaves which, under the influence of sunlight, decomposes the carbon-dioxide taken in from the air, fixing the carbon and setting free the oxygen.

Laticiferous vessels (Lat. latex, a liquid; fero, I bear): Elongated tubes containing a fluid which in *Hevea braziliensis* is known as rubber latex and occurs in the inner and middle layers of the cortex.

REVIEWS AND NOTICES OF BOOKS.

A Research on the Eucalypts and Their Essential Oils. By Richard T. Baker and Henry G. Smith. Government Printer, Sydney, 1920. Royal 4to, pp. 470, with 120 plates and numerous text figures.

In this fine work the authors have given us the result of many years' careful study of the principal and most important group of plants native to Australia, viz., the Eucalypts. The present work is more particularly directed to a study of the oils of the different species. Eucalyptus oils now find employment in many ways, their best known use probably being for medicinal purposes. The demand at present for medicinal oils is mostly for those having a high cineol content, the "British Pharmacopœia" standard being 55 per cent. of cineol. The question, however, is not yet settled as to whether cineol is the most valuable constituent in eucalyptus oils, and Messrs. Baker and Smith express the opinion that the medicinal value of eucalyptus oils is more probably due to an admixture of various constituents than to any one alone, but rightly conclude that a study of comparative therapeutic values of the oils of various species is a task beyond the scope of their work and more fitted for the medical practitioner. Few Queensland species have a high cineol content, the best being *E. populifolia*, the common "Bimbil Box" or "Poplar Box," which occurs over large areas of inland Queensland and New South Wales, the cineol content being 70 per cent. in the fresh oil; unfortunately, however, the yield is small.

An important use to which the oils of certain species is put is the separation of metallic sulphides by a flotation process, the principal species used for this purpose being *Eucalyptus dives* (Broad-leaved Peppermint). Among the most valuable of eucalyptus oils are those suitable for perfumery purposes. *Eucalyptus citriodora*, a species confined almost entirely to Queensland, has an oil composed almost entirely of the aldehyde citronellal, and is in considerable demand. Another Queensland species, *Eucalpytus Staigeriana*, occurs on the Palmer River districts, and has an oil which Messrs. Baker and Smith state could be used as a substitute for lemon oil as a flavouring essence.

The authors demonstrate their method of classification principally by the oils, and the distinct relationships between the leaf venation and the class of oil yielded are shown.

One hundred and seventy-eight species are dealt with, so that it will be seen that the authors have described most of the common Australian species, though we notice one or two of the commonest Queensland species are not dealt with, *e.g.*, *E. papuana* and *E. alba*, both of which cover large areas of country in North Queensland. Both are probably very low oil yielders, and the authors make no pretence to have exhausted their subject, so that research in various species is still left for future workers. Seventeen species are featured by colour and twenty-four by black-and-white plates. A very handy feature is the figure of the seed capsule accompanying the botanical description of each species. This is certainly a great help, as capsules of Eucalypts are fairly persistent on the trees, or, if fallen, can generally be picked up under the tree.

In conclusion, as the authors are retiring from official life, we may be permitted to congratulate them sincerely on this the crowning product of their scientific labours. The work reviewed can be confidently recommended to anyone wishing a comprehensive account of the Australian Eucalypts. Unfortunately no price is marked on our copy.—C.T.W.

CHATS ABOUT PRICKLY-PEAR.

By J. H. MAIDEN, I.S.O., F.R.S., F.L.S., Government Botanist, and Director, Botanic Gardens, Sydney.

APPARATUS.

Rollers.—A good deal of useful work has been done in the crushing of pear by heavy rollers, and sometimes the bruised pear is sprayed in addition. Mr. James H. Doyle, of Invermein, Scone, had much experience with pear, and he used (when I was at Scone) what he called a roller and a crusher. The roller is much the heavier and consisted of a long ironbark log. The crusher is also a roller, but of iron, and is lighter. The crusher was used direct when the pear was not over 2 feet high. When the pear was higher the roller was used. Bullock teams were used for this work.

Sprayers.—One sprayer utilises the motive power of acetylene gas, which is generated as the spraying proceeds, but there are quite a number of sprayers on the market, as every orchardist and gardener knows.

Injectors.—Then we have various injectors—for example, the well-known English appliance (often like a walking-stick, to avoid the user stooping), in which a hollow point pierces a dandelion or other weed in a lawn, and pressure on a spring releases a little of the poison, which destroys the weed. One inventor uses a deliquescent pill in his injector, which is pressed into the pear. There are various injectors of more or less merit, chiefly in use in Queensland.

MY SCONE EXPERIMENTS OF 1907-8.

