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THE COTTON PLANT IN SOUTHERN QUEENSLAND.

By DANIEL JONES, Adviser in Cotton Culture.

Eight weeks' travel through the driest and most fertile regions of Southern Queensland investigating the merits and behaviour under the unusually trying drought conditions hitherto experienced proves beyond cavil that in the cotton plant farmers have a staple crop not excelled by any other at present grown.

In this land of magnificent distances illustrating by this, as it does, the immense territory in which this crop can be profitably raised, it is surprising that the value of such an important industry has not been seized upon with more avidity than it has done hitherto, being as cotton is now recognised as the hardiest of all crops to withstand drought or other seasonal inclemencies.

In this article, necessarily a brief one, I will endeavour to present the case for the cotton plant in as concise a manner as I am able to do.

Perhaps I may first begin by brushing away some of the fallacies so commonly field anent the handling of the crop, as usually expressed by those not so well informed as they might be.

My inquiries chiefly relate to investigations in cotton-growing centres located between Mitchell, 372 miles inland from the coast, Warwick, 159 miles, and other localities within 50 miles of the city of Brisbane. The thriving condition of the cotton plant indicates that we have a vast region on which the foundations of a valuable industry can be well and truly laid if attention be concentrated on this subject.

COTTON DEFIES DROUGHT

better than any other plant at present grown. In no instance in my travels have I observed a cotton shrub fail to fruit this season, while every other form of vegetation was either dead or dying as a consequence of the prevailing drought.

On one farm visited, the owner was gathering a better crop of fibre than the same shrubs produced during the previous season, due to the fact that the plants were longer established. Usually, in our experience, the second year's growth furnishes a heavier yield of fibre than plant cotton does.

The perennial character of the shrub in some localities favours a larger production of cotton, inasmuch as the plant is more hardy and less affected by adverse seasonal conditions. Hence our advantage over growers in America, where the shrub must be raised as an annual, and is subject to seasonal conditions which preclude raising cotton as cheaply as is done in Queensland.

As bearing on this aspect of the industry, it is gratifying to note that this plant has ability to withstand prolonged drought even better than some forest trees. During this last month I have observed forest trees severely affected, while cotton shrubs in the neighbourhood were to be seen cropping vigorously on sound, healthy bushes.

Perennial-grown fibre usually is not quite as good in length of staple as on first-year plants, but the difference is not so great as to advise a departure from our established custom. If, however, the higher class of Sea Island is wanted, then it would be prudent to attempt the cultivation of this particular variety in this way. By doing so we would lose the value of the hardihood and more profuse production of the plant, so that it is, as yet, a moot point as to which method should be adopted in growing this type of cotton.

Sea Island fibre, if grown on the perennial system, usually gives a better yield, and is much easier picked than is the annually sown product, but the quality of the lint is inferior. Despite this being so, experience has shown that the quality of the cotton is such as to merit its cultivation, particularly as it will bear profitable crops up to six or eight years.

British authorities for this reason condemn our method of raising cotton as a perennial plant, although they always assess at a high value the samples of this fibre sent them for appraisement. Intimately related to this aspect is the fact that when, some time since, I submitted a sample of the Eureka, a perennial variety, to the Lancashire brokers, they valued the fibre at 1s. per lb., when American was worth 7d. This goes to show that though there may be a reason for discounting the value of perennial-grown fibre, it is not of such importance as to discourage tilling cotton as we do. I am now taking the twelfth crop from plants in Brisbane, and the bushes have come through the drought remarkably well, showing no signs of dwindling. I have, in a former article, dwelt on this aspect of the matter, but more recent investigations prompt me to again refer to the question, confirming, as they do, the more extended investigation, my former statements.

THE HARVESTING OF COTTON

is a subject on which there are erroneous ideas, particularly among those not familiar with the subject, who often permit an opinion to misplace a fact.

The picking of cotton by hand is, no doubt, a process entailing some personal discomfort until the picker becomes accustomed to the ordeal; nevertheless, it is a light, clean work, and one at which either the owner himself or his employee can make a good wage. I have met juveniles in the Lowood District and other places recently who have gathered from 100 to 130 lb. in a day of eight hours. As one grower I met paid 1d. per lb. for picking, it will be seen that a juvenile having this celerity can make at least from 8s. to 10s. per day. This is over the usual sum paid, ¾d. per lb. being the usual rate of pay for picking.

Assuming, however, that the owner gathers his 100 lb. of fibre per day, his earning on last season's values of 4d. per lb. of cotton in seed is 33s. 4d. for his day's toil. Each member of the family over school age employed can undertake and execute this task also.

I recently met a grower who, with his own family of three, gathered over 300 lb. of cotton a day, the then value of which was £5. By growing different varieties this earning ability can be extended, if required, to cover from five to eight months of the year. It is clear, then, that the harvesting of cotton, although perhaps a tiring task, has abundant compensations which other crops are unable to show.

Growers frequently have the opportunity of selecting in the field such types as are attractive; hence the ability of the picker is greatly enhanced by the ease with which the cotton can be taken from the pods.

It occasionally happens that the grower pays undue attention to the gathering of the fibre. Clean cotton is a desideratum, but it is not expected that growers should take such care in eliminating leaf or other débris which the cotton gin can better clean up. Old-time growers in particular have thought that the same system must be carried out to-day as in former years, when facilities were not so good for treating the fibre. Cotton picked in the afternoon on a dry day rarely requires sunning. In the morning's gathering, however, a little care is required not to pack damp fibre, but if the morning's cotton is spread for a few hours at the end of the rows, in all probability, if the day is sunny, the fibre will be in safe condition to bale for transport.

I have on occasions found growers take such pains with cotton as to discourage them in regard to future planting, a care quite uncalled for at the present time.

THE MECHANICAL PICKER

has for long years been the dream of the cotton-grower. Should such a machine as is here described materialise and prove the practical success which it promises to become, then will come the solution of the labour problem in cotton production.

The writer, in 1907, tested and patented a vacuum picking process in Melbourne, and subsequently at Roma street, Brisbane, based on the suction principle. Efforts were then made to arouse sufficient interest in the project, without avail. Since that time, the Federal Institute of Science and Industry, learning of the abortive attempt to build a machine, appointed a committee comprising Mr. Norman Bell, electrician, the late L. P. Weston, of the University, and the writer, to carry out tests along lines already tested, which promise to materialise into valuable service to the cotton-grower in Queensland in particular. Tests shows that, with tractive varieties of cotton, the fibre can be removed from the bolls with great rapidity.

Certain types of cotton growing in Queensland are exceptionally well adapted for mechanical picking by reason, not only of their tractive character, but of their habit of growth, which enables the system to be effectively employed once a machine is constructed.

In another portion of this Journal will be found illustrations taken from the "Scientific American," showing the method of dealing with the matter of harvesting cotton. This is claimed to be a success, and it is fervently hoped it will prove up to American description of its ability to handle cotton. In our local tests we have reason to expect that a modified system will suit our conditions better than the American one, and steps are to be taken to further locally test the improvement designed. It will not only simplify, but cheapen the cost of the machine, so that every grower will be able to own and operate his own plant. The American machine, said

to be a success, is on identical lines of the one tested and patented by the writer in Melbourne in the year mentioned. I shortly expect the American to further forestall the Australian by adding a further improvement to the machine, the Institute of Industry and Science having, on a recent date, made public the process. There is every reason to be grateful to anyone who will assist in promoting the construction of an effective mechanical cotton-picking machine, and we wish the folk who can do it "good luck."

The Profits of Cotton-growing

have during the past few seasons been of a very satisfactory nature. Personal investigation indicates that up to £26 worth of cotton has, in one instance, been gathered from 1 acre in the Lowood District by Mr. Litzow. This gentleman is well versed in the vocation, and has for a long series of years been intimately connected with cotton-growing. His advocacy of cotton is based on personal knowledge, and he is ever instancing his own experience as a guide to other farmers in the district to induce them to engage in the cotton industry. Mr. Litzow showed me a plot slightly less than an acre in extent, from which in the 1917 and 1918 seasons he has gathered £50 worth of fibre. The cotton was of the Upland variety, and had but the usual tillage. In the last year it suffered somewhat from drought, but had ever so small a rainfall happened, the crop would have been larger. As it was, over 1,700 lb. of seed cotton were obtained from 1 acre.

In the Marania district, right amongst the prickly-pear belt, one grower obtained an average of £20 worth of cotton from an area of 5 acres. Another grower on the Condamine, not far from Miles, got the same sum per acre from a block of 3 acres, and the owner writes that, but for the dry weather and an attack of insect pests, the yield would have been much greater.

So far as my investigations enable me to judge, no grower this past season has failed to get reasonable returns from the cotton plot. I have seen places where the fibre remained unpicked, when any smart adult or juvenile could easily gather from 2s. 6d. to 4s. worth of cotton per hour. Nevertheless, a lot was wasted for want of either time or disposition to win the money.

The Lacking Factor in Cotton Production

is simply that there are no persons to do it. The drift into the cities is largely responsible for this condition of things. In addition, several of our rural occupations have not been chosen with due regard to their suitability to our climatic and seasonal conditions; hence many farmers are sadly disappointed with the results of their farm operations. Not so with cotton. In many instances we have trusted to crops more adapted to temperate climates than to a subtropical or tropical environment.

This is singularly true of the cotton plant, which is subtropical in its character, while wheat and most grain crops are the reverse. Our Queensland farmers might well revise their rural methods and more closely investigate in what way a new departure will benefit the whole class.

The field operations required to successfully raise cotton are of the simplest nature, and will meet the requirements of either the inexperienced in farming or those with only a little capital to expend. Hence the probabilities of new settlers making good with this crop are much more favourable than with others which need more experience and capital to profitably produce.

A large influx of settlers into the rural centres known to be adapted to the cotton plant would at once meet the conditions wanted to increase the crop, if only to the dimensions reached a half century since, and would be of inestimable service to the country.

NO VOCATION WILL ASSIST SOLDIERS' WIDOWS

to maintain their families in such comfort and independence as can be achieved by assisting the widow to settle on, say, a 5-acre block with a comfortable dwelling provided.

A few hundred families resident in a cotton-growing centre would provide, from the juvenile element in the family, much of the help required by the farmer at picking time. As this work would be well paid for and be constant for several months of the year, the home treasury could be well filled with cash for household needs. In addition, the family could maintain themselves cheaply by having a small farm residence on which to raise poultry, vegetables, or, if necessary, a few acres of cotton or castor bean, products which are easy to raise on small lots and will bring in a substantial increase to the widow's pension.

If our land settlement authorities take up this question in this manner, problems of land settlement and labour drift to the cities would to some extent be solved and rural pursuits materially advantaged by an influx of new folk, to whom the new life would prove immeasurably better than the artificial existence of the great cities.

HOMESTEADS FOR THE RETURNED SOLDIERS

could be furnished by the thousand in these districts from either large holdings by purchase or by the subdivision of smaller areas that would meet every demand from this direction. Thousands of acres which now return a gross production of only a few pounds' value per acre could by an easy process of assisted land settlement be made 50 per cent. more remunerative than at the present, utilised as they are in growing low-value crops. Compared with that possible to produce from a cotton field, the crops now popular with the farmer do not in any way represent the latent value of the soil. Only by this new departure in rural activities will the settler do full justice to himself, his family, and his country.

CELERITY IN PICKING COTTON

depends largely on the facilities offered in the field. Too many growers are timid in putting under crop an ordinary sized plot, but confine themselves to a few acres, fearing inability to gather.

It is quite patent to anyone familiar with this vocation that if only, say, 5 acres are under crop, and if two or three of the farmer's family start to pick, the amount of fibre remaining after a couple of days' work will be a minus quantity. This precludes a good day's gathering, and instead of 100 lb. or over being picked, the shrinkage amounts to half what ought to be picked. Failure to gather the ordinary estimated amount is frequently due to an insufficient area to operate upon.

Granting that in a good flush of fibre a juvenile's capacity for picking is 100 lb. daily, and assuming an average yield per acre to be 1,000 lb. of cotton, this should be but a ten days' task for one picker. To put into the field more than one hand to 10 acres at the commencement of the harvesting season is thus likely to nullify the ability of the picker by reason of absence of a sufficiently large crop, which has to be divided among several pickers instead of allowing one hand to have the whole field to himself.

Assuming that it is possible to gather fibre on 100 days in the season, which is quite within the range of practicability, it follows that one person gifted with celerity of an ordinary nature could control at least 10 acres in the season. As the picking season in Queensland can be made to extend for at least seven months in the year, it will be seen that the task set down as practical for a picker can even be exceeded, based on the idea of ability to gather the quantity assumed per day.

As the outside cost of raising an acre of cotton from seed time to the harvest period should not exceed 40s. an acre—in many localities less than this. Seed being delivered free by the Department, restricted cultivation can hardly be excused under the circumstances.

COTTON SEED IMPORTS.

The Federal Government has issued a proclamation prohibiting the importation of cotton seeds to Australia from any part of the world excepting under permit.

In connection with this proclamation, we in Queensland welcome it as a step which should have been taken long ago. Fortunately, no evil results followed the importation of cotton seed to Queensland in the early day of cotton-growing in our State, if we except the appearance of the cotton boll worm, if, indeed, that pest came with the first importation of cotton seed in the sixties, which is more than doubtful, seeing that the worm was found in maize cobs before cotton was dreamt of in the then colony. The Queensland Department of Agriculture has always exercised the utmost vigilance to prevent the introduction of undesirable plant pests, with the result that the formidable boll weevil, which devastates thousands of acres in the cotton-growing States of America, and has cost the United States Government some £15,000,000 in attempts to eradicate it, is unknown in Queensland, and the same may be said of the leaf-eating cotton worm, the American red cotton-stainer, and various fungoid pests common in older cotton-growing countries.

The necessity for extreme caution in importing cotton seed cannot be too strongly emphasised, and this is clearly shown in an article in the Year Book of the Department of Agriculture of Madras, India, 1918. The writer is the Acting Government Entomologist, Mr. T. V. Ramakrishna Ayyar, B.A., &c., the subject, "Some Notes on the habits and Life History of the Stem Weevil attacking Cambodia Cotton." "This weevil," he says, "is a very small creature about an eighth of an inch in length, resembling more or less the stored rice weevil. Curiously enough, it has been noted in Behar, in Northern India, and in South India it appears to be confined to the Coimbatore district. There is not yet sufficient ground to state with any amount of authority that the insect is one of the many introduced forms in India. But that it should be found in widely distant areas such as the two above-mentioned, without being found anywhere between these two, shows something surprising regarding its distribution and occurrence. If it exists in some tracts, there is no reason why it should not appear on cotton in other tracts, as this creature does not confine its attacks solely to Cambodia cotton, but also to local varieties, as is found on the Coimbatore farm."

The writer explains that the mischief is not done by the adult weevil, but by the young one, called the "grub," which bores through the stem tissue of the plants, and affects them very seriously. When young plants are attacked, they are in most cases killed, as the slender stem is unable to stand the attack. In the case of those which are grown up (say four or five months old), though the stem is affected, although many dry up, several plants withstand the attacks. In bad cases the loss might be put down at from 15 to 20 per cent. of the usual out-turn. The prevention methods, of whatever nature, have to be directed to the prevention of the weevil laying eggs on healthy plants. With this idea in view, the following methods were tried:—

(*a*) When the pest was apprehended, young plants were smeared at the stem just above the ground with dilute phenyl.

(*b*) The stem at the ground level was earthed up with a mixture of loose soil and lead arsenate powder.

(*c*) The plucking and burning of badly infested plants.

The first two methods produced no results worth recording, as the plants so treated became infested as usual. The prevention method of pulling out and destroying the first attacked plants considerably checked the ravages of the pest. But this, of course, has to be resorted to by all cultivators in one tract, else the benefit will be unappreciable.

The entomologist believes that if there is a lull of at least two months between one cotton season and the next, when there will be no cotton plants at all in a tract, the pest may be starved out and some reduction in its numbers effected.

This pest has, thanks to stringent regulations, and to the fact that no Indian cotton seed has been imported by the Queensland Department of Agriculture, never made its appearance in our State, and all the seed obtained from the United States and from Egypt has been absolutely sterilised at the shipping ports, and again on arrival. All seed supplied to our farmers is, therefore, free from either insect or fungoid pests.

BEEKEEPING MAY INCREASE THE COTTON CROP.

Fertilisation of the Cotton Flower takes place soon after Sunrise—Twenty five to Fifty Pollen Grains necessary for each Flower—Shedding of Bolls often due to Imperfect Fertilisation.

ROWLAND M. MEADE, Bard, Cal.*

The percentage of cotton flowers that develop into mature bolls is generally low. Even under the most favourable conditions many of the buds do not reach the blooming stage, and many flowers that open fail to set bolls.

A test of twelve Upland varieties made at Bard, Cal., in 1911, showed that during the first thirty days of flowering, 44 to 66 per cent. of the flower buds aborted before opening, and that 22 to 52 per cent. of the flowers that opened failed to develop into bolls. An examination of all the nodes on the fruiting branches at which it would have been possible for bolls to develop showed that at only 12 to 23 per cent. of these nodes were bolls produced.

In the same series of varieties at San Antonio, Tex., in 1912, 35 to 82 per cent. of the flowers that opened failed to mature bolls. The shedding at San Antonio was doubtless due largely to unfavourable climatic conditions, as drought, and, also, to the depredations of the boll weevil. The boll weevil, however, is not present at Bard, and as irrigation is practised the lack of water could hardly be an important factor. Inadequate pollination was considered as a possible cause of the shedding, when the flowering stage had been reached.

The cotton flower is a large, cup-shaped blossom; it is borne in an upright position on the upper side of the fruiting branch. The structure and relation of floral parts are shown in Fig. 16. The pollen grains are very large and have moist spinose surfaces, so that they tend to cohere when freed from the anthers and are not carried about by the wind.

