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GENERAL INDEX.

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QUEENSLAND AGRICULTURAL JOURNAL

VOL. XXXI. 1 JANUARY, 1929. PART 1.

Event and Comment.

It was a Good Year.

TAKEN all round the year just ended was a good one for Queensland agriculture. Most farming districts continued to make steady progress. On all sides are signs of healthy expansion which followed generous and well-distributed rains over most of the closely settled areas. A wider appreciation of modern methods of husbandry is becoming general. There are evidences, for instance, that the Queensland dairyman is no longer content to tolerate star boarders in his herd, and the same spirit is becoming characteristic of every branch of rural industry. In this healthy progress the Department of Agriculture and Stock has been no small influence. Every encouragement is given by it to the strengthening of the bond of interest and sympathy between farmer and official. The Department prides itself on its accessibility and service to all engaged in the work of the country and, as a consequence, is accepted by farmers as a wise guide and a firm friend in difficulty. In all our rural enterprises there is a growing disposition to take the broad and long view of our problems and co-operate whole-heartedly with the Department in its efforts towards agricultural stability. The last Annual Report of the work of the Department by the Under Secretary (Mr. Graham) and its appendices, show unmistakeably that the heads of departmental divisions and their staffs are closely informed with all that is happening to all forms of husbandry in the field, on the run, and in the factory, and there is a certainty about their reports that stamps them as men who know their job and are very keen on it.

In the course of a notable address to a ward conference of members of the Lockyer Local Producers' Associations, and which is presented at length in this issue, the Minister for Agriculture and Stock (Mr. W. Forgan Smith) described the wide range of interests and duties covered by officers of the Department and the

immense value of their services to the farming industry, and consequently to the State. In that fine address the Minister showed how closely inter-related are the activities of the Department and the work of the man on the land, right from the turning of the furrow to the selling of the product.

Though much has been done in the extension of this service there is much more to do, and in the coming year the Department looks naturally to the farmer for hearty and practical co-operation in the effort to place and keep Queensland among the foremost agricultural countries of the world. As the Minister has pointed out, Queensland, a pioneer in land settlement, has quite fittingly become a pioneer in agricultural organisation, and this phase of her enterprise is continuing to attract inquiries from other countries seeking information as to the form of agricultural organisation and marketing control initiated by the Queensland Government for the benefit of the Queensland farmer. Only the other day further requests for information were received from noted economists in California, and these serve to indicate the extent of the world interest in Queensland's efforts to scientifically organise its rural industries, and may be regarded as some slight recognition of our claim as a pioneer in the field of social and economic reform.

Work.

IT was Elbert Hubbard who said that once men thought work was a curse; then it came to them that it was a necessary evil; and yesterday the truth dawned upon them that it is a blessed privilege. In his impressive seasonal message to the citizens of Queensland the Minister, Mr. Forgan Smith, as Deputy Premier of the State, possibly had something like that in mind when he pointed out the nobility of the simple task and the wisdom of our starting the New Year well by performing satisfactorily the duty that lies closest at hand. After all no really healthy-minded man could endure a life of idleness or futility, least of all Australians with a continent to conquer and only the spade work yet done. To labour is to pray, as the old philosopher had it, and the dignity of worth is really built on how we do our day's work. Time and the angels are on the side of the man or the people who do the work of the world; and humanity, healthy humanity, has no time for parasites. The world used to be divided into two classes, masters and slaves. Later on they became gentlemen and workers. The designation was altered, but the relationship remained practically the same. To-day, the vast majority of us are workers and glad to be workers believing in ourselves, appreciating the dignity of the common or necessary task and its successful performance as a lift along the road to better things, both for ourselves and posterity.

The Economics of Dairying.

OVER in New Zealand, an investigation, similar to that entered into recently in Queensland, has been made into the economics of the dairying industry and with very much the same results. For the purposes of the inquiry it was considered, broadly speaking, that rural economies may be divided into two sections—management and marketing. The whole of the attention of the official investigators, in this instance, was devoted to the side of farm management. It was held that the analysis of management factors would be very useful to both present and prospective settlers; and that the systematic collection and study of facts relative to a large number of farms would provide a fund of information of great assistance to the farmer, and which would, ordinarily, be beyond his reach. Accordingly a complete survey of conditions as to production and costs was made on two hundred dairy farms. The first object was to determine what was the most important factor in dairying, and that of production per acre or per cow was the conclusion reached. That is precisely what our own Departmental Economic Committee decided after a close study of the position and conditions of the industry in Queensland. Interests, rates, maintenance, and general charges must all come out of the land and, as far as possible, every acre should return its fair proportion of the expenses of the whole enterprise. Summarised, the general conclusions arrived at by the New Zealand investigators were the necessity of aiming at higher production per acre, and raising herd production averages, which, in the long run, amounts to very much the same thing. Other points brought out were that proper feeding of the herd

is of greater moment than breeding high producers, but to us there is no apparent reason why these should not go together; and that where there is sufficient feed for all the animals, it is unsound to cull unless the discarded cow can be replaced by a higher producer. The advantage of top-dressing of pastures was also made clear to the investigators. Maintenance expenses over all the farms worked out at about £5 per cow, and this they accepted as a sound general figure. On the same basis of inquiry it would be interesting to find out just how much the Queensland cow has to produce before her owner can collect a profit.

A Queenslander Abroad.

LIKE most Australians who go abroad, Mr. W. T. Harris, the Secretary of the Co-operative Dairy Association, who last year enjoyed a well-earned holiday on a world tour, has come back a better Australian. He had the good fortune of being able to visit many of the older dairying countries, including Canada, Great Britain, the Irish Free State, and Denmark, and what he saw intensified his enthusiasm for the Australian system of co-operation. Everywhere he went he found an interest in Queensland's rural legislation, and he was never tired of quoting it as evidence of our progressiveness. There were systems, methods, and ideas, too, which he found worthy of our adoption, and other points in dairy practice worthy of our emulation. Let Mr. Harris tell portion of his story in his own words:—

"I'm satisfied Queensland can hold her own against the world so far as the dairying industry is concerned. I believe we should use every endeavour to increase production and quality, but it is satisfactory to know the co-operative associations in this State have done well.

"I travelled through England, Scotland, and Ireland. The growth of the industry in Ireland is remarkable. The value of her exports to England last year was £4,000,000 and she will be a serious competitor with Denmark for that trade. The quality of the Irish product has improved out of all knowledge.

"In Denmark I found that the factories were not better equipped than our own factories. The best butter is exported to London, and yet the average Dane eats margarine instead of butter because of its relative cheapness. Denmark is a remarkable little country, and there herd testing is carried on methodically. Denmark is producing more butter than ever and in 1926 her production was 4,200,000 tons of milk, yet dairymen there did not appear to be very prosperous as we in Queensland understand prosperity. They have to spend all their money in foodstuffs and fertilisers and have to scratch for a living from daylight to dark. The butter not exported is consumed in the country, but it is an extraordinary fact that the Danes consume four times as much margarine as butter.

"In the Fraser Valley in Canada I found herd testing carried out on an excellent system and the conviction was forced on me that the factory managers in Queensland must encourage herd testing in every possible way. No country in the world, however, can hold its own against Australia so far as climatic conditions for dairying are concerned.

"In London I found it was a moot point whether Australian butter was consumed as "Australian" butter. There is a good reason for this probable loss of identity and that is—lack of a continuity of supply. English distributors handle blended butters. The English people cannot afford to use butter as generously as we do. They want a butter that will spread readily and thinly. Australians eat the best butters and are not used to skimping themselves either, but other peoples are not so favoured in this respect as we are. Whisky, coffee, and cigarettes are blended, and I cannot see any reason why butter should not be blended. Retailers have to supply what consumers want.

"Australia's great butter difficulty in London is lack of regular supplies and every effort must be made to remedy that state of affairs. I was not impressed with the advertising campaigns conducted in Great Britain on behalf of Australian butter. F.O.B. sales do, in my opinion, a great deal of harm. With such a method of selling, market prices are not maintained at proper levels and I would advise factories against selling butter f.o.b. I am glad to be home again and am anxious to do what I can to assist in maintaining Queensland's proud position in the dairying industry."

PLATE 1.

A Scene on the Atherton Tableland, North Queensland. One of the richest potential agricultural regions in the world. A modern dairy farm, walled in by tropical jungle.

The Minister's New Year Message

To the Citizens of Queensland.

The Deputy Premier and Minister of Agriculture and Stock, Hon. W. Forgan Smith, included in his seasonal greetings to the citizens of Queensland the following impressive message :—

"Our duty as citizens of the Commonwealth, as contributors to the work of our generation, is to take our share of the difficulties and the dangers of common enterprise, as well as its rewards and profits.

"The coming year and the future generally will make demands on our courage, resolution and goodwill, and our skill in constructive citizenship. It is an accepted axiom that civilisation makes progress only so long as the courage of man responds to the human needs of each generation, and so we should not allow ourselves to visualise our destiny as a permanent soft job. The task of humanity is a hard one, destined to become harder with the passing of the years, and we must guard against any weakening of our national character, lest we endanger our inheritance from the pioneers.

"The road to achievement lies through work and the capacity to endure, and our progress demands a clear perception of the dangers and the difficulties that beset our times, together with a realisation of the value of the common task, backed by a resolve to get our job done and done well.

"Citizenship is a responsibility as well as a right, and we should regard it as a privilege to serve the State in any capacity. Service is the greatest test of character, and determines the greatness or otherwise of a nation as well as individuals.

"There is no better country in the world than Australia, and if we are brave enough and good enough we can make it a better place still. Let our resolve, therefore, be to always work with this objective in view, and we can commence with the duty that lies nearest to us."

W. Forgan Smith

Deputy Premier.

PLATE 2.—GROUP OF DELEGATES AND FARMERS WHO ATTENDED THE LOCKYER WARD CONFERENCE OF LOCAL PRODUCERS' ASSOCIATIONS AT GATTON COLLEGE ON 27TH NOVEMBER, 1928.

The Deputy-Premier and Minister for Agriculture, Mr. W. Forgan Smith, M.L.A., is fifth from the left in the front row; Mr. George Logan, M.L.A. (Member for the District), is on the Minister's right, with Professor Murray and Mr. W. A. Fielding (Chairman of the Conference) on the Minister's left.

AGRICULTURE IN QUEENSLAND.

SYSTEMATIC ORGANISATION OF RURAL INDUSTRY.

MINISTER'S COMPREHENSIVE REVIEW.

WHAT THE DEPARTMENT OF AGRICULTURE AND STOCK IS DOING—STATE FARMS—GRAIN PROPAGATION AND IMPROVEMENT—SCIENCE AND FARMING—POOLS IN OPERATION—SUGAR GROWING AND DAIRYING—FARMER'S WOOL SCHEME—PIG AND POULTRY RAISING—DEPARTMENTAL ORGANISATION.

"We have provided all necessary legislative machinery to assist in the extension of agriculture, with a view to improving the conditions of those engaged in primary production.

"Co-operative activity is the most significant social and economic factor in the life of the community to-day, and, according to the manner in which it is developed and controlled, so will the future of the various industries be determined.

"I look to the farmers and those interested in agriculture generally to be loyal to their own organisations; to help so far as in their power to place them on a better and more stable footing; to elect leaders distinguished for their honesty of purpose, vision, and capacity; and to co-operate also in all the efforts that are being made by my Department to improve the standards of production and efficiency generally in industry."—*Hon. W. Forgan Smith.*

AT a Ward Conference of the Local Producers' Associations of the Lockyer District, held at the Queensland Agricultural High School and College at Gatton on Tuesday, 27th November, the Deputy Premier and Minister for Agriculture and Stock, Hon. W. Forgan Smith, delivered a notable address, in the course of which he reviewed the organisation and activities of his Department and its influence on rural industry in Queensland.

Mr. W. Forgan Smith was present at the invitation of the Executive of the Laidley and Grantham Wards of the Local Producers' Associations. Mr. W. A. Fielding, of the Laidley Ward, occupied the chair, and in welcoming the Minister to the Conference said that "personally he had come in contact with the Minister of Agriculture before he had come to the Lockyer district, and putting party politics aside, he could say that in Mr. Forgan Smith the man on the land had a most sympathetic Minister—a practical man, out to assist the farmers. He could also state that if any body of farmers put up any practical scheme or request to the Minister he would do his best to see that the request be granted. There was no splitting of straws with the Minister, who was straight out. The Minister's interests were those of the farmers in trying to bring about better conditions for them." (Applause.)

Following is the text of the Minister's remarks:—

In the immediate post-war period, agriculture, not only in Queensland and Australia but throughout the world, was faced with perplexing and unprecedented difficulties. So far as legislation could be applied to both cause and effect, it was applied in Queensland in a series of enactments that have aroused the interest and often inspired the emulation of authorities in other States and other countries. Queensland, a pioneer in industry and settlement and social improvement, became again a pioneer in agricultural legislation.

Systematic Rural Organisation in Queensland.

As a result of these activities, cotton growing, practically non-existent, was raised to a promising industry. Systematic organisation of rural industry along co-operative lines was initiated. The Council of Agriculture, together with subsidiary

organisations under farmer control, were established. The system of pooling of primary products was widely extended, and a fruit marketing system organised. The co-operative movement was strengthened; banana-growing was brought under strict white labour conditions, making it an entirely white man's industry. The stabilisation of the meat and dairying industries was advanced long stages nearer accomplishment. The Commonwealth Sugar Agreement was renewed. Sugar Cane Prices legislation was adjusted to make its operation more equitable to the growers. Advances to settlers were liberalised. The poultry industry was protected to the extent of minimising, as far as possible, the incidence of disease. A practical scheme for the improvement of draught farm horses was launched successfully. Protection was given to farmers and orchardists in relation to specifics for insect pest destruction. Bird and animal sanctuaries were increased in number and area. The scientific and technical branches of the Department of Agriculture and Stock were extended, and the system of departmental publicity made more comprehensive in respect particularly to the effective filming of Queensland at work in rural industry as part of a considered scheme of rural educational propaganda. Legislation providing for organised marketing was also passed.

To the man on the land Agriculture and Stock is the most important of our administrative departments, and there are few countries in the world where the welfare of the farmer is more concern of efficient and experienced officers than in Queensland. In every phase of inland enterprise, guidance is freely given by men whose personal knowledge of local conditions in every district and practical experience are at the disposal of anyone embarking on a life on the land.

Through the Sugar Experiment Stations the canegrower has the benefit of scientific advice and field service on the farm in every branch of his calling. Cane varieties are tested under every-day conditions, and cane sets supplied to the farmer. Sugar-mills, on the boards of which growers are represented directly, have been established in every chief sugar district. The price of the product is regulated equitably by Cane Prices Boards, and through them every interest concerned is assured of a fair and square deal.

Queensland, a pioneer in industry and settlement and social improvement, is also a pioneer in agricultural legislation.

Specialists and graders give the farmer every possible assistance in respect to cotton cultivation, and the whole available resources of science and the services of a highly trained corps of scientists are at the call of the agriculturist in Queensland.

Queensland is the only country in the world in which dairying is conducted in the tropics successfully on a big scale. Ninety-eight per cent. of our butter production and 96 per cent. of our cheese output are produced co-operatively under farmer control.

Dairy instructors and inspectors operating throughout the producing regions are well equipped with the knowledge necessary to assist and inform the dairymen in every way. The dairy farmer has the advantage of expert advice on all matters relating to his calling, from sowing and improving pastures, through every phase of animal husbandry, to manufacturing, right to landing his finished product in cold store or on the London and other overseas markets. Herd testing and breed improvement each claim practical attention and direction.

Pig and poultry raisers are provided for amply in respect to expert advice. In every fruitgrowing district field instruction in cultivation, in contending with insect and vegetable pests, in grading, packing, shipping, and marketing, in the cultivation and marketing of tropical fruits, is available.

The service and advice of experienced veterinary surgeons are always available to any stockowner in difficulties or needing practical guidance in any way. Similar services are available in respect to sheep and wool. Clips up to 1,500 fleeces from any one holding are classed at nominal cost and prepared for the salesmen's catalogues. In this way the interests of the small flockowner are conserved and his clip presented to the buyer in the best marketable form.

In agricultural chemistry the Queensland farmer is served by men most eminent in their profession, and who form the staff of probably the best equipped laboratory of its kind in Australia. A special branch of the Department devotes itself to the protection of the farmer in respect to ensuring that seeds, stock foods, fertilisers, and specifics for pest destruction are kept up to prescribed grades and standards.

The excellent public services that have been established by the Queensland Government and are being extended to meet every development in agricultural progress in this State are detailed as follows:—

WHAT THE DEPARTMENT IS DOING.

The Department of Agriculture is administrative, educational, and co-operative, the latter in so far that circumstances frequently call for the financing of rural enterprises as well as assistance to the individual farmer. The Government is always ready and willing to aid his industry in every practical way. Field practice, scientific research, and the economics of agriculture are all covered by the activities of the Department in its encouragement of primary industries.

Agricultural Activities—State Farms.

Roma State Farm, situated some 4 miles from Roma, comprises 780 acres adjoining Bungeworgorai Creek. A considerable area is devoted to wheatgrowing, whilst the balance is used for fodder crops, orchard, and grazing purposes. This farm specialises in the breeding of wheat for Queensland conditions, and a number of the wheats now in cultivation in Queensland have been evolved at this farm. Additional promising varieties have recently been brought into cultivation.

Gindie State Farm, 15 miles from Emerald, in the Central district; area 16,000 acres. This farm is used principally for the breeding of beef Shorthorns, and a high-class stud is maintained. Two small horse studs—Suffolk Punch and Clydesdale—are carried on here. Young animals are bred at Gindie for the purpose of improving the stock of farmers and graziers, and the stud is continually being improved by the purchase of fashionably-bred sires.

To the man on the land Agriculture and Stock is the most important of our administrative departments, and there are few countries in the world where the welfare is more the concern of efficient and experienced officers than in Queensland.

Kairi State Farm, between 600 and 700 acres of typical scrub land, is situated in the heart of the Atherton scrub. Developmental work has been pushed on, and approximately 500 acres are now cleared, or in the process of clearing, and under grass. About 100 acres are cropped to provide grain and fodder for farm stock, and a number of miscellaneous and experimental crops are raised. The stock consists of Illawarra, Shorthorn, and Jersey studs, which are maintained for the improvement of district stock. A high-class Berkshire stud is also carried on, and a small stud of Tamworths has recently been established. A Suffolk Punch stallion is kept for the use of farmers in the district. A cane nursery has been instituted for the purpose of rehabilitating cane grown on coastal areas.

Home Hill State Farm, situated at Home Hill; area 311 acres, portion of which is capable of being irrigated, and is used mainly for the purpose of raising supplies of cane of new and approved varieties for distribution to local sugar farmers.