The most important practical result of these experiments was that they proved that pear cannot be killed by spraying alone. It is comparatively easy to kill the fleshy "leaves" (technically called "joints") of the prickly-pear, so that the plant may appear quite dead. For example, the pear on a 5-acre block was "killed" in that way. The above-ground vegetation appeared dead, and other work was proceeded with, but in the course of a few weeks the pear on this portion was almost as vigorous again as usual. Different blocks were treated with various strengths of arsenic, dissolved in a solution of caustic soda or carbonate of soda (washing soda).

Now, in a prickly-pear there is what is known in common language as a "bulb." It is immediately underground, and it is nature's arrangement to enable the plant to tide over an excessively dry or difficult time—for example, injury to the joints or roots. The bulb is much like a joint in shape; the roots extend from it, and so do the joints. It is a store-house of what botanists call reserve material; it contains starchy bodies and water necessary for the continuance of the life of the plant.

The ordinary methods of spraying affect only the portion sprayed upon—that is, the above-ground portion; when trouble comes, the bulb just "lies low," and in due course replaces the plant; given favourable conditions, the pear may be as bad as ever.

A number of experiments were made at Scone by wounding the bulb alone, and though this action was found to injure the vitality of the plant, it was not fatal. The implement employed was a weapon about 5 feet long, consisting of a strong wooden handle (like a rake-handle) capped with a steel point. In other words, the handle was shod with steel, and the cap was continued into a chisel-like weapon.

The method finally decided upon was to treat an area with the above weapon, and then spray the whole of the plant, taking particular care that some of the liquid ran into the wounded joint. It appeared that this should be done soon after the wounding—that is, the sprayer should soon follow the man engaged in stabbing, since nature begins at once to repair the wounds inflicted by the stabber, and to close the tissues to the free access of the poison.

When poison was applied to the wounded bulb I never knew a case of the plant failing to die. It was also found that the whole plant should be sprayed, and not the joints or leaves only. It was observed that when the bulb is injured the plant falls over and the joints lie prostrate on the ground, or, at all events, in most cases touch the ground in more places than before. This just suits the pear, which roots at every joint, and so multiplies the evil. But when the whole plant, wounded bulb and all, is sprayed, the whole of the plant dies. We traced the dead roots for a considerable distance, while the green portion of the plant was as dead as the proverbial cock-robin.

Having established the principle that the bulb, as well as the plant above ground, must be destroyed, the way is clear for inventors. Ingenious individuals are wanted to invent implements and devices to do this stabbing of the bulb economically. A twist of the wrist to open up the bulb is found necessary in practice. Devices for economically applying the poison to the wounded bulb are also required. I have already seen two such devices for poisoning and stabbing in one operation—an Australian one and an English one.

I am of opinion that the slashing or wounding of the joints recommended by so many experimenters with sprays is unnecessary, and therefore a waste of money.

Of course, bad pear country is impregnated with pear seed, and there is always a danger of pear reoccupying a paddock from this cause alone. If the plants are treated with a hoe as they appear, they may be destroyed without much labour.

The experiments showed that the best strength was 1 lb. commercial white arsenic and 1 lb. caustic soda, dissolved in 20 gallons of water. Caustic soda is a most acrid substance, of course, and produces severe sores on the hands, &c., of any person touching it. It is a more efficacious solvent than washing soda, but I fear that its dangerous nature will prevent most people from having anything to do with it.

On the whole, I think that an arsenical preparation is most efficacious. If, as the result of the further experiments, my view is borne out, then the official declaration of the fact will cause manufacturing chemists to fill requirements.

I do not attach so much practical importance to the bulb as I once did. I still think that the stabber should be occasionally used, with special plants, in order to make a good job.

MORE RECENT EXPERIMENTS.

Since 1910 the Department of Agriculture has supervised trials with numerous preparations, proprietary specifics, and mechanical methods of destruction suggested by officers of the Department and by others. A large amount of work has been done along this line, but with little or no success as to the great majority of the specifics and methods.

The difficulties of treating prickly-pear in any manner that has a commercial recommendation have also directed attention to such other agencies as fungi, bacteria, and insects, and various trials have been conducted by the Department along these lines, without anything definite yet being reached.

A COMPETITION SUGGESTED.

As to the future, I would make the following unofficial suggestions for a competition in clearing infested land:—

1. Arrangements might be made for the practical test of (*a*) spraying machines and other appliances and devices for the economical distribution of liquid and solid poisons with the view to the destruction of prickly-pear; (*b*) other machines, appliances, and devices for destroying pear.
2. Owners of specifics for the destruction of prickly-pear might be invited to conduct experiments.

The above experiments should be free of cost to the Government, except in regard to supervision of the experiments, and the application of such tests as may be necessary with the view to securing impartial comparative trials.

If there is a mechanical device or specific of special value, these experiments would probably disclose it, and the publication of a decision to that effect would immediately render the property of great value.