PERIOD OF FERTILISATION SHORT.

The period during which fertilisation is possible lasts only a few hours. The flowers open soon after sunrise, commence to wither as the temperature rises in the middle of the day, and close in the evening, when the stigmas are dry. The second or third day after blooming the petals, stamens, and pistil separate from the rest of the flower and fall from the plant.

In some types the relative position of the stigmas and stamens is favourable, and in others unfavourable, for self-pollination. This doubtless partially accounts for the differences between varieties with respect to the percentage of flowers that develop into bolls.

LONG STAPLE COTTON OFTEN SELF-STERILE.

Most of the flowers with long stigmas projecting above the stamens do not become completely self-fertilised, as the anthers and stigmas are too widely separated. The flowers of many of the long staple varieties are of this type, the stigmas often exceeding the anthers by 15 mm. (See Fig. 1.) The bolls resulting from such flowers have 23 to 50 per cent. of aborted seeds, and it seems not unreasonable to attribute this abortion in part to the lack of perfect pollination. Flowers with short stigmas embedded among the upper stamens are readily self-fertilised. Such an arrangement is shown in Fig. 2. Erect stamens, either long or short, are also favourable to self-fertilisation, since they bring the anthers in close proximity to the pistils.

Cotton bolls have three to five locks or compartments, each containing six to eleven ovules, the number varying with the type of cotton. Few locks of long staple types contain more than nine seeds, while most of those of big-bolled, short, staple types have at least eight seeds, but mature bolls in which all of the seeds are fertile are rare. In the bolls of Upland varieties 10 per cent. to 25 per cent. of the ovules fail to develop into seeds. There is usually a slightly higher percentage of aborted seeds in the bolls of the long staple types.

* This report was found among the papers of the late Rowland M. Meade in essentially the same form as presented.—J. H. Kempton.

LARGE AMOUNT OF POLLEN NEEDED.

It was found by preliminary investigation that the bolls failed to set unless at least 25 grains of pollen were applied to the stigmas; even with this number only one or two seeds matured in each lock. As each lock contains from six to eleven ovules, it is necessary for at least 25 to 55 grains of pollen to reach the stigmas in order that all the ovules of a four or five-locked boll be fertilised.

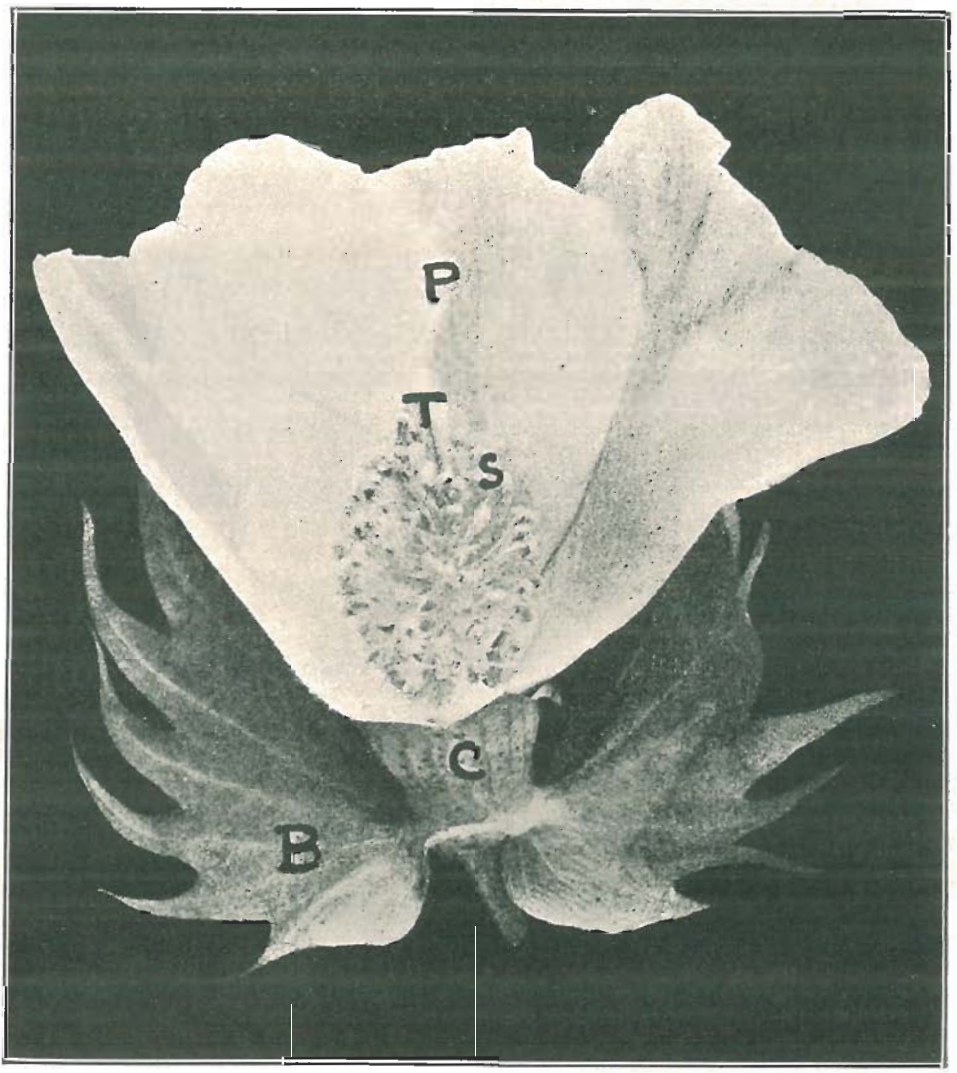

PLATE 11 (FIG. 1).—AN UPLAND COTTON FLOWER.

A dissected flower enlarged two diameters to show construction. *B*, bracts; *C*, calyx; *S*, stamens; and *P*, petals. *T*, stigma protruding above the stamens. Insects can easily visit the stamens and collect pollen without ever touching the pistil, which projects above the stamens. (Fig. 1.)

An experiment was conducted at San Antonio, Tex., during 1913, to determine whether an increase in boll production might be expected as the result of complete pollination. Two varieties of cotton were chosen for this investigation—Durango, a long, staple type with stigmas exserted beyond the stamens, and Acala, a short, staple type with short stigmas embedded among the stamens. The separation of the anthers from the stigmas in the Durango flowers reduces the chance of self-fertilisation, while the conditions found in Acala cotton favour self-fertilisation. Two rows of each variety were planted for this experiment.

EXPERIMENT EXPLAINS DIFFERENCE.

One of the rows of each variety was designated as *A*, and the other as *B*. The flowers in the *A* rows were completely self-pollinated, anthers being removed by hand, and the pollen scattered over the pistil until the stigmas were well covered. The flowers in the *B* rows were allowed to become pollinated naturally.

A small string tag with the date of opening of the blossom was securely fastened about the branch at the base of the flower to mark the position of each flower that failed to develop into a boll. The hand pollination in the *A* rows produced the effect that might be expected from the work of bees or other pollinating insects operating in great numbers, except that the manipulation of the stigmas may have been slightly injurious. There were no indications of this, however, and, as far as possible, normal conditions were provided.

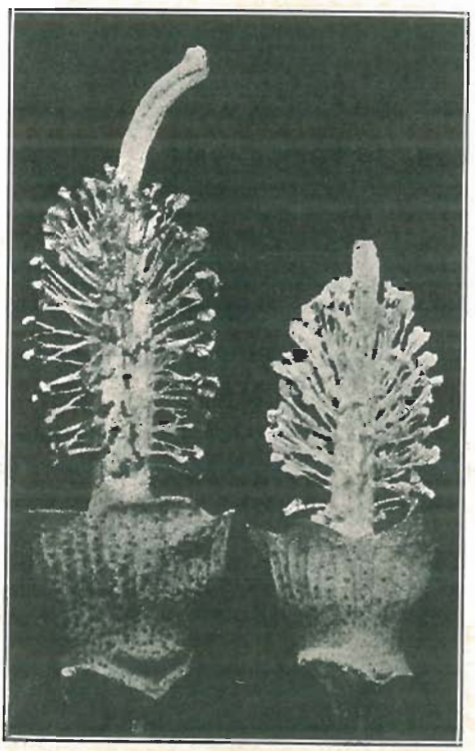

PLATE 12 (FIG. 2).—COTTON FLOWER TYPES.

Section of an Upland X Egyptian cotton flower on left, showing long exserted pistil. Flowers of this type are seldom completely self-fertilised. Section of a short stapled Upland cotton flower on right, with short pistil imbedded among the stamens. Flowers of this type are usually self-fertilised. Enlarged two diameters to show detail. (Fig. 2.)

The experiment was carried on during the early part of the season, when conditions were favourable for growth, and were discontinued after 10th July, because of extreme drought and the presence of boll weevils.

At the end of the season a complete record was taken of the matured bolls and of the vacant nodes bearing tags. It was thus possible, each day's record having been kept separately, to determine the percentage of flowers of each day that developed into mature fruit.

ARTIFICIAL POLLINATION BETTER.

As was anticipated, better results (an increase of nearly 11 per cent.) were obtained by artificial pollination in the Durango cotton than in the Acala variety, in which the increase was only about half as great. As before stated, the flowers of the former have exserted pistils, not adapted for perfect self-pollination, while those of the latter variety have short pistils.

The lowest percentages of bolls produced were found in the open pollinated rows of both varieties, whilst the highest percentages were found in the hand pollinated rows. In the open pollinated row of Durango, the lowest and highest percentages of bolls produced were 11 and 69.6, respectively; in the hand pollinated row, 32 and 81, respectively. In the open pollinated Acala row the lowest and highest percentages were 23 and 59, respectively; in the hand pollinated row, 34.8 and 65.5, respectively.

No effort was made to exclude insects, and the weather conditions during the course of the investigation were not unfavourable to their activities. It is evident from the increased yield of bolls secured in the long-pistiled Durango variety through artificial pollination that the presence of additional pollinating insects would aid in reducing the high percentage of shedding. The value of honey bees in this connection is recognised in some localities, and it would seem that growers of long-stapled varieties might find beekeeping a distinct advantage to the cotton crop.—"The Journal of Heredity."

NOTICE TO COTTON PLANTERS.

The Department of Agriculture and Stock is prepared to receive Raw Cotton, gin and market it on owners' account. An advance of 2d. per lb. for the year 1919 will be made upon the raw cotton received, and any surplus after sale will be paid to the growers *pro ratâ*, after deducting charges. Consignments are to be forwarded addressed to the Department of Agriculture, Brisbane, who should be advised of the despatch.

Suppliers at the close of the 1918 season received 4d. per lb. for their cotton inclusive of the advance of 2d. per lb.

COTTON ON THE CONDAMINE.

The photograph here reproduced was taken on Mr. W. E. Knight's farm "Valverde," Condamine, near Miles. Mr. Knight believes firmly in the value of cotton as a farm crop, and but for the severe drought, he would have had half as much again from the area, as, after a shower in March, the field showed a mass of blossoms and set bolls. Under the adverse conditions, his crop from 3 acres realised £60.

PLATE 13.—A COTTON FIELD ON THE CONDAMINE.

COTTON-PICKING MACHINE.

The "Melbourne Leader" of 11th January, 1919, describes a cotton-picking machine, which is reported as being highly successful in America. This machine is identical in principle with patent designs taken out by Mr. Daniel Jones, Instructor in Cotton Cultivation, of the Queensland Department of Agriculture, in Melbourne in 1906. Mr. Jones anticipates that subsequent improvements tested in Brisbane indicate that a simpler and less costly apparatus can be utilised.

Cotton-growers all over the world have had to be content with the labour of hand pickers, whose daily average amounts to about 100 lb. of seed-cotton, expert pickers being able to pick 200 lb. or even more on a heavy crop. A full description of the machine appeared as follows in the "Scientific American," 19th October, 1918:—

A SUCCESSFUL COTTON-PICKER.

By Edward C. Crossman.

Down in the Imperial Valley, California, where the mercury pirouettes gracefully between the 100 and 120 mark during the summer, and where the only drawback to raising cotton is the inability to get the garnerers thereof in the hot months, there

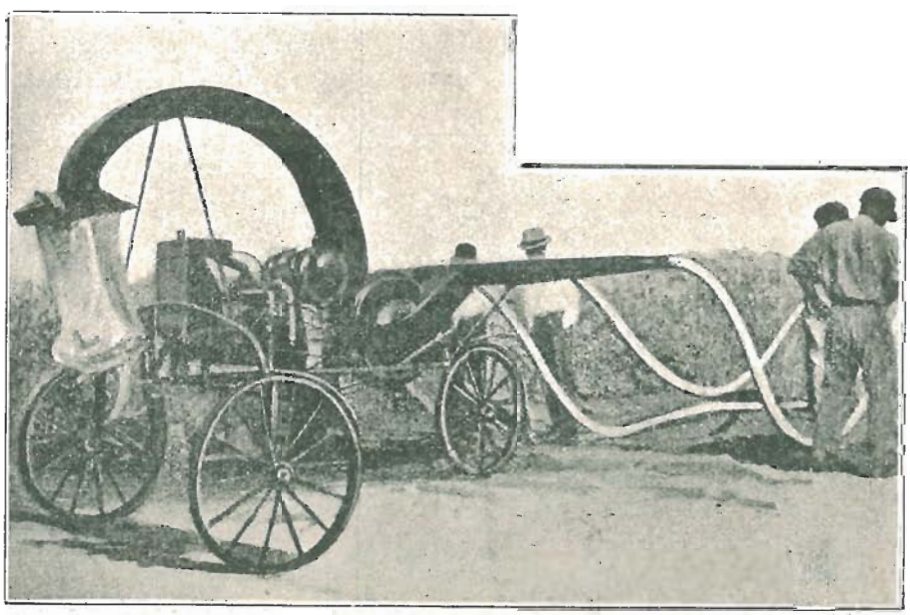

Plate 14 (Fig. 1).

is working a cotton-picking machine which, with the hard cash of the harvester "trust" considerably invested in it, must rank at least beyond the wild-eyed, blue-print stage.

To date the machine has produced cotton cleaner than that hand picked, and to date it has beaten three and four to one the pickers working by hand process as contrasted with the inexperienced men handling the picking nozzles. All of this was with the mercury around the 115-in-the-shade mark, when both pickers and crew of machine were more concerned in keeping from catching fire than in making cotton-picking records.

The largest and most experienced cotton broker in California has pronounced it practical and a success, and was the means of getting the harvester aggregation to turn its cold and fishy optics in the direction of the machine, and to untie the many knots in its purse strings to build the present and second model.

The machine weighs but 1,000 lb., and so is easily moved around from place to place. Draped artistically around its light skeleton are the 300-lb. 16-horse power engine, the suction pump for the nozzles, and the centrifugal separator for parting the cotton from the leaves, sticks and what-not, taken in by the open-minded picking nozzles.

An 8-ft. pipe runs transversely over the machine, and from this extend the light, 18-ft. rubber pipes with their patent nozzles, five of them in all.

The powerful suction pump on the machine endeavours constantly to keep the picking pipes in a state of vacuum, wherefore, when the nozzle is passed over a row of bolls, the suction picks up the cotton and carries it through the pipe and to the centrifugal separator. Here a powerful fan with hollow vanes, a departure in fan construction, separated the cotton from the leaves, the sticks, and the "motes,"

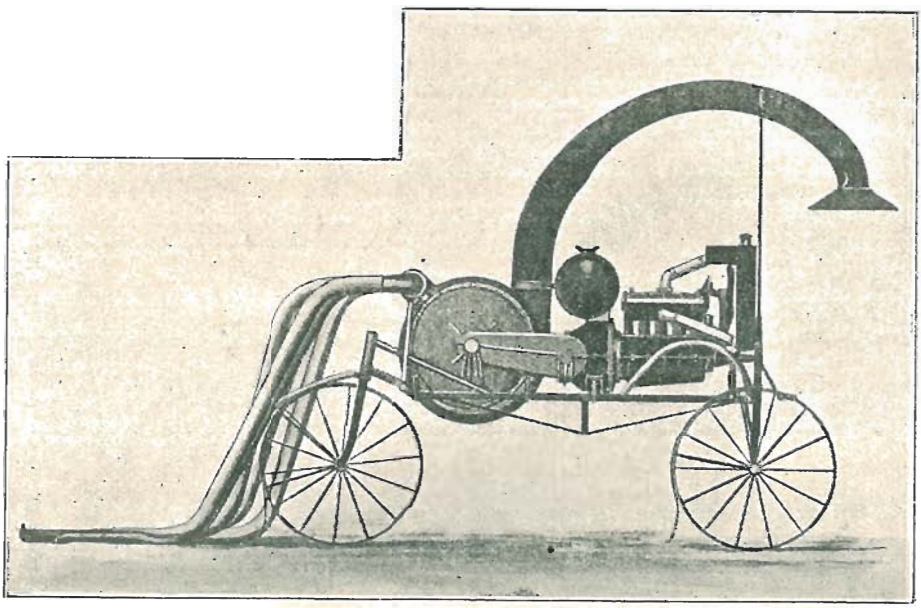

PLATE 15 (FIG. 2).

which are not desirable, and finally drives the separated mass through a curved pipe at the rear. The leaves and motes are driven out through perforations in the top of the pipe; the cotton is driven through to the sack or basket at the end.

Each one of the five picking nozzles and rubber pipes is handled by a man, and the speed of action depends on the skill he acquires. A single sweep of the patent nozzle across a row of the white blossoms is alleged to pick them clean, the time being about that required to pick one boll.

The rate of picking cotton by hand seems to vary from 100 to 200 lb. per day—the record being made by a coloured person, who picked 900 lb. in a day, but did it on the run and without attempting to do more than to get the easiest reached. Also, cotton-pickers are wasteful, the waste running as high as 50 per cent. of the crop, and the amount, according to the Government reports, running into hundreds of millions. It is human nature to pick the bolls on the top, and to let those lying in

the back-breaking strata at the bottom of the bush remain to sleep in the southern sunshine.