Field Experiment Plots.—A system of establishing experimental plots on various farms situated in the Northern, Central, and Southern districts was initiated a few years ago. Plots are established for variety trials, seed propagation, and seed improvement purposes.

Pasture Improvement Trials.—Latterly experiments have been carried out in the Northern and near North Coastal districts for the purpose of carrying out improvement trials in pastures, in combination with fertiliser experiments.

Agricultural Operations Generally.

The Department provides expert advice in cultural operations, and this is at the disposal of the farmers in every district. For the purposes of administration the State is divided into three divisions—Southern Central, and Northern. A senior instructor with the necessary staff has been assigned to each division, and specialists are engaged in advisory and experimental work peculiar to each province.

Wheat Propagation and Improvement.

A scheme of wheat propagation plots is carried on in conjunction with the Wheat Board, and its value has been proved particularly in regard to (1) the bringing of improved varieties into cultivation; and (2) the maintenance of purity

of type of wheats cultivated. In addition wheat experimental plot work is carried out in certain districts in co-operation with local growers. The results of this work are shown in improved yields and higher bushel weights.

The seed wheat raised and distributed by the Department has undoubtedly been of substantial economic advantage to the wheatgrowers of the State. The Director of Agriculture (Mr. H. C. Quodling) and his assistant (Mr. Clydesdale) have charge of this work.

In addition, paspalum pasture renovation work has been carried on, and sound results obtained. Added to this work was assistance in broom millet and maize seed selection, silage demonstrations, and dairy and pig fodder experimental work. Accounts of these activities are set out in the Departmental Annual Report.

Maize Improvement.

Seed maize improvement work is being carried on systematically by Instructor C. McKeon, and among the more important results obtained under this head is the development of a special type of grain ("Durum" Maize) suitable for growing in the moister regions, such as the Atherton Tableland.

Other Crops.

Other crops that come within the range of practical field attention include peanuts, tobacco, potatoes, green manuring crops, cassava, arrowroot and sweet potatoes, onions, summer and winter fodder, sorghums, lucerne and other fodder crops, root crops, cotton, tomatoes.

Fertiliser and cultural trials have also been carried out in respect to these and other crops by and under the direction of the Senior Instructors in Agriculture in each Division (Messrs. Gibson, Brooks, and Pollock, respectively).

Analytical Work.

The Agricultural Chemist and his staff are engaged throughout the year in analysing soils, waters, dairy and other produce, and other substances.

The Departmental laboratory is regarded as the most modern and best equipped in the Commonwealth.

The whole available resources of science and the services of a highly trained corps of scientists are at the call of agriculturists in Queensland.

The Seeds, Stock Foods, Fertilisers, and Pest Destroyers Investigation Branch has been established to safeguard the farmer from imposition in respect to the quality of these commodities when they are offered for sale.

This section of our scientific service to the farmer is very little known to the general public. In fact, it is a matter for wonder why public interest in science generally is usually so very small. It is rather extraordinary that this should be so since anybody who takes the trouble to inquire even into the history of scientific thought and method, and still more into that of any particular discovery or generalisation of ecomomic value, is immediately struck with the peculiar pleasure to be derived from actual scientific pursuits. The indifference of the large mass of people to those pursuits which are designed especially to make them happier and more comfortable is remarkable. Is it because most of us prefer to be impressed rather than be convinced?

Though science enters into every phase of our existence, there does not seem to be any spontaneous recognition of the fact. Behind all our modern marvels, (radio, which is regarded is one of the miracles of the age, and the rest), there is a vast field of research, and behind all our progress in agriculture you will find the long and patient effort of the scientist to whose vision and energies we owe so much of our material wealth and every-day comfort.

The Chemistry Branch of the Department may well be described as a "silent service," and like most services of that character its record is a record of work well done, of continued effort and continued achievement from which has come much of our wealth and progress in rural industry, which we are now beginning to recognise and properly appraise.

Our Agricultural Chemical Laboratory has, over the thirty years since its establishment, worked up from a one-man show to its present high state of efficiency, both in personnel and equipment.

Over a long series of years the Branch has performed much valuable work for the farmer, the results of which are readily available in many publications that are really text-books on the industry. That work covers improvement in fodders and grains and field crops generally; both fundamental and applied research in respect to fertilisers, pasture improvement, dipping fluids, pest destroyers, and stock foods. Among the most useful of the activities of this Branch was the work carried out in fertilising experiments for bananas on land which had been under cultivation for as long as fifty years, and which, through exhaustion, had become practically barren. By proper and thorough cultivation and manuring, the soil on this area, on principles and practice laid down by the Agricultural Chemist, was brought up to the fertility of virgin land.

In addition, a close survey of soils of agricultural districts has been made. This revealed in some districts a distinct depletion of plant foods, and the Chemist set out to correct them by demonstrating, to the advantage of the industry, the necessity of improving methods of cultivation and of using, judiciously, artificial fertilisers where their need was proved.

Added to all these avenues of investigation there is the regular routine work of the Branch, which covers, among other important work, a comprehensive series of analyses of great importance to the manufacturing as well as to the primary side of agricultural industry in Queensland. These analyses number many thousands in the course of the year, and include a wide range of tests among the chief of which are analyses of stock foods. The Chemist also collaborates with the agricultural specialists in carrying out a regular series of field experiments, pasture renovation and improvement, and fodder plot trials.

Stock Nutrition Experiments.

Another very valuable investigation was made into a sheep problem, the main points of which were small lambing percentages and malnutrition. This led to the recommendation of a stock lick which has already through its use on several holdings doubled the stock carrying capacity, even in drought years, on certain areas. Other similar investigations that produced remarkable and satisfactory results have covered feeding experiments with sheep, to ascertain the percentage

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of digestibility of various common fodders under our climatic conditions; practical feeding experiments, which were carried out at Wallumbilla to get a true idea of the food value of prickly-pear when used for milk cows, steers, and sheep; an investigation on plants poisonous to stock, more particularly a full investigation on plants containing a hydrocyanic acid yielding glucoside, like those of the sorghum family and others; analyses of tanning contents of Queensland wattles and mangrove barks; and the inauguration of seed testing, which culminated in the establishment of a separate departmental seed-testing laboratory which is the most complete, up to date, and efficient in any of the States of the Commonwealth.

Reverting to the inquiry into the sheep problem presented by cases of malnutrition and lambing losses in the Central District, and as a solution of which the Chemist had recommended—as a result of his investigations—the use of a stock lick, this is what one grazier had to say in the course of a report on its effect—

"Since using this lick I have not seen a sign of sickness nor have I drenched for worm. My usual carrying capacity prior to using was about a sheep to 2 acres, or 40,000 sheep. Results have proved so satisfactory that I have gradually increased the numbers, until at the commencement of the 1926 drought I had 85,000; 15,000 went away in September, leaving 70,000 which are still all in good, strong condition, and from which there has not been more than the normal losses."

From results like that we get some idea of the economic value—the real money value—of the work of the Chemist, and what it means to the State; and also what agricultural science is doing for the industry in Queensland. And we also learn to appreciate the high public services of other good workers in the vineyard who,

through their field and laboratory effort, have accomplished much and have either gained or saved, actually or in prospect, for both the State and Commonwealth, many millions sterling.

An Efficient Publicity Service.

Before passing on to a consideration of other institutional factors in our rural progress, reference might be made to a difficulty that has always confronted the research worker and other technical workers in agriculture—that is the difficulty of getting widespread and speedy publicity for the results of their work. The application of the knowledge gained by research to daily farm practice must always be slow, but there is no reason why we should not do our best to speed up the process. The Department recognises this, and has provided an efficient publicity service which embraces the "Queensland Agricultural Journal" and leaflets and bulletins, all of which are issued by the Department of Agriculture to the farmer without charge.

"A Nation of High Standards."

Purely material resources, essential as they are, are worth little if the people who own them do not know how to use them. Intelligence, courage, and keen enterprise must be applied to the development of wealth from its crude to its finished form.

As Australians we have cheerfully and deliberately chosen to be a nation of high standards, and we have to just as cheerfully and deliberately pay the price of a high civilisation—as a matter of fact we must—in high average efficiency. In Queensland, so far as agriculture is concerned, it is our aim to get the best out of our job of developing a vast primary industrial State. The job is a big one, but we are learning to make the fullest use of the tools of education and intelligently controlled energy in a workmanlike way. In agricultural progress particularly in Queensland we have done pretty well so far, but naturally we have got to keep on evolving new ideas as to how we can do better, for modern conditions demand increased efficiency in every avenue of life, and increased efficiency means high standards, a high degree of comfort, and a complete national life.

In agricultural chemistry the Queensland farmer is served by men most eminent in their profession, and who form the staff of probably the best equipped laboratory of its kind in Australia.

ORGANISATION OF THE AGRICULTURAL INDUSTRY.

The first Primary Producers' Organisation Act was passed in 1922, and crystallised the Government's policy for the organisation of the farming community. The cost of the council was borne at the commencement by the Government, but by the amending Act passed in 1923 the council was empowered to make levies on primary producers for administrative and other purposes, subject to certain conditions, which included, in the case of special levies, provision for primary producers having a vote to decide whether or not a special levy should be made.

In the original Act the organisation was on the following basis:—A Local Producers' Association was formed in every centre where a minimum of fifteen primary producers decided on that course. The agricultural areas of the State were divided into nineteen districts, and all the Local Producers' Associations in a district had the right to elect a District Council. Each of the nineteen District Councils appointed one member to the Council of Agriculture, which in addition had the Minister as president and five Government representatives. From the working of the Council it was demonstrated that to have the organisation on a commodity basis would be preferable, and with this object in view the Act was amended in 1925 to permit of Commodity Boards having direct representation on the council.

As the change was somewhat in the nature of an experiment, the actual details of the system of reorganisation were left to the Governor in Council, and as a result the new council was organised in October, 1925, on the basis of—

8 representatives from 8 District Councils,
8 representatives from 8 Commodity Boards,
4 representatives of the Government,
1 Minister as president,

21 in all.

The experience of the change was of such a nature that in 1926 the organisation by legislative enactment was put wholly upon a commodity basis. Each industry has now the full control of its own affairs, and the farmers elect their own different boards, and each of them functions with full authority in its own particular industry. From the various Commodity Boards representatives are chosen who act on the Council of Agriculture. The power of the Council of Agriculture to raise levies has been removed and diverted to the Commodity Boards, which finance the Council by means of precepts.

Since the inception of the Council of Agriculture in 1922, up to the 30th June, 1927, the Government assisted the council to the extent of £103,481.

In 1926 the Primary Producers' Organisation and Marketing Act was passed, and this was primarily a consolidation of and improvement upon the then existing Primary Producers' Organisation Acts and Primary Products Pools Acts, which were both repealed, but in the consolidated Act there have been retained the principles of both repealed measures, but the organisation of primary producers is now on the following basis:—

(1) There is a Council of Agriculture.

(2) The Council is composed entirely of representatives of each of the Pool Boards and Commodity Boards. This means that the producers are organised entirely on a commodity basis, and the actual council at present consists of an elective chairman; the Director of Marketing; two representatives of the Butter Board; and one representative each of the Queensland Cane Growers' Council, the Egg Board, the Broom Millet Board, the Committee of Direction of Fruit Marketing, the Peanut Board, the Cheese Board, the Wheat Board, the Cotton Board, the Atherton Tableland Maize Board, the Arrowroot Board, and the Northern Pig Board.

In 1928 occasion was taken to amend the "*Primary Producers' Organisation and Marketing Act of* 1926," with the result that all our agricultural organisation legislation has now been widened and consolidated. The provisions of the Act are now applicable to all primary industries including fruit and wheat.

The Department of Agriculture and Stock is administrative, educational, and co-operative. The Queensland Government is always ready and willing to aid agriculture in every practical way.

Pools in Operation.

Some idea of the scope of marketing by controlled boards in this State is contained in the following facts and figures, which show the value of the various commodities controlled by each Commodity or Marketing Board (the figures being those for the year 1927):—

	£
Sugar-cane	7,108,907
Butter	5,024,957
Fruit	1,915,079
Cheese	560,355
Wheat	1,040,486
Cotton	144,576
Eggs	274,740
Atherton Maize	165,336
Arrowroot	*20,244
Atherton Pig	16,200
Canary Seed	11,109
Peanuts	108,662
Broom Millet	18,270
Total value	£16,408,921

*Approximately.

Those figures indicate that a very large volume of agricultural production of Queensland is controlled by marketing boards exercising powers conferred on them by legislation passed in this Parliament. The value of agricultural production of the State, including dairying, poultry, and bee farming, for the year ended June 1926, amounted to £18,932,840. Of this amount agricultural products to the value of £14,770,936, or 78 per cent., were under the control of commodity or marketing boards. However, it may be said that in any one year approximately three-fourths of the annual value of the agricultural production of Queensland is marketed through the pooling system. The general policy has been uniformly successful from its inception. There is no single case of any marketing board having been unsuccessful in its operation, and all have been maintained on a sound financial basis. From time to time the Government has either made advances of credits to these boards or has guaranteed credits. In other cases financial institutions, without any guarantee from the Government at all, have provided them with the necessary fluid capital to carry on their operations. In every case these marketing boards have met their obligations, and not one penny of Government guarantee has been called up. All that indicates a very healthy state of affairs with regard to this form of policy, and justifies the Government in continuing this line of activity.

The Department of Agriculture and Stock provides expert field advice, and this is at the disposal of the farmer in every district of the State.

Favoured by Producers.

Further tangible evidence of the confidence of the producers in the pooling system is the fact that, when votes have been taken on the question of the continuance or otherwise of an existing pool, an increasing percentage is invariably noted in the number of producers for the carrying on of the pool concerned. For example, the several pools now operating have been adopted on the following majorities:—

Arrowroot, established in 1922 without any opposition.

Atherton Maize, established in 1923 without any opposition.

Northern Pig, established in 1923 without any opposition; renewed in 1926 without any opposition.

Broom Millet, established in 1926 without any opposition.

Butter, established in 1925 by a 75 per cent. majority; renewed in 1928 without any opposition.

Canary Seed, established in 1925 by a 75 per cent. majority; renewed in 1928 without any opposition.

Cheese, established in 1922 by a 91 per cent. majority; renewed in 1925 without any opposition; renewed in 1927 without any opposition.

Cotton, established in 1926 without any opposition.

Eggs, established in 1923 by an 87 per cent. majority; established in 1925 by a 73 per cent. majority; renewed in 1926 by a 66⅔ per cent. majority.

(That indicates a falling-off in the percentages of those in favour of pooling, which is often due to a greater number of poultry farmers being brought within the ambit of the pool.)

Peanuts, established in 1924 without any opposition; renewed in 1925 without any opposition; renewed in 1926 by a 90 per cent. majority.

Stanthorpe Tomatoes (superseded by Committee of Direction), established in 1922 by a 78 per cent. majority.

Wheat (under the Wheat Pool Act), established in 1921 by a 97½ per cent. majority; extended in 1924 by an 89 per cent. majority; extended in 1928 without any effective opposition.

It is of interest at this stage to refer briefly to the operations of the Sugar Board and the Butter Board, which can be regarded as having the control on the marketing side of two of the State's most important agricultural industries.

Butter Board.

This was constituted on the 19th February, 1925. It applies to the whole State, and the Government guaranteed the pool £600 for preliminary administrative expenses.

The Queensland Butter Pool controls the marketing of all butter sold within the State by fixing prices and licensing wholesale agents. It does not actually handle butter itself. The board practically acts as an accounting body, and particulars of the prices realised for butter by wholesale agents are conveyed to the Pool Board, who in turn adopt means for equalising (so far as export and local sales are concerned) the wholesale prices to factories throughout the State. The equalisation scheme adopted by the Queensland Butter Pool is worked in conjunction with the Commonwealth Patterson Scheme.

The operations of the Butter Pool Board have resulted in dairy farmers benefiting to the extent of £493,585 over and above the prices received by dairymen in Victoria, New South Wales, and London parity, as distinct from any material advantages that may have accrued as the result of the operations of the Patterson Scheme.

The Department is associated with the producers in further improving the conditions of primary industry in respect to marketing both at home and oversea.

Dairying.

As late as the year 1900 the quantity of dairy produce marketed in Queensland was insufficient to meet the domestic requirements of the population, but since that time this branch of husbandry has developed at a rate unequalled probably in any other part of the world. Twenty years ago there was not enough butter produced in this State to provide a cargo for a small coastal steamer on which a refrigerating plant had been installed with the idea of conveying Queensland butter to Sydney for transhipment overseas. To-day the largest ocean liners visiting the port of Brisbane load butter cargoes direct from the Departmental Cold Stores at Hamilton.

Moreover, Queensland butter has won and retains a most favourable reputation on the overseas market, and has frequently secured first place for quality in open competition with the world's butter-producing countries.

In twenty years, largely on account of the work of the Agricultural Department, dairying has developed into a national industry next to sugar in annual value.

In 1911 Queensland produced 27,800,000 lb. of butter and 3,718,257 lb. of cheese. In the year 1921 (taking the ten-year period) the production of both commodities rose to 60,900,000 lb. and 15,000,000 lb. respectively, and in addition 15,000,000 lb. of condensed milk were produced in the latter year. In the course of the decade production more than doubled. The latest figures are (1927-28)—butter 69,464,414 lb., cheese 14,009,606 lb.

The monetary value of the industry increased from £2,250,000 in 1911 to £7,250,000 in 1927. Fifteen years ago there was no appreciable production of cheese, but to-day, largely through the inspiration and energy of the Department, Queensland is now the biggest cheese exporting State in the Commonwealth.

The development of dairying is more dependent upon efficient team work than upon individual effort, and to achieve the extraordinary success outlined it was necessary for the producer, the manufacturer, selling agent, and Departmental officers to work together harmoniously, and of these the lastmentioned was not the least important.

The progressive dairy farmer realises that high-producing cows increase profits and to this end he is co-operating with the Department in extending herd-testing operations.

The Dairy Cattle Improvement Subsidy Scheme is being availed of by dairy farmers, and through it the number of high-class sires among out dairy herds has been increased.

New Regulations under "*The Dairy Produce Act of* 1920" provide for higher technical training and efficiency of factory staffs.

The Department is now associated with the producers in further improving the conditions of the industry in respect to marketing both at home and oversea; applying modern methods to dairy practice and animal husbandry; and adding to the butter fat production of our dairy herds.

I want to give some figures with regard to the prices to farmers taken from the report of the Queensland Farmers' Co-operative Association Limited, for the year ended 30th June, 1928. The success of its operations can be regarded as typical of the progress that has taken place in the dairying industry in Queensland. The figures given in the return show the total amount of butter manufactured by the Association since its inception, the amount paid to its suppliers, and the average price paid per lb., all grades.