The way in which effect should be given to these suggestions would require consideration, but the problem would not be a very difficult one.

My personal experience so far leads me to the belief that some solid preparation of arsenic and soda (one containing more or less sodium arsenite) is most deadly to prickly-pear. Experiments in open competition may show that some other substance (including arsenious trichloride) is more efficacious.

Cost is the keynote of all work in fighting prickly-pear. Thousands of individuals know how to kill prickly-pear, but the agency may be too expensive or objectionable in some other direction.

The Markets.

PRICES OF FARM PRODUCE IN THE BRISBANE MARKETS FOR JANUARY, 1921.

Article.		JANUARY. Prices.
Bacon	lb.	1s. 5d.
Barley	bush.	...
Bran	ton	£9 15s.
Broom Millet	"	£25 to £35
Broom Millet (Sydney)	"	£50
Butter (First Grade)	cwt.	238s.
Chaff, Lucerne	ton	£7 to £10
Chaff, Mixed	"	£8 to £8 15s.
Chaff, Oaten (Imported)	"	£9 to £10 5s.
Chaff, Oaten (Local)	"	£8 to £8 10s.
Chaff, Wheaten	"	£7 10s. to £8
Chaff, Panicum	"	...
Cheese	lb.	1s. 2d.
Flour	ton	£19 10s.
Hams	lb.	1s. 8d. to 1s. 11d.
Hay, Lucerne	ton	£5 to £6 10s.
Hay, Oaten	"	...
Honey	lb.	6d. to 7d.
Maize	bush.	5s. 6d. to 6s.
Oats	"	2s.
Onions	ton	£8 5s. to £11 10s.
Peanuts	lb.	5d. to 9d.
Pollard	ton	£9 15s.
Potatoes (English)	"	£2 15s. to £10
Potatoes (Sweet)	cwt.	2s. 5d. to 4s. 9d.
Pumpkins (Cattle)	ton	£3 10s. to £5
Eggs	doz.	1s. 4d. to 1s. 7d.
Fowls	per pair	7s. 10d. to 10s. 6d.
Ducks, English	"	6s. to 6s. 9d.
Ducks, Muscovy	"	9s. to 15s.
Geese	"	15s. to 16s.
Turkeys (Hens)	"	15s. to 23s.
Turkeys (Gobblers)	"	36s. to 50s.
Wheat (Chick)	bush.	7s. 6d. to 8s. 3d.

VEGETABLES—TURBOT STREET MARKETS.

Asparagus, per dozen bundles	...
Beans (French), per sugar bag	2s. to 11s.
Beetroot, per dozen bundles	...
Cabbages, per dozen	2s. 6d. to 6s.
Carrots, per dozen bunches	1s. to 2s.
Cucumbers, per dozen	3d. to 1s. 6d.
Lettuce, per dozen	...
Marrows, per dozen	1s. to 3s.
Peas, per sugar bag	6s. to 14s. 6d.
Potatoes (Sweet), per sugar bag	2s. 6d. to 4s. 9d.
Pumpkins (table), per doz.	2s. to 10s. 6d.
Rhubarb, per bundle	...
Tomatoes (prime), per quarter case	5s. to 11s.
Tomatoes (inferior), per quarter case	1s. to 5s.
Turnips (Swede), per cwt.	...

SOUTHERN FRUIT MARKETS.

Article.	JANUARY. Prices.
Bananas (Tweed River), per double case	15s.
Bananas (Queensland), per double case...	20s. to 25s.
Bananas (Fiji), per double case	...
Cape Gooseberries, per case	...
Lemons, per bushel case	9s. to 12s.
Mandarins, per case	4s. to 6s.
Oranges (common), per bushel case	20s. to 25s.
Oranges (Navel), per bushel case	16s. to 18s.
Passion Fruit, per half bushel case	5s. to 8s.
Pineapples (Queensland), per double case	20s. to 25s.
Pineapples (Ripley), per double case	10s. to 14s.
Pineapples (common), per double case	10s. to 14s.
Tomatoes (Queensland), per quarter case	12s. to 20s.

PRICES OF FRUIT—TURBOT STREET MARKETS.