The persons running the California machine, described and illustrated, claim that five men with the machine can pick 1,000 lb. per man per day of ten hours, or 5,000 lb. per day, and that it does a clean job instead of a wasteful one, because the nozzles do not mind being required to get down into the bottom of the plant.

There remain plenty of woodpiles for the Ethiopian to hide in, and it may be that the machine without brains, even though directed by human hands at the very nozzles, will still not pick with the proper discrimination, but the fact remains that this is the first one on record to reach even the present stage of hopefulness.

As cotton authorities allege that last year not far from a million persons were engaged in the harvesting of cotton, the machine able to do the work of five times the number of men needed to operate it, and to do it with little labour on the part of the crew, might well be an invention of serious national need.

PLATE 16 (FIG. 3).

ONIONS AND ONION-GROWING.

As the time approaches for preparing for an onion crop, it will not be out of place to give directions for sowing the seed and for the after cultivation of this most valuable vegetable. There is no reason why onions should be imported in such quantities as we see daily arriving by steamer from the Southern States. The climate here is perfectly adapted to them, and, if only planted on suitable soil and given the necessary attention, heavy crops are an almost certain result. At one time it used to be said that onions could not be profitably grown as a field crop in the Blenheim district, near Laidley. To disprove this, the writer determined to experiment on the sandy loam of the scrub land on Sandy Creek. The seed was sown in April; the variety, Brown Spanish. The land to which they were to be transplanted was well worked and then rolled to make a hard, compact bed. Transplanting as carried on throughout July, and the season having proved favourable the result was a heavy crop of magnificent bulbs, which gave a splendid return for the labour

expended. Now, if such a result can be obtained by one farmer, it follows that others can do the same. As there are thousands of acres of similar land under cultivation both there and in many other portions of the State, it only requires determination on the part of the farmers to enable them to successfully displace the importations from the South.

On looking over an old diary of farm operations, it appears that the writer's crops averaged 6 tons per acre, and sold at £25 per ton. Are there many crops which will give a like return? The present price of onions in the market is about £24 per ton. Now, suppose a crop to yield 8 tons per acre (and we know that double that return has been made), the cash return for a medium crop will amount to £192. Certainly there is a considerable amount of labour involved in planting out an acre or two of onions, but that labour is amply compensated for by the net returns.

A consideration of the following notes, based on practical experience, may, therefore, be of some service. Let us first consider

THE SOIL.

The most suitable soil for onions is a rich sandy loam, such as that of the Blenheim scrubs—free, friable, and easy to work, a soil that will not cake, and not lying so low as to retain the superabundant moisture after heavy rains. In such a case the land should be well drained. An eastern or south-eastern aspect has been proved to be better than if the land sloped to the west, as the onion does not require intense heat to bring it to perfection.

Before sowing the seed, it is important that the seed beds should be clear of weeds and of their fallen seeds. By sowing in April or May, there is not much to fear from weeds; still, it is advisable that the land, both of the seedbeds and of the area proposed to be planted out, should be turned up and exposed to the weather for some time previous to sowing. As soon as the weeds appear, give the land a good scuffling, and if this be done two or three times between March and April there will be no trouble afterwards. If the soil be not virgin scrub, or if it has borne crops for many years in succession without manuring, it should be thoroughly well manured with stable dung, ashes, bonedust, &c., as the onion demands plenty and the best of nourishment. New scrub land is rich enough in natural fertilisers not to require any addition of manure.

PREPARING THE SOIL.

In planting out onions a very serious mistake is often made, and that is, the soil is carefully worked, reduced to a fine tilth, and the plants are set out in a soil which is loosened to a depth of perhaps 8 inches. From land prepared in this manner no good results need be expected. The onion requires a firm bed; otherwise the plant, instead of making a large well-shaped bulb, will run to neck, and have more the appearance of a leek than of an onion. Therefore, the land before being planted must be well solidified by rolling.

THE SEEDBED.

Onions may be sown broadcast, or they may be drilled in, or they may be sown in a seedbed and afterwards planted out in the same manner as cabbages. The best way is to drill them in. In this case, about 2 lb. of seed per acre will be required. The seeds must be dropped at a distance of about 2 inches apart in the drill, and the drills should be from 12 inches to 15 inches distant from each other. The plants will afterwards require thinning out with the hoe. When sown in a seedbed, planting out must be resorted to—a tedious process, but one that pays well for doing well.

On rich soil the plants may be 6 inches apart. The drills should be slightly raised, and the roots of the plant firmly embedded in it—allow the bulb to, as it were, squat on, not under the surface. As the plant grows, the soil must be kept perfectly clear of weeds, and, where the working of the ground has thrown the soil against the bulbs, it must be drawn down, so that only the root is in the ground. Where this has not been attended to, the remedy for the resulting want of bulb formation is to wring the necks of the plants, or, at least, to bend them down with a twist. This will have the effect of inducing the formation of bulbs.

When sowing the seed, care should be taken that they are not covered to more than their own depth. If sown deep, many seeds fail to germinate, and most of those that do appear will make an abnormal growth of neck, causing much labour in drawing away the soil from the incipient bulbs. The writer has never sown onions broadcast, and therefore offers no opinion on the value of the method. Of course more seed would be required per acre, and, if weeds are troublesome, a good deal of hand work would be necessary.

Now, about the seed. There are few seeds so annoyingly deceptive as onion seed. So difficult was it to get good seed in the State even at 10s. per lb. in the good old days, that growers imported it from Spain. The largest growers at Oxley, Messrs. Martindale and Nosworthy, were most successful with imported seed, but the writer had a very bad experience in this business. Twenty pounds weight of onion seed was sent from a friend in Germany. Instead of packing it in hermetically sealed bottles, he stowed it in calico bags in the body of an immense wooden Swiss cuckoo clock. When the clock was opened the bags of seed were examined and looked perfect in colour and shape; but, alas! When subjected to pressure, no oily fatness was perceived; and when at last it was given a chance and sown thickly in drills, five acres returned the magnificent yield of 72 lb., which, at the rate of £28 per ton, amounted to 18s. Certainly, the land, after a week's waiting for the seed to germinate, was utilised otherwise, but not 1 cwt. of onions was harvested.

Make sure, therefore, of the seed. After sowing, it should germinate in less than a week.

In former days large onions were always aimed at, but now the public taste is in favour of medium-sized bulbs, so that closer planting may be adopted.

Onions may be known to be ripe by the drying up of the tops. As soon as this happens, take them up by hand and leave them on the ground between the rows to dry. As soon as they are dry, carry them carefully with as little bruising as possible to the barn.

As before stated, the Brown Spanish has proved most successful in this State, but the gentlemen above mentioned grew what they called the large White Portugal onion. It certainly was a splendid bulb, and fetched very high prices in the markets of Brisbane, Maryborough, and Rockhampton.

PULVERISED LIME IN AGRICULTURE.

So long ago as 1895, a thoroughly well equipped experimental station was established on Lord Rosebery's Scottish estates at Dalmeny Park. There it was that experiments were continuously carried out, with a view to ascertaining the value of lime to the agriculturist, and in order to enable a small dressing to be equally distributed over the soil, the lime was mechanically ground to a fine state of division. The results of the experiments were highly satisfactory. When they were commenced ground lime for agricultural purposes had never been heard of, whereas, ever since, there has been an ever-increasing demand for this substance.

Of late there were so many representations made to the Minister for Agriculture by farmers, orchardists, and others on the land, that they were unable to procure supplies of this most important material for the agriculturist at prices which would enable them to use it extensively on their lands, that the Department of Agriculture obtained a lime pulveriser, and established it at Gore, as the most suitable locality for the distribution of lime to the orchardists of the surrounding districts. The price was fixed at a low rate per ton, and the conditions were duly advertised in the "Queensland Agricultural Journal." The enterprise of the Department has not hitherto met with the success which was anticipated, few orders having been received even from those who persistently urged for the assistance which the sympathetic Minister now afforded them. The result of this disappointment has been that unless orders should greatly increase by the end of this month, the plant at Gore will be closed down, and will not be installed again anywhere, until orders for large quantities are received.

MARKET GARDENING.

RHUBARB-GROWING FROM SEED.

By THOS. JOHNSON, Frenchman's Creek, Rockhampton.

Rhubarb (*Rheum Salisum*) can be grown in Central Queensland as easily as in the more temperate parts of Australia. I have grown it in the Rockhampton district for years, and this little paper is to give to the public the result of my experience in connection with its cultivation. In the first place, the would-be grower must bear in mind that here rhubarb, like almost every other vegetable, must be treated as an annual and grown from seed.

I use the word vegetable, because, botanically, it cannot be said to be a fruit or to produce a fruit, although it is never used except as a fruit and in medicines. It can be grown on almost any kind of soil which has a good natural drainage; shallow soils with clay subsoil are liable to become waterlogged in wet weather, and are unsuitable. I have grown it on rich scrub soils with excellent results, and last year I had even better results from its cultivation on the stony alluvial deposits at the foot of the Berserker Ranges near Rockhampton, and this in face of the fact that there was no rainfall of any value during the last eight months of last year; consequently, the crop had to be grown from the seedbed to maturity, and through the growing period absolutely by irrigation. I grew by this means about 900 (nine hundred) bundles from 1½ square chains of land.

Now, a word as to the best variety to grow in this district. The old giant, and other large coarse varieties, I have discarded; they are slow in coming to maturity, the stalks are inclined to be stringy, and the colour, when cooked, is of a sickly pinkish green hue, not at all appreciated by the housewife.

The variety known as Topp's Crimson Winter proved excellent as regards colour and texture, but the stalks were rather small for marketing purposes. The variety I have found most suitable for hot, dry districts, is known as "Sydney Crimson Winter;" it is a compromise between the giant and the small variety, of medium size in length and thickness of stalk, a bright crimson colour when cooked, free from stringiness and of excellent flavour, and when to this can be added that it is a hardy and vigorous grower, it will be seen at once that it cannot be excelled as a good all-round variety for tropical Queensland.

March is the best time to sow the seed. Let the seedbeds be similar to those you would make up for raising cabbage plants, and remember that rhubarb is as gross a feeder as the brassica tribe, and requires very liberal treatment in the matter of manure—the richer the land the heavier the crop. The seedbeds should be raised 6 or 8 in. above the surrounding land so as to secure perfect drainage, as the young plants are very liable to damp off in wet weather; when about 6 in. high, and having three or four sturdy leaves each, transfer to the permanent beds, in showery weather if possible, but should it be hot and dry, and the plants in danger of becoming drawn in the seedbed, proceed at once to make lines 2 ft. apart each way on your permanent beds, fill these with water, and while still wet transfer the plants to them, pressing down very lightly, water again, and cover entirely with a large handful of mulch, and leave them so for four days, when they must be uncovered. In doing this, do not remove the mulch, but just make a hole in the middle of it large enough for the leaves to come through.

Now cover the whole of your bed with a manure mulch if possible; but, failing that, any old half-rotten leaves or grass will do; then thoroughly soak the whole bed with water.

The only after treatment is thorough watering when required, and a good crop should be assured. Rhubarb beds, laid down as above, should continue to yield good stalks for four or five months, or well into the hot weather of November or December.

Poultry.

REPORT ON EGG-LAYING COMPETITION, QUEENSLAND AGRICULTURAL COLLEGE, FEBRUARY, 1919.

The conditions for the month have been severe. Hot sultry days and dust storms were very prevalent. A number of birds are now moulting, but not so many as might have been expected under the trying conditions. A big percentage have that pale livery appearance which would be rectified by green feed, but this is unprocurable. Although the laying generally has been poor, there were several noteworthy performances registered, viz.:—Range P. Farm's A bird with 27 eggs to her credit in 28 days; L. G. Innes's C with 26; A. E. Walter's F with 25; D. Fulton's A with 25. The weekly scores for Mrs. Anderson's pen, which headed the list for the month, were 33, 33, 31, 21. This is very satisfactory, and the more so because the birds were removed at a time when there was a chance of a severe check followed by a premature moult. Three deaths occurred amongst the competing birds, and Mr. Macrae's two reserve birds died also. The causes of deaths among the birds competing will be dealt with fully in the final report. The two reserves were killed by a sheet of iron in a whirlwind during a thunderstorm. The same whirlwind took a bird belonging to the College 40 feet in the air without causing it any harm, although others were killed. The competition birds which died were T. Taylor's A bird, Oakland P. F., and D. Fulton's B. The lastnamed has been replaced. The following are the individual records:—

Competitors.	Breed.	Feb.	Total.
LIGHT BREEDS.			
*Dixie Egg Plant	White Leghorns ...	102	1,475
*G. W. Hindes	Do.	110	1,407
*E. Chester	Do.	96	1,373
*T. Fanning	Do.	107	1,347
*W. Becker	Do.	79	1,292
*C. P. Buchanan	Do.	85	1,283
*Mrs. L. Henderson	Do.	79	1,270
*W. Lyell	Do.	93	1,268
*Geo. Prince	Do.	76	1,265
*Geo. Howard	Do.	90	1,254
*G. H. Turner	Do.	65	1,249
*Dr. E. C. Jennings	Do.	103	1,237

EGG-LAYING COMPETITION—*continued.*

Competitors.	Breed.	Feb.	Total.
LIGHT BREEDS—*continued.*			
*E. A. Smith	White Leghorns ...	84	1,255
*L. G. Innes	Do.	85	1,221
*Oakland Poultry Farm	Do.	63	1,196
*C. Knoblauch	Do.	72	1,193
*R. Holmes	Do.	70	1,187
*Range Poultry Farm	Do.	96	1,187
*Quinn's Post Poultry Farm	Do.	80	1,173
*Thos. Taylor	Do.	82	1,163
*O.K. Poultry Yards	Do.	60	1,142
Mrs. L. F. Anderson	Do.	118	1,140
*Mrs. A. T. Coomber	Do.	76	1,131
B. Caswell	Do.	47	1,126
*J. M. Manson	Do.	66	1,118
J. J. Davies	Do.	40	1,117
Harold Fraser	Do.	82	1,110
*Homalayan Poultry Farm	Do. ...	75	1,107
*Mrs. R. Hunter	Do.	97	1,098
Geo. Trapp	Do.	103	1,065
Mrs. A. G. Kurth	Do.	71	1,069
*J. Zahl	Do.	65	1,046
H. B. Stephens	Do.	71	1,010
*C. Porter	Do.	53	1,006
O. W. J. Whitman	Do.	34	995
*T. B. Hawkins	Do.	51	989
Progressive Poultry Pens	Do.	80	981
Shaw and Stevenson	Black Leghorns	62	979
S. Wilkinson	White Leghorns ...	73	977
*J. W. Newton	Do.	61	968
B. Chester	Do.	70	960
H. F. Britten	Do.	68	958
P. O. Oldham	Do.	66	946
G. Williams	Do.	59	938
W. A. Wilson	Do.	79	920
R. T. G. Carey	Do.	32	909
A. W. Walker	Do.	72	878
HEAVY BREEDS.			
*Nobby Poultry Farm	Black Orpingtons ...	93	1,309
*D. Fulton	Do.	92	1,250
*R. Burns	Do.	101	1,203
*E. Morris	Do.	88	1,158
*A. E. Walters	Do.	84	1,148
*E. F. Dennis	Do.	60	1,132
*Mars Poultry Farm	Do.	88	1,129
T. Hindley	Do.	72	1,113
*W. H. Reilly	Chinese Langshans ...	90	1,100
*W. Smith	Black Orpingtons ...	96	1,089
A. Shanks	Do.	76	1,062
E. M. Larsen	Do.	75	1,050
*J. W. Macrae	Do.	87	1,017
T. W. Lutze	Do.	55	965
*F. A. Claussen	Rhode Island Reds ...	52	827
Jas. Fitzpatrick	Do.	48	774
H. Puff	Do.	43	763
W. J. Mee	Black Orpingtons ...	49	759
Totals	...	4,897	71,796

* Indicates that the pen is engaged in the single hen test

DETAILS OF SINGLE HEN PENS.

Competitors.	A.	B.	C.	D.	E.	F.	Total.
LIGHT BREEDS.							
Dixie Egg Plant	217	240	227	221	242	278	1,475
G. W. Hindes	267	228	220	240	233	219	1,407
E. Chester	244	220	220	244	229	216	1,373
T. Fanning	236	212	244	185	235	235	1,347
W. Becker	217	224	199	235	193	224	1 292
C. P. Buchanan	185	221	221	215	222	219	1,283
Mrs. L. Henderson	215	190	217	182	249	217	1,270
W. Lyell	207	235	227	197	205	197	1,268
Geo. Prince	187	233	200	234	204	207	1,265
G. Howard	205	200	223	289	186	201	1,254
G. H. Turner	154	147	240	223	275	210	1,249
Dr. E. C. Jennings	175	261	221	189	211	180	1,237
E. A. Smith	193	237	192	209	208	196	1,235
L. G. Innes	220	224	274	132	154	217	1,221
Oakland Poultry Farm	175	202	221	202	215	181	1,196
C. Knoblauch	222	193	217	187	167	207	1,193
R. Holmes	209	226	191	193	174	194	1,187
Range Poultry Farm	141	241	180	214	207	204	1,287
Quinn's Post Poultry Farm ...	240	196	184	142	226	191	1,173
Thos. Taylor	147	213	198	186	209	210	1,163
O.K. Poultry Farm	165	217	200	176	210	174	1,142
Mrs. A. T. Coomber	174	204	191	206	151	205	1,131
J. M. Manson	224	204	228	169	142	151	1,118
Homalayan Poultry Farm ...	216	183	172	146	202	188	1,107
Mrs. R. Hunter	168	189	133	191	2 9	208	1,098
J. Zahl	213	171	197	198	156	111	1,046
C. Porter	158	172	172	181	110	213	1,006
T. B. Hawkins	205	137	182	152	148	165	989
J. W. Newton	190	214	122	128	182	132	968
HEAVY BREEDS.							
Nobby Poultry Farm	259	228	206	123	241	252	1,309
D. Fulton	262	189	186	194	169	250	1,250
R. Burns	189	208	170	189	256	200	1,203
E. Morris	167	184	205	233	200	169	1,158
A. E. Walters	170	210	149	214	203	202	1,148
E. F. Dennis	229	170	192	132	208	201	1,132
Mars Poultry Farm	204	204	160	196	185	180	1,129
W. H. Reilly	186	198	196	156	151	213	1,100
W. Smith	245	183	143	174	156	188	1,089
J. W. Macrae	124	146	183	180	199	185	1,017
F. A. Claussen	137	141	140	145	148	107	827

ANTI-COCKROACH SUBSTANCES.