An analysis of the return indicates that for the period from 1902 to 1914 inclusive—a period of fourteen years—the average price per lb., all grades, paid by the Association to its suppliers ranged from a minimum of 7¼d. per lb. to a maximum of 11½d. per lb., whilst from 1915 to 1928 inclusive—a period of fourteen years—the average price per lb., all grades, paid to suppliers ranged from a minimum of 1s. 1¼d. per lb. to a maximum of 1s. 10¾d. per lb.

Averaging the prices paid each year from 1902 to 1914, gives an average price paid during the period under review of 8.98d. per lb., whilst on the same basis, for the second period, from 1915 to 1928—under a Labour Government—the average price paid to suppliers amounts to 15.76d. per lb., or a direct increase in return to the dairy farmers of 77.5 per cent.

The Commonwealth "Year Book," No. 20 for 1927, comments thus on the expansion in recent years of the dairying industry in Queensland, and the influence such increased production has had upon the output for the Commonwealth as a whole—

"The marked development of dairying in Queensland, where the butter production has nearly doubled since 1913, was responsible for the largest share of the increased butter output in Australia, while Victoria and New South Wales also made important contributions to the general progress."

Queensland is the one country that produces cane sugar successfully by white labour. The industry pays more than six millions sterling annually in wages to White Australian workers.

The Sugar Board.

This Board does not come under the Pools Act. The Commonwealth Government relinquished control of sugar as from the 30th June, 1923, but agreed to a two years' embargo subject to the formation of a Queensland Sugar Pool. The Queensland Government acquired the 1923 season's sugar by proclamation under the Sugar Acquisition Act, and established an Advisory Board on which the Queensland Government, the Australian Sugar Producers' Association, the United Cane Growers' Association, and the millers had one representative each.

The Pool Board, which was constituted in July, 1923, took over from the Commonwealth the surplus sugar on hand at 30th June, 1923. It also completed arrangements with the refining companies for the refining and distribution (for Australian requirements) of the surplus sugar and the 1923 production. The Board was successful in obtaining reduced rates for the carriage of the raw sugar from Queensland ports to refineries. The Pool Board acts for the raw sugar millers collectively in connection with the refining and selling of the product, instead of the individual millers, as in previous days, making separate selling agreements.

The original two years' embargo against the importation into the Commonwealth of black-grown sugar was renewed in 1925 and again in 1928, and will be in operation until August, 1931, to which date the Sugar Board's appointment was also extended.

The Sugar Industry.

Queensland is the one country that grows sugar-cane successfully by white labour under white labour conditions. The industry pays more than six millions sterling annually to white Australian workers. Sugar has been an important factor in building up other industries, the export of which amounts to £17,000,000 annually.

The industry employs over 20,000 people and more than 100,000 persons are dependent upon it. The capital invested in it amounts to £16,000,000 exclusive of working capital.

In 1871 there were only 9,581 acres under cane. In Queensland to-day the cane area is well over 200,000 acres.

In 1914 sugar-growing was a struggling industry. It is now one of the most efficient in the Commonwealth. In 1914 the tonnage of sugar manufactured was 225,847. The average annual tonnage of sugar manufactured for the last two years reached over 400,000 tons.

This extraordinary development in this one industry alone was due in a very great measure to the organisation, inspiration, support, and continued encouragement of the Queensland Agricultural Department. Sugar Experiment Stations have been established in the several cane-growing districts, and scientific agricultural principles, relating principally to plant breeding, selection, fertilisation, and cultivation, are being applied widely and successfully by officers of the Agricultural Department.

All the machinery possible for thorough organisation and distribution and marketing of primary products has, largely through the Department of Agriculture and Stock, been placed at the disposal of the Queensland farmer.

OTHER DEPARTMENTAL ACTIVITIES.

Farmers' Wool Scheme.

The Farmers' Wool Scheme is being used by very many more of the smaller holders this year than ever before. There were rarely 100 bales in the store before Christmas, but this year there are many more bales of finished wools in brokers' hands, and remaining to be handled. The greater quantity consigned to the Department has always come in the New Year.

Sheep on the coastal areas are increasing in numbers and sheep-raising there has gone considerably past the experimental stage. The services of Departmental instructors in sheep and wool are at all times available to the small flock owner.

Pig Raising in Queensland.

Pig raising is an important industry, particularly in those districts in Southern Queensland in which dairying and mixed farming are carried on, and on the Darling Downs and other wheat-growing areas.

On the Atherton Tableland.

The industry is becoming of importance on the Atherton Tableland and the Cairns hinterland districts, and in both Northern and Central Queensland. The Northern Pig Board, controlling the marketing in the important pig-raising areas of the North, functions satisfactorily, and now that the Board has been granted an extension of time over which to organise the marketing of all available pigs, success in this industry is assured. There can be no doubt that the organisation of the industry in the far Northern districts and the establishment of the farmers' own co-operative bacon factory has placed the industry on a permanent basis, and has assured for the producer a reliable market outlet for all the pigs he cares to make available for handling by the Board. This permanence, and the fact that the Board has been able to finance satisfactorily and return to the producer payable prices, has meant a rapid increase in the number of pigs produced, and it is safe to say that at no previous stage in the history of the Atherton Tableland have matters been so satisfactory and prosperous as they are in the pig-raising industry there to-day.

Stud Pigs at the State Farm, Kairi, Atherton Tableland.

The State Farm at Kairi continues to produce, and make available to farmers at reasonable prices, stud pigs of the Berkshire and Tamworth breeds. Visitors, especially farmers, are always welcomed and are given every facility for inspecting the stock and the operations of the farm.

The Bacon Business.

Though this industry, in common with many other agricultural industries, suffered a severe set-back as a result of the long-continued dry spells during 1926-27, conditions are rapidly returning to normal. The whole of the eight bacon factories operating in Queensland now report an increasing supply of better quality prime-conditioned bacon pigs, with good prospects for a continuance of supplies.

Fresh Pork Trade.

There is also an increasing demand for fresh pork both for local consumption and for export. Several of the meat export firms have engaged in the export of frozen pork with satisfactory results. This is a branch of the business well worth fostering, for there are extensive markets overseas for pork products. Indeed, the export of bacon is under consideration by various factories throughout this and other States.

Australian Pig Industry Council.

The prospects ahead of the pig industry, and the need for investigation into the conditions ruling on the local and overseas markets, has led to the formation of the Australian Pig Industry Council and the Queensland Pig Industry Committee, on both of which Departmental officers have a seat. These committees are composed of delegates representative both of producing and manufacturing interests, as well as of State and Commonwealth Departments, and are charged with the responsibility of co-operating wherever and whenever possible in an endeavour not only to extend local markets and production but to foster the export trade and place the industry on a more permanent and lucrative basis. State committees also function in the other States.

Fruit.

In respect of legislation, the Fruit Cases Act has been discarded in favour of a new measure, "*The Fruit and Vegetables Act of* 1927," which is calculated to materially improve marketing conditions, both for the producer and purchaser.

The Diseases in Plants Act has remained unaltered, with the exception of additional proclamations prohibiting the transference of banana plants into areas in which diseases are not known to exist.

"*The Primary Produce Experiment Stations Act of* 1927," has for its object the establishment of experimental stations for the purposes of experimentation with the different fruit crops from practically all aspects, including varieties, cultural and manurial, fruit transport, &c., taking each fruit separately and commencing with bananas. Demonstration plots have been established and are still being conducted in respect to citrus, pineapples, and strawberries, where the methods of the Department are applied for the information of fruitgrowers generally.

Diseases in Live Stock.

The Department supplies large quantities of preventive vaccines to stock-owners, such as quantities of pleuro-pneumonia virus and blood for immunisation against redwater, blackleg vaccine, and contagious mammitis vaccine.

Active measures have been taken to prevent the further spread of the cattle tick into clean areas.

The inspection and registration of stallions is now being carried out by a Central and Southern Queensland Board. In time the effect of this legislation should be fully realised, as the inspections and examinations are for the purpose of preventing the carrying on of hereditary diseases, such as side bone, ring bone, and spavin.

The testing of dipping fluids is carried out free of cost to all owners of dips, so that the farmer can be assured of the strength of the solution he is using on his stock.

Strict measures are taken to ensure a healthy meat supply under hygienic conditions.

Poultry Raising.

Poultry raising still continues to increase in value in Queensland, and during the present year the oversea export of eggs has exceeded that of any previous season. Primary producers generally are giving more consideration to the keeping of poultry as an adjunct to their general farming operations, while the practice of commercial poultry farming has extended considerably.

There is no doubt that the existing marketing condition, made possible under the Primary Producers Pools Acts, is directly responsible for the development of this industry. It is estimated that approximately 3,000,000 dozens of eggs will be handled by the Pool Board and its agents during the present year, and it will readily be understood that the stability of the industry is only made possible by organised marketing of this large quantity in a city with a population of 275,000. Especially is this so when thousands of householders keep a sufficient number of birds, not only to supply their own requirements, but have a surplus which they usually trade with their grocer.

The Government is not unmindful of the possibilities of the industry, and have associated with the Department of Agriculture and Stock a Poultry Expert, and with the Department of Public Instruction a Poultry Instructor, while the Department of Public Lands has an attendant whose duty it is to attend to the large public hatchery at Mount Gravatt. In addition an Inspector of Poultry has been appointed, while provision has been made by the Department on estimates of this year for an assistant instructor.

Wheat.

Wheatgrowing has received attention at the same time and the annual Queensland yield has reached as high as 4,000,000 bushels, worth over £1,000,000. Over a ten-year period, as a result of the activities of the Department and the investigations and practical work of its specialist officers, the average yield per acre has exceeded that of other wheat-growing States, excepting Tasmania, and the distinction of obtaining the highest average yield per acre (20.91 bushels) belongs to Queensland.

The results of wheat breeding and cultural tests by the Departmental officers are evident in improved milling tests and a wide range of newer varieties suitable to Queensland conditions. The Queensland wheat-grower is not a one-crop man, and he usually engages in diversified farming including lamb-raising, pig-raising, and dairying. In all these branches the scientific and specialist training of our field officers are at the disposal of the man on the land.

Cotton.

After the cotton collapse of the seventies small attempts to resuscitate the industry were made at different times, but these attempts were only spasmodic. In 1920 cotton growing in Queensland was little more than a mere memory. In that year the Department initiated a strong revival. It erected a cotton-gin at its headquarters in Brisbane which enabled growers to have their seed cotton treated economically and prepared for market. The Department directed its energies towards re-establishing the industry on a sound basis. Protective legislation was passed. Specialists were engaged as demonstrators and instructors. It is a branch of agriculture that has been beset with many difficulties, but in face of them the Department has succeeded in placing it on a firm commercial basis, and under Departmental guidance it now shows every prospect of becoming an important and thriving source of agricultural wealth. This is evident in the definite result that, through it, much new wealth is added annually to Queensland. The industry is capable of almost limitless expansion and cotton-growing is coming to be regarded as a valuable subsidiary crop in many districts. Individual farmers, mostly growing small areas under cotton, now number 6,000. The industry is controlled by the Cotton Board which is elected by the growers.

DEPARTMENTAL ORGANISATION—A REVIEW.

The Department is organised along sound administrative, commercial, and educational lines. The several branches, each with a technical head and a staff of competent instructors and inspectors, cover every phase of farming from field work to scientific laboratory investigation. For experimental and practical demonstration work State farms, controlled by Departmental officers, have been established in selected districts. On these farms the breeding and propagation of cereals and other crops suitable to Queensland conditions, both temperate and tropical, strict stock breeding (cattle, horses, sheep, and pigs), irrigation, and every other branch of modern farm practice are carried out. In addition to their general utility, these farms are also designed as educational centres where the latest ideas of husbandry can be tested and applied. Extension of this work is provided for in experimental plots on selected farms in the several districts on which, with the co-operation of the farmers themselves, field crop trials are made, the results of which are recorded carefully for the general guidance, both of the Department and the farmers.

Sugar experimental stations have been established in the chief sugar-growing regions with the object of improving the quality of cane, testing values of, and demonstrating different methods of cultivation, and also for carrying out fertilising and other experiments. General scientific research is also an important feature of the activities of these stations. For investigating diseases and pests of sugar-cane a sugar investigation station has also been established. These stations are having a very big influence on the prosperity of the State's chief agricultural industry.

Stock Experiment Stations have been established in the Northern and Southern divisions of the State for the purpose of investigating stock diseases and keeping the farmers informed in respect to modern developments in animal husbandry in all its branches. Other Departmental activities cover horticulture in all its branches; grading, packing, transporting, and marketing all primary commodities; supervision of imports and exports of primary products, both in raw and manufactured forms; assurance of benefit to the farmer by the strict enforcement of the Fertilisers, Stock Foods, Pure Seeds, and other related Acts; making available to the farmer the technical and advisory services of the Agricultural Chemist and his staff; making available to stock raisers the services of an experienced bacteriological and veterinary staff, particularly in relation to stock pests and diseases; and administering the Brands Act, the Dingo and Marsupial Act, and the specific legislation affecting the agricultural industry in all its ramifications.

Another feature of the functions of the Department is a system of effective publicity. The "Queensland Agricultural Journal" serves as an effective vehicle for current, technical, and topical information on farm affairs and problems. Pamphlets on technical subjects by technical officers and advisers are regularly published. Queensland at work in the rural industries has been filmed effectively and released for exhibition at home and abroad, and all the latest methods of publicity and the discoveries of modern science are pressed into the service of the Department on behalf of Queensland farmers.

Organised marketing boards in Queensland have in every case met their obligations. Not one penny of Government guarantees has been called up. This indicates a very healthy state of affairs.

A highly-trained entomological and pathological staff deals with the problems of insect infestation and plant diseases affecting Queensland's internal economy.

A Co-operative Wool Classing and Selling Scheme operates under the Department for the benefit of the small sheep farmer. To sum up then the activities of the Department may be summarised as follow:—

Scientific—Technical and Instructional.—Employment of scientific investigators for special problems (blow fly, fruit fly, banana beetle borer, bunchy top, &c.). Agricultural chemistry in all its branches. Instruction in the field in every branch. Plant and live stock improvement, including:—Wheat-breeding and propagation plots, maize improvement, pasture improvement. Scientific investigation of animal and plant pests and diseases. Dairy and farm management. State studs—Horses, cattle, pigs. General crop improvement (cereals, forage, roots, vegetables, fruits, vines, and legumes). Testing of commercial and industrial plants (Cassava, &c.). Animal husbandry in all its branches. Fodder conservation.

Commercial.—Classing and marketing of farmers' wool clips. Formation of Primary Products Pools. Encouragement and financing of Farmer Co-operative enterprises. Extending the activities of the Advances to Settlers Board. Administration of Cane Prices Boards. Administration of Commodity Boards. Ensuring the supply to the farmer of pure seeds, stock foods and fertilisers. Controlling dairy produce from the pastures to places of shipment. Raising and maintaining high export standards. Exploiting and development of new markets. Assistance to Co-operative Butter Factories and other kindred enterprises. Guaranteeing cotton prices. Co-operating with the Commonwealth in marketing matters and other branches of agricultural economics.

Legislative.—By special and general legislation on the initiative of the Department the agricultural industry has been more or less stabilised. Rural legislative record in Queensland has been unequalled in any other State. In one session (1923) as many as twelve measures initiated by the Department relating to farming interests

were passed into law. Some of these measures have since been amended to provide for altered circumstances and to more effectively safeguard or extend the interests of the agriculturist.

All the machinery possible for thorough organisation and distribution and marketing of products has been placed, largely through the agency of the Department, at the disposal of the farmer.

Publicity.—Recognition of the value of appropriate publicity, particularly in relation to the marketing of products has been recognised in—Radio service, industrial films, free issue of Departmental publications.

General.—The practical recognition and supply of the needs of the agricultural industry in all its phases, the conservation of the rights of farmers to a fair and reasonable return for their enterprise, and everything else that will bring agriculture into line with the State's most profitable industries. Departmental success that is the result of a broad visioned policy, allied with administration in sympathy with its peculiar needs, is inextricably woven with the fortunes of the agricultural industry in Queensland.

Co-operative organisation, wisely managed and efficiently controlled, will reduce costs and ensure to the farmer a more equitable return for his energy and enterprise.

A POLICY FOR THE FUTURE.

I have indicated at some length the scope of the activities of the Department of Agriculture in its relation to the economic life of the agricultural industries of this State. We have provided all the necessary legislative machinery to assist in the extension of agriculture with a view to improving the condition of those engaged in primary production. Co-operative activity is the most significant social and economic factor in the life of the community to-day, and according to the manner in which it is developed and controlled so will the future of the various industries be determined.

It must be remembered, however, that in dealing with co-operative organisation the words "co-operative" or "organisation" of themselves do not confer any benefit. For any benefit to be conferred by a new form of organisation it must be more efficient than the form of organisation which it seeks to displace.

Marketing.

Co-operative organisation wisely managed and efficiently controlled, by eliminating waste in various directions, can reduce costs and enable a greater return to accrue to the farmer. By well-devised and orderly marketing gluts can be prevented, depressions guarded against, and in countless different ways orderly marketing or orderly supply of goods to a market can be of benefit to all concerned. Why should the farmer be the only individual who has no control over the marketing of his own produce? Almost every other form of human activity that produces has some foreknowledge of the marketing conditions. The demand that there will be for a given product in a given market at a given time can be estimated with a degree of accuracy; and organisation can be so effected as to supply that market regularly with a view to preventing low prices and gluts from time to time.

Organisation and Orderly Control.

These are the days of organisation and orderly control; and if that organisation and control are carried out in a manner not detrimental to the public interest, it will be of distinct benefit to society. Most of the difficulties in the world at the present time are due to bad organisation in production and distribution. Where production exceeds consumption under a given form of organisation, periods of trade depression follow with resultant difficulties to all concerned. With modern methods and machinery, the productive power of mankind in industry has increased enormously. Production can be carried on with greater rapidity than consumption can overtake it; and, as a result, we have a cycle of recurring trade depression within a narrow ambit of social organisation. Therefore, the remedy is orderly marketing and orderly control of industry with a view to estimating and supplying human needs.

Better Conditions for the Farmer.

Orderly marketing by a scientific organisation, which can be established under the Primary Producers' Organisation and Marketing Act, will enable the farmers, provided they use it properly, to obtain better conditions for themselves, and by those better conditions better organisation, improving the conditions of the great mass of the people generally, and thus be of benefit to the nation as a whole. Gluts are no good to the farmers. They mean that, when he has large crops, either through bad organisation or bad marketing, he gets a very small price, and on some occasions no worth-while price at all. In other cases when values are high he has little or no produce to sell. Those methods are bad both for the farmer and for the people who consume his produce. Of course, climatic conditions cannot be completely controlled, but I am satisfied that, with the application of proper methods, many of these difficulties can be removed.