Apples, Eating, per bushel case	8s. to 19s.
Apples, Cooking, per bushel case	3s. to 9s.
Apricots (prime), per half bushel case	2s. to 8s.
Apricots (inferior), per half bushel case	2s. to 4s.
Bananas (Cavendish), per dozen	½d. to 10d.
Bananas (Sugar), per dozen	4d. to 10d.
Bananas (Lady's Finger), second quality, per dozen	...
Bananas (Lady's Finger), third quality, per dozen	...
Cherries, per tray	12s. to 16s.
Cocoanuts, per sack	£1 5s.
Grapes, per lb.	3d. to 6d.
Cape Gooseberries, per quarter bushel case	...
Lemons (Lisbon), per quarter case	5s. to 8s.
Mandarins, per case	...
Mangoes, per case	3s. to 6s. 6d.
Nectarines, per quarter case	3s. 6d. to 6s.
Oranges (second crop)	1s. 6d. to 3s.
Papaw Apples, per tray	2s. to 4s. 6d.
Passion Fruit, per quarter case	4s. 6d. to 9s.
Peaches, per quarter case	1s. 6d. to 6s.
Pineapples (smooth), per case	6s. to 9s.
Pineapples (rough), per case	3s. to 8s.
Pineapples (Ripley Queen), per case	1s. 6d. to 5s. 6d.
Plums, per case	1s. to 5s. 6d.
Rockmelons, per dozen	1s. to 6s.
Water-melons, per dozen	1s. to 12s.

TOP PRICES, ENOGGERA YARDS, DECEMBER, 1920.

Animal.	DECEMBER. Prices.
Bullocks	£18 5s. to £21 15s.
Cows	£14 2s. 6d. to £16 5s.
Merino Wethers	32s. 9d.
Crossbred Wethers	39s. 6d.
Merino Ewes	26s. 3d.
Crossbred Ewes	32s. 9d.
Lambs	27s. 3d.
Pigs (Backfatters)	£7 11s.
Pigs (Bacon)	£5 9s.
Pigs (Porkers)	£4 10s.
Pigs (Suckers)	£1 7s.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF DECEMBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALLS DURING DECEMBER, 1920 AND 1919, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Dec.	No. of Years' Re-cords.	Dec., 1920.	Dec., 1919
North Coast.	In.		In.	In.
Atherton	7·33	19	8·71	1·13
Cairns	9·21	38	8·37	1·01
Cardwell	8·42	48	4·23	0·73
Cooktown	7·07	44	6·89	1·43
Herberton	5·51	33	7·85	0·77
Ingham	7·16	28	6·26	1·26
Innisfail	10·29	39	5·31	1·34
Mossman	12·56	12	9·51	2·59
Townsville	5·61	49	1·21	0·68
Central Coast.				
Ayr	3·73	33	2 78	0·93
Bowen	4·37	49	2·19	0·09
Charters Towers ...	3·51	38	3 67	0·22
Mackay	6·85	49	2 37	0·14
Proserpine	8·65	17	2·10	0·27
St. Lawrence ...	4·29	49	0·92	0·03
South Coast.				
Biggenden	4·14	21	3·55	0·45
Bundaberg	4·27	37	10·59	0·05
Brisbane	4·87	69	2·57	1·58
Childers	4·79	25	7·90	0·22
Crohamhurst ...	7·32	25	3·09	0·45
Esk	4·20	33	1·66	2·01
Gayndah	3·71	49	6·98	0·53
Gympie	5·68	50	3·07	0·06
Glasshouse M'tains	6·64	12	2·77	1·26
Kilkivan	4·10	41	3·17	0·03
Maryborough ...	4·39	49	10·08	0·10
South Coast—continued:	In.		In.	In.
Nambour	6·10	24	3·67	1·13
Nanango	3·52	38	1·28	0·43
Rockhampton ...	4·28	33	0·98	0·39
Woodford	5·25	35	2·08	2·40
Darling Downs.				
Dalby	2·13	50	2·61	2·40
Emu Vale	3·47	24	3·01	2·47
Jimbour	3·09	32	0 88	1·86
Miles	2·42	35	2·84	0·84
Stanthorpe ...	3·43	47	2·84	0·93
Toowoomba ...	4·11	48	4·10	1·27
Warwick	3·44	33	2·40	1·62
Maranoa.				
Roma	2·28	46	2 50	1·73
State Farms, &c.				
Bungeworgorai ...	2·36	6	1·63	1·29
Gatton College ...	3·32	21	2·14	1·82
Gindie	2·68	21	1·49	0·52
Hermitage ...	2·76	14	2·31	1·73
Kairi	7·92	6	...	0·79
Sugar Experiment Station, Mackay	8 25	23	2·04	0·04
Warren	3·13	6	1·40	Nil

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for December, 1920, and for the same period of 1919, having been compiled from telegraphic reports, are subject to revision.

GEORGE G. BOND, State Meteorologist.

COST OF A COTTON SEED OIL MILL.

The "South African Sugar Journal" (Dec., 1920) states the cost of an up-to-date oil mill erected in South Africa to make crude oil only would be about £900-£1,200 for each ton of seed to be crushed per day of twenty-four hours. The smallest workable plant would be one of 8 to 10 tons capacity. In addition to this, considerable working capital would be required.