1. Sodium fluoride was found to be the most rapid killer of roaches of all substances tested. Only twenty-four hours were required to kill 100 per cent. in cage tests, even when the material was diluted down to 18 per cent. content. Practically 100 per cent. were killed in treated kitchens by the use of a mixture containing 50 per cent. sodium fluoride.

2. Borax, unadultered, and in combination with inert matter wherein there was less than 12 per cent. borax, required from three to seven days to kill all of the roaches in cage tests, proving it to be very slow. Borax, used alone, was only partially effective in kitchen tests.—U.S. Department of Agriculture.

The Orchard.

CO-OPERATION AMONGST FRUIT GROWERS.

We have, in previous issues of the journal, published several articles on the advantages of co-operation in the disposal of orchard produce. So far back as 1896 an important paper on this subject was read by Mr. A. Lorie, general manager of the Teviot and Alexandra Fruit Growing Company, at the Conference of Australasian Fruitgrowers held at Wellington (New Zealand), in which he discussed the whole question of co-operation, the result being that the company mentioned held the proud position of being the most independent body of fruitgrowers in the then colony. History repeats itself, and to-day we find the fruitgrowers of the North Coast of Queensland combining to ship their fruit by special trains direct to Sydney and Melbourne, under arrangements made with the Commissioner for Railways. The whole scheme is clearly set forth in the following letter received by Mr. A. H. Benson, Director of Fruit Culture, Queensland Department of Agriculture, from the secretary of the North Coast Fruitgrowers' Association, dealing primarily with the dispatch of special fruit trains to the Southern States, by means of which Queensland fruit can be landed in Melbourne in four and a-half days from Gympie. Already several of these special fruit trains have continued to run weekly since 30th January, and heavy consignments have been forwarded direct to the Southern capitals, thus avoiding the inevitable losses previously experienced by the process of unloading from train to steamer, and additional losses owing to the length of time in transit and other difficulties under the old system.

Following is a report on the progress of the scheme, which should recommend itself to all fruitgrowers throughout the State where direct railway communication with the Southern States is available:—

FRUIT TRAIN TRANSIT TO SOUTHERN STATES.

The transit of Queensland fruit to the Southern States has for a number of years attracted the attention of the various growers. The present methods, boat and rail, have been exceedingly unsatisfactory, more especially during our summer months, the former owing to the heavy risk of the fruit becoming overheated and boiled, and the latter owing to the length of time taken in reaching its destination.

Some two and a-half years ago, at a meeting of fruit-growers held in Brisbane, under the superintendence of the Department of Agriculture, the question of a fast fruit train service to the Southern States was spoken of.

The initial stage of broaching the subject to the Queensland Railway Commissioner was undertaken by A. C. Elphinstone, Esq., M.L.A., and then afterwards by the directors of the Queensland Co-operative Fruitgrowers, Limited, who went so far as to ascertain the feeling of the fruitgrowers along our North Coast line as far as Gympie, but there the subject was allowed to drop. However, during December, 1918, Mr. J. T. Wilson, of Woombye, took the matter in hand with determination, and after

interviewing the Railway Commissioner and obtaining from him the assurance that for a guarantee of £200, with a minimum load of 75 tons and a maximum of 112 tons, the fruit could be landed in Melbourne in four and a-half days from Gympie. The freight was reduced by about 25 per cent. for consignments of 6-ton lots, and required to be from one consignor to one consignee.

Mr. Wilson, with this assistance from the Railway Department, undertook the organising of the fruitgrowers on the North Coast line. As a result of his organisation, combined with the growers' support, the Railway Department on 30th January, 1919, was enabled to run its first fast fruit train to Wallangarra. This train consisted of twenty-three wagons, the tonnage of fruit being about 160 tons when it left Caboolture, and comprised chiefly pineapples and bananas. Since that date the train has continued to run weekly (every Thursday), and so far the weights carried have been respectively 86 tons, 180 tons, 120 tons, and 221 tons, while an extra train in February on the Tuesday carried 111 tons; another special fruit train on Thursday, 6th March, carried 190 tons, thus showing what can be done by co-operation. The Department are asking if a three-train service per week could be arranged, so that the loading could be distributed more evenly. This is an exceedingly difficult matter, as our climatic conditions are a large governing factor in the gathering of the various fruits, and will need the very careful attention of growers. These huge consignments, though handled expeditiously by our own Railway Department, have somewhat taxed the carrying capacity of the New South Wales Department, caused through the great distance which they have to haul the empty wagons from Sydney to Wallangarra. If growers would but organise and introduce a scheme whereby the Department's wish for a three-train service per week could be ratified, then will the fruit be landed in Melbourne at its guaranteed time and the market supply be more evenly regulated. In respect to organisation, an association composed of fruitgrowers and called "the North Coast Fruitgrowers' Association" has been formed, and embodies the districts between Caboolture and Gympie, and including the Kilcoy and Mary Valley lines. This association is out to watch all items of interest to fruitgrowers, and to band them together for mutual benefit. It therefore behoves all growers who have their own welfare at heart to assist this association, which has undertaken the guaranteeing of the fruit train. Therefore, fruitgrowers, assist your fellow-growers by co-operation and keep the fruit train running.

To the above, Mr. F. J. Young has supplied the following particulars to Mr. A. H. Benson, Director of Fruit Culture:—

List of Stations with Tonnage of Fruit carried on the First Seven Fruit Trains, 30th January to 4th March, 1919.

	Tons	cwt.	qr.	lb.
Amamoor	3	0	0	0
Gympie	38	19	0	0
North Arm	3	7	0	0
Cooroy	69	18	0	0
Eumundi	20	7	0	0
Yandina	31	12	0	0
Nambour	200	15	0	0
Woombye	249	6	0	0
Palmwoods	299	7	0	0

	Tons	cwt.	qr.	lb.
Eudlo	20	0	0	0
Landsborough ..	33	15	0	0
Glass House Mountains	43	0	0	0
Pomona	0	7	2	0
Beerburrum	11	0	0	0
Mooloolah	3	8	0	0
Beerwah	24	10	0	0
Traveston	1	7	0	0
Total ..	1,053	18	2	0

Tropical Industries.

CANE GRUB INVESTIGATION.

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

"The unprecedented dry weather, for this time of the year, is having a rather serious effect upon the late-planted cane. It is just the condition for the rapid development of the cane grubs; and they are already beginning to show, by the yellowing of the cane, in a few places, at the Greenhills Estate. Out of 181 greyback grubs picked up behind the plough, 22nd January, in the field of ratoons, E1, 68 were in the first stage, 112 in the second, and 1 had already reached the third or final stage. Digging under the yellowing stools of ratoons in E2, 5th February, I found an average of six grubs, mostly in the second stage. This field is in the worst infested area, and suffered severely last season, so it is not surprising to find that these infested stools have no roots, and can be easily pulled out with one hand.

"It will be of interest to record that greyback beetles were still in evidence on the feeding trees, 5th February, and dissection showed that these stragglers were full of eggs. This was just about two months after the first beetles emerged in this district, so the period for cultural control has been somewhat extended.

"I have improved the opportunity during the past month for securing further data on controlling factors—both better cultural methods, and the all-important one of feeding trees.

"BENEFITS OF INTENSIVE CULTURAL METHODS.

"Recently I was most gratified by an interview with Mr. David Hunter, a man of long experience in the sugar industry on the Johnstone; and his record as a grower has been so successful, especially in the handling of grub-infested land, that his observations should have the greatest value.

"Mr. Hunter first came to the district about twenty-eight years ago, taking charge of land for the Colonial Sugar Refining Company, for they grew their own cane at that time. He was quick to notice the value of filter-press on cane land, and became an advocate of intensive surface cultivation.

"About 1906 he took on one of the company's farms, which had been thrown out of cultivation for years because of the grubs. This pest had been so severe in the early days that the land was not considered profitable to grow cane; hence he got the place on very reasonable terms, and, being near the mill, he made arrangements for the complete output of compots. Mr. Hunter began applying this in 1908, and by thorough cultivation he soon had the farm in perfect tilth—not a weed in sight anywhere, and he kept the cultivators going so that none would show.

"I was interested to learn that Mr. Hunter believes filter-press is rather attractive to grubs, and that he found ammonium sulphate to be the opposite. Anyway, he says that he has seen cane treated with this latter chemical standing and perfect while untreated cane alongside had fallen because of the grubs. He does not agree with the usual statement, that ammonium sulphate robs the soil, for he is in accord with the most up-to-date knowledge of fertilisers. He says that there is no question that this chemical brings about a bumper crop, hence a portion of all the available plant foods are used up, and these must be renewed from time to time. For this purpose he used meatworks manure. He also returned to the soil all the waste from the crop—no trash was burned. He accomplished this by relieving into every other row, when the plant crop was cut, and applied manure and cultivation in the free middles. The trash from the first ratoons was relieved into the middles which had been cultivated, and the alternate ones were broken up and fertilised. Finally, the trash from the second ratoons was left, and the whole thing ploughed in. He used this regular system of three crops before ploughing out; and says that late planting is the thing for that class of soil. It is needless to say that he had no trouble from grubs.

"Then, too, results were apparent in the crops that he took off, for these doubled or trebled those of adjoining farms, and in one case, I found by the mill records, he cut 43 tons per acre when his neighbour across the road, on the same class of soil, cut 9 tons—the difference being due entirely to better methods.

"THE QUESTION OF FEEDING TREES.

"Mr. Hunter is also a thorough believer in the destruction of feeding trees, for he says that the grubs move back as the scrub is felled. He advocates removing the scrub and pasturing the land for half-a-mile back from all cane areas, using cane pest destruction funds to assist in this work. He said that the owners of the scrub would, of course, pay part, and the mills could make use of some of the wood to help out on the expense. Cost of felling and burning would be, approximately, £5 per acre at this time.

"Mr. C. E. Jodrell, who is another pioneer of the Goondi District, also gave me some of his very valuable observations. He is one of the most extensive growers to-day; and came on to his farm, in the stumps, twenty-five years ago. In those early days the grubs often ate everything out, so it was the exception to get even a 15-ton crop. He told me that the beetles were then in hordes in the feeding trees just behind his house; and that the flying foxes made havoc among them, so that the remains of the beetles were several inches deep on the ground in the morning. He said that he could plainly see the broken parts of the greybacks in the excrement of the bats.

"I was interested to learn that there has been no trouble from grubs on this farm since the scrub was cut on the hills surrounding it, about eighteen years ago.

"Mr. Jodrell also owns a farm at Daraji; and he told me that he always had trouble from grubs on the part bordering the scrub, but that there is no injury in the fields lying about half a mile away from these feeding trees.

"Mr. Ernest S. Smith, cane inspector at Goondi Mill, from his extensive observations in the district, is emphatic in his belief that the proximity of the feeding trees accounts for grubs in the soil. He told me that it is a well-recognised fact that grubs, which were once very serious throughout the Goondi District, have disappeared as the line of scrub has been moved back. It is now only the land lying within half a mile of the scrub that is affected. He could not recall a single instance where fields further away from the feeding trees were troubled.

"That it is not the length of time that land has been cleared that makes it immune, Mr. Smith cited the Innisfail Estate, which was opened up about thirty years ago, and it is still troubled badly with grubs every year, simply because it is bordered by scrub, for the same class of land on the town side of the river is not infested.

"In October, 1917, I called attention to an interesting observation along this line by Mr. W. Walker, who has been a resident of Macknade district for the past forty years. He said that he used to notice a very definite relation of infestation to a particular fig-tree in his fields. He found that the beetles usually went from this feeding tree with the wind, and infested the cane on that side, at some distance from the tree more than immediately around it.

"This suggestion bears fruit when we study an estate like Greenhills, where there is always a considerable portion infested. For two seasons I have been collecting data as to the distribution of the grubby areas, and have indicated these upon a carefully drawn map, using degrees of shading to show relative abundance.

"Examination of this map points clearly to the fact that the infested fields lie largely within one-half mile of the feeding trees, and, also, that the prevailing winds, from the south-west, are largely responsible for bringing the beetles from the feeding trees, which are abundant in that direction. Attention should be called to the fact that there is a considerable area of the estate which is considered land safe from infestation, and though part of this is bordered by the forest to the east, the cane is little infested, evidently because the prevailing winds blow away from these fields into the feeding trees.

"It must be kept in mind that cane is not at all essential to the beetles in their development, for they do just as well in grass land; in fact, the wild grasses are their native food plants. It is interesting to note in this connection that the greybacks are very abundant, even up on top of the range, where there is no sugar-cane for them to feed upon. The only reason that they become such a pest in some of our fields is that we have subjected them to abnormal conditions by removing their native food plants, and destroying all humus in the soil by our destructive methods of farming—taking off the crop every year and even burning all the trash.

"Careful measurements in the region about Meringa, where the cane has suffered severely from grubs for years, show that all the infested fields lie well within the one-half mile limit from feeding trees. Here the worst infestation was on the high ground, where the beetles would naturally come to rest from their flight. It must also be noted that these high spots are naturally poor in humus, and consequently the work of the grubs is more quickly noticeable.

"FIELD EXPERIMENTS.

"The cane in the cultivation plots at Greenhills is at present looking well, especially the plant cane in fields D1 and D2. Unfortunately, I was unable to get the cultivation started as early in the flight of the beetles as I desired, and in the ratoon field E1, it was almost a month late in some of the plots, so that small grubs were turned up at the very first treatment. All three of these fields border the feeding trees, and have always been the ones most infested, so we are hoping for some rather conclusive results, in spite of our late start.

"The fields L6 and L7 are in the badly infested area, but, as I have previously noted, a successful crop was secured from these at the last cutting. The lower half of L6 was planted near the end of September, 1917, and after late cultivation, produced an excellent crop. The upper half, planted in June, 1917, was a failure, because of the grubs, which put the cane down in February, 1918. The field L7 was planted about the first of October, 1917, but had rather poor cultivation, and was pretty weedy. In spite of this, however, the crop was fair, indicating that even the horse work that it did get disturbed the grubs so that they were held in check."

STERILISATION OF TOBACCO SEEDS.

TOBACCO SEEDBEDS.

STEAM AND OTHER METHODS.

In tobacco production, to grow the right sort of seedling plants is of special importance. Successful transplanting from the seedbed to the field requires vigorous seedlings, and the growth of the crop in the field, especially in the early stages, is largely dependent upon the character of seedling used. Great importance is to be attached to securing strong, healthy seedlings. The young plants in the bed are liable to be injured, and therefore it is necessary to protect them from parasitic and other enemies, which may injure and retard their growth or even kill them. Chief among these enemies are weeds and certain fungous diseases, especially rootrot. Spots in the beds are also frequently found where the soil conditions are such that normal development cannot be attained, says the writer of a bulletin issued by the United States Department of Agriculture.

These difficulties can be eliminated or greatly reduced by the sterilisation of the seedbeds, which now is recognised as an important feature in tobacco growing. Seedbeds are sterilised for the control of diseases and to kill weed seeds and hibernating insects. When properly done, the saving in weeding costs usually pays for the whole operation of sterilisation. The process has the additional advantage of insuring freedom from diseases and the production of more vigorous seedlings.

Sterilisation by surface burning has been widely practised for generations in the South, and, in fact, has been used at one time or another in nearly all tobacco districts. In the Southern districts it has been customary to select each year a new location for the seed bed, and the chief object of burning has been to free the bed from weed seeds.

In the Northern districts permanent seedbeds with glass covers are in more or less general use, and the widespread appearance of fungous diseases, especially rootrot, has made some sort of sterilisation necessary. Since open fires are impracticable in these districts, a process of steam sterilisation has been worked out, which now is used extensively in the cigar-leaf producing districts of the Connecticut Valley, Pennsylvania, and Wisconsin, and has been employed with success in several other sections, notably in western Kentucky and Tennessee, and in the Burley District. This method is both economical and effective, and with more or less modification is adapted to practically all tobacco-growing districts.

The steaming of the soil is the most satisfactory method of sterilisation which has been developed up to the present time. The direct application of the steam to the soil by means of an inverted pan or hood has now been in successful operation for a number of years. Thus far this process has been most extensively employed, perhaps, in the Connecticut Valley, but because of its many advantages and its effectiveness it is being widely adopted in other tobacco-growing districts.

PREPARATION OF SEEDBED.

The seedbed is thoroughly prepared in the usual manner for sowing the seed. The soil is well worked, the fertilisers spread and mixed in the soil, and the bed brought to fine tilth, so that after the steaming is completed it is only necessary to

rake the bed lightly before sowing the seed. It is important that nothing but the seed and the diluting material, also sterilised if necessary, should be added to the bed after sterilisation.

A comparatively dry bed is the first requisite for successful steaming, as it is practically impossible for the steam to penetrate wet soil. Glass-covered beds may be dried with comparative ease by covering them with sash several weeks before steaming. The bed is protected from the rains and snows of spring, and the sun's rays warm the soil and drive off excessive moisture. Cloth-covered beds may be protected for two weeks before steaming when rain or snow threatens by stretching over them cloths which have been painted with a thin mixture of linseed oil and drier.