I look to the farmers and those interested in agriculture generally to be loyal to their own organisations, to help so far as is in their power to place them on a better and more stable footing; to elect leaders distinguished for their honesty of purpose, vision, and capacity, and to co-operate also in all the efforts that are being made by my Department to improve the standards of production and efficiency generally in industry.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF NOVEMBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALLS DURING NOVEMBER, 1928 AND 1927, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Nov.	No. of Years' Records.	Nov., 1928.	Nov., 1927.
North Coast.	In.		In.	In.
Atherton	1·95	27	5·54	0·20
Cairns	3·84	46	7·11	0·43
Cardwell	3·97	56	9·43	0·77
Cooktown	2·59	52	4·39	0·50
Herberton	2·43	41	5·15	1·30
Ingham	3·43	33	13·89	1·25
Innisfail	5·96	47	13·68	2·46
Mossman	3·36	15	13·51	1·13
Townsville	1·78	57	3·59	0·08
Central Coast.				
Ayr	1·64	41	3·96	0·69
Bowen	1·27	57	3·49	1·07
Charters Towers ..	1·41	46	5·04	0·06
Mackay	2·85	57	10·75	2·28
Proserpine	2·72	25	6·53	1·66
St. Lawrence ...	2·22	57	5·29	1·89
South Coast.				
Biggenden	2·68	29	2·03	3·98
Bundaberg	2·53	45	1·49	5·28
Brisbane	3·74	77	2·90	5·82
Caboolture	3·38	41	1·73	8·21
Childers	2·68	33	1·51	3·73
Crohamhurst ...	4·37	35	0·91	7·23
Esk	3·24	41	1·68	6·87
Gayndah	2·84	57	1·93	6·89
Gympie	3·14	58	1·38	4·16
Kilkivan	2·54	49	1·37	2·31
Maryborough ...	3·10	56	0·91	3·86

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Nov.	No. of Years' Records.	Nov., 1928.	Nov., 1927.
South Coast—continued:	In.		In.	In.
Nambour	3·87	32	0·64	6·87
Nanango	2·61	46	3·22	2·56
Rockhampton ...	2·18	41	1·70	3·42
Woodford	3·21	41	1·69	4·87
Darling Downs.				
Dalby	2·66	58	2·70	4·41
Emu Vale... ...	2·67	32	1·09	2·75
Jimbour	2·33	40	3·99	4·17
Miles	2·40	43	2·25	3·45
Stanthorpe ...	2·73	55	1·73	4·03
Toowoomba ...	3·27	56	1·63	4·85
Warwick	2·60	63	2·02	4·66
Maranoa.				
Roma	2·07	54	1·52	2·59
State Farms, &c.				
Bungeworgorai ...	2·06	14	1·06	1·47
Gatton College ...	2·79	29	1·77	4·53
Gindie	2·05	29	2·65	2·50
Hermitage ...	2·69	22	1·30	2·97
Kairi	1·82	14	6·14	0
Sugar Experiment Station, Mackay	2·53	31	6·87	3·15
Warren	2·96	14	4·17	1·70

20th December, 1928.

J. H. HARTSHORN,
Acting Divisional Meteorologist.

Bureau of Sugar Experiment Stations.

A BUNDABERG EXPERIMENT PLOT.

An experiment plot on Mr. Knudsen's property at Bonna was initiated in 1926 at the request of the Branyan Farmers' Association. The area occupied is one acre, and is situate on the river bank. This was divided into four plots as under:—

Plot 1—Planted with cowpea, ordinary ploughing.

Plot 2—Planted with cowpea, and subsoiled.

Plot 3—Planted with cowpea, not subsoiled, but mixed manures applied.

Plot 4—No cowpea, manures, or subsoiling. (Check plot.)

The cowpea on plots 1, 2, and 3 was planted in October of 1926, and it was intended to plant the cane in March, 1927. Owing to the very heavy rain at that time planting had to be postponed till August of that year.

The following table shows the results:—

Plot No.	Treatment.	Weight of Cane per Acre in English Tons.	Weight of Commercial Cane Sugar per Acre in English Tons.
1	Ploughed four times to 10 inches and planted with cowpea	40·30	5·39
2	Ploughed four times and subsoiled to 18 inches; planted with cowpea	42·11	5·60
3	Ploughed four times to 10 inches and planted with cowpea and fertilised at following rate per acre, viz., sulphate of ammonia 200 lb., sulphate of potash 100 lb., and meatworks 300 lb.	49·05	5·99
4	Four ploughings only to 10 inches	39·40	4·44

The results are extremely satisfactory, the cost of treatment not being excessive. The yield of the manured plot gave an increase of 9.65 tons of cane above the check plot (No. 4) for an expenditure for manure of £4 15s. per acre.

The work throughout was performed in a most competent manner by Mr. Knudsen and his sons, to whom the thanks of the Bureau are due.

QUEENSLAND'S PRINCIPAL INSECT PEST OF SUGAR-CANE.

The Entomologist at Meringa (Mr. E. Jarvis) has submitted the following report for the period, November to December, 1928, to the Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby:—

In these matter-of-fact days one is apt to disregard the air of seeming mystery or romance which invests or surrounds a big emergence of "greyback" cane beetles from fertile soils of the Cairns district, immediately after a tropical downpour during November or December.

The truth of those well-known lines "The poetry of Earth is never dead," finds, I think, abundant expression in such an appearance of insect profusion; when myriads of winged creatures responding to nature's magic touch, and being moved collectively, as it were, by some common but irresistible impulse, simultaneously forsake their subterranean pupal chambers, and hastily tunnelling upwards to the surface enter upon their brief aerial existence:—

"In wild abandonment 'mong mystic shades,
To court the golden hours, and taste the joys
Of that strange wonderland."

The metamorphosis of insects has long occupied the close attention of entomologists; but, although science is able to accurately figure and describe the differences in structure, form, and coloration of a species, and to some extent, through study of its internal anatomy, trace the final phases of transition or development from the pupal to the imago or perfect condition, we cannot explain how it happens that a lowly caterpillar, fitted only to crawl over and feed upon leaves or other food of a vegetable nature, should finally transform into a glorious honey-sipping butterfly attired in those rainbow tints or metallic colours which invariably excite universal wonder and admiration.

How different again, is our common cane grub, that lives for six or seven months in darkness underground, almost mechanically ingesting soil day by day in order to extract from it organic matter, or devouring the succulent roots of sugar-cane and other plants; how unlike it is to the well-known "greyback" cockchafer of our forest lands, which is equally at home whether tunnelling in the damp soils or flying around its various feeding-trees.

Some people would have us believe that the age of miracles is past, although, on the other hand, it has been stated by Lord Avebury that "our very existence is a miracle in itself." Certainly, to the true scientist or lover of nature, the life-cycle changes and complex metamorphosis of the cockchafer in question—one species only out of considerably over ten thousand beetles recorded from Australia—appear truly miraculous; while economic investigation regarding its habits and œcology during the larval and adult stages of development, coupled with such problems as its inter-relations with other insects, biological control, and a study of the various artificial remedial measures likely to prove effective against this serious cane pest, open up an almost inexhaustable field for scientific inquiry.

In America, owing to the number of economic entomologists available, it has been possible to estimate approximately the extent of financial losses due to the ravages of primary insect pests. It is thought that about 10 per cent. of every crop is probably destroyed by insects. "It would be within the statistical truth," says Folsam, "to say that it costs American farmers more to feed their insect foes than it does to maintain the whole system of education for everybody's children"; while the annual loss occasioned by insects amounts to nearly twice as much as it costs to maintain the American army and navy.

Such a statement should make Australians realise the supreme importance of enforcing strict quarantine supervision, with a view to preventing as far as possible the disastrous introduction into this country of certain notoriously destructive insects.

Regarding the economic status of our "greyback" cockchafer, I may state that, unlike several closely-related scarabæidæ occurring in other countries (genera *Lachnosterna* and *Melolontha*) which have a life cycle of from two to three years, the life of our Queensland species *Lepidoderma albohirtum* Waterh., from egg to adult beetle, is completed in twelve months.

It is probably due to this fact, coupled with the large size and voracity of its grubs, that we must attribute those capabilities for destruction which during seasons of normal rainfall have enabled this insect to take first place as a pest of cane. The importance of systematic action, however, when attempting to combat such insidious foes as the larvæ of cockchafer beetles has not yet been fully realised by our farmers; many of whom, who would not dream of neglecting to manure their crops at the right time, still continue to postpone treatment for cane grubs until signs of injury are apparent, and it has become too late to remedy the evil.

Emergence of Cane Beetles in the Cairns District.

Since reporting last month that "greybacks" had appeared on the wing about 14th November, a very decided emergence of this cane pest has occurred; beetles having been much in evidence around Meringa, Kamma, Gordonvale, Highleigh, &c., where the numbers of beetles on feeding-trees have exceeded previous emergences noticed during the last few seasons. At the present time (11th December) plenty of specimens are still on the wing, although egg-laying has been proceeding since about the 3rd December.

Proportion of Sexes during Aerial Existence.

Data obtained by collecting several hundred specimens from food-plants growing close to the Experiment Station showed that on 19th November (about a week after emergence of these beetles) 60 per cent. of those captured proved to be of the female sex; while out of a collection of 323 beetles made the following day (20th November) 198 were females. Nineteen days later (3rd to 10th December) an additional 400 "greybacks" yielded a percentage of 43 females, indicating that the period of oviposition was in progress.

Beetles Attracted to Electric Light.

On 29th November, a beetle-trap designed a few years ago by the writer, was fitted with an electric lamp of 32-candle power in order to see if such form of illumination would prove as attractive to these insects as acetylene light.

This trap was placed close to a "Weeping Fig" tree (*Ficus Benjamini*), on which a number of "greybacks" were feeding. In less than two hours eighty beetles were captured, forty-one of which proved to be females.

It was found by experiment that setting the lamp in a concave reflector of about 8 inches diameter did not, apparently, make the light more attractive.

FIELD REPORTS.

The Northern Field Officer, Mr. A. P. Gibson, reports on the Mossman cane areas, inspected from 7th to 20th November, as follows:—

MOSSMAN.

Rainfall.

January	8.65
February	37.14
March	14.84
April	2.91
May	1.25
June	0.40
July	1.07
August	0.34
September	0.14
October	0.51
November	11.21 (to 20th)

It will be seen that the fall to date has been badly distributed. Available past annual rainfall sheets showed that the November fall was the greatest for many years.

1928 Crop, its Harvesting and Milling.

The season commenced on 12th July and finished on the 1st November. Though the area cut was less, the tonnage harvested per acre was greater than that of the previous year. The crop in quantity and quality was short and sweet. Prolonged dry weather fully ripened the crop and enabled harvesting and milling operations to proceed uninterruptedly. However, it stayed the crop growth, and aided the pests, and brought about diminished yields and increased harvesting costs. Practically the whole crop was fired prior to its harvesting. As the cane was erect more per man per day was cut, therefore the factory was fully supplied all the time. All past milling records, such as crop sweetness, tons milled per week, tons sugar manufactured per week and season, were eclipsed. The crop was estimated at 80,000 tons; 78,542 tons were milled, yielding approximately 11,700 tons of sugar. The mill average c.c.s. was remarkably high, being 15.53 per cent. The major varieties milled were H.Q. 426 and Badila. The mill could comfortably crush another 20,000 tons, and it would not be impossible to make up the deficiency on the sugar lands at present growing cane by better farming, drainage, and judicious fertilising.

The New Crop.

Timely rain has improved wonderfully the 1929 crop prospects. The early planted cane had germinated favourably. Farming methods, though good in some instances, are not what they might be. The fruits of good and timely tilling may easily be detected. Some fields had not been touched since harvesting, small wonder poor crops are cut.

Planting.—Planting was under way. The soil had not been too well prepared. The seed used for the greater part was poor. Lack of rain at the end of the season compelled most farmers to harvest all cuttable cane, hence the difficulty in procuring seed. Not a few farmers filled the plant cane gaps by transplanting cane stools. It should always be seen that these are disease-free. Transplanting may be successfully accomplished during a wet sunless period.

Manuring.—Different manures, different rates, and different application methods were noted. It is not feasible that the popular mixtures used are suitable for all our different canes and soils throughout Queensland's sugar-growing belt. Fertilisers are not always applied as early as they should be. It should be remembered that cane growth once lost cannot be recovered, therefore it is desirable to fertilise early so as to force the early growth along. By so doing the interspaces are covered in a quicker time, evaporation is checked, and weeds suppressed; also the cost of production is reduced.

Pests and Diseases.

Heavy nightly flights of beetles, commencing about 7 p.m., were noted. Numerous emergence or descending holes were found in most fields. Wireworms were damaging primary plant cane shoots. Army caterpillars were noted devouring the cane foliage in isolated parts. Rats were eating newly forming cane, also the perished stems lying about the fields, suggesting they are hungry and that now is the right time for poisoning. Heaps of cane cut to seed prior to the rain, and covered with trash, were damaged by this pest.

Diseases noted were Leaf Stripe, "Jump Up" or Downy Mildew, Leaf Scald, and Mosaic. Leaf Stripe, the major disease, though very bad in parts, is becoming less. Mosaic was found in the variety B. 156 growing at Saltwater.

DAINTREE.

A brief inspection of the Daintree was made; the natural beauty of the river would be hard to surpass. The river banks are scrub covered, the land slopes back in places to great swamps. What could be seen of the soil was good. It is said there are 4,500 acres of good land blessed by a 100-inch rainfall. Already there is a butter factory at work on the upper reaches, and surrounding it is dairying land equal to the very best in Queensland.

QUEENSLAND FRUIT IN SYDNEY.

This interesting news item is taken from the Sydney "Evening News" (7th December, 1928):—

Fine specimens of tropical fruits were shown to the Housewives' Association at the Lyceum Club yesterday by Mr. P. J. Nally, of the Queensland Tourist Bureau.

Exhibiting a large pineapple, he said he had purchased it in King street for 4s., whereas in the Sydney fruit markets the same fruit could be purchased for 17s. a case. Mangoes, which were sold in Sydney for 1s. 6d. each, were sold in Queensland at £1 a case of nine dozen, and the prolific papaws, sold in our city for 4s. each, were fed to fowls.

The papaw, he said, could be utilised for making ointment, paint, chutney, as vegetable marrow, and as dessert. In addition to this, the wrapping of the leaf round tough steak would cause the meat to become deliciously tender.

To bring Queensland fruits within reach of Sydney people, many of whom did not know the flavour of the tropical products, Mr. Nally said that he hoped to establish a stall in the city.

He suggested that if the Housewives' Association bought sugar in bulk, say in ½-ton lots, it could be retailed to members, who would effect a saving thereby.

THE SPIRIT OF CHRISTMAS.

From the Queensland Cane Growers' Council to the Editor:—

"The spirit of Christmas calls to a better appreciation of the value of old friendships.

"We consider ourselves fortunate in being among those to wish you a Christmas of joy and contentment and an exceptionally happy New Year."

INSECT ANATOMY.

By ROBERT VEITCH, B.Sc., Chief Entomologist.

The body of an insect consists of three very distinct regions each of which is composed of a number of segments. These three regions are the head, the thorax, and the abdomen, each of which can be clearly distinguished in such a common insect as the Queensland fruit fly or the ordinary house fly. The main anatomical features and functions of these various regions will now be dealt with in some detail.

The antennæ, the eyes, and the mouth parts are the most conspicuous features on the insect head. They all perform highly important functions in insect life, and, although impressions can be received by the insect through the agency of organs situated on different parts of the body, the impressions that are received by the organs situated on the head include the extremely important ones of sight, smell, touch, taste, and hearing.

The Antennæ.

The antennæ are a pair of very conspicuous jointed appendages which are situated on the head either between or in front of the compound eyes. The shape and size of these antennæ vary tremendously in the different families of insects, but although these variations are of great scientific importance their discussion is unnecessary in these notes. It may be mentioned, however, that not only do striking differences occur in the structure of the antennæ of different insects, but they may also be found in the two sexes of the same species—e.g., in mosquitoes the antennæ are very plumose or feathered in the male, whereas in the female they are pilose or clothed with down.

Sense of Smell.

It is generally agreed that the olfactory sense or sense of smell is located mainly but not necessarily exclusively in the antennæ. Definite evidence exists to show that in certain insects the sense of smell is wholly restricted to the antennæ, and if these organs are removed the insects lose the olfactory sense. It must be pointed out, however, that in some other insects the removal of the antennæ does not appear to be accompanied by the loss of the sense of smell, a fact that seems to indicate that the olfactory sense in these particular species is not restricted to the antennæ. Nevertheless it is probably correct to say that the sense of smell in the majority of insects is mainly if not wholly restricted to the antennæ.

The olfactory sense may perform several functions; it may enable an insect to find a suitable medium in which to place its eggs or maggots as in the case of the blowflies. In these the sense of smell is extremely acute, and has been admirably developed for the purpose of enabling the flies to locate their maggots food supply. A second function of the sense of smell is illustrated by the fact that it has been demonstrated that in certain moths the males find the females only by virtue of the olfactory sense possessed by the antennæ; when these organs are removed the males are no longer able to find the females for mating purposes. Thirdly, there is the relationship that exists between the sense of smell and the choice of food plants by female insects for the purpose of egg-laying or oviposition.

Perception of Sound.

The antennæ may also function for the perception of sound, a fact that is well illustrated in the case of mosquitoes. The antennæ of the male mosquito are very plumose, as a result of an extremely pronounced development of antennal hairs, and it has been experimentally demonstrated that these hairs may be set in vibration when certain tones are produced. It is argued that in this manner the male is able to locate the buzzing sound produced by the female and so can fly to it for mating.

It must not be assumed, however, that the sense of hearing in insects is confined to the antennæ. On the contrary, auditory organs are also known to occur on other portions of the body, including the legs and abdomen.

Sense of Touch.

The sense of touch is also well developed in the insect world, and, as in the case of the auditory organs, it is by no means confined to one region of the body, although it is believed to be particularly well developed in certain portions, included amongst which are the antennæ. Apart from those areas in which the tactile sense is exceptionally well developed, practically any other part of the surface of the body possesses the sense of touch.

The Eyes.

The eyes in the insect world are of two distinct types—firstly, there are the large compound or faceted eyes; and secondly there are the smaller simple eyes or ocelli. The compound eyes are clearly seen on each side of the head in such an insect as the Queensland fruit fly. An examination of these compound eyes by means of a hand lens will show that superficially they consist of an enormous number of very small areas or facets.

The number of facets in the compound eye is generally very large, being 4,000 in the case of the common house fly, as many as 25,000 in certain moths, while 28,000 have been recorded in some species of dragon flies. Exceptionally, there may be only a few facets, six to nine having been recorded in the worker caste of one species of ant.

The simple eyes are frequently absent in the adult insects, and in rare cases even the compound eyes may be missing. The simple eyes are generally the only organs of sight in immature forms of insects possessing a complete metamorphosis, such as caterpillars, but in internal parasites, such as small wasp larvæ, even these simple organs of vision are absent.