Farm and Garden Notes for March.

FIELD.—Take every opportunity of turning up the ground in readiness for sowing and planting winter crops. The main crop of potatoes should at once be planted. As the growth of weeds will now be slackening off, lucerne may be sown on deeply cultivated soil. The latter should be rich and friable, with a porous subsoil. The land should be thoroughly pulverised. Do not waste time and money in trying to grow lucerne on land with a stiff clay subsoil. Prepare the land a couple of months before sowing, care being taken to cross plough and harrow before the weeds have gone to seed. This ensures a clean field. Sow either broadcast or in drills. In the former case, 20 lb. of seed will be required; in the latter, 10 lb. A good stand of lucerne has been obtained with less quantities. Should weeds make their appearance before the plants have sent down their tap roots, mow the field. Before they can again make headway enough to do any damage, the lucerne will be strong enough to hold its own against them. Harrow and roll the land after mowing. Gather all ripe corn. It is now too late to sow maize, even 90-day, with any certainty of harvesting a crop of grain. Rye grass, prairie grass, Rhodes grass, oats, barley (in some districts, wheat), sorghum, vetches, carrots, mangolds, and swede turnips may be sown. In Northern Queensland, sow tobacco seed, cowpea, carob beans, sweet potatoes, opium poppy, &c. Sow anatto, jack fruit, and plant kola-nut cuttings. Some temperate zone vegetables may be planted, such as egg plant, potatoes, &c. Coffee-planting may be continued. Harvest kafir corn and paddy. Cotton picking will now be in full swing. Pick cleanly, and expose to the sun for a few hours before storing or baling. Pick none but fully ripe bolls.

FLOWER GARDEN.—Now is the time to plant out bulbs. A complete garden could be furnished with these charming plants, which are to be had in every colour and variety. Amongst the many are—Amaryllis, anemone, arum, babiana, crinum, crocus, freesia, ranunculus, jonquils, iris, ixias, gladiolus, narcissus, jacobean lilies, tigridia, tritonia.

All bulbs like well-drained, somewhat sandy soil, with a plentiful admixture of leaf mould. Herbaceous plants and annuals which it is intended to raise from seed should be sown this month. Such are antirrhinums (snapdragon), asters, cornflowers, dianthus, larkspurs, daisies, cosmea, candytuft, lupins, gaillardias, godetia, mignonette, poppies, pansies, phlox, sweet peas. Cannas now planted will require plenty of food in the shape of liquid manure. Put in cuttings of carnations. Chrysanthemums require attention in the way of disbudding, staking, watering with liquid manure, &c. Growers for exhibition will thin out to a few buds and protect the flowers from rain and sun. Dahlias should be looking well. To secure fine blooms, disbudding should be done.

Now, as to climbers which may now be planted. These are—*Allamanda Schotii* (beautiful yellow), *Antigonon leptopus*, a charming cerise-coloured climber; *Aristolochia elegans*, handsome as an orchid and easily grown; *Aristolochia ornithocephala* (Dutchman's Pipe), very curious, large, always attracts attention; *Asparagus plumosa* grows in any shady place; *Beaumontia grandiflora*, splendid white flower, grand for a fence, will grow 50 ft. high; Bignonias of several kinds; Bougainvilleas, with their splendid leafy pink and purple flowers, rapidly clothe a fence or unsightly shed with a blaze of blossom; *Quisqualis indica*, a fine creeper, flowers pink, changing to white; Wisteria, purple and white. Most beautiful is the *Bauhinia scandens*, rarely seen about Brisbane. We grew a plant of this climber at Nundah, and it soon closed in the front of the verandah for a distance of over 80 ft. The leaves are very small, and in the flowering season it presents almost a solid mass of beautiful round bunches of blossoms, something like the hawthorn bloom—pink and white. It seeds freely, but the seeds are difficult to germinate, and when they have produced a plant it is still more difficult to rear it. A rooted sucker from the main stem will in all probability grow.

KITCHEN GARDEN.—During this month a very large variety of vegetable seeds may be sown in readiness for planting out where necessary in the autumn, which begins on the 20th of March. All unoccupied land should be roughly dug, and, when required, add well-decomposed manure. Transplant cabbage, cauliflower, celery, &c. Sow french and broad beans, beet, carrot, turnips, radish, cabbage, cauliflower, cress, peas, onions, mustard &c. Former sowings should be thinned out and kept clear of weeds. Mulch round melon and cucumber beds with a good dressing of long stable manure, as it assists in keeping the fruit clean and free from damp. Cucumbers, melons, french beans, and tomatoes should be looked for every day and gathered, whether required or not, for if left on the vines to perfect their seeds, the plants will soon cease to be productive, or will form inferior, ill-shaped, and hence unsaleable fruit.