EFFECT OF FROST.

The presence of frost in the surface soil retards the penetration of the steam and makes it necessary to continue the process for an unusually long period. The ground must first be thawed before the desired heating can be brought about, and this causes a fuel consumption more than double that required where the soil is in proper condition. Where there is frost in the surface soil the steam does not penetrate more than a few inches, because of the condensation of the steam in the cold ground.

In order to thaw out the seedbeds before steaming, a good practice is to cover them with glass for several weeks, as has been suggested for wet beds. The glass allows the heat from the sun's rays to be confined within the bed during the day, warming the soil, and putting it in a mellow condition. Without such preparation even partial sterilisation would be impossible in some sections till late in the spring.

USE OF FORMALDEHYDE.

When steam sterilisation cannot be used, formaldehyde may be employed to control seedbed diseases. One gallon of commercial 40 per cent. formaldehyde solution is diluted in 50 gallons of water. This solution is applied at the rate of two quarts per square foot of seedbed, using a common sprinkling can.

The seedbed should be prepared for sowing, and to do the most effective work the soil should be dry enough to absorb all of the formaldehyde solution. To prevent the washing of the soil, the necessary quantity should be put on in a number of applications, at intervals of, say, 20 to 30 minutes. When all the solution is absorbed the bed should be covered with blankets for twenty-four hours to confine the fumes. It should then be aired for eight or ten days to allow the escape of the fumes from the soil. The seed should not be sown so long as there is a trace of the formaldehyde, for this will kill the germinating seed or young seedlings.

The use of formaldehyde is recommended only when steam sterilisation is not practicable. Its cost is greater than the cost of steaming, and it is usually less effective.—"Town and Country Journal."

THE DESIRABILITY OF INCREASING OUR SUGAR PRODUCTION.

By HARRY T. EASTERBY, General Superintendent, Bureau of Sugar Experiment Stations.

It is an unfortunate fact that the sugar-mills of Queensland during the past fifteen years have, on the average, never been supplied with cane to much more than 50 per cent. of their capacity. The Northern sugar-mills have a better record in this respect than those from Mackay to the South, due largely to better climatic conditions for the growth of cane, but even many of these mills do not receive anything like the cane they could crush, except in abnormal seasons like 1913 and 1917. There is at present existing in this State sufficient milling power to manufacture 355,000 tons of sugar, but the largest tonnage ever turned out in any one year to date amounted to 307,714 tons in 1917. The average production for the fifteen years prior to and including 1917 was only 176,000 tons of sugar in Queensland. It is true that, owing to the erection of three new large mills in Queensland since 1913, the average production has been raised, but we have still a long way to go before our existing sugar factories are fully utilised. I am not for one moment suggesting over production, of which there is at present very little fear, it having only occurred once during many years, while the difference between our average production and the Australian consumption leaves a great deal to be desired. It will, of course, be objected that climatic factors have a very great deal to do with limiting crops, and this is undoubtedly true, but there is a great deal to be done in improving our production per acre, apart from this objection; and even droughts may be minimised

to a large extent by proper methods of cultivation, of which more hereafter. The Commonwealth is looking to Queensland to keep Australia supplied with sugar, and I am inclined to think that the Federal Government will maintain such a price as will warrant canegrowers supplying the demand. It is neither patriotic nor good business to send hundreds of thousands of pounds out of this country to purchase sugar grown by cheap black labour at a time when every sovereign is required within the Commonwealth, especially as the countries from whom sugar is bought do not take much from us.

The Federal Royal Commission which dealt with the industry said: "The problem of the sugar industry to-day is not, save in subordinate respects, a problem of industry, wealth, or of production; it is primarily and essentially a problem of settlement and defence.

"The supreme justification for the protection of the sugar industry is the part that the industry has contributed and will, we hope, continue to contribute, to the problem of settlement and defence of the northern portions of Australia."

These questions are unfortunately little understood in the Southern States, where a clamour for cheaper sugar is frequently made by interested parties, as well as by the Press. If the white labour ideals of Australia are to be maintained, the consumer must be prepared for some little sacrifice, and I believe that he would have no objection to make it if he knew the facts as we know them.

The war has had a deterrent effect upon production in Queensland owing to the enormous increase in price in every article used by sugar-growers. Now it is happily over, we may hope for cheaper implements, fertilisers, and commodities generally.

We have now to consider in what way cultivation may be stimulated and increased.

First.—The completion of the North Coast Railway line will have the greatest effect in this direction, and all energies should be bent towards the rapid building of those sections still in progress.

Secondly.—Cheaper freights on lime and fertilisers should be made a leading plank in the farmers' platform.

Thirdly.—The use of tractors by the larger farmers will have a decidedly favourable effect in enabling more work to be done in a limited time.

Fourthly.—The growth of better varieties. This now being a bread-and-butter matter, owing to the establishment of Cane Prices Boards, will greatly tend to a larger production of sugar and better prices for the grower, while the miller will also be benefited by better canes entering into manufacture.

Fifthly.—The burning of cane should be discontinued and even prohibited. The loss to farmers and millers alike is considerable, first, by loss of weight, and, secondly, from the destruction of sugar and difficulties of manufacture.

It is, however, from better methods of cultivation that we shall derive the most part of our increased production, and it would be well to devote a portion of this article to the subject. While we have many intelligent cane farmers in Queensland, who are up to date in most respects, there are still a large number who do not get all they should from their farms. Thorough cultivation, both before and after planting cane, should be made a golden rule by all growers. The soil should be well broken up to begin with and deeply ploughed. Further cross ploughings should then take place, at least to the number of four. Liming should also be practised, because, owing to the long-continued growth of cane upon the same land, the soil in the majority of cases has become acid in reaction. Now it is a well-known fact that soils with an alkaline reaction are much to be preferred for sugar crops. In order, therefore, to sweeten up the soil, act as a deterrent of disease, and render soil more friable, the application of at least 1 ton of lime per acre every four or five years is strongly to be urged. There are many other benefits to be obtained from a dressing of lime, which may be summarised as follows:—

1. It acts on dormant mineral matter and renders available phosphoric acid and potash which would otherwise remain inert.

2. Acts on organic matter and converts part into nitrogen compounds available for the crop.

3. Enables the plant to make the greatest use of artificial fertilisers.

4. With moisture and warmth it favours the maintenance of abundant bacterial life, especially those forms which aid in nitrification.

5. It develops the activity of root bacteria in leguminous crops. In soils with an acid reaction the fixation of nitrogen from the air is frequently at a standstill.

Lime is usually applied to soils either as burnt lime (lime oxide), air-slaked lime (principally lime carbonate), water-slaked lime (lime hydrate), or as pulverised limestone. The very high price of lime in many sugar districts in Queensland renders its application an expensive business. This is largely due to the freights charged, and when it is considered how largely dependent the Northern steamship traffic is on the sugar industry, one would think that it would pay the shipping companies to carry such articles as lime and fertilisers at nominal rates in view of the increased business that would result from the extra output of sugar, the greater prosperity of sugar-farmers and others, which would enable them to more frequently travel, and the carriage of a larger number of labourers to deal with enhanced crops.

A further method of increasing production is by practising some method of rotation. This, in the case of cane, is best done with a leguminous crop.

Nitrogen is the soil element that becomes the most quickly exhausted, as it is also the element that is the most expensive to purchase. The nodules upon the roots of leguminous crops, under favourable conditions, are the abode of countless thousands of bacteria, being themselves minute living plants which have the power of seizing nitrogen from the air. In this way a leguminous crop may get from the atmosphere from 100 to 200 lb. of nitrogen per acre, which, at the present price of nitrogen in organic fertilisers, is worth, say, from £4 to £8.

There are other advantages in ploughing under leguminous crops, which may be summarised as under:—

1. During growth, the ground is shaded and moisture is conserved.
2. Erosion of fine earth is prevented during heavy rains.
3. Weed killing is promoted.
4. The deep tap roots of leguminous plants bring available plant food from the subsoil to the surface soils.
5. The interposition of a crop other than cane will act in minimising fungoid diseases and insect attacks. If the habitat of parasites attacking the cane is removed for a time, it must result in their dying out or of their disappearance.

All cane farmers should rotate in some way or another; thus, where corn will grow, cowpeas and corn make a fine rotation and will pay well.

The greatest supervision should be exercised at the time of planting, so that only good, sound plants, free from disease, are selected. Top plants are usually considered the best, but bottom plants have also been found to give a high percentage of germination. It is preferable for a farmer to change plants with a neighbour rather than grow cane continually from his own seed. Cane brought from a colder climate to a warmer one invariably does well.

The best width of the row has been found from numerous experiments in Louisiana, Hawaii, and Queensland to be 5 ft. In the case of a straight-growing cane like D1135, this could be reduced to 4 ft. 6 in. with advantage during normal seasons. Three-eye plants are usually considered the best to use, dropped in the furrow about 6 in. apart. The depth of planting and amount of covering can safely be left to the farmer's own judgment, as conditions vary so much in different districts. Labour can be saved at this stage by the use of the cane planter, a machine which is being increasingly used on our cane farms.

As soon as the cane is up about 6 in., the subsequent shallow cultivation should commence, and this, if properly done, is a factor which materially contributes to the success of the crop.

The importance of subsequent cultivation cannot be too strongly emphasised. One of the world's leading authorities upon the culture of cane (Professor Stubbs, of Louisiana) says: "The cultivator should be run as frequently as possible, so that a thin layer of earth is removed from the great body of soil and laid as a mulch upon the surface. In this way the continuous upward movement of moisture through the soil into the air is checked just below the surface, so that roots of plants can appropriate it. The finely divided earth on the surface has the power of attracting hygroscopic moisture from the air—a not insignificant fact in times of drought, with heavy dews at night." The question may be asked: "Which best promotes the above advantages, the cultivator, which stirs only to a limited depth and never inverts, or the plough, which runs 6 to 12 in. deep, completely inverting the soil and burying plant foods and ferments beyond resurrection for the growing crop? The plain and candid reply is—the cultivator. Again, but little stress has been laid upon the damage done by the frequent cutting of the cane roots by ploughs, a damage often fatal to good crops." So impressed were Louisiana farmers by this reasoning that they many years ago abandoned the cultivation of cane between the rows with the plough.

Professor Hilgard (Soils) says: "The loose tilth of the surface, which is so conducive to the rapid absorption of the surface water, is also, broadly speaking, the best means of reducing evaporation to the lowest possible point. . . . It is true

that relatively coarse compound particles are incapable of withdrawing capillary moisture from the dense soil or subsoil underneath, just as a dry sponge is incapable of absorbing any moisture from a wet brick, while the dry brick will withdraw readily nearly all the water contained in the relatively large pores of the sponge. A layer of loose, dry surface soil is therefore an excellent preventive of evaporation, and to moderate the access of excessive heat and dryness to the active roots."

If the cultivation of a plant crop has been carried out as indicated, fertilisers should not be necessary, but it is always wise, in seasons of average rainfall, to apply manures to ratoon crops. These should be mixtures of nitrogen, potash, and phosphoric acid as having given the best results when used with cane. Potash, though scarce at present, should soon be on the market again at reasonable rates, according to late advices.

It has been shown that a crop of cane of the variety known as HQ426, sixteen months old, removes from the soil 163 lb. potash, 83 lb. phosphoric acid, and 96 lb. of nitrogen per acre, thus showing the necessity for the renewal of these elements by fertilising.

Ratoons should also receive thorough and frequent cultivation, in order that they may be made to produce as much sugar as possible.

In these ways production could be materially increased in a manner profitable to the worker, grower, miller, State, and Commonwealth.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF FEBRUARY, 1919, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALLS DURING FEBRUARY, 1919 AND 1918, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Feb.	No. of Years' Records.	Feb., 1919.	Feb., 1918.		Feb.	No. of Years' Records.	Feb., 1919.	Feb., 1918.
North Coast.	In.		In.	In.	*South Coast*—continued:	In.		In.	In.
Atherton	9·67	17	1·81	9·62					
Cairns	14·03	36	7·85	18·06	Nambour	8·96	22	5·06	5·67
Cardwell	17·02	46	8·88	16·98	Nanango	4·54	36	2·58	2·91
Cooktown	13·61	42	10·29	13·48	Rockhampton ...	7·82	31	3·31	8·20
Herberton	7·49	31	2·81	10·02	Woodford	9·32	31	2·36	9·33
Ingham	15·65	26	6·05	18·40					
Innisfail	22·07	37	11·32	20·07					
Mossman	15·13	10	16·46	14·55	*Darling Downs.*				
Townsville	12·16	47	8·36	7·12					
					Dalby	2·98	48	3·38	2·17
Central Coast.					Emu Vale	2·39	23	1·54	1·13
					Jimbour	3·0	31	2·13	0·42
Ayr	9·43	31	2·54	8·30	Miles	2·75	33	1·29	3·36
Bowen	8·79	47	3·73	14·66	Stanthorpe ...	3·45	45	2·58	0·86
Charters Towers ...	4·40	36	2·21	11·26	Toowoomba ...	4·57	46	0·76	2·26
Mackay	11·77	47	6·05	9·89	Warwick	3·05	31	2·24	2·30
Proserpine	10·96	15	4·94	13·34					
St. Lawrence ...	8·26	47	1·55	7·49					
					Maranoa.				
South Coast.									
					Roma	3·17	44	3·33	0·36
Biggenden	3·89	20	2·71	4·15					
Bundaberg	6·45	35	3·22	5·62	*State Farms, &c.*				
Brisbane	6·48	68	0·89	2·25					
Childers	6·17	23	3·77	8·89	Bungeworgorai ...	2·50	5	5·15	0·45
Crohamhurst ...	15·03	25	3·10	7·38	Gatton College ...	3·17	20	0·55	1·59
Esk	5·94	31	0·53	2·18	Gindie	2·94	20	1·57	5·84
Gayndah	4·26	47	1·93	5·31	Hermitage ...	2·48	13	2·97	1·59
Gympie	6·75	48	2·63	7·28	Kairi	7·24	5	2·65	*
Glasshouse M'tains	9·50	10	2·71	9·03	Sugar Experiment Station, Mackay	10·44	22	6·75	11·77
Kilkivan	5·24	39	1·83	4·07	Warren	3·92	4	2·55	10·96
Maryborough ...	6·67	47	2·10	7·39					

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for February this year, and for the same period of 1918, having been compiled from telegraphic reports, are subject to revision. * Not received.

GEORGE G. BOND, State Meteorologist.

Science.

A SUN PROPHECY FULFILLED ON EARTH.

The following remarkable communication from a correspondent was published in the *Agricultural Journal*, Natal, 1900.

A prophecy of drought, heat, and famine over a large portion of the world, to continue up to the present year, made by Mr. Douglas Archibald in the *Westminster Gazette* of 19th March, 1897, "has been verified in almost every detail." So says the *Philadelphia Press* of a recent date. The actual prophecy referred to was contained in the following passage: The wave of tropical drought has not come to an end yet, and when it does the sunspot effect would tend to prolong it through the period of minimum which is due in 1900. At such times it is very rare for the tropical rains to be plentiful or well distributed, which latter is an important factor in regard to the growth of crops.

Consequently, though it is unpleasant to be a prophet of evil, the fact that an extra tendency to drought is just now coincident with a sun which is approaching its recurrent period of freedom from spots gives us little ground for expecting a bumper monsoon to terminate the present distress in India. On the contrary, unless these remarkable changes which have occurred since 1892 are due to some cosmical cause unconnected with the sun which will disappear in a few months, we shall have to look forward to other droughts and famines before the arrival of the sunspot maximum of 1904.

Commenting on this, the *Philadelphia Press* says:

It must be clear from this forecast, which has been verified in almost every detail by the terrible second famine in India, and which is confirmed in the scarcely favourable monsoon which is now prevailing in India, that it is the infrequency of sun spots, and not their frequency, which gives us these hot waves. And that we are at a period of minimum sunspot activity we know, not only from the daily investigation of the sun, but by means of the eclipse of 28th May, when the corona was of that type always connected with an absence of sun spots.

Concerning the future, both as regards India and elsewhere, Mr. Archibald now writes to us as follows: "I consider that the present period of more or less continuous and pronounced tropical drought reached its culminating epoch in 1899, when the deficiency of rain over the entire Indian area amounted to 11.14 inches, or 25 per cent. below the annual average. This deficiency coincided with a very low Nile and generally drought conditions over very large tracts of Asia, Africa, Australia, and America.

"I believe it to be the greatest deficiency ever recorded in India, and to be partly due to the exceptional coincidence of a sunspot minimum and abnormal solar conditions with the culminating dry phase of the Brückner cycle.

"By 1904 the sunspots ought again to be at a maximum, and this same year marks the termination of the eighteen dry and warm years of the Brückner cycle and the commencement of the generally, and especially in the tropics, eighteen years wet and cold period.

"These joint considerations led me, in 1897, to name 1904 as the probable limit of the droughty period. I see no reason to modify the forecast I gave then, which our sharp Transatlantic cousins have so favourably noticed, beyond saying that the culminating point has probably been reached, and that between now and 1904 the tropical rains and monsoons will probably gradually become more normal in amount and distribution.

"I will also venture to say that between 1904 and 1920 there will probably be no droughts and famines in India of a magnitude approaching those of 1896 and 1899-1900; but that the period will be generally characterised by summer rains of a more normal character throughout the tropics.

"Similar characteristics will also affect the general weather in the extra tropics during the same years, although the sunspot changes usually affect certain latitudes—particularly the belt between 30 degrees and 40 degrees—oppositely compared with the remainder of the earth.

"In general where the harvest is more beneficially influenced by a good supply of rain than by drought and sunshine, the conditions ought to average better during

these years even near the Poles, especially in the years following the sunspot maxima of 1904 and 1915. If anything could accentuate this, it would be found in the remarkable curve of harvests in Finland traced by Dr. Lemström for the years 1810 to 1877 in his paper read at the Chicago Congress of 1893, which follows the curve of sunspots for the corresponding period in every detail.