The discussion of insect eyes would be incomplete without a reference to the fact that frequently marked sexual differences occur in the eyes—e.g., in most flies the compound eyes in the male are appreciably larger than in the female.

Power of Vision.

With respect to the power of vision possessed by the two types of eyes just discussed, it is generally believed that through its compound eyes the insect is able to detect movements made by other animals or objects and also to recognise form. The power to detect movement probably extends to some considerable distance, but the perception of form is thought to be restricted to a few feet, probably six or seven. It is further believed that the simple eyes enable the insect to distinguish the form of objects in a crude manner, but such power is restricted to objects very close at hand. The simple eyes further enable the insect to distinguish light from darkness.

The Mouth Parts.

The mouth parts of many insects have undergone very profound modifications, and a number of distinct types of mouth may be observed even in the course of a very casual examination of some of the commoner insects. These varying types of mouth parts belong to the four following classes:—

(1) Biting and chewing mouths.

(2) Piercing and sucking mouths.

(3) Biting and sucking mouths.

(4) Sucking mouths.

Each of these types of mouth parts is worthy of some discussion.

Biting and Chewing Mouth.

The biting and chewing type of mouth is well represented by the grasshoppers and beetles. These insects feed by biting off and swallowing the tissue of the plants on which they live. The mouth parts have been modified to permit of this type of feeding, and the damage caused by these insects when attacking foliage or other tissue is usually very obvious.

Piercing and Sucking Mouth.

The piercing and sucking type of mouth is that possessed by scale insects, orange bugs, mosquitoes, and many other species of outstanding importance. In these insects the mouth has been so modified that certain parts thereof known as stylets function for the piercing of the skin, cuticle, or epidermis. Through the wound thus made the insect sucks out the blood or sap of its host animal or plant. The results of attacks by insects belonging to this class are not generally quite so obvious as in the case of those possessing biting and chewing mouth parts. Most people are aware, however, of the painful impression left by the attacks of sandflies and mosquitoes, and they also very frequently see leaves or young twigs of trees that have curled up and withered as a result of the attacks of aphids or plant lice. When plants are severely attacked by these insects the drain on their sap is frequently tremendous, and the plants are consequently stunted and sickly; in fact they not infrequently succumb to the attack in cases where the insects feeding on them are abnormally abundant. The importance of insects possessing this type of mouth is further demonstrated by reference to the fact that mosquitoes are responsible for the transmission of several very serious diseases of human beings.

Biting and Sucking Mouth.

The biting and sucking type of mouth is one that is found in the Hymenoptera, the Order to which the bees and wasps belong. In this type the mandibles and jaws are well developed for biting, but at the same time other parts of the mouth are so modified that the insect is also able to suck up liquid food. Insects belonging to the other three classes possess mouth parts that can either bite or suck, but this is the only class in which both these modes of feeding can be adopted.

Sucking Mouth.

The last type of mouth part to which reference has to be made is that of the sucking type possessed by butterflies and moths. The mandibles in most of the moths and butterflies are absent, and other parts

of the mouth have been modified so as to produce a long sucking tube through which liquids can be sucked up. Insects possessing this type of mouth are generally quite incapable of destroying plant tissue, i.e., when they are adults; of course, moths in their immature forms as caterpillars possess a totally different type of mouth and they are, in that stage of their life history, able to cause very serious losses. It has been said that moths are incapable of injuring plant tissue, and that statement in general is quite sound. There are, however, some exceptions, including the orange-piercing moths, which are quite important citrus pests.

The Thorax.

The thorax is the second or middle region of the insect body. It consists of three segments and typically bears two pairs of wings and three pairs of segmented legs in the adult stage. The second pair of wings in the flies, however, is represented by two small knobs known as halteres or balancers. Further exceptions occur in some families in which both pairs of wings are missing or rudimentary, sometimes in both and sometimes in one sex only. In other abnormal cases the wings may be restricted to a single pair in one sex only.

The Wings.

The first pair of wings is always situated on the middle segment of the thorax, the second pair being on the hind segment. When an insect possesses only a single pair of wings it is almost invariably the second pair that is absent. It has also been demonstrated that in some wingless insects (such as the flea) the wings have degenerated through lack of use, but in certain very primitive insects no trace of wings can be found even in the embryo.

The wings in many species such as the bees, wasps, dragon-flies, and flies are generally quite clear and membraneous. This is, however, by no means always so, for in the grasshoppers and their allies the front wings are distinctly leathery while in the beetles they are typically hard and horny. Again, in the moths and butterflies both pairs of wings are generally densely clad with scales which frequently give rise to extremely beautiful wing patterns. It is thus evident that the wings of insects are subject to very great variation.

Very powerful muscles, whose function it is to operate the wings, are situated within the external skeleton of the thorax. These may drive the flight organs at the rate of 330 strokes per second, as is the case with the house fly, or on the other hand they may produce the much slower rate of vibration that is typical of many common butterflies, only nine strokes per second having been recorded in certain species.

The Legs.

The insect leg consists typically of five segments, the last of which is itself usually composed of five parts of varying size. This terminal segment of the leg usually bears two claws and is also frequently furnished with a pulvillus or pad. The pad is typically adhesive and is generally held to be responsible for the power that flies and other insects possess of being able to walk on ceilings and on the undersides of leaves, &c., in an inverted position.

Legs occur in the great majority of adult insects, but in their immature stages legs are by no means invariably present—e.g., many beetle larvæ and most hymenopterous larvæ are legless, and the legless condition is the rule in the larvæ of flies.

The legs function primarily for walking or running but they are frequently modified for other purposes—e.g., in certain species the fore legs have been so altered in structure as to be suitable for burrowing, while in some species they have been adapted for seizing other insects. The hind legs in certain species have been abnormally developed so as to permit of jumping or leaping for considerable distances.

The Abdomen.

The abdomen, which constitutes the third region of the body, consists of a series of segments that exhibit comparatively little variation. Perhaps the most conspicuous external features of the abdomen are those associated with reproduction, for in the females of many species an ovipositor or egg-laying tube is distinctly visible.

Respiration.

Respiration in the insect world takes place through a system of air tubes or tracheæ, which ramify throughout the whole of the body, and in this way carry oxygen to the various tissues and organs. The openings in the body wall which permit of air entering the tracheæ are known as spiracles or stigmata. These occur in pairs on the thorax and abdomen and are generally situated laterally. Special provision for respiration is made in the case of the larvæ of aquatic insects, the special organs developed to meet the unusual conditions being known as gills.

Reproduction.

The normal procedure of sexual intercourse is generally necessary for reproduction in insects, and the sexual act is typically followed by the laying of fertilised eggs. To this generalisation there are, however, quite a number of exceptions, for many insects are viviparous—i.e., the females do not lay eggs but give birth to living larvæ or nymphs. The eggs are produced within the body of the female, but they are retained therein until the incubation period has been completed; the maggots or nymphs that have hatched are then extruded by the female. Many aphids and scale insects are viviparous as also are many species of flies.

A further point worthy of note in connection with insect reproduction is the fact that occasionally reproduction can take place without sexual intercourse. This phenomenon is known as parthenogenesis.

SUGAR-CANE GROWING IN QUEENSLAND.

Sugar-cane is grown in Queensland on a long but fairly narrow coastal strip, extending over 1,000 miles in length, lying between latitudes 15 and 28 south. Parts of this belt are separated from each other by tracts of non-sugar country, and the latter, due to deficient rainfall or poorness of soil, are not utilised for cane. The bulk of the staple is grown within the tropics.

It is the State's largest agricultural industry, the total area under cane approaching 300,000 acres, the number of farmers engaged in it being 7,300. It gives employment to 28,000 men, and the wages paid amount to £6,000,000 per annum. It probably pays the highest wages of any agricultural industry in the world, and is the only cane-sugar producing country which carries on the growing and manufacturing of sugar by white labour. Directly and indirectly, the industry employs some 100,000 persons.

The growing of sugar-cane is essentially a small farmer's industry.

The number of raw-sugar mills in Queensland at the present time is 35, the latest addition being the fine Government sugar factory in the Tully River district, North Queensland. The erection of this mill has caused a large settlement to come into being, with schools, banks, stores, picture shows, &c., where only six years ago a dense tropical scrub existed. The cost of a new sugar-mill such as the Tully was between half and three-quarters of a million pounds—that is, to erect and equip with tramlines. There are also two refineries—one at Bundaberg and one at Brisbane.

The large towns of Cairns, Innisfail, Ingham, Ayr, Mackay, and Bundaberg are almost entirely supported by the Queensland sugar industry, and many other thriving townships are absolutely dependent upon it.

The State Government, naturally, takes a very keen interest in this great industry, and the price paid for sugar is the outcome of negotiations by the State with the Australian Federal Government. In order to protect farmers, the Sugar Cane Prices Acts were passed, and the grower has a voice in the fixing of the price for his product. Another result of the care given by the Government to the industry is the great reduction (nearly 2 tons) in the average weight of cane required

to make 1 ton of sugar. This is largely due to the introduction of better varieties of cane, more careful cultivation, better mill work, and organised instruction.

This article is intended to help growers in securing greater efficiency in the cultivation of cane, and so to reduce their costs of production; also to be of assistance to intending sugar-growers who desire to purchase cane farms.

The sugar industry has increased the population of North Queensland by over 30 per cent. in recent years.

There are many persons in Queensland who have purchased cane farms without any great knowledge of canegrowing, while many others frequently apply to the Department of Agriculture for information on the subject. The main points upon which information is sought are in relation to what might be termed the economics of the cane farm: What amount of capital is required to buy a farm? What working plant is needed? And what will be the return per acre?

In the present condition of the sugar industry it has, first of all, to be recognised that no Crown land is at present available for sugar-growing, so a would-be cane farmer must purchase a farm which has an assignment to an existing mill, or else lease such a farm.

It may be pointed out that the average size of a cane farm in Queensland is 36 acres, the largest farms being in North Queensland. The following table shows the average size of farms from Cairns to the Logan River district:—

Cairns to Townsville	48 acres.
Townsville to Mackay	43 acres.
Bundaberg, Childers, Maryborough, &c. ..	27 acres.
Maroochy to Logan	9 acres.

It will, therefore, be seen that the smaller farms are in the southern part of the State, where many canegrowers take up the growing of other crops or go in for dairying as a side line. In North Queensland canegrowing is the sole occupation of the cane farmer, and the high price of property in the belt of land from Ingham to Cairns compels his whole attention to making a living from cane alone.

The greater part of the farms in the Tully, South Johnstone, Babinda, and Innisfail cane areas were originally under scrub which was of a heavy nature.

In North Queensland, the buyer, when purchasing farms which have been developed from scrub lands, should select those with a good depth of soil. Light red soils on ridges should not be taken in preference to

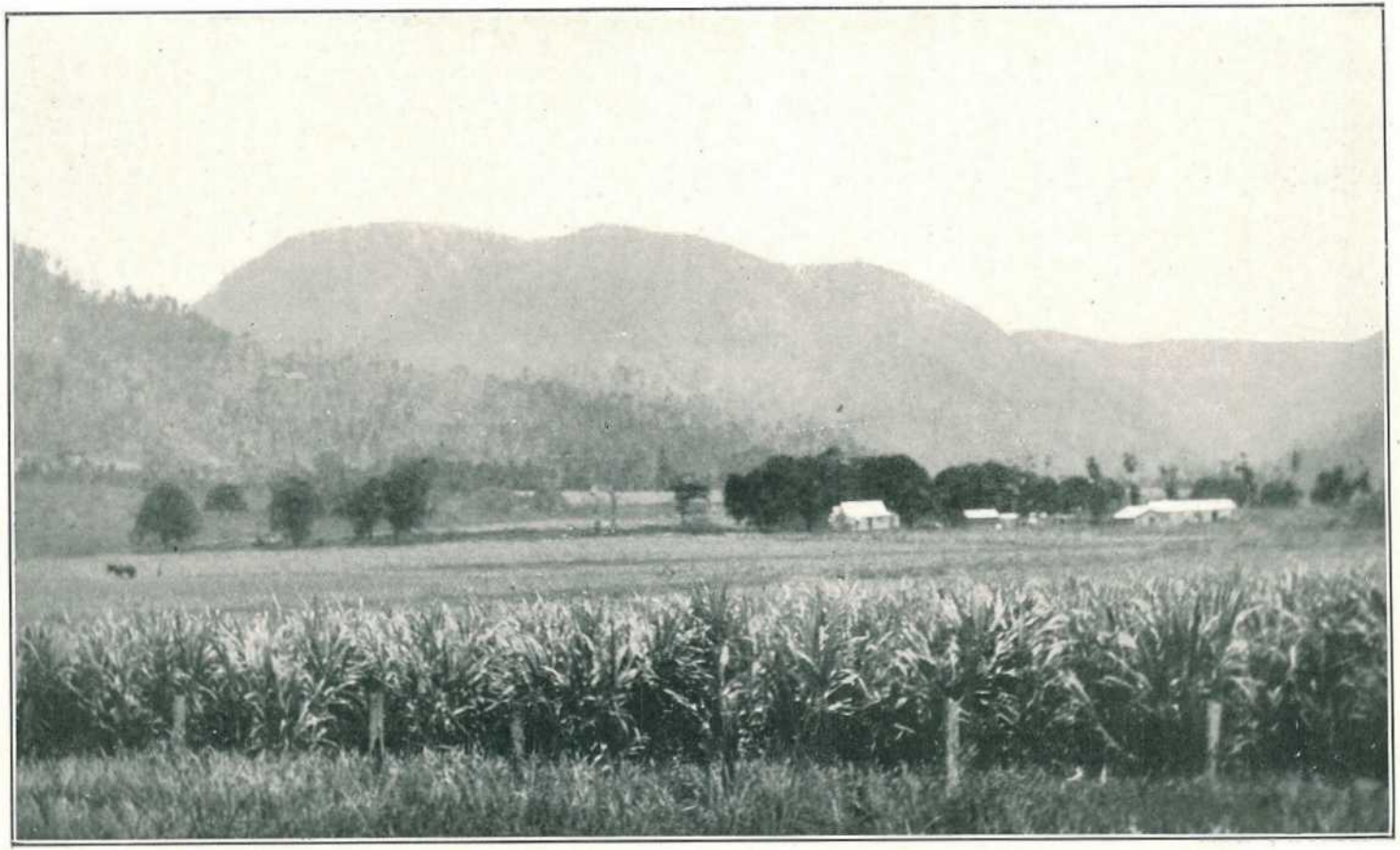


PLATE 3.—CANE FARMER'S HOMESTEAD AND CROP NEAR REDLYNCH, CAIRNS RAILWAY.

dark chocolate soils of level formation. The high cost of clearing these dense scrubs renders the price per acre of land under cane much higher than forest soils.

Southern scrub timbers are lighter in character than the northern ones. The nature of the soil on the farm and its depth and colour should be carefully ascertained before purchase.

As a general rule, the rich red volcanic soils that have carried scrubs, such as the Woongarra sub-district of Bundaberg, and the famed Isis (Childers) scrubs, are the best cane lands in southern Queensland.

Farms on forest lands are generally cheaper in price. The best of these soils for sugar-cane in North Queensland originally carried Moreton Bay ash (or Blackbutt, as it is sometimes called), acacia, and cocky apple. Other forest country had ironbark, bloodwood, poplar gum, cabbage gum, blue gum, tea-tree, wattle, &c. Southern forest lands grow a good many of these trees, though not much poplar gum. Country covered entirely with poplar gum is usually shallow, with a stiff clay subsoil, and should be avoided for canegrowing.

It may happen that improved farms offered for sale have a portion still under scrub or forest, and the cost of clearing and planting such an area when required for cane has to be taken into account. The following gives the approximate cost of this work on northern scrub soils according to location, kind of scrub, and nature of burning:—

Brushing, felling, burning, logging, and reburning—£12 to £17 per acre.
Holing for cane plants—3s. 9d. to 4s. 6d. per hundred.
Plants—£3 to £4 15s. per acre.
Labour-planting—£3 to £4 15s. per acre.
Chipping—£5 to £12 per acre.

In many of the Northern scrubs, the cost of felling, lumping, burning, holing, making roads, planting, and fencing have been given from £33 to £50 per acre. Grubbing and stumping have been taken to cost from £8 to £25 per acre, according to the timber.

In the Southern districts the cost of planting cane on the lighter scrubs would be much smaller, and has been set out as under:—

	Per acre. £	*s.*	*d.*
Brushing, felling, clearing, lumping, and burning ..	3	10	0
Holing	2	10	0
Plants	2	10	0
Planting	2	0	0
Chipping three times	4	10	0
	£15	0	0

Scrub lands, after carrying from three to five or more crops, are then usually stumped and put under the plough.

Forest lands are nearly always completely cleared—i.e., they are at once stumped and put under the plough. The cost of clearing forest land varies a good deal, and may run into as much as £17 per acre in North Queensland and from £5 to £10 per acre in Southern Queensland. The cost of breaking up, further cross ploughings, and planting of cane would be additional.

The sugar industry employs 21,000 men in the cane fields and 7,000 in mills and refineries.

Purchasing Improved Farms.

When setting out to purchase an improved cane farm, the intending buyer should make detailed inquiries as to the value he is going to get for his money. The officers of the Bureau of Sugar Experiment Stations, attached to the Department of Agriculture and Stock, are at all times ready to give information and advice on the matter. The managers of the sugar mills to whom the farmers supply cane will always be found willing also to give information and advice. Always see that the cane land is properly assigned to a sugar mill, that the cane crop and improvements are worth what is being asked, and examine the soil and surroundings carefully, the latter particularly with reference to economic transport to the sugar mill.

The price of land varies considerably according to the location of the farm, from about £20 to £130 per acre. The lower priced farms are situate in Southern Queensland, where the yield per acre is usually not so high, and where the crops take longer to grow. The high-priced farms are mostly in North Queensland, where the returns are regular and droughts are practically unknown. These lands are all improved, and the improvements consist of the cane crop, team of horses, necessary implements, residence, and stables. The climate in North Queensland is a good one. The mills are modern and efficient, and are amply provided with tramlines and locomotives for carrying in the crops. The adjacent townships are provided with post and telegraph offices, schools, medical men, hospitals, &c.

Queensland is the only country growing sugar-cane by white labour. The sugar industry is the mainstay of the White Australia policy.

The more capital a man has the better chance he possesses of doing well rapidly. The smallest amount of capital a man would require would be £500 to pay a deposit and carry on, but if he were buying a cane farm about Innisfail, Babinda, or Cairns £2,000 would be much better to enable him to pay a fair amount of deposit and have some capital to carry on until his crop came in.

The following could be stated as the basic equipment for a small improved cane farm, apart from the cane crop:—

Buildings.—Residence, implement shed, stables, and chaff-cutting shed.

Implements.—Single disc plough, 28-inch, 3-horse swing plough, light 10-inch ratooning plough, Planet Junior scuffler, disc harrow, tine harrow, and roller.