Orchard Notes for March.

THE SOUTHERN COAST DISTRICTS.

The marketing of the main crop of pineapples will continue to occupy the attention of growers; and as it is probable that the plantations have been allowed to get somewhat dirty during the previous month, they should be cleaned up as soon as ever the crop has been got off. The fruit of the new crop of citrus fruit will be showing signs of ripening towards the end of the month; and as the fruit during this period of its growth is very liable to the attack of insect pests of various kinds, it is important that steps should be taken to prevent loss arising from this cause as far as possible.

Large sucking moths of several kinds attack the fruit as soon as it shows signs of ripening; and as they always select the first fruit that shows signs of colouring, it is a good plan to gather a few forward fruit and to ripen them up quickly by placing them on a barn floor, and covering them up with bags or straw. They will turn colour in a few days, and develop the characteristic scent of the ripening fruit. The fruit so treated should be hung up in conspicuous places in the orchard as trap-fruit, as not only will it attract the moths, but also the fruit-flies. The moths will be found clustered round the trap-fruits in large numbers, and can then be easily caught and destroyed. Fruit-fly will also puncture such fruit; and if the fruit is destroyed before the larvæ reach maturity, a later crop of these insects is prevented from hatching out. Fruit-flies may also be caught in large numbers by means of such artificially ripened fruits. The fruits are smeared with tanglefoot, and hung about the orchard. The fly, attracted by the colour, settles on the fruit, and is caught in a similar manner to house-flies on specially prepared sticky paper. These simple remedies, if carefully carried out, will result in the destruction of large numbers of sucking moths and fruit-flies.

The yellow peach-moth that does such damage to peaches in spring, and that attacks corn, sorghum, cotton bolls, custard apples, and many other plants and fruits, often does a lot of damage to citrus fruits. It acts in a very similar manner to the second or later generations of the codling moth or pomaceous fruits, in that it lays its eggs where two fruits touch, under the shelter of a leaf on the fruit, at the stem end of the fruit, and, in the case of navel oranges, in the navel itself; in fact, anywhere that there is a likelood of the egg not being disturbed. The egg hatches out into a small spotted caterpillar, which eats its way into the fruit, causing it to ripen prematurely, and fall off. Where two fruits touch, it often eats into an destroys both, and it frequently leaves one fruit to go and destroy a second. It is a very difficult insect to deal with, owing to the number of fruits and plants on which it lives; but, as far as citrus fruits are concerned, the best remedy is undoubtedly to spray the fruit with a remedy that will destroy the young insect when it starts to eat the skin of the fruit. Bordeaux mixture has been found efficacious, but I am of opinion that spraying with Paris green and lime, Kedzie's mixture, or arsenite of lead, will also have good results. The latter poison is, in my opinion, well worth giving a thorough test, as it sticks to the fruit and leaves for a long time. Bordeaux mixture, either alone or in conjunction with Paris green or Kedzie's mixture, is, however, a good remedy, as not only will it destroy the laræ or prevent the moth from attacking the tree, but it is also the best remedy for black brand or melanose, as well as tending to keep all other fungus pests in check. Fight fruit-fly systematically—both by means of the sticky fruit already recommended and by gathering all fly-infested fruit, such as guavas, late mangoes, kumquats, &c., as well as any oranges or mandarins that may have been infested, as if kept in check now there will be little loss throughout the season. A little fruit will be marketed towards the end of the month. See that it is gathered and sweated for seven days before marketing, and don't gather it too immature. Beauty of Glen Retreat mandarins are often gathered and marketed as soon as they shows signs of colouring. They the then as sour as a lemon, and anyone who is unlucky enough to buy them will steer off mandarins for some time to come. This variety should not be gathered till thoroughly ripe, as when marketed in an immature state it spoils the market, as it puts people off eating citrus fruit.

Clean up the orchard after the summer rains, and have everything ready for the marketing of the crop. See that there is a good supply of clean, dry case timber on hand, as one of the greatest scources of loss in shipment is packing fruit in green cases.

Strawberry planting can be done throughout the month. Plant such berries as Federation on the lowest ground, and Aurie, Anetta, Trollop's Victoria, and Glenfield Beauty on warm, well-drained soils. Prepare the land thoroughly, so that it is in perfect tilth, and in a fit state to retain moisture well; as on this, as much as anything, the success of the crop depends. Where new orchards are to be planted, get the land ready—not the clearing, which should have been done months ago, but the working of the land, as it is advisable to get it thoroughly sweetened before putting the trees in.

THE TROPICAL COAST DISTRICTS.

The Notes for February apply equally to March. Keep down weed growth, and market any sound citrus fruits. Clean up the orchards as well as possible, and keep pines clean. Get land ready where new orchards are to be set out, as tree-planting can be done during April and May. Pines and bananas can still be planted, as they will become well established before winter.