"The areas, however, which are affected most seriously by the combined Sunspot-Brückner causes are chiefly the large continental areas near the Equator—such as Central India, Asia, Africa, and parts of Australia and America, and it is to these that my former and present forecasts more particularly apply."

DROUGHTS AND FLOODS.

In connection with the above article "A Sun Prophecy Fulfilled," published in this issue of the Journal, we have received the following remarkable calculation on droughts and floods from a correspondent:—

The droughts repeat in ones and twos, fives and eights, and the flood years are in the noughts and threes in each decade. The ones and twos droughts commence in the ones and last through the twos, and break up in the beginning of the threes; and the fours and fives begin in the fours, last through the fives, and break up in the beginning of the sixes. This has been verified, as we had droughts in—

1851-52, 1861-62, 1871-72, 1881-82, 1891-92, 1901-02.
1865, 1875, 1885, 1895, 1905, 1915.
1868, 1878, 1888, 1898, 1908.

All the ones and twos and fives and eights of each have been either medium or bad droughts.

Records of floods have been published for 1860-63, 1870-73, 1880-83, 1890-93. Thus, according to the above, we have the following table as a guide for all years:—

Years ending 1—Drought commences.
Years ending 2—Continues through this year.
Years ending 3—Breaks in the beginning and there will be floods.
Years ending 4—Drought begins.
Years ending 5—Continues through this year.
Years ending 6—Breaks in the beginning of this year.
Years ending 7—Plenty of rain. Good growing year.
Years ending 8—Drought commences.
Years ending 9—Continues through this year.
Years ending 0—Breaking in this and there will be floods.
Example—The years 1901, 1911, 1921, etc., all end with the figure one.

THE PURIFICATION OF WATER FOR BUTTER AND CHEESE FACTORIES.

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

On several occasions during the recent severe drought, when water supplies were reduced to a minimum of questionable quality, advice has been sought as to the best means of converting an objectionable, and even offensive, fluid into a useful commodity. Water of good quality is essentially necessary in butter and cheese factories, especially freedom from organic impurities and bacterial contamination. That this is naturally impossible with water derived from surface streams or lagoons is well known, and that it is often so with water drawn from wells of shallow depth is also true because surface contamination easily takes place. In some soils wells of even 100 feet in depth are easily contaminated unless lined with some absolutely watertight material, and in such cases these waters are quite innocently believed to be perfect, a bore 100 feet or so in depth, lined with steel casing, may generally be expected to yield a supply free from organic impurities, but even this water may be greatly improved by subjecting it to a proper system of aeration. Bore waters are often highly charged with mineral elements, more or less objectionable, and are generally deficient in dissolved oxygen. In most butter and cheese factories pressure filters of some kind are used, and these rapidly become clogged with impurities, necessitating very frequent cleaning, and while they succeed in removing all matters in suspension, they do not impart to the water the dissolved oxygen in which it is often deficient. The method here suggested will deal with all classes of waters except those highly saline in character. It is not an experiment, as that stage

has been passed, and the principles advocated applied in practice with marked success. Although the writer is not aware of the application of this method to the purification of water for butter factory purposes, it is certain that the results would repay any factory for the comparative small cost incurred in its installation, in the saving of time now lost in the frequent cleansing of the pressure filters, and in depriving some waters of those characteristic odours which may be described as "fishy," "marshy," or "grassy."

In the year 1902 the writer suggested to the Brisbane Board of Waterworks a practical method for the purification of the water of the Enoggera reservoir, which had so far resisted all attempts at improvement, and it was proposed to expend a large sum, on the advice of the professional officers of the Board, in installing a chemical precipitation process which was not only expensive to instal, but would incur a large annual expenditure in maintenance and attention. The principle suggested by the writer had never yet been applied to the purification of potable water, and it differed radically from all methods previously experimented with, most of which involved precipitation of the impurities by the addition of one or more chemicals, settlement, and subsequent filtration through sand. In the bacterial method of treatment, as suggested, no chemical is added to the water and no precipitated matter has to be disposed of. It has been found that sand filtration removes only a small portion of the organic matter in solution, but it was expected that this method after being in operation for a short time would remove almost all the organisms present, because of the great excess of oxygen which was supplied during its passage through the filter. This suggestion was at first received with some derision and not a little scepticism by men who were regarded as prominent scientists. The Board, however, decided to give it a trial, and the results cannot be better described than by quoting from a paper read by the Board's Analyst before the Royal Society of Queensland on the 5th August, 1905, just three years after the institution of the tests. After naming other processes, the Analyst says:—"A method of water purification has been tried which, strictly speaking, comes under neither of the heads mentioned. This ingenious process was suggested by Mr. Arthur Morry, of this city, who, at that time, was District Supervisor of Public Works, and in that capacity had devoted a considerable amount of time and thought to the subject of water purification. The type of filter is described as 'Biological Oxidising Beds,' and consisted in passing the water through beds about 6 feet high, built up from the ground, and filled with gravel or coal in varying grades. In some of the filters, these beds are so constructed as to admit of side aeration, but the feature which is common to all is the method of delivering the unfiltered water on to the filter. This is done through an 'Intermitter,' from which the water is discharged at intervals into the basin of a revolving sprinkler running on ball-bearings, which distributes it regularly and evenly over the surface of the filter bed, through which it slowly percolates and flows into underdrains which lead into a small receiving vessel. The object of this method of discharging the effluent is to insure the thorough aeration of the water in its passages through the filters. That this has been effected is proved by the fact that even in the warmest weather the effluents from all but one of these filters contained over 95 per cent. of dissolved oxygen, and it has been proved that this aeration is chiefly produced during the passage of the water through the bed of the filter itself, the bacterial reduction effected being about 92 per cent."

These filters were subsequently known as the "Morry type" and the results generally were so good, effecting such a remarkable reduction in the organic matter and colour of the water, as to determine the Board, after consultation with an eminent American expert, to adopt the bacterial method of treatment as here explained for the Enoggera supply. The filters also attracted great attention throughout Australia, and were regarded as having solved what had hitherto been considered a very difficult problem. They can be used effectively in the treatment of water from swamps, and stagnant waterholes in creeks, removing the "grassy" or "swampy" taste and colour, and charging it with life-giving oxygen. They can therefore be usefully applied on stations and farms, being easily constructed, generally with local materials, while the mechanical arrangements are not difficult to obtain.

For the treatment of water, however, which has become polluted by earthy matter in suspension following heavy storms, some preliminary method of precipitation must be adopted, followed by oxidation, to get the best results. This is easily accomplished by passing the water through narrow channels of brick, concrete, or timber, in which thin slabs of alumino-ferric are placed on edge—a combination of alum and iron—when sufficient is dissolved to cause precipitation of all matters in suspension—if the water is already alkaline—if not, a small quantity of lime must be previously added. After settlement the effluent is then pumped into the "Intermitter," from which it is at intervals discharged on the oxidising beds. The results will be seen in a beautiful liquid, sparkling like the mountain springs and imparting life, energy, and vivacity to its consumer.

LIME AND MAGNESIA IN QUEENSLAND SOILS.

By J. C. BRÜNNICH, F.I.C., Agricultural Chemist.

The great **need of applying lime** to a large number of Queensland soils has been repeatedly urged in this Journal, and this necessity arises from the fact that a large percentage of our soils are not only **deficient** in their **lime contents,** but that a still greater percentage contain **excessive amounts of magnesia.**

A collation of the results of the analyses of 1,773 samples of soils, carried out at our agricultural laboratory and at the laboratory of the Sugar Experiment Station, shows that these soils may be classified as follows :—

27·64 per cent. contain under ·25 per cent. of lime (CaO),
44·7 per cent. contain from ·25 to ·75 per cent.,
21·1 per cent. contain from ·75 to 1·5 per cent., and
6·8 per cent. contain over 1·5 per cent. of lime.

With regard to magnesia we find—

35·7 per cent contain less than ·25 per cent. of magnesia (MgO), and comparing the amounts of magnesia and lime we find that—

34·0 per cent. have a ratio of 1 ÷ 1 and over of MgO ÷ CaO and only

6·6 per cent. have a ratio of less than 1 ÷ 3 of MgO ÷ CaO., the importance of which will be explained later on.

In an **average good loamy soil,** a **lime content** of less than **·25 per cent.** is considered **low, ·25 to ·75 per cent.** of lime is **fair, ·75 to 1·5 per cent.** of lime is **good,** and over **1·5 per cent.** of lime **high.**

Soils containing less than **·25 per cent magnesia** may be considered **deficient** in this constituent.

It must be clearly understood, however, that this classification cannot be generally applied as a hard-and-fast rule, as in a **loose sandy soil** from **·25 per cent. to ·75 per cent.** of lime and ·25 per cent. of magnesia may be considered **good,** because on account of the good physical condition of such soil the plants develop a good deep root system, and can therefore draw their supply of plant foods from a much larger volume of soil than in a soil of heavy nature.

In **heavy clayey soils,** again, amounts of lime between **·25 per cent. and ·75 per cent.** must be considered **low,** more particularly if the amount of magnesia is high or higher than the amount of lime, which is a common occurrence in such soils.

A **magnesia-lime ratio** of 1 ÷ 1 or over is considered **unfavourable** to fertility, and for most crops the most suitable MgO ÷ CaO ratio is 1 ÷ 2 or 1 ÷ 3 or less.

In order to make the information collected from the soil analyses more generally useful, the districts or localities from which samples were obtained are grouped herewith in accordance with the classification mentioned above.

It is only natural that in some of the districts great variations in the quality and composition of the soils exist, and therefore many localities appear in two or more classes.

Low Lime Contents, under ·25 per cent., at:—

Abbotsford
Aldershot
Aloomba
Aspley

Barcaldine
Beerburrum
Beerwah
Bidwell
Buderim Mountain
Bulimba
Bungeworgorai

Cairns
Charters Towers
Childers
Cleveland
Comet Downs
Cooper's Plains
Cooroy

Dakabin
Dalby
Degilbo

Eight-Mile Plains
Eudlo
Eumundi

Gin Gin
Glass House Mountain
Gooburrum
Goodna
Goondi
Gramzow

Innisfail
Invicta
Isis

Kalkie
Kamerunga
Kedron
Killarney
Kin Kin
Kolan
Kuraby

Loganlea

Maleny
Maroochy
Maryborough
Miles
Mitchell River
Mooloolah
Moreton
Mossman
Mourilyan
Mount Bauple
Mount Gravatt
Mount Windsor
Mulgrave

Nambour
Nelson
Nikenbah
Noosa
North Arm
North Kolan
Nudgee
Nundah

Oakhurst
Oman-ama
Ormiston

Pialba
Pomona

Rosedale

Sandgate
Stanthorpe
Strathpine
Sunnybank

Tahiti
Tewantin
Thursday Island
Tinana Creek
Torbanlea
Traveston

Wallumbilla
Warwick
Wellington Point
Westwood
Woodford
Woody Point
Woombye

Yandina
Yengarie
Yerra

Fair Lime Contents, between ·25 and ·75 per cent., at:—

Aspley
Atherton
Avondale
Ayr

Baffle Creek
Barolin
Beenleigh
Benowa
Bingera
Birkdale
Birthamba
Blackbutt
Bowen
Buderim Mountain
Bundaberg

Caboolture
Charters Towers
Chinchilla
Cleveland
Comet
Coolabunia
Cooran
Cooroy
Cordalba
Crow's Nest
Cunnamulla
Currajong Creek

Dawson
Diddilibah
Doolby
Dulacca

Eagleby
Edenvale
Eton
Eudlo
Eumundi

Fairymead

Garrah
Gayndah
Gin Gin
Goodnight Scrub
Goodwood
Goombungee
Goondi
Goondiwindi
Gootchie
Graceville
Gympie

Halifax
Hambledon
Highfields
Homebush
Horton

Ingham
Inglewood
Innisfail
Invicta
Isis

Jardine

Kalkie
Kamerunga
Killarney
Kingaroy
Kuraby

Livingstone
Loganholme

Mackay River Flats
Manly
Mareeba
Marburg
Maroochy
Miara
Millaa Millaa
Moggill
Moreton
Mossman
Mount Basilisk
Mount Bauple
Mount Jukes

Fair Lime Contents, between ·25 and ·75 per cent., at—*continued*:—

Mount Taroom
Mount Morgan
Mulgrave
Mundubbera
Mungar Junction
Murgon

Nanango
Nambour
Nerang
Nudgee
Normanton

Oakwood
Ormiston
Oxenford

Perry Scrub
Pialba
Plane Creek
Proserpine

Ripple Creek
Roma

Samford
South Kolan
Sunnybank
Sunnyside
St. Helena

Taabinga
Tallegalla
Tamaree
Thanes Creek
Tinana
Tingalpa
Tingoora
Toowoomba

Wallumbilla
Warwick
Watawa
Wellington Point
Winton
Woodford
Woongarra
Worongary

Yandina
Yarraman
Yepoon
Yeulba

Zillmere

Good Lime Contents, ·75 to 1·5 per cent., at:—

Atherton
Ayr

Baffle Creek
Bajool
Barcaldine
Beaudesert
Beenleigh
Bethania Junction
Biggenden
Birkdale
Booyal
Bowen
Boyne Valley
Brookfield
Bundaberg
Burdekin

Calliope
Cambooya
Charters Towers
Childers
Clifton
Colington
Cunnamulla

Dawson Valley
Drayton

Esk

Farleigh
Fassifern

Gatton
Gayndah
Gin Gin
Greenmount
Gympie

Hermitage
Homehill
Hughenden

Jimbour

Kalkie
Kingaroy
Kirchheim

Laravale
Livingstone
Loganlea
Longreach

Mackay
Marburg
Marian
Maryborough
Mooloolah
Moreton
Mount Bartopp
Mount Garnet
Mount Kent
Mount Larcom
Mundubbera
Murgon

Nambour
Nanango
Nerang
Nundah

Oxenford

Plane Creek
Proserpine

Raglan
Rawbelle
Rosewood

Samford
Sunnyside

Tallegalla
Tarong
Te Kowai
Toogoolawah
Tuchekoi
Tweed Heads

Wallumbilla
Watawa
Waterview
Westbrook
Woodmillar Scrub

High Lime Contents, over 1·5 per cent., at:—

Albert River
Alton Downs
Atherton

Baking Board
Beaudesert
Beenleigh
Bindango
Booyal
Bowen

Calliope
Cairns
Cambooya
Cannindah
Capella
Clifton

Dalma Scrub
Dawson River
Don Delta
Dulacca

Farleigh
Flinders Siding

Gayndah
Goomburra
Gowrie Junction
Greenmount
Gympie

Hughenden

High Lime Contents, over 1·5 per cent., at—*continued*:—

Isis Downs
Kandanga Creek
Kingaroy
Kynuna
Marmor
Mary River
Mount Jukes
Mount Mee
Muan
Nobby
Perry Scrub
Plane Creek
Pittsworth
Raglan
Rosehill
Rosewood
Samford
Tarampa
Tawah
Warra
Warwick
Westbrook
Westwood
Wowan

Low Magnesia Contents, under ·25 per cent., at:—

Abbotsford
Aloomba
Aspley
Barcaldine
Beerburrum
Beerwah
Bidwell
Bingera
Birthamba
Buderim Mountain
Bundaberg
Cairns
Charters Towers
Childers
Chinchilla
Cleveland
Cooroy
Currajong
Dalby
Eton
Gin Gin
Glass House Mountain
Gooburrum
Goodna
Gootchie
Hambledon
Homebush
Horton
Ingham
Innisfail
Invicta
Isis
Kalkie
Kamerunga
Kingaroy
Kolan
Kuraby
Loganlea
Mackay
Marian
Maroochy
Maryborough
Miles
Mitchell River
Moggill
Mooloolah
Mourilyan
Mount Larcom
Mulgrave
Nambour
Nelson
Nudgee
Nundah
Oakhurst
Oakwood
Ormiston
Perry Scrub
Pialba
Roma
Sandgate
South Kolan
Stanthorpe
St. Helena
Tahiti
Tingalpa
Traveston
Wallumbilla
Watawa
Wellington Point
Woodford
Woody Point
Woombye
Woongarra
Yandina
Yengarie
Zillmere

High Magnesia Lime Rates, percentage of Magnesia equal or higher than per cent. Lime, at:—

Aloomba
Aspley
Atherton
Barcaldine
Beaudesert
Beenleigh
Bingera
Biggenden
Brookfield
Bundaberg
Cambooya
Dawson River
Drayton
Dulacca
Eagleby
Eudlo
Fairymead
Gatton
Gin Gin
Goodnight Scrub
Goodwood
Goondiwindi
Greenmount
Halifax
Hambledon
Hermitage
Ingham
Innisfail
Invicta
Isis
Johnson
Kandanga Creek
Kirchheim
Killarney

High Magnesia Lime Rates, percentage of Magnesia equal or higher than per cent. Lime, at—*continued* :—

Maleny	Nambour	Sunnybank
Marmor	Nerang	South Johnston
Maroochy	North Arm	
Miara	Nundah	
Miles	Nudgee	Tallegalla
Mitchell River		Tewantin
Mooloolah		Toowoomba
Moreton	Oman-ama	Toogoolawah
Mossman		Traveston
Mount Basilisk		
Mount Bauple	Perry Scrub	Wallumbilla
Mount Gravatt	Pialba	Warwick
Mount Garnet	Proserpine	Watawa
Mount Larcom		Westbrook
Mourilyan		Woodford
Mulgrave	Roma	
Mungallala	Rosewood	
Murgon	Ripple Creek	Zillmere

In the localities *underlined* the high Magnesia Lime ratio is particularly predominant.