Power.—A 3½-h.p. oil engine, chaffcutter, and sawbench.

Stock.—Three good draught horses or tractor and saddle hack. Two dairy cows are also desirable.

Miscellaneous.—Sulky or car, oils, benzine.

Tools.—Hoes, spade, shovel, pick, axe, files, cane knives, and set of carpenter's tools.

Equipment would vary according to the size of the farm purchased.

In addition to the cost of the farm with its improvements, the purchaser must be prepared for rates, taxes, interest, depreciation in buildings, implements, and stock, levies, assessments, wages, repairs, fuel, &c.

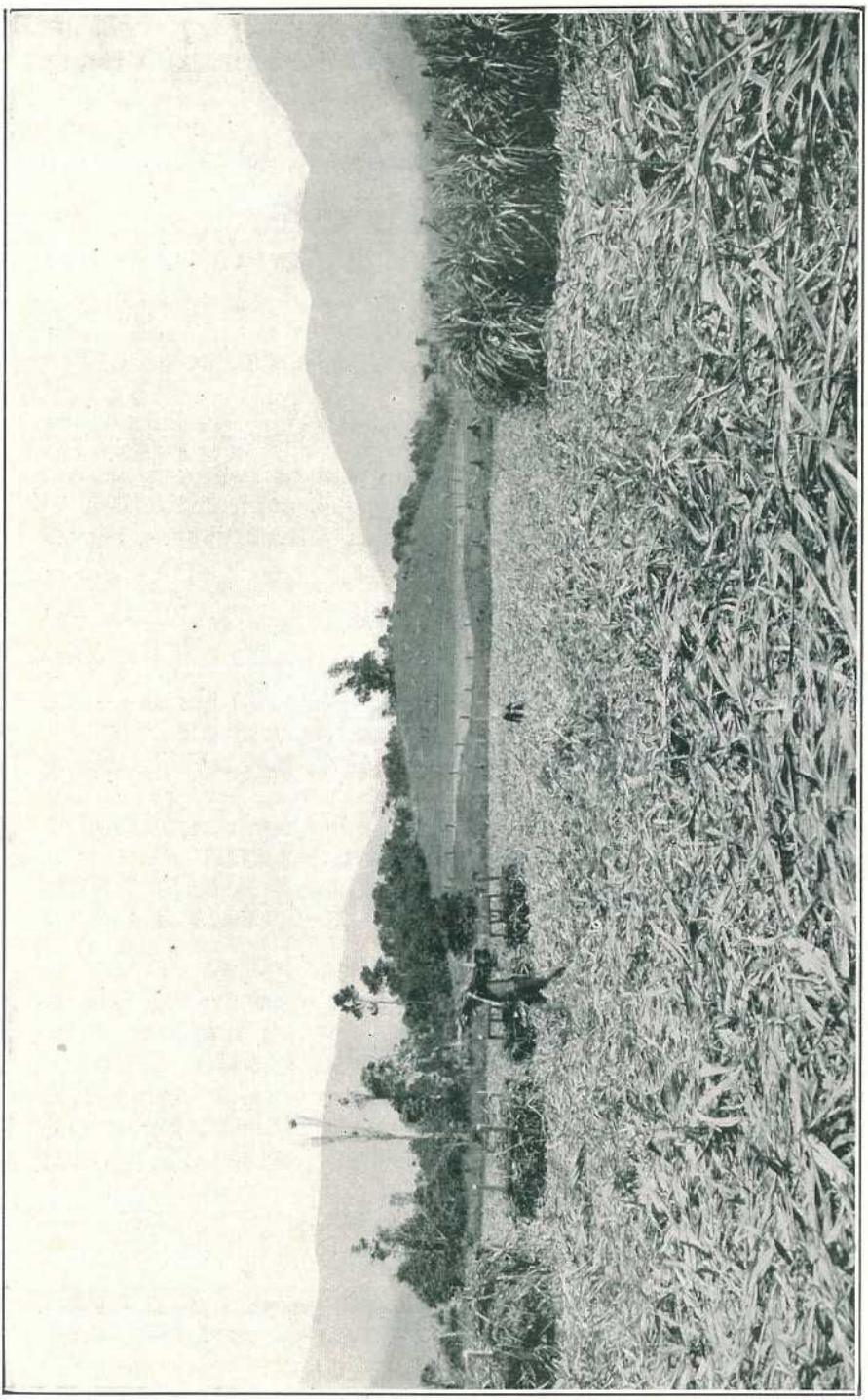
Cultivation of Cane.

The foregoing remarks are intended for new growers who wish to enter the industry; the following are for the benefit of canegrowers already in sugar-growing as well as for those commencing, and apply to land under the plough, as the greater part of the cane lands in Queensland come under this category, especially in the older areas which have been growing cane for many years. In the following districts either the whole or the greater part of the canegrowing lands are under the plough:—Logan, Maryborough, Isis, Bundaberg, Mackay, Proserpine, Lower Burdekin, Herbert River, Innisfail, Mulgrave, Hambledon, and Mossman.

For the purpose of ploughing out stools, a disc plough, either double or single, is generally used, and the discs should be particularly sharp so as to cut up the stools as much as possible. A few farmers make a practice of carting away the old stools, and if the time and labour can be afforded it is often wise to do this, as it gets rid of any disease and borer. It is, however, recognised that there are many difficulties in the way of carrying this out, and, if it is not practicable, the stools should be cut up so as to secure their quicker disintegration.

Liming.

Some cane lands require lime. This can generally be ascertained from an analysis of the soil, which is carried out free of charge to sugar-growers by the Department of Agriculture and Stock through the Sugar Bureau. As a general rule, lime is required in most of the areas above



(Bartle Frere Mount.)

PLATE 4.—FROM FIELD TO MILL.—LOADING CANE TRUCKS ON DR. KNOWLES'S FARM, NEAR BABINDA, NORTH QUEENSLAND.

Townsville, while below it the application of lime has not been found particularly payable.

Lime is usually applied to the soil in the following forms:—

(*a*) Burnt lime or lime oxide.

(*b*) Air-slaked lime—i.e., burnt lime that has been allowed to gradually slake in the air, and which ultimately becomes lime carbonate.

(*c*) Water-slaked lime (lime hydrate).

(*d*) Pulverised limestone (lime carbonate).

Burnt lime is the most valuable form for sweetening soils and producing alkalinity, especially on our Northern canefields, where the rainfall is great and the humus plentiful. It is, however, hard to obtain in a fine condition, and is disagreeable to handle. By air-slaking, however, it soon crumbles into a fine powder, which gradually turns into lime carbonate—a milder form of lime. This can be easily applied, and is recommended where a quick action is desired.

Ground or pulverised limestone is also very useful, but its action is comparatively slower.

The Relative Value of Different Forms of Lime.

Fifty-six pounds of fresh burnt lime contain the same amount of lime as 100 lb. of carbonate of lime (ground or pulverised limestone), 100 lb. of old air-slaked lime, or 74 lb. of water-slaked lime. One hundred tons of burnt lime have the equivalent value of 178½ tons of pulverised limestone or carbonate of lime.

The pulverised limestone is much more agreeable to handle than burnt lime, even when the latter is air-slaked; but in considering cost it has to be remembered that in value 1 ton of burnt lime is equal to approximately 1¾ tons of ground limestone, and will slake to that amount.

The Railway Department, at the request of the Bureau of Sugar Experiment Stations, now carries lime at ½d. per ton per mile when the distance exceeds 25 miles.

Lime should be spread broadcast with shovels, selecting the early morning for the purpose, when there is little or no wind, and it should be immediately ploughed under. This ploughing should be shallow, as the lime will naturally work through the soil. It is sometimes preferred to harrow the lime in, reserving the ploughing till a few weeks later.

Machines are made to distribute lime, and an implement of this nature can be very well used with pulverised limestone and slaked lime.

Necessity of Restoring Humus to Soils.

One of the best methods in preparing land for cane crops is the growth of a green manure crop and its subsequent ploughing under. This

is not only a form of rotation, which in itself is highly beneficial, but it is a means of restoring humus to our old cane lands, and is a prime essential in the making of a fertile soil. Humus benefits the soil physically—

1. By augmenting its water-holding capacity.
2. By increasing its warmth.
3. By bettering its texture and being a controlling factor in the determination of fine earth.

The defence of this continent and the maintenance of White Australia are involved in the preservation and advancement of the sugar industry.

Humus in the soil is lowered by—

1. The continued growth of crops.
2. Bare fallowing.
3. The continued use of artificial fertilisers.

The best possible crops to grow for green manuring purposes are the legumes, such as cowpea, Mauritius bean, velvet and soya beans, lupins, vetches, &c., and it is strongly recommended that an excellent method for restoring fertility to the soil is the growth of a leguminous crop of some kind for the purpose of ploughing under.

Generally speaking, it takes from six to eight weeks for the crop to rot down. When this has taken place, if the time is convenient, the ground can be got ready for the succeeding cane crop.

Drainage.

If the ground is inclined to become water-logged, or if subject to heavy tropical rains, it would be wise to drain the area to be put under cane. Tile draining is the best form to adopt; but this is usually costly, and good results may frequently be obtained from surface drainage, such as laying the land is beds, with a water furrow between so many rows of cane. These can be led to drains along the headlands if the lay of the land is suitable.

Deep Ploughing and Subsoiling.

The tractor for ploughing purposes is now coming into extensive use, in North Queensland especially, and in many places good and inexpensive work is being done by its means. It is, however, of limited use on small areas, where horses are to be preferred. Nearly all the tractors in use pull from two to four discs and burn crude kerosene.

Land for canegrowing should be cross-ploughed deeply, not less than four times, and well worked up by harrowing, and, if necessary, rolling till it attains a fine state of tilth for planting. Every energy should be

bent towards securing the land in perfect heart, remembering that tilth should be secured prior to planting, not after it. With a good deep soil-bed in fine order the best results can be hoped for. In considering this phase of the question the matter of subsoiling naturally crops up.

The experience of the Mackay Sugar Experiment Station, and of many Queensland farmers who have tried it, is that subsoiling pays handsomely on alluvial soils. The method of subsoiling recommended is to open up a furrow with the swing plough to the depth of the soil usually ploughed, and then to use a subsoiler, which will loosen or stir the soil to the depth of another 6 inches below this, but which will not bring any of this lower soil to the top. At the Mackay Station the depth ploughed varies from 12 to 14 inches and the depth of the subsoil-stirring from 6 to 8 inches, thus forming a mass of fine, loose soil for the needs of the crop, while it is also a great help in the conservation of soil moisture. That the roots of the cane will take advantage of deep and subsoil cultivation is shown by the fact that roots have been found at 4 feet deep in loose soils.

Good cultivation, careful choice of plants, and proper fertilising are the factors of success in canegrowing.

Having got our soils in perfect tilth, as previously described, we must now turn our attention to the planting, upon which so much depends. The greatest supervision should now be exercised, so that only good, sound plants, free from disease, are selected. Even if it is necessary to pay a somewhat higher rate for good plants from outside, it is well worth while. Generally speaking, plant cane from 10 to 12 months old, or first ratoon of the same age, should be taken. If the time of planting corresponds to that of harvesting, it is a good plan to cut as many top plants as possible from the best of the cane going to the mill. These are undoubtedly superior to the parts of the cane situate lower in the stick, although butts make good plants. Top plants cannot always be procured, and it is then usual to cut up the whole stick for plants.

The best width of row has been found from numerous experiments in Louisiana, Hawaii, and Queensland to be 5 feet, though in the case of a straight-growing cane, such as D. 1135, this could be reduced to 4 feet 6 inches. The drilling is best accomplished by means of a double-mouldboard or drill plough. The plough should make a good wide drill about 9 to 10 inches deep in the loose soil. Where the cultivation has been deep and good, this will leave a few inches of soil for the plant to lie on. Some farmers believe in going very deep with the plough and cleaning everything out to the hard bottom, but our experience has been that better results are obtained where a certain amount of loose earth is left at the bottom of the furrow. Moreover, in a dry time, when planting by hand, there is usually a certain amount of moisture in this loose soil into which

the plants can be pushed down, and so give them a much better opportunity to strike more rapidly. Three-eye plants are almost universally favoured, but the distance at which the plants are to be spaced apart in the row varies greatly in the different districts. At Bundaberg the plants are often placed 12 to 18 inches apart, while on the Herbert River the planting is almost continuous. A good average distance for the spacing, and one we have found to give good results, is 6 to 9 inches. In North Queensland Badila can be planted 12 inches apart. The plants are usually put in about 9 inches deep when planting by hand and covered with from 2 to 4 inches of soil—2 inches when conditions are very moist and 4 inches when they are very dry. When planting by hand, the cane sets should be laid in the ground with the eyes at the sides if possible. The cane-planting machine, however, is now largely used, and, while spacing cannot be carried out so evenly by its means, it puts the plant well down into the moist soil. It is a great labour-saver, and many types of machine are now upon the market.

Queensland requires to increase its yield of cane and sugar per acre. Only the best treatment of the soil will do this.

As soon as the cane is up about 6 inches the subsequent shallow cultivation of the interspaces between the rows should take place; the drills may be cleaned and cultivated with what is known as the cane chipper or drill cleaner, or cultivating and weeding attachment. Failing one of these the drills must be chipped or weeded by hand with hoes.

Shallow cultivation of the interspaces after the crop is up not only destroys weeds but leaves a level mulch of soil on the surface, and so conserves the moisture. Every care should be taken not to cut the young roots of the cane which are commencing to form and reach out for plant foods and moisture. The cultivator should be run over the interspaces, if possible, every fortnight until the cane is high enough to lay by—i.e., if the cultivation between the cane pulls off green leaves it should be discontinued.

The method of cultivation of interspaces at the Sugar Experiment Stations is by using a Planet Junior cultivator fitted with broad sweeps or hoes. Good results have always followed this, and it is most necessary during dry periods.

While the use of a disc harrow may be permitted during the early stages of the crop, especially when some form of drill cleaner is pulled behind, its use should be prohibited directly it is found that the young cane roots (which subsequently begin to stretch out laterally) are being cut.

Application of Manures.

When the young plant cane is about 18 inches high the application of fertilisers should be made, if considered necessary, to the plant crop. From a long experience of Queensland cane lands, it can be definitely affirmed that the manurial elements needed in the growing of successful cane crops are nitrogen, potash, and phosphoric acid. These are usually supplied in the following fertilisers:—

Nitrogen in—

Nitrate of soda contains about 15 per cent. nitrogen.

Sulphate of ammonia contains about 20 per cent. nitrogen.

Nitrate of lime contains about 12½ per cent. nitrogen.

Nitrolim contains about 18 per cent. nitrogen.

Dried blood contains about 11 per cent. nitrogen.

Meatworks manure contains about 3 to 7 per cent. nitrogen.

Potash in—

Sulphate of potash contains about 48 per cent. potash.

Muriate of potash contains about 50 per cent. potash.

Phosphoric acid in—

Superphosphate contains about 16 per cent. phosphoric acid.

Rock phosphate contains about 18 per cent. phosphoric acid.

Guano contains about 15 per cent phosphoric acid.

Thomas phosphate contains about 17 per cent. phosphoric acid.

Meatworks manure contains about 17 per cent. phosphoric acid.

Bonedust contains about 20 per cent. phosphoric acid.

Basic superphosphate contains about 19 per cent. phosphoric acid.

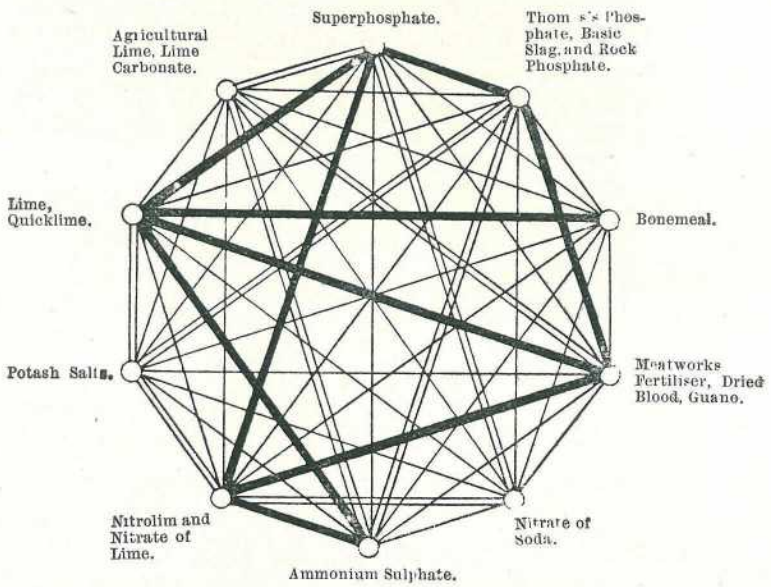
Thorough cultivation means increased production per acre.

Under the Fertilisers Act it is required that the dealer shall at the time of sale, or before delivery, give to the buyer an invoice certificate signed by the seller or his agent, stating the full name and place of business of the dealer; the name, trademark, brand, or sign used to mark packages containing such fertiliser and used to identify such fertiliser; the quantity or net weight of fertiliser comprised in the sale; the composition of the fertiliser, setting forth the proportion per centum in which such fertiliser contains the following ingredients:—Nitrogen, phosphoric acid, potash, and lime, and the forms in which they respectively occur; and, in the case of bonedust, basic slag, agricultural lime, &c., the percentage of coarse and fine material.

Furthermore, every dealer who sells fertiliser, which term includes offering or exposing for sale and having in possession for sale, shall

securely affix to each package a printed label, clearly and truly certifying:—The number of net pounds of fertiliser in the package; the figure, trademark, or sign under which the fertiliser is sold; the chemical composition of the fertiliser, in the same manner as stated on invoice certificate; and the state of fineness for certain fertilisers.

In mixing fertilisers care must be taken not to bring ingredients together which would lead to decomposition or loss of some part of the manure. Thus, should lime be mixed with sulphate of ammonia, a loss of nitrogen would take place. A simple guide for the mixing of manures is given in the accompanying diagram:—



All fertilisers joined by a *single line* can be safely mixed together and kept for any length of time. Fertilisers joined by a *heavy black line* should never be mixed together; those connected by a *double line* should only be mixed immediately or a short time before application.

Canegrowers can send samples of their soils to the Department of Agriculture for free analyses, and letters of advice as to the application of fertilisers by the Director of Experiment Stations will be sent out with the results.

The following is a typical mixture for sugar-cane, which could be varied according to requirements:—

250 lb. sulphate of ammonia per acre.

100 lb. sulphate or muriate of potash per acre.

250 lb. meatworks manure per acre.

Experiments in the field with fertilisers is a practice that can be highly recommended.