THE SOUTHERN AND CENTRAL TABLELANDS.

Finish the gathering of the later varieties of deciduous fruits, as well as grapes. Clean up the orchard, and get ready for winter. Get new land ready for planting; and where there are old, dead, or useless trees to be removed, dig them out and leave the ground to sweeten, so that when a new tree is planted to replace them the ground will be in good order.

In the drier parts, where citrus trees are grown, keep the land well worked, and water where necessary.

TO WATERPROOF CLOTHES.

SOME TRIED RECIPES FOR HOME TREATMENT.

In addition to what has already been published in the "Queensland Grazier" recently on this subject, the following might prove of use:—

"Every woman desires to be well dressed, but this very natural wish is not always easy to satisfy. For this very reason one cannot dispense with a mackintosh. We can never depend on the weather, and it is not wise, with a limited wardrobe, to run the risk of having new clothes ruined through a heavy and unexpected downpour from which they would have been safely protected under a sensible all-enveloping raincoat.

"A really strong mackintosh that will stand any amount of hard wear and remain waterproof to the last is quite inexpensive to buy, and a reliable method of making one for herself is sure to be a welcome suggestion to any woman whose purse is slender.

"First buy some strong unbleached calico at about 7d. a yard, and get a good pattern of a loose rainproof coat which can easily be obtained—publications devoted to matters of feminine interest giving patterns. The pattern should be carefully studied before setting to work, as the discouraging experiences of many an amateur dressmaker is but the result of lack of attention in this respect. Do not stint the stuff, as it is better to have such a coat too loose than too tight.

"When completed, dampen it thoroughly and roll it up for a few hours. Now take 2 lb. of white lead paint ready mixed (at about 4d. per lb.), and to thin it down to the right consistency add to it a pint of raw linseed oil (6d. per pint). The mixture should be liquid, but do not, however, make it as weak as water. Apply one coating, and lay out the coat on a flat surface for about an hour, then hang it up to finish drying.

"Repeat the process three or four times, allowing each coating of paint to dry thoroughly before adding another. After this treatment the coat should be soft, pliable, as well as rainproof, and as durable as if it bore the label of a good house of waterproof makers.

"Perfect waterproof can also be obtained by soaking any woollen material for twenty-four hours in a liquid prepared by adding one gallon of cold water to ½ lb. each of sugar of lead and alum. Stir in the alum and sugar of lead, and allow to stand, stirring occasionally all day. Then pour off into a clean pail or tub, and into this put the garment. At the end of the twenty-four hours do not wring, but merely hang up in the shade and allow to drip dry. The process does not in any way stiffen the material. The quantity given would be sufficient to waterproof a skirt. For a mackintosh it would be well to double the amount, as there should be sufficient liquid to entirely cover the stuff.

"Riding habits thus made rainproof, at the cost of a few pence, are invaluable in the country."

SEED TESTING.

Samples of any seeds purchased or offered for sale as seeds for sowing may be sent to the Department of Agriculture and Stock for examination.

WEIGHT OF SAMPLE TO MAIL.

Wheat, Oats, Barley, Maize, Rice, Rye, Peas, Cowpeas, Beans, Tares	8 oz.
Millet, Sorghum, Sudan Grass, Panicum, Buckwheat, Lucerne, Clover, Linseed	4 oz.
Rhodes, Paspalum	2 oz.
Turnip, Cabbage, Parsnip, Carrot, and Vegetable Seeds of like size	½ oz.
All Seeds other than those included above	2 oz.
Vegetable Seeds in made-up packets	3 packets

In the case of samples containing a large amount of Foreign Ingredients, it is advisable to send double the weight mentioned.

When drawing a sample be careful to obtain a quantity from the top, bottom, and middle of each bag. These should be thoroughly mixed to ensure the sample being uniform.

The name of the seed, quantity that the sample represents, also name and full address of the sender, should be on every sample.

If the result of the examination is required for purposes of sale, a fee of 2s. 6d. per sample will be charged.

No charge will be made to Farmers sending in samples of seed which they have purchased as seed for sowing, providing the following particulars are given:—

Vendor's name and address.

Name of seed.

Quantity purchased.

Date of delivery.

Locality where seed is to be sown.

Name and address of purchaser.

Samples, with covering letter, should be addressed to—

UNDER SECRETARY,

DEPARTMENT OF AGRICULTURE AND STOCK,

BRISBANE.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S.

TIMES OF SUNRISE AND SUNSET.

AT BRISBANE.