The important **functions of lime** in relation to **soil fertility** and plant nutrition are well known and generally recognised.

Sir A. D. Hall, the late Director of the celebrated Rothamsted Experiment Station, as president of the agricultural section of the 84th meeting of the British Association for the Advancement of Science, held in Australia in 1914, stated in his opening address as follows :—

" Of all the soil factors making for fertility I should put lime the first ; upon its presence depend both the processes which produce available plantfoods in quantities adequate for crop-production at a high level and those which naturally regenerate and maintain the resources of the soil ; it is, moreover, the factor which is most easily under the control of the agriculturist."

Lime is an **indispensable plantfood,** intimately connected in the growth of the plant with the building up of proteins and carbohydrates, and neutralization of organic acids.

Lime has powerful **action** on the **physical properties of a soil**, and both as burnt lime and a carbonate of lime increases the **water-holding capacity** of soil.

Lime in the form of air-slaked **burnt lime** has the most powerful action on the soil structure, as it **coagulates the clay**, thereby increasing porosity of the soil and facilitates the percolation of water through the soil.

Further important functions are the **neutralization** of **organic acids** in the soil, and the **decomposition of injurious compounds**. Lime aids in the fixation of soluble phosphoric acid and prevents the formation of the more insoluble alumina and iron phosphates. Addition of burnt lime to a soil actually makes **phosphoric acid available** from insoluble iron and alumina phosphates. Lime has also some action on the insoluble **potash salts** in the soil, and increases their solubility in water, thereby rendering them more **readily available.** This action is particularly valuable

on heavy clay soils, but would lead to loss of potash in light sandy soils, and for this reason lime must be applied in form of lime carbonate (crushed limestone) to the latter soils.

Lime has a particularly powerful action in aiding **decomposition** of organic matter, the **humus,** in the soil, producing at the same time **soluble nitrogenous compounds** therefrom. Addition of lime produces neutrality or even slight alkalinity of a soil, which is necessary for the important process of **nitrification,** by which the organic nitrogenous compounds are gradually changed into **ammonia salt** and finally into **nitrates,** in which form alone the nitrogen can be utilised by the plants.

The presence of a sufficient amount of lime greatly increases the activity of **azoto-bacteria,** which are the agents of the **fixation of atmospheric nitrogen.**

Magnesia, which as a rule is found in sufficient amounts in the soil, is also an **indispensable plantfood,** as it is found in every living cell, and is a constituent of chlorophyl, the green colouring matter of plants.

In the seeds generally larger amounts of magnesia than of lime are found. The ash of maize is particularly poor in lime and rich in magnesia, containing on an average about 2 per cent. of lime, 13 per cent. of magnesia and 53 per cent. of phosphoric acid. The ash of wheat contains about 5 per cent. of lime, 14 per cent. of magnesia, and 40 per cent. of phosphoric acid.

In the leaves and twigs lime generally predominates, and leguminous plants, like clover and lucerne, contain large amounts of lime in their ash.

Magnesia salts found **in excess** in any soil act as a **plant poison,** and, as a matter of fact, magnesia salts can only be utilised for plant nutrition in presence of sufficient amounts of lime salts. As a rule, a **ratio of 1 part of magnesia** to **three parts of lime** is the **most favourable** for plant nutrition. Some cereal crops can tolerate higher amounts of magnesia, up to a ratio of 1 ÷ 2 and even 1 ÷ 1, whereas leguminous plants, which require much more lime, always do best with the ratio near 1 ÷ 3.

Dr. Voelcker has shown by experiments with wheat, carried out at the Woburn Experiment Station, that the **addition of magnesia** to a soil poor in this constituent will be attended with benefit as long as the amount of magnesia does not exceed that of lime, but if the magnesia be in excess, there will be diminution of produce. Magnesia appears to have an influence in producing greater leaf development and greener foliage, shorter straw, and later ripening; also changes in the nature of root system and character of the grain.

H. Rigaux has proved that in Belgium, where the soils are particularly poor in magnesia, containing only ·01 to ·04 per cent. MgO, manuring with magnesia salts (using 670 lb. of magnesium sulphate or Epsom salts per acre) gave very considerable increases in various crops—cereals, beets, and potatoes.

About ·25 to ·3 per cent. of magnesia in soils is considered a sufficient amount, and therefore in our soils, as a rule, enough, if not too much, magnesia is present.

In many of our sugar districts the **magnesia-lime ratio** is very **unfavourable,** more magnesia than lime being present. A sugar soil at Innisfail, for instance, contains only ·2 per cent. of lime and 2·2 per cent. of magnesia ; a scrub soil in the Bundaberg district contains ·65 per cent. of lime and 3·6 per cent. of magnesia. Such soils, in order to produce good crops, must be limed heavily, and it is only an economic question if sufficient lime can be applied to produce better results.

It is of interest to note that on a sugar soil at Porto Rico, reported to contain according to analysis made by P. L. Gile, ·60 per cent. of lime and 3·32 per cent. of magnesia, an application of lime at the rate of 3,000 lb. per acre increased the sugar-cane crop from 44 tons to 69 tons, whereas a simultaneous application of a rich manure only yielded 61·6 tons per acre.

The lime is generally supplied to soils in the form of **crushed limestone** (lime carbonate) or as **air-slaked burnt lime.** From the effects of lime already described it is easily understood that **burnt lime** is only necessary in **exceptional cases,** where a rapid action is required. For ordinary purposes of supplying lime the **agricultural lime** is to be **preferred.** In some cases a mixture of burnt lime and crushed limestone may be recommended.

The amounts of lime required per acre are very considerable, as an acre of soil to a depth of 12 inches weighs on an average about 3,500,000 lb. or 1,565 tons, and in order to add only $\frac{1}{10}$ **per cent. of lime** an application of 3,500 lb. or **31 cwt.** of **pure lime** (CaO) or **56 cwt.** of **pure lime carbonate** ($CaCo_3$) would be necessary.

If the lime is of poorer quality, containing impurities, increased amounts must be applied, as seen from the following small table :—

Amounts (in cwt.) of agricultural lime or burnt lime to be applied per acre.

To give Per Acre 12 in. deep	Agricultural Lime containing :—					
	60 %	80 %	100 %	—	—	$CaCO_3$
	or Burnt Lime containing :—					
	33·6 %	44·8 %	56 %	80 %	100 %	CaO
$\frac{1}{10}$ % CaO	96	70	56	39	31	Cwt.

Because lime must be applied in large amounts, its **cost** is of the greatest importance to the farmer. Hitherto quite extraordinary prices for lime of all sorts had to be paid in Queensland, and for this reason its use was greatly restricted.

The Department of Agriculture and Stock imported a **Jeffrey Lime Pulver**, a machine largely used by farmers in America for crushing limestone on their fields. The machine is at present at Gore and the Department can supply crushed limestone at 22s. 6d. per ton on the trucks.

This price is still high, but would undoubtedly be reduced as the operations are extended and the demand increases. It is not the intention of the department to keep the pulver at Gore, but rather to send the machine in turn to various districts, so that the farmers may form co-operative companies and work the lime in each locality under the Co-operative Agricultural Production Act, and may themselves crush the lime of deposits available in their neighbourhood in sufficient amounts for the demand of a few seasons. By this means the cost could be cut down to a minimum, as the work could be done by the farmers themselves, and particularly the cost for freight, by avoiding sending the crushed limestone over long distances, is reduced.

Prof. Cyril J. Hopkins, of the Agricultural Experiment Station at Illinois, U.S.A., the great advocate of the use of large quantities of crushed limestone and pulverised rock phosphate for the maintainance of permanent fertility, reports (1913) that ground limestone can be obtained at the cost of 60 cents a ton (1 dollar in bags) from the Southern Illinois Penitentiary, and at the cost of 50 cents to 1 dollar from twenty-nine different firms.

This price of **2s. to 4s. per ton,** according to quality and fineness, is extraordinarily low. At no place the lime costs the Illinois farmers, including all railway charges, more than **8s. per ton.**

Although the cost is so low, many farmers prefer crushing their own limestones, and five firms are selling machines suitable for this purpose.

In Victoria crushed limestone is sold at the quarries at 12s. 6d. to 15s. per ton in trucks.

Any farmer willing to experiment with liming the soil on his farm, pasture, or orchard, who purchases agricultural lime from the Department of Agriculture and Stock in quantities not less than 1 ton, should communicate with the Under Secretary of the Department, or the Director of Agriculture, or with one of the Instructors in agriculture or fruit culture in the various districts. As in such cases the analyses of the soil before and after liming are of particular educative value, such analyses of samples taken, under the direction of a Departmental officer, would be made free of charge, where approved experiments are so arranged. In this case careful record of the results of liming would have to be kept.

General Notes.

OPEN SEASON FOR OPOSSUMS AND BEARS.

Trappers and shooters of Opossums and Bears should note that the season for their operations this year commenced on 1st April, and will close on 30th September, 1919.

WANTED TO SELL, HIRE, OR EXCHANGE.

Have you an unused farm implement which you would exchange for, say, a cow? Your household has many unwanted articles—your neighbour likewise. To enable our readers to exchange these, we are opening an advertising column in the Journal. Send in a list of the articles you wish to exchange. Full particulars appear on page xx. of this issue.

SOCIETIES, SHOW DATES, ETC., 1919.

AYR.—Lower Burdekin Pastoral, Agricultural, and Industrial Association. Secretary, A. E. Dean. Annual Exhibition, 27th and 28th June.

BIGGENDEN.—Biggenden District Agricultural and Pastoral Society. Shaw dates: 26th and 27th June.

BOWEN.—The Bowen Pastoral, Agricultural, and Mining Association. Secretary, F. Sellars. Show dates: 19th and 20th June.

CHARLEVILLE.—Central Warrego Pastoral and Agricultural Association. Secretary, L. O. Easton. Show dates: 27th and 28th May.

CHARTERS TOWERS.—Towers Horticultural Society. Secretary, Jas. H. Chappel. Show dates 6th and 7th August.

DALBY.—Dalby Pastoral and Agricultural Association. Show dates: 29th and 30th April.

ELIMBAH.—Elimbah Farmers' Progress Association. Secretary, Chas. Rutter.

GAYNDAH.—The Gayndah Pastoral, Agricultural, Industrial, and Horticultural Association. Show dates: 1st, 2nd, and 3rd July.

KOONDAI-I (Bell).—Koondai-i Dairymen's Association. Secretary, Jas. Johnston.

MANLY.—Manly Fruitgrowers' Mutual Benefit Association. Secretary, J. Alcorn.

MAREEBA.—Mareeba District Mining, Pastoral, Agricultural, and Industrial Association. Secretary, P. H. O'Donnell. Show dates: 3rd and 4th June, 1916.

MOUNT MORGAN.—Mount Morgan Poultry and Kennel Club. Show dates: 5th and 6th June.

NAMBOUR.—The Maroochy Pastoral, Agricultural, Horticultural, and Industrial Society. Show dates: 10th and 11th July.

NANANGO.—Nanango Horticultural, Pastoral, and Mining Society. Show dates: 30th April, 1st May.

OAKEY CREEK (*viâ* Eumundi).—Kenilworth Farmers' Association. Mr. A Hughes has been appointed Secretary, *vice* Mr. G. B. Sutton.

ROCKHAMPTON AGRICULTURAL SOCIETY.—19th, 20th, and 21st June.

ROCKLEA.—Rocklea Agricultural and Industrial Association. Secretary, A. Abercrombie. Show date: 27th September, 1919.

TOOGOOLAWAH.—Toogoolawah Pastoral and Industrial Association. Secretary, D. Young.

TOOWOOMBA.—Royal Agricultural Society of Queensland. Dates of Annual Exhibition, 6th, 7th, and 8th May, 1919.

WARWICK.—Eastern Downs Horticultural and Agricultural Association. Secretary, H. Sterne. Show dates: 11th, 12th, and 13th February.

The Markets.

PRICES OF FARM PRODUCE IN THE BRISBANE MARKETS FOR MARCH, 1919.

Article.		MARCH. Prices.
Bacon	lb.	11½d.
Barley	bush.	4s. 2d. to 5s. 4d.
Bran	ton	£7 10s.
Broom Millet	,,	£50 to £75
Broom Millet (Sydney price)	,,	£75 to £82 10s.
Butter (First Grade)	cwt.	186s. 8d.
Chaff, Mixed	ton	£11 15s. to £13
Chaff, Oaten	,,	£9 10s. to £10 10s.
Chaff, Lucerne	,,	£14 to £14 15s.
Chaff, Wheaten	,,	£8 10s. to £9 10s.
Cheese	lb.	1s. 0½d. to 1s. 1½d.
Flour	ton	£12
Hams	lb.	1s. 3d. to 1s. 4d.
Hay, Oaten	ton	...
Hay, Lucerne	,,	£13 to £14
Hay, Wheaten	,,	...
Honey	lb.	3d. to 6d.
Maize	bush.	7s. to 7s. 10d.
Oats (Seed)	,,	5s. 6d.
Onions (Imported)	ton	£24 15s.
Peanuts	lb.	4d. to 6d.
Pollard	ton	£8 10s.
Potatoes	,,	£15 10s. to £18 5s.
Potatoes (Sweet)	cwt.	5s. to 8s.
Pumpkins (Cattle)	ton	£20 10s.
Eggs	doz.	1s. 5d. to 2s. 1½d.
Fowls	per pair	2s. 9d. to 9s.
Ducks, English	,,	2s. 10d. to 3s. 1d.
Ducks, Muscovy	,,	3s. to 8s.
Geese	,,	7s. to 8s. 5d.
Turkeys (Hens)	,,	9s. 6d. to 11s.
Turkeys (Gobblers)	,,	25s. to 30s.
Wheat (Milling)	bush.	5s. 9d.

VEGETABLES—TURBOT STREET MARKETS.

Beans, per sugar-bag	4s. to 12s. 6d.
Beetroot, per dozen bundles	1s. 3d. to 1s. 6d.
Cabbages, per dozen	7s. 6d. to 25s.
Carrots, per dozen bunches	1s. to 1s. 9d.
Cucumbers, per dozen	2s. 6d. to 4s.
Lettuce, per dozen	...
Marrows, per dozen	4s. to 11s.
Parsnips, per dozen bunches	1s. 3d. to 2s.
Peas, per sugar-bag	10s. to 15s.
Potatoes (Sweet), per cwt.	5s. to 8s.
Pumpkins (table), per cwt.	12s. to 24s.
Tomatoes, per quarter-case	3s. 6d. to 11s.

SOUTHERN FRUIT MARKETS.

Article.	MARCH. Prices.
Bananas (Queensland), per case	8s. to 10s.
Bananas (Tweed River), per case	7s. to 21s.
Bananas (Fiji), per bunch	12s. to 14s.
Bananas (G.M.), per bunch	...
Bananas (G.M.), per case	8s. to 18s.
Lemons, per bushel-case	18s. to 24s.
Passion Fruit (Queensland), per case	18s. to 20s.
Pears, per case	4s. 6d. to 12s.
Pineapples (Queens), per double case	5s. to 9s.
Pineapples (Ripleys), per case	5s. to 9s.
Pineapples (Common), per case	5s.
Tomatoes, per half-case	5s. to 9s.

PRICES OF FRUIT—TURBOT STREET MARKETS.

Apples, Eating, per bushel-case	12s. to 20s.
Apples, Cooking, per bushel-case	7s. to 12s.
Bananas (Cavendish), per dozen	3d. to 6d.
Bananas (Sugar), per dozen	4d. to 5½d.
Citrons, per hundredweight	8s.
Cocoanuts, per sack	15s. to 25s.
Grapes, black, per lb.	6d. to 8d.
Grapes, white, per lb.	4d. to 6d.
Lemons (Lisbon), per case	20s. to 25s.
Mangoes, per bushel-case	3s. to 9s.
Passion Fruit, per quarter-case	8s. to 11s.
Peaches, per half bushel-case	4s. to 8s. 6d.
Peanuts, per lb.	4d. to. 6d.
Pears, per quarter-case	12s. to 16s.
Persimmons, per quarter-case	4s. to 6s.
Piemelons, per hundredweight	3s. 6d.
Pineapples (Ripley), per dozen	1s. to 6s.
Pineapples (Rough), per dozen	1s. to 6s.
Pineapples (Smooth), per dozen	4s. to 5s. 6d.
Plums, per case	7s. to 11s.
Rockmelons, per dozen	4s. to 12s.
Sugar-melons, per dozen	5s. to 15s.
Tomatoes, per quarter-case (ripe)	8s. to 12s. 6d.
Tomatoes, per quarter-case (green)	2s. to 4s.

TOP PRICES, ENOGGERA YARDS, FEBRUARY, 1919.

Animal.	FEBRUARY. Prices.
Bullocks	£22 10s. to £25
Bullocks (Single)	£27 10s.
Cows	£12 5s. to £15 17s. 6d.
Merino Wethers	42s. 3d.
Crossbred Wethers	40s.
Merino Ewes	40s.
Crossbred Ewes	37s. 6d.
Lambs	34s. 6d.
Pigs (Porkers)	45s. 6d.

ASTRONOMICAL DATA FOR QUEENSLAND.

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

TIMES OF SUNRISE AND SUNSET.

AT BRISBANE.