In applying nitrogen, if nitrate of soda is used, it should be remembered that it is easily leached from the soil; hence it should not be

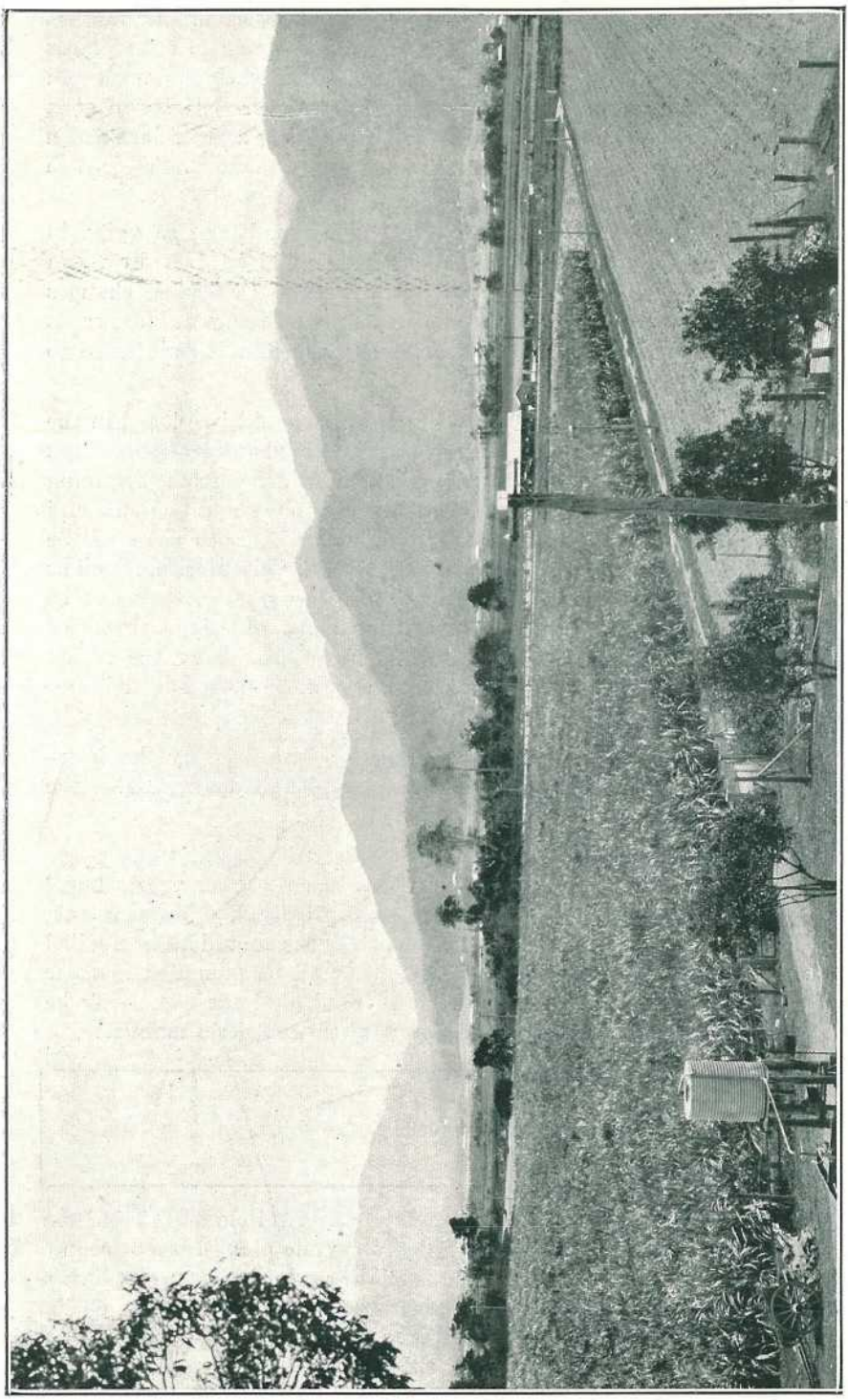


PLATE 5.

From Bombaderie Farm.)

CANE FIELDS AT THE FOOT OF BARTLE FRERE, THE DOMINATING MOUNTAIN MASS OF THE COASTAL RANGE, BABINDA, NORTH QUEENSLAND.

applied during a heavy wet season. It is a great plant stimulant, and has frequently been found to add such strength and vigour to cane plants that it strongly aids in obtaining other mineral food, such as potash and phosphoric acid, from the natural reserves in the soil. Nitrate of soda will often show its effects in a week or two, producing a rich, dark-green colour in the foliage, and cause a marked improvement in the growth of the cane.

Nitrogen, in the form of sulphate of ammonia, is not so quick in action as in nitrate of soda, while nitrogen in dried blood, bonedust, and meatworks manure is still slower in action, requiring chemical changes to convert it into nitrate so as to become available to the plant. Meatworks manure in the wetter cane areas of North Queensland is preferable to superphosphate as being less soluble.

It is not recommended that mixed fertilisers should be placed in the drill with the cane plants. As soon as the cane is about 18 inches high drills 4 to 5 inches deep should be drawn about 10 inches from the young cane on each side of the row, and the fertiliser is put into these drills and then covered, or a manure distributor can be used. Both sides of the row, however, should be treated. If nitrogenous fertilisers alone, such as nitrate of soda and sulphate of ammonia, are being used, they can be applied on the surface of the soil near the cane. Organic forms of nitrogen, such as meatworks and blood manures, requiring the action of soil organisms to render them available, should be placed in drills as above and covered.

For ratoons the manures can be applied while working the inter-spaces. They may be dropped in the furrow ploughed away from the cane and then covered.

On given soils, particularly on some of the red volcanic type, better results from the use of organic fertilisers, such as bonemeal, blood manure, meatworks manure, &c., have been realised. Megasse ash, molasses ash, farmyard manure, and filter press cake should all be availed of when they can be procured. The latter should be ploughed in some three or four months before the cane is planted, and the same may be said regarding the application of molasses when used as a manure.

Restore the plant foods to the soil.

Sugar-cane removes varying amounts of the vital elements from the soil. It is estimated, from analyses of the total cane plant (except roots) made in the Agricultural Laboratory, that the variety known as Clark's Seedling, sixteen months old, took from the soil 163 lb. of potash, 83 lb. of phosphoric acid, and 96 lb. of nitrogen, while the variety known as Badila, of the same age, took out of the land 139 lb. of potash, 44 lb. phosphoric acid, and 107 lb. of nitrogen per acre.

If the above instructions have been followed, the season favourable, and the land of fair average quality, a heavy crop of cane should result. This on old lands is usually easily harvested, as facilities in the way of tramlines are, as a rule, provided. The cost of cutting is governed by the Award of the Board of Trade. Farmers should be particular in having their cane cut to the ground level, or slightly below it, because if this is done the cane ratoons very much better. Unsightly stumps of cane sticking up above the soil for 3 or 4 inches or more should be strongly condemned.

When the cane is harvested it is necessary to turn to the ratooning of the cane—i.e., the second growth of a crop from the stools of the first or plant crop.

Ratooning.

As soon as the cane is cut the farmer must make up his mind as to what he is to do with the trash, or dead leaves and tops, from the preceding crop. The tops whilst green are to a large extent used for forage purposes, so that, as a rule, there are not many of these left. The trash is usually burned in Queensland, but, if possible, after the last ratoon crop has been taken off it should be ploughed in to provide humus for succeeding crops of cane.

Practise the best methods of ratooning. They will be found the most profitable.

Ratoons should be well cultivated, and the following method can be recommended:—Immediately the trash is burnt off open up the middles of the rows to a depth of at least 9 inches with the swing plough. Next plough away from the cane rows on to the middles so that all the ground between the rows has been moved. Then run the tine harrows over all to level off. On alluvial soils all the rows should be subsoiled to a further depth of 6 inches after the swing plough is used. Subsequent cultivation with the Planet Junior fitted with broad hoes can then be carried out in the same manner as recommended for the plant crop. The results obtained at the Mackay Sugar Experiment Station for this method were as under:—

Crop.	Yield of Cane per acre where the ground between the rows was ploughed and subsoiled.	Yield of Cane per acre where the ground between the rows was only ploughed to eight inches.
	English Tons.	English Tons.
First Ratoons	38·9	27·0
Second Ratoons	31·3	19·2
Third Ratoons	20·4	9·91

These experiments were not fertilised.

By adding manures still larger results have been obtained. The usual methods practised by farmers, however, do not make use of the subsoiler. The following are favourite ways of ratooning:—

(*a*) Trash burnt and four furrows ploughed between cane rows. Land levelled down by use of tine harrows or cultivator.

(*b*) Trash burnt, procedure same as above, but only three furrows ploughed between rows.

(*c*) Trash burnt and ground cut up first with disc harrows crossways. Then use of plough between rows, followed by tine harrows crossways.

(*d*) Trash burnt, four furrows ploughed between rows, and skeleton plough used in furrows next to cane.

(*e*) Trash burnt and land treated with spring-tooth cultivator or a grubber instead of being ploughed.

(*f*) Trash left and rolled in each alternate interspace. Every other interspace well cultivated with the plough. In this way each row of cane has one side cultivated and one side uncultivated, but covered with trash.

(*g*) Trash left and cane allowed to volunteer without any cultivation at all. This method is sometimes advantageous in a droughty season, but is not to be recommended as a regular thing.

All these methods are in use, or some variation of them. In the writer's opinion the best cultivated ratoons (other things being equal) give the highest yields.

As a rule, considerably more benefit is got from the manuring of ratoons than from the manuring of plant cane, and this experience is common. This is strikingly shown in the following summary of experiments carried out at Mackay:—

Plant Crop.			First Ratoon Crop.		
Manures.	No Manures.	Difference.	Manures.	No Manures.	Difference.
50·7	47·4	3·3	42·4	31·7	10·7
Second Ratoon Crop			Third Ratoon Crop.		
Manures.	No Manures.	Difference.	Manures.	No Manures.	Difference.
38·8	24·1	14·7	35·9	19·8	16·1

The above are in terms of tons of cane per acre.

Irrigation.

The climatic variations in Queensland from year to year are often so great that canegrowing is only certain in those districts possessing a

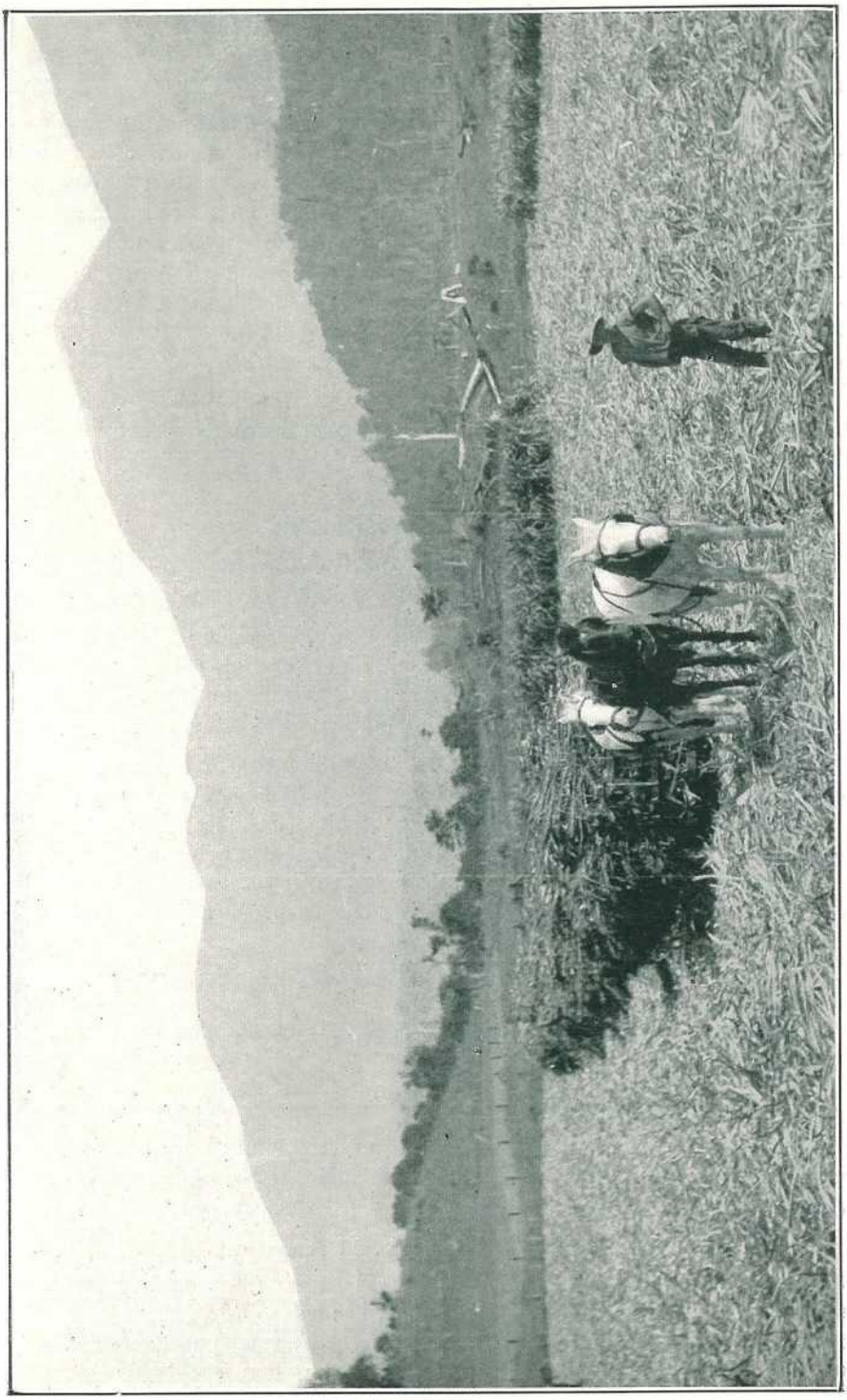


PLATE 6.—FROM FIELD TO MILL—READY FOR THE ROAD, BABINDA, NORTH QUEENSLAND.

high average rainfall. Districts with an average rainfall of 50 inches and under suffer exceedingly during dry spells, and irrigation would prove highly payable in such localities.

At the present time the only canegrowing district that uses irrigation water to any extent is the Lower Burdekin, situated some 40 to 50 miles south of Townsville. On the north side of the Burdekin River irrigation has been practised for a number of years, the plants used being the property of the farmers. Water is found at shallow depths, and is easily obtainable by sinking spearheads. On the south side of the river the Government have installed a complete system, available to growers of cane. Wells have been sunk and the pumps are electrically driven from a central power-house.

The cost of applying irrigation water on the Lower Burdekin is comparatively high, even though the most economical method is used, but the results usually pay extremely well.

Efficiency in Sugar Growing.

Efficiency in the production of cane depends upon a number of factors, the principal of which could be summarised as follows:—

1. Each cane farmer should make a study of his soil, from both a physical and chemical standpoint. The analyses of cane soils are carried out free of charge by the Bureau of Sugar Experiment Stations, and a great deal of useful information can be learned in this way.

2. The equipment of a cane farm should be the best possible, and every attention should be given to the care of implements, preservation of harness, and the health and feeding of farm animals. Ploughs and other implements should not be left out in the weather, but be carefully greased and put under shelter as soon as finished with. The best and latest type of implements should, if possible, be procured, so that work may be done economically as well as efficiently.

Make it your aim to be an efficient cane farmer and so make money.

3. Labour of the best type should be selected, and the farmer should aim at making his permanent hands comfortable, at the same time giving them to understand that he expects a fair day's work for a fair day's pay.

4. Proper methods of keeping accounts should be adopted on the farm, so that the canegrower knows what he is about and what each operation is costing him. Nowadays a farmer has to be a sound business man to be efficient, as there are so many different phases requiring attention. He must be familiar with profit and loss, otherwise he will work in the dark.

5. Varieties of cane should be selected which are likely to give the highest results from a commercial cane-sugar point of view and yield of cane per acre.

6. In preparing for a plant crop, the soil should be thoroughly stirred by at least four ploughings, the depth of each being regulated by the depth of soil. In alluvial soils, such as river banks, subsoiling frequently gives excellent results in the shape of enhanced crops. Care should be taken that the soil presents a fine state of tilth just prior to planting.

7. The planting of cane should be very carefully supervised, and only good, sound plants free from disease should be used.

8. Fertilisers should be judiciously chosen, and care should be exercised in purchasing, so that the best and most concentrated fertilisers are procured. The farmer should see that he obtains the manure he orders, and should not buy more manure than he intends using. Bags of fertiliser should be prevented from getting wet. Advice as to fertilisers can always be obtained from the Bureau of Sugar Experiment Stations. Rotation should be practised, and green manure crops, such as Mauritius bean and cowpea, made use of for maintaining the nitrogen and humus contents in the soil.

9. It may be necessary on some soils to apply lime for the purpose of sweetening soils, rendering stiff soils more friable, and correcting mineral acidity.

10. The weeding should be carefully and efficiently done, and headlands should be kept clean so as to prevent rats and other pests that injure cane. The canefields themselves also should be kept as clean as possible, so that the plant foods in the soil go towards feeding the cane and not towards feeding weeds.

11. Farmers should endeavour to grow their own forage for stock purposes.

12. Vegetable and fruit growing on a small scale is useful for the dietary of the farmer and his employees, while one or two cows will also prove valuable in providing fresh milk and butter.

13. Every farmer should have a small area for experimental purposes, both for the growing of varieties and the testing out of fertilisers.

It may be objected that to carry out all the above will put too heavy a load on the small farmer, but these ideals could be kept in view and gradually put into practice. Many farmers, of course, have adopted most of these objectives towards efficiency and are successful accordingly.

What should be aimed at is the securing of higher tonnages from smaller areas of land. It is only by adopting the very best methods that this can be done and the overhead charges be reduced per ton of cane.

Weather.

Hot, humid conditions are the best for the sugar-cane plant, and, fortunately, these generally obtain during the period of the maximum growth of the crop in Queensland. The wet season is usually synonymous with the three hot summer months of January, February, and March.

Although the weather is hot and humid during this period, the higher temperatures experienced in the dryer belts of Australia are not common. A temperature of 100 degrees is rarely recorded. It is unusual for the thermometer to show much above 90 degrees, even in the middle of summer. Indeed, during times of heavy rain, the weather becomes comparatively cool, but as soon as the sun reappears the atmosphere becomes steamy and the growth of the cane is vigorously promoted.

On the coast of Queensland, where sugar is grown, the greatest rainfalls occur where the mountain ranges come close into the coast. Where they are considerably distant, as at Bundaberg and Ayr, the lowest precipitations take place. Consequently the greatest amount of rain falls at Babinda and Innisfail, where the lofty ranges of Bartle Frere and Bellenden-Ker are not far from the seaboard.

Rainfall.