1921.	JANUARY.		FEBRUARY.		MARCH.		APRIL.	
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Sets.	Rises.	Sets.
1	4·57	6·45	5·22	6 42	5·41	6 20	5·58	5·46
2	4·58	6·45	5·22	6·41	5·41	6·19	5·58	5·45
3	4·59	6·45	5·23	6·41	5·42	6·18	5·59	5·14
4	4·59	6 46	5 24	6·40	5·43	6·17	5·59	5·43
5	5 0	6·46	5 24	6·40	5·43	6·16	6·0	5·42
6	5·1	6 46	5·25	6·39	5·44	6·15	6 0	5·41
7	5 2	6·47	5·26	6 38	5·45	6·14	6·1	5·40
8	5·2	6·47	5·27	6·38	5·45	6·13	6·1	5·39
9	5·3	6·47	5·27	6·37	5·46	6·12	6·2	5 38
10	5·4	6·47	5·28	6·36	5·46	6·10	6·2	5·37
11	5·5	6 47	5·29	6·36	5·47	6·9	6·3	5·35
12	5·5	6 47	5·30	6·35	5·47	6·8	6·3	5·34
13	5·6	6·47	5·30	6 34	5·48	6·7	6·4	5·33
14	5·7	6·47	5·31	6 33	5·48	6·6	6·4	5·32
15	5 8	6·47	5·32	6·33	5·49	6·5	6·5	5·31
16	5·9	6·47	5·32	6·32	5·49	6·4	6·5	5·30
17	5·9	6·47	5·33	6·31	5 50	6·3	6·6	5·30
18	5·16	6·47	5·34	6·30	5·50	6·2	6·6	5·29
19	5·11	6·47	5·34	6·30	5·51	6·1	6·7	5·28
20	5·12	6·46	5·35	6·29	5·51	6·0	6·7	5·27
21	5·12	6·46	5·36	6·28	5·52	5·59	6·8	5·23
22	5·13	6·46	5·36	6·27	5·52	5·58	6·8	5·25
23	5·14	6·45	5·37	6·26	5·53	5·57	6·9	5·24
24	5·15	6·45	5·38	6·25	5·53	5·56	6·9	5·23
25	5·15	6·45	5·38	6·24	5 54	5·55	6·10	5·22
26	5·16	6·44	5·39	6·23	5·54	5·53	6·10	5 21
27	5·17	6·44	5·40	6·22	5·55	5·52	6·11	5 20
28	5·18	6 44	5·40	6·21	5·55	5·51	6·11	5·20
29	5·19	6·43	...	...	5·56	5·50	6·12	5·19
30	5·20	6·43	...	...	5·56	5·49	6·12	5·18
31	5·21	6·43	...	...	5·57	5·48	...	...

PHASES OF THE MOON, ECLIPSES, &c.

(The times stated are for Queensland, New South Wales, and Victoria, where the clock time is identical).

			H. M.
9 Jan.	●	New Moon	3 27 p.m.
17 ,,	☾	First Quarter	4 31 p.m.
24 ,,	○	Full Moon	9 8 a.m.
31 ,,	☽	Last Quarter	6 2 a.m.

Apogee on 9th. Perigee on 23rd.

8 Feb.	●	New Moon	10 37 p.m.
16 ,,	☾	First Quarter	4 53 a.m.
22 ,,	○	Full Moon	7 33 p.m.

Apogee on 5th. Perigee on 21st.

1 Mar.	☽	Last Quarter	abt. m'night
10 ,,	●	New Moon	4 9 a.m.
17 ,,	☾	First Quarter	1 49 p.m.
24 ,,	○	Full Moon	6 19 a.m.
31 ,,	☽	Last Quarter	7 13 p.m.

Apogee on 5th. Perigee 21st.

8 Apr.	●	New Moon	7 5 p.m.
15 ,,	☾	First Quarter	8 12 p.m.
22 ,,	○	Full Moon	5 50 p.m.
30 ,,	☽	Last Quarter	2 9 p.m.

Apogee on 2nd and 30th. Perigee on 17th at 3 p.m.

ECLIPSES.

An Annular Eclipse of the Sun visible in North of Scotland but not in Australia will occur on April 8th.

An Eclipse of the Moon will occur on April 22nd, when the Moon will rise totally eclipsed.

The Planets Venus, Mars, and Uranus will be remarkably close together apparently on January 9th, and will form a fine celestial picture with the Moon on the 13th.

For places west of Brisbane, but nearly on the same parallel of latitude—27½ degrees S.—add 4 minutes for each degree of longitude. For example, at Toowoomba the sun would rise about 4 minutes later than at Brisbane if it were not for its higher elevation, and at Oontoo (longitude 141 degrees E.) about 48 minutes later.

At St. George, Cunnamulla, and Thargomindah the times of sunrise and sunset will be about 18 m., 30 m., and 38 minutes respectively, later than at Brisbane.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhere about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.