1919.	JANUARY.		FEBRUARY.		MARCH.		APRIL.	
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Sets.	Rises.	Sets.
1	4·57	6·45	5·21	6·42	5·41	6·20	5·58	5·47
2	4·58	6·46	5·22	6·42	5·42	6·19	5·59	5·46
3	4·59	6·46	5·23	6·41	5·42	6·18	5·59	5·44
4	5·0	6·46	5·24	6·41	5·43	6·17	6·0	5·43
5	5·0	6·46	5·24	6·40	5·44	6·16	6·0	5·42
6	5·1	6·47	5·25	6·39	5·44	6·15	6·1	5·41
7	5·2	6·47	5·26	6·39	5·45	6·14	6·1	5·40
8	5·2	6·47	5·27	6·38	5·45	6·13	6·2	5·39
9	5·3	6·47	5·28	6·37	5·46	6·12	6·2	5·38
10	5·3	6·47	5·28	6·36	5·46	6·11	6·3	5·37
11	5·4	6·47	5·29	6·36	5·47	6·10	6·3	5·36
12	5·5	6·47	5·30	6·35	5·48	6·9	6·4	5·35
13	5·6	6·47	5·31	6·35	5·48	6·8	6·4	5·35
14	5·6	6·47	5·31	6·34	5·49	6·7	6·4	5·34
15	5·7	6·47	5·32	6·33	5·49	6·6	6·5	5·33
16	5·8	6·47	5·33	6·32	5·50	6·5	6·5	5·32
17	5·9	6·47	5·33	6·31	5·50	6·4	6·6	5·31
18	5·10	6·47	5·34	6·30	5·51	6·3	6·6	5·30
19	5·10	6·47	5·35	6·29	5·51	6·2	6·7	5·29
20	5·11	6·47	5·35	6·28	5·52	6·1	6·7	5·28
21	5·12	6·46	5·36	6·28	5·52	6·0	6·8	5·27
22	5·13	6·46	5·36	6·27	5·53	5·59	6·8	5·26
23	5·14	6·46	5·37	6·26	5·53	5·58	6·9	5·25
24	5·15	6·45	5·38	6·25	5·54	5·57	6·9	5·24
25	5·16	6·45	5·38	6·24	5·54	5·56	6·10	5·23
26	5·16	6·45	5·39	6·23	5·55	5·55	6·10	5·22
27	5·17	6·44	5·40	6·22	5·56	5·53	6·11	5·21
28	5·18	6·44	5·41	6·21	5·56	5·52	6·11	5·20
29	5·19	6·43	...	...	5·57	5·50	6·12	5·19
30	5·20	6·43	...	...	5·57	5·49	6·12	5·18
31	5·21	6·42	...	...	5·58	5·48	...	...

PHASES OF THE MOON.

The Phases of the Moon commence at the times stated in Queensland, New South Wales, Victoria, and Tasmania.

			H.	M.	
2 Jan.	●	New Moon	6	24	p.m.
9 „	☾	First Quarter	8	55	p.m.
16 „	○	Full Moon	6	45	p.m.
24 „	☽	Last Quarter	2	22	p.m.

The Moon will be nearest the earth on the 11th about 8 p.m., and farthest from the earth on 24th about 9 a.m.

1 Feb.	●	New Moon	9	7	a.m.
8 „	☾	First Quarter	4	52	a.m.
15 „	○	Full Moon	9	38	a.m.
23 „	☽	Last Quarter	11	48	a.m.

The Moon will be nearest the earth on 5th about midday, and farthest away on the 21st about 6 a.m.

2 Mar.	●	New Moon	9	12	p.m.
9 „	☾	First Quarter	1	14	p.m.
17 „	○	Full Moon	1	41	a.m.
25 „	☽	Last Quarter	6	34	a.m.

The Moon will be nearest the earth on the 4th about midnight, and farthest away on the 20th about 11p.m.

1 April	●	New Moon	7	4	a.m.
7 „	☾	First Quarter	10	38	p.m.
15 „	○	Full Moon	6	25	p.m.
23 „	☽	Last Quarter	9	21	p.m.
30 „	●	New Moon	3	30	p.m.

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 will rise and set about 4 minutes later than at Brisbane, 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.

Farm and Garden Notes for May.

FIELD.—During this month, the principal work in the field will be the sowing of wheat, barley, oats, rye, and vetches. There is no time to lose now at this work. Potatoes should be hilled up. Cut tobacco. The last of the cotton crop should now be picked, the bushes being stripped daily after the dew has evaporated. Cotton-growers are notified that cotton-ginning and baling machinery has been installed on the premises of the Department of Agriculture and Stock in William street, where seed cotton will be received by the department from the growers, to whom an advance of 1¾d. per lb. will be paid. The cotton will then be ginned, baled, and marketed in the best market, and whatever balance to credit is shown when account sales are received will be distributed amongst the suppliers according to the amount of cotton supplied by them. Only bare expenses of preparing the shipments and freight, if the cotton is exported, will be deducted. Thus it will be seen that cotton-growers will have a sure market for their produce. Every effort should be made to ensure feed for stock during the winter by utilising all kinds of green fodder in the form of silage or hay. Those who own dairy stock will be wise to lay down permanent grasses suitable to their particular district and soil. A few acres of artificial grass, notably Rhodes grass, will support a surprisingly large number of cattle or sheep in proportion to acreage. Couch grass in the West will carry ten to twelve sheep to the acre. Coffee-picking should now be in full swing, and the berries should be pulped as they are picked. Strawberries may be transplanted. The best varieties are Pink's Prolific, Aurie, Marguerite, Annetta, Phenomenal, Hautbois, and Trollope's Victoria. Aurie and Marguerite are the earliest. In some localities, strawberry planting is finished in March, and the plants bear their first fruits in August. In others, fruit may be gathered in July, and the picking does not end until January.

KITCHEN GARDEN.—Onions which have been planted in seed beds may now be transplanted. The ground should long since have been thoroughly cleaned, pulverised, and should be rolled previous to transplanting. Onions may still be sown in the open on clean ground. In favourable weather plant out cabbages, cauliflowers, lettuce, lecks, beetroot, endive, &c. Sowings may also be made of all these as well as of peas, broad beans, kohl-rabi, radishes, spinach, turnips, parsnips, and carrots. Dig and prepare beds for asparagus.

In making asparagus beds, select the best soil in the garden. The most favourable is a deep, sandy loam, dug deep and well manured, a good sprinkling of salt being added to the surface a month or two before the planting season, that the rain and atmosphere may act upon it. Before planting, the ground should have another good dressing of well-rotted manure, be trenched again 2 feet to 2 feet 6 inches deep, and again be sprinkled with salt, leaving the surface neat and even.

During May or June mark out the beds 4 feet wide. Cut three trenches 6 inches deep which will complete each bed. In these, place the plants 15 inches asunder, spreading out the roots, and leaving the crowns 2 inches below the surface. Fill in the earth quickly. The object of making the beds so narrow is that they may not be trodden upon, as, from the length of time they remain without any further opportunity for deep digging, everything must be avoided which would tend to compress the earth.

For subsequent cultivation we refer our readers to articles on asparagus growing in this Journal, Vol. xxiv., April, 1910, and Vol. vi., New Series, July, 1916.

FLOWER GARDEN.—Planting and transplanting may be carried out simultaneously during this month in showery weather; the plants will thus be fully established before the early frosts set in. Camellias and gardenias may be safely transplanted, and also soft-wooded plants as verbenas, petunias, pentstemons, heliotrope, &c. Cut back and prune all trees and shrubs ready for digging. Dahlia roots should be taken up and placed in a shady situation out of doors. Plant bulbs such as anemones, ranunculus, snowflakes, freesias, ixias, watsonias, iris, narcissus, daffodils, &c. Tulips will not suit the Queensland climate, but hyacinths may be tried, although success is doubtful. All shades and screens may now be removed to enable the plants to get the full benefit of the air. Fork in the mulching, and keep the walks free from weeds. Clip hedges and edgings.

Orchard Notes for May.

THE SOUTHERN COAST DISTRICTS.

The advice given respecting the handling and marketing of citrus fruits in the last two numbers of the Journal applies with equal force to this and the following months. Do not think that you can give the fruit too much care and attention; it is not possible, as the better they are handled, graded, and packed the better they will carry, and the better the price they will realise.

Continue to pay careful attention to specking, and fight the blue mould fungus everywhere. Don't let mouldy fruit lie about on the ground, hang on the trees, or be left in the packing-shed, but destroy it by burning. Keep a careful lookout for fruit fly, and sweat the fruit carefully before packing. If this be done, there will be little fear of the fruit going bad in transit or being condemned on its arrival at Southern markets. Where the orchard has not been already cleaned up, do so now, and get it in good order for winter. Surface working is all that is required, just sufficient to keep moisture in the soil; keep down undergrowth, and prevent the packing of the surface soil by tramping it down when gathering the fruit.

Keeping the orchard clean in this manner enables any fallen fruit to be easily seen and gathered, and it need hardly be stated, what has been mentioned many times before, that diseased fruit should on no account be allowed to lie about and rot on the ground, as this is one of the most frequent causes of the spreading of many fruit pests.

May is a good month to plant citrus trees, as if the ground is in good order they get established before the winter, and are ready to make a vigorous growth in spring.

Don't plant the trees, however, till the land is ready, as nothing is gained thereby, but very frequently the trees are seriously injured, as they only make a poor start, become stunted in their growth, and are soon overtaken by trees planted later, that are set out under more favourable conditions. The land must be thoroughly sweet, and in a good state of tilth—that is to say, deeply worked, and worked down fine. If this has been done, it will probably be moist enough for planting; but should there have been a dry spell, then, when the hole has been dug and the tree set therein, and the roots just covered with fine top soil, 4 to 8 gallons of water should be given to each tree, allowed to soak in, and then covered with dry soil to fill up the hole. If sound, free, sandy loams that are naturally scrub soils, holes may be dug and the trees planted before the whole of the ground is brought into a state of perfect tilth. It is, however, better to do the work prior to planting, as it can then be done in the most thorough manner; but if this is not found possible, then the sooner it is done after planting the better. If the land has been thoroughly prepared, there is no necessity to dig big holes, and in no case should the holes be dug deeper than the surrounding ground either is or is to be worked. The hole need only be big enough to allow the roots to be well spread out, and deep enough to set the tree at the same depth at which it stood when in the nursery. Plant worked trees 24 to 25 ft. apart each way, and seedings at least 30 ft. apart each way.

Towards the end of the month cover pineapples when there is any danger of frost; dry blady grass or bush hay is the best covering. Keep the pines clean and well worked—first, to retain moisture; and, secondly, to prevent injury from frost—as a patch of weedy pines will get badly frosted when a clean patch alongside will escape without any serious injury.

Slowly acting manures—such as meatworks manure when coarse, boiling-down refuse, farm manure, or composts—may be applied during the month, as they will become slowly available for the trees' use when the spring growth takes place; but quickly-acting manures should not be applied now.

THE TROPICAL COAST DISTRICTS.

May is a somewhat slack month for fruit—pines, papaws, and granadillas are not in full fruit, the autumn crop of citrus fruit is over, and the spring crop only half-grown. Watch the young citrus fruit for Maori, and when it makes its appearance spray with the sulphide of soda wash. Keep the orchard clean, as from now till the early summer there will not be much rain, and if the orchard is allowed to run wild—viz., unworked and dirty—it is very apt to dry out, and both the trees and fruit will suffer in consequence.

Bananas should be kept well worked for this reason, and, though the fly should be slackening off, every care must still be taken to prevent any infested fruit being sent to the Southern markets.

Citrus fruits can be planted during the month, the remarks *re* this under the heading of the Southern Coast Districts being equally applicable here.

THE SOUTHERN AND CENTRAL TABLELANDS.

Get land ready for the planting of new deciduous orchards, as although there is no necessity to plant so early, it is always well to have the land in order, so as to be ready to plant at any time that the weather is suitable. The pruning of deciduous trees can commence towards the end of the month in the Stanthorpe district, and be continued during June and July. It is too early for pruning elsewhere, and too early for grapes, as a general rule. Keep the orchard clean, particularly in the drier parts. In the Stanthorpe district the growing of a crop of blue or grey field peas, or a crop of vetches between the trees in the older orchards, is recommended as a green manure. The crop to be grown as a green manure should have the soil well prepared before planting, and should be manured with not less than 4 cwt. of phosphatic manure, such as Thomas phosphate, or fine bonedust, per acre. The crop to be ploughed in when in the flowering stage. The granite soils are naturally deficient in organic matter and nitrogen, as well as phosphoric acid, and this ploughing in of a green crop that has been manured with a phosphatic manure will have a marked effect on the soil.

Lemons will be ready for gathering in the Roma, Barcaldine, and other districts. They should be cut from the trees, sweated, and cured down, when they will keep for months, and be equal in quality to the imported Italian or Californian fruit. If allowed to remain on the trees, the fruit becomes over-large and coarse, and is only of value for peel. Only the finest fruit should be cured; the larger fruit, where the skin is thicker, is even better for peel, especially if the skin is bright and free from blemish; scaly fruit, scabby, warty, or otherwise unsightly fruit is not suitable for peel, and trees producing such require cleaning or working over with a better variety, possibly both.

The remarks *re* other citrus fruit and the work of the orchard generally, made when dealing with the coast districts, apply equally well here, especially as regards handling the crop and keeping down pests.

BREEDERS OF PUREBRED STOCK IN QUEENSLAND—BEEF AND DAIRY CATTLE.

The Office of the Secretary of the undermentioned Herd Book Societies is 303 Queen street, Brisbane:—

The Australian Hereford Herd Book;
The Shorthorn Herd Book of Queensland;
The Jersey Herd Book of Queensland;
The Illawarra Herd Book of Queensland;
The Ayrshire Herd Book of Queensland;
The Milking Shorthorn Herd Book of Queensland;
The Holstein-Friesian Herd Book of Australia.

NOTE.—Animals registered in the Commonwealth Standard Herd Book are not necessarily eligible for entry in the Jersey Herd Book of Queensland.

Name of Owner.	Address.	Number of Males.	Number of Females.	Herd Book.
	DAIRY BREEDS.			
	AYRSHIRES.			
L. H. Paten	"Jeyendel," Calvert, S. & W. Line	8	21	Ayrshire Herd Book of Queensland
J. H. Paten	Gwandalan, Yandina	6	21	Do.
Queensland Agricultural College	Gatton	4	10	Do.
State Farm	Warren	3	83	Do.
J. W. Paten	Ayrshire Park, Wanora, Ipswich	10	42	Do.
J. H. Fairfax	Marinya, Cambooya	9	55	Do.
J. Holmes	"Longlands," Pittsworth	6	20	Do.
H. M. Hart	Glen Heath, Yalangur	7	21	Do.
F. A. Stimpson ..	Ayrshire Stud, Fairfield, South Brisbane	7	77	Do.
M. L. Cochrane ..	Paringa Farm, near Cairns	5	21	Do.
John Anderson ..	"Fairview," Southbrook	7	34	Do.
	JERSEYS.			
T. Mullen	"Norwood," Chelmer	3	20	Jersey Herd Book of Queensland
Queensland Agricultural College	Gatton	2	31	Do.
M. W. Doyle	"Oaklands," Moggill	4	12	Do.
G. A. Buss	Bundaberg	1	15	Do.
R. Conochie	Brooklands, Tingoora	9	21	Do.
W. J. Barnes	Millstream Jersey Herd, Cedar Grove	10	37	Do.
W. J. Affleck	Grasmere, N. Pine ..	6	31	Do.
J. N. Waugh and Son	Prairie Lawn, Nobby	3	28	Do.
W. J. H. Austin ..	Hadleigh Jersey Herd, Boonah	2	11	Do.
State Farm, Kairi ..	Kairi, *viâ* Cairns ..	4	16	Do.
H. D. B. Cox	Sydney (entered in brother's name)	3	16	Commonwealth Standard Jersey Herd Book
	GUERNSEYS.			
Queensland Agricultural College	Gatton	2	2	Eligible, but no Guernsey Herd Book of Australia

BREEDERS OF PUREBRED STOCK IN QUEENSLAND—*continued.*

Name of Owner.	Address.	Number of Males.	Number of Females.	Herd Book.
	DAIRY BREEDS—*continued.*			
	HOLSTEINS.			
Queensland Agricultural College	Gatton	2	9	Holstein-Friesian Herd Book of Australia
George Newman ..	"St. Athan," Wyreema	12	47	Do.
F. G. C. Gratton ..	"Fowlerton," Kingsthorpe	1	15	Do.
R. S. Alexander ..	Glenlomond Farm, Coolumboola	1	3	Do.
Ditto	Ditto	1	..	Holstein-Friesian Herd Book of New Zealand
S. H. Hoskings ..	St. Gwithian, Toogooloowah	..	..	Holstein-Friesian Herd Book of Australia
C. Behrendorff ..	Inavale Stud Farm, Bunjgurgen, Q.	3	9	Do.
E. Swayne	West Plane Creek, Mackay	1	2	Do.
	ILLAWARRA.			
A. Pickels	Blacklands Stud, Wondai	4	62	Illawarra Herd Book of Queensland
J. T. Perrett and Son	Corndale, Coolabunia	3	43	Do.
W. T. Savage	Ramsay	2	22	Do.
Hunt Bros.	Springdale, Maleny ..	3	62	Do.
	MILKING SHORTHORNS.			
P. Young	Talgai West, Ellinthorp	2	42	Milking Shorthorn Herd Book of Queensland
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W. Middleton	Devon Court, Crow's Nest	3	27	Do.
A. K. Yorksten ..	"Dunure," Miles ..	2	8	Do.
	BEEF BREEDS.			
	SHORTHORNS.			
T. B. Murray-Prior ..	Maroon, Boonah ..	2	37	Queensland Shorthorn and Australian Herd Books
C. E. McDougall ..	Lyndhurst Stud, Warwick (2)	25	100	Queensland Shorthorn Herd Book
Godfrey Morgan ..	"Arubial," Condamine	3	6	Do.
W. B. Slade	E. Glengallan, Warwick	2	20	Do.
	HEREFORD.			
A. J. McConnell ..	Dugandan, Boonah	19	36	Australian Hereford Herd Book
E. M. Lumley Hill ..	Bellevue House, Bellevue	45	127	Do.
Tindal and Son ..	Gunyan, Inglewood	50	400	Do.
	SUSSEX.			
James T. Turner ..	The Holmwood, Neurum	2	4	Sussex Herd Book of England