The following table shows the average annual rainfall in each of the sugar districts:—

District.	Average Annual Rainfall in Inches and Hundredths.	Districts.	Average Annual Rainfall in Inches and Hundredths.
Mossman	82·91	Proserpine	76·96
Cairns	90·49	Mackay	68·52
Mulgrave	81·91	Bundaberg	44·40
Babinda	165·00	Gin Gin	37·71
Innisfail	149·20	Childers	42·07
Ingham	80·53	Maryborough	46·14
Halifax	89·17	Pialba	38·04
Ayr	44·48	Nambour	60·93
Bowen	40·60	Beenleigh	48·87

Exceptionally heavy rains occur occasionally, causing severe floods over the cane in low-lying areas. If the water subsides within two or three days little damage may be done, but should rain continue and the cane remain under water for a week or more, the crop is often lost.

Humidity.

The mean relative humidity or percentage of moisture in the air is a most important factor in the growth of cane. This is determined from the readings of the thermometers known as the "dry" and "wet" bulb.

The dry bulb shows the external shade temperature of the air, while the wet bulb shows the external shade temperature of evaporation, and

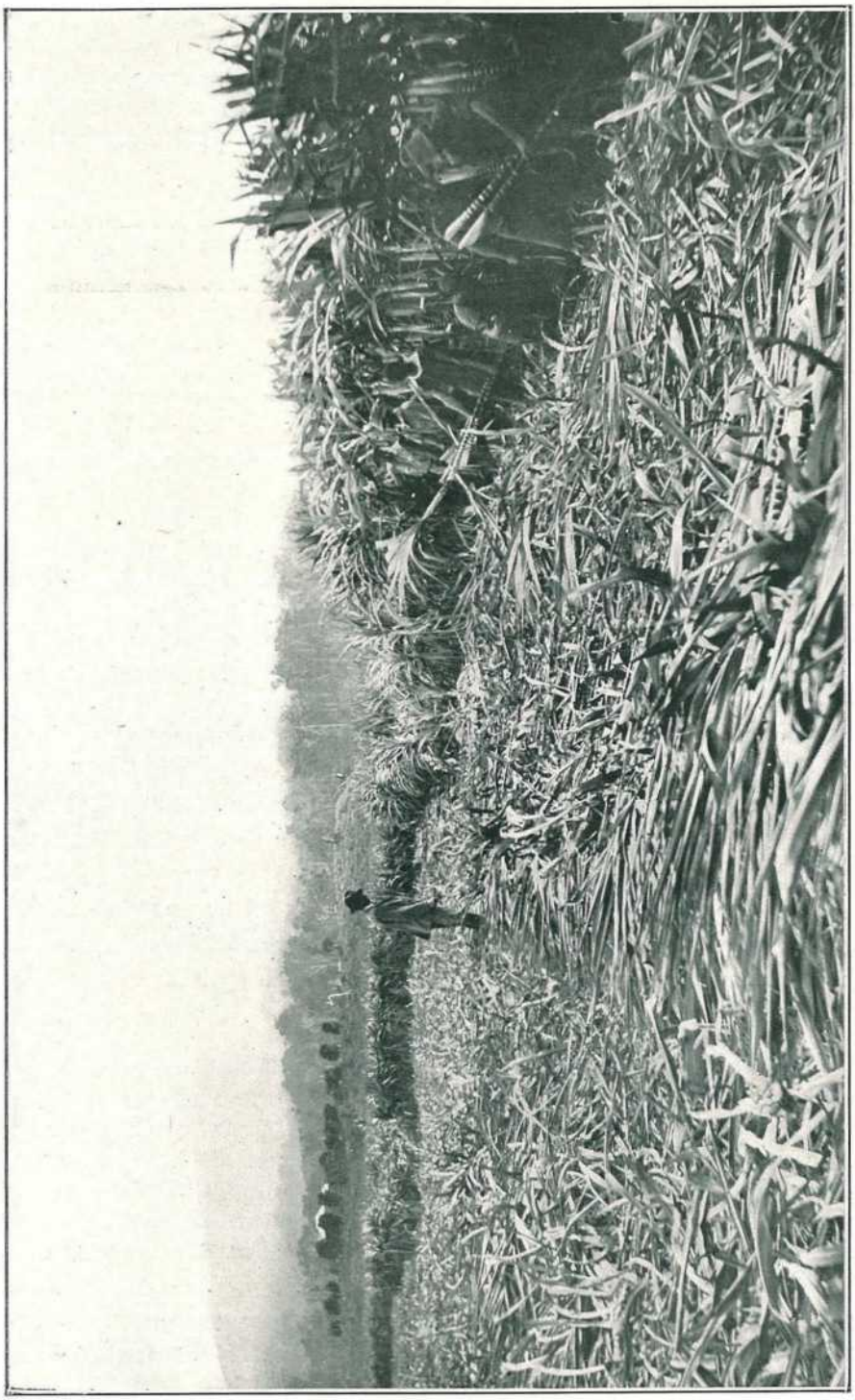


PLATE 7.—CUTTERS AT WORK IN A TYPICAL CANEFIELD, BABINDA, NORTH QUEENSLAND.

is kept covered by wet muslin attached to a reservoir of water by strands of cotton which keep the muslin supplied by capillary attraction. When the wet bulb under these conditions reads over 80 degrees the weather is exceedingly oppressive, and should it go up to 88 degrees it is regarded as highly prejudicial to human life. The table hereunder gives the percentage of relative humidity in the principal coastal towns in the sugar districts at 9 a.m.:—

Place.	Percentage of Humidity.
Bundaberg	69·0
Mackay	75·0
Ayr	68·0
Innisfail	80·0
Cairns	70·2

Frosts.

These principally do damage to sugar-cane in those districts from Mackay southward. More or less severe frosts occur every few years in the Bundaberg, Gin Gin, Maryborough, Mount Bauple, and Nambour districts, while parts of the Mackay district are occasionally affected. When cane is badly damaged by frost, the whole of the leaves become dry and yellow, and fermentation sets in down the stick, killing off the eyes. Unless such cane is quickly harvested and sent to a mill, deterioration sets in rapidly, the commercial cane sugar is greatly reduced, and it soon becomes unfit for manufacture. If possible, therefore, when cane becomes frosted, immediate arrangements should be made for its crushing.

Droughts.

These rarely occur in the Northern sugar districts, and then only in a modified form. In some of the Southern sugar districts they take place periodically, and the only cure is an irrigation system.

Pests and Diseases.

The sugar-cane plant is subject to many pests and diseases. The Government, by its Agricultural Department and Sugar Bureau, maintain a staff of entomologists and pathologists to assist farmers in the control of insect pests and cane diseases. Numerous bulletins are issued for the guidance of farmers, and officers make visits to farms and give advice on the spot. Full information and help can always be obtained by communicating with the Director of Sugar Experiment Stations, care of the Department of Agriculture and Stock, Brisbane.

The most serious insect pest is the white grub. "The grub" is the popular name given to the larvæ of certain cane beetles which feed on the roots of sugar-cane. Another severe pest in North Queensland is the weevil borer, which attacks the cane by boring into it.

Other insects, such as moth borers, caterpillars, wireworms, and white ants, cause loss to canegrowers.

The major diseases attacking cane in Queensland are:—Fiji, Gumming, Mosaic, Leaf Scald, Leaf Stripe, Red Rot. Bulletins dealing with the control of these diseases may be obtained from the Bureau of Sugar Experiment Stations.

Do not neglect pests and diseases. Get advice at once.

Economics.

The price of sugar fluctuates from year to year, this being largely caused by seasonal variations. Under favourable climatic conditions over-production takes place, and this entails export of sugar abroad. The Australian price, which is at the present time £26 per ton, has to be pooled with the price that can be obtained for the product overseas. The amount received, therefore, varies in the proportion of exported sugar to that used for home consumption. The Queensland Government established a Sugar Board which deals with this aspect of the question and makes arrangements for the refining of the raw sugar. Arrangements have also to be made with the Commonwealth Bank respecting the financing of the exportable sugar. There is at the present time an embargo existing which prevents the importation of cheaply grown sugar from abroad, such sugar being produced by coloured labour. The price of sugar for the past three years has been as follows:—

	£	*s.*	*d.*
1925	19	10	7
1926	24	10	10
1927	22	0	4

The exportable sugar for these years was:—

	Tons.
1925	211,000
1926	74,777
1927	152,384

On the price of sugar depends the price paid to the farmers for cane. This is regulated by another Board created by the Queensland Government, called the Central Sugar Cane Prices Board.

The value of sugar produced in Queensland in 1927 was over £11,000,000.

A Local Cane Prices Board is constituted under the Regulation of Sugar Cane Prices Acts for nearly every mill in the State, on which boards the canegrowers have equal representation with the millowners. These boards have independent chairmen. The boards meet annually to fix the price of cane and the conditions governing the delivery of same. An Award is made; but should either side consider it unfair or unjust an appeal lies to the Central Board.

The Cane Prices Boards watch the farmers' interests.

Prices are fixed in accordance with the analyses of the cane at most of the mills—that is, the growers are paid on what is known as the commercial cane sugar in the cane. The Central Board also restricts the growing of disapproved varieties of cane—i.e., those with low sugar content or which for other reasons are not considered suitable. Cane testers are employed at the mills to safeguard farmers' interests. Their duties include the supervision of the weighing, sampling, and the analyses of the cane. This ensures the canegrowers getting a fair deal. The average price paid for cane in 1914 was only £1 3s. per ton. During the last two years the average price has been about £2 1s. 3d. per ton. It can safely be said that the operation of the Cane Prices Act has put over one and a-half million sterling into the pockets of the Queensland canegrowers than would otherwise have been the case.

The following is a specimen of a Cane Prices Board Award:—

Percentage of Commercial Cane Sugar.	When 94 N.T. sugar is £21 1s. per ton.	Increase or Decrease per £1 above or below £21 1s. 0d.
	£ s. d.	s. d.
7	0 12 5	0 7
8	0 16 2	0 9
9	0 19 11	0 11
10	1 3 8	1 1
11	1 7 5	1 4
12	1 11 2	1 6
13	1 14 11	1 8
14	1 18 8	1 10
15	2 2 5	2 0
16	2 6 2	2 2
17	2 9 11	2 5
18	2 13 8	2 7

Deductions are made for burnt cane, diseased cane, bad topping, trashy or dirty cane.

Labour.

The wages paid to field labourers and canecutters are governed by Awards of the Board of Trade, and these are altered from time to time. The Award now existing is as follows:—

WAGES.

The rate of wages to be paid to employees shall not be less than the following:—

——	No. 1 District.	No. 2 District.	No. 3 District.
	Per Hour.	Per Hour.	Per Hour.
	s. d.	*s. d.*	*s. d.*
(1) Field workers, over 18 years of age ..	2 $4\frac{9}{11}$	2 $3\frac{2}{11}$	2 $2\frac{1}{11}$
(2) Youths from 14 to 16 years of age ..	1 $3\frac{3}{11}$	1 $1\frac{10}{11}$	1 $0\frac{9}{11}$
Youths from 16 to 18 years of age ..	1 $6\frac{3}{11}$	1 $5\frac{2}{11}$	1 $3\frac{3}{11}$
Cane cutters (day labour)	2 $10\frac{9}{11}$	2 $8\frac{7}{11}$	2 $7\frac{9}{11}$
	Per Week.	Per Week.	Per Week.
Field workers (over 18 years of age) engaged by the week	£ *s. d.* 4 16 0	£ *s. d.* 4 10 0	£ *s. d.* 4 6 0

CANECUTTING—WAGES AND CONDITIONS.

(1) Notwithstanding the rate hereinbefore provided for canecutters' day labour, an employee may contract with his employer to cut cane at piecework rates.

No canecutter shall be employed other than by day labour or at piecework rates.

(2) The minimum rates which shall be paid by the employer for cutting cane for harvesting at piecework rates shall be according to the following scale:—

——	No. 1 District.	No. 2 District.	No. 3 District.
	s. d.	*s. d.*	*s. d.*
15 tons to the acre and over	8 0	7 9	7 6
14 to 15 tons to the acre	8 3	8 6	7 9
13 to 14 tons to the acre	8 6	8 3	8 0
12 to 13 tons to the acre	9 0	8 9	8 6
11 to 12 tons to the acre	9 6	9 3	9 0
10 to 11 tons to the acre	9 9	9 6	9 3
9 to 10 tons to the acre	10 8	10 5	10 2
8 to 9 tons to the acre	11 2	10 11	10 8
7 to 8 tons to the acre	11 8	11 5	11 2
6 to 7 tons to the acre	13 2	12 11	12 8
5 to 6 tons to the acre	16 2	15 11	15 8

The rates for canecutting in the Proserpine district shall be 1½d. per ton more than those in the No. 2 district.

A Form of Agreement for cutting is provided in the Award, and can generally be bought at printers' and stationers' shops in canegrowing districts.

No agricultural industry in Australia employs so much manual labour or distributes so much capital.

Cost of Production of Cane.

This naturally varies in different localities and under seasonal variations. The cost in one district is often totally different to the cost in another. The more cane produced per acre the lower, as a rule, is the cost of production of a ton of cane. There are so many factors entering into the cost of production that it is not possible at present to give definite figures.

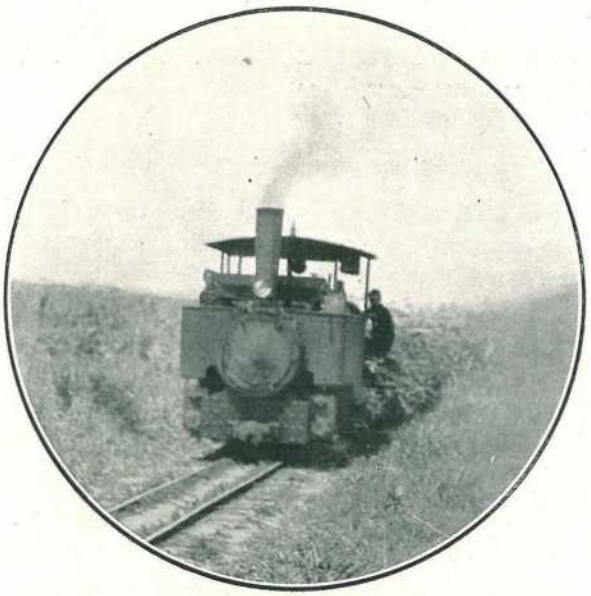


PLATE 8.—HAULING CANE TO THE MILL.

Government Assistance.

The Bureau of Sugar Experiment Stations, a sub-branch of the Department of Agriculture, was established by the Queensland Government in 1900.

This institution has at present three Sugar Experiment Stations—one at Mackay, one at Bundaberg, and a third on the Johnstone River near Innisfail. Laboratories are established at which soil investigations are undertaken, and analyses of fertilisers, limestones, waters, sugar-canes, and sugar-mill products are carried out for growers and millers.

The introduction of new varieties of cane from other countries and the raising of a large number of seedling canes is a part of the work of the Bureau. The testing of these upon commercial lines in laboratory and field entails much investigation. In addition to this, experiments in cultivation, rotation, fertilising, and irrigation are carried out.

Entomological Stations are in existence at Bundaberg, Mackay, and Cairns. Pathological investigations into diseases of sugar-cane are carried out by a staff of trained men.

Queensland's sugar production in 1870 was 2,854 tons; and in 1927 was 485,745 tons.

Financial Aid.

The Government assist farmers through the Agricultural Bank. The maximum amount that may be advanced to any one individual cane farmer or on any separate proposition is £1,700. The money may be utilised for the payment of liabilities already existing, the effecting of improvements, purchase of stock and plant, and for other purposes in connection with the undertaking.

The rate of interest on loans, excluding those discharging liabilities, is at present 5 per cent. per annum. The rate of interest for advances involving the discharge of liabilities for purchase money or mortgages is 6 per cent.

The term of the loan is fixed when the advance is approved, up to a maximum of twenty-five years, which includes a period of five years during which interest only is payable.

General details as to the securities required and other conditions attaching to advances may be ascertained on reference to the pamphlet issued by the bank.

It may be pointed out that many of the growers obtain seasonal assistance on the security of crop liens, to which the bank usually raises no objection in cases where it is interested.

Many thousands of pounds have been granted to growers in the principal canegrowing districts of Queensland. A large proportion of such advances was made for the purpose of releasing existing liabilities on the holdings.

If you like the "Journal," kindly bring it under the notice of your neighbours who are not already subscribers. To farmers it is free and the annual charge of one shilling is merely to cover postage for the twelve months.

RURAL ROUTES IN QUEENSLAND.

THE WORK OF THE MAIN ROADS COMMISSION.

The Seventh Annual Report of the Main Roads Commission, from which the subjoined notes have been taken, commends itself strongly to all concerned with rural progress in Queensland.

A web of well-constructed arterial highways is spreading gradually over the State. This is a result of the soundly organised work of the Commission in conjunction, when necessary, with Local Authorities. A survey of a year's achievements leaves the impression that the Commission is one of the most important factors in our country life.

Through the courtesy of the Commission we are enabled to reproduce some of the excellent plates included in its Report, and which illustrate the immense value of its community services.—Ed.

SUMMARY OF OPERATIONS.

IN the course of the year a length of 683 miles of main roads was gazetted, while the total of developmental roads was increased by 104 miles. This makes the total lengths as at 30th June, 1928—5,576 and 362 miles respectively.

Two hundred and twenty-eight miles of road were completed and 130 miles were partially completed during 1927-28 in the area of ninety-four Local Authorities. In addition 2,035 lineal feet of bridges and culverts over 3-feet span were completed and 3,327 lineal feet were partially built. This makes the total length of works completed (and the equivalent in partially constructed work) 890 miles of road and 13,200 lineal feet of bridges, representing an approximate average cost of £3,321 per mile, inclusive of bridges, a number of which have been of some magnitude, or £2,763 per mile, exclusive of bridges.

Maintenance works were carried out on over 5,030 miles of road in 113 Local Authority areas. These works included the reconstruction and maintenance of bridges, and complete patrolling and seasonal maintenance of roads constructed under the Main Roads Acts and Federal Aid Roads Agreement.

Compared with the year ending 30th June, 1927, the number of Local Authority areas in which permanent works and maintenance has been carried out has increased by 12 and 9 respectively.

It is interesting to compare road expenditure in this State with that of the United States, with its population of 115,000,000 and area of 3,027,000 square miles. The annual main road expenditure of the United States approximates 23s. 3d. per head or £44 per square mile. Queensland, with a population of 911,700, expended last financial year an amount of £678,399 on permanent works on main roads, equal to 15s. per head or £1 0s. 3d. per square mile. The total expenditure incurred by the Commission on permanent works and maintenance for the year amounts to 18s. 2d. per head or £1 4s. per square mile.

The average costs under the Federal Aid programme in the United States of America for the fiscal year 1928 are between £5,000 and £6,000 a mile, but in Queensland it is necessary to make our money go nearly twice as far.

The ratios of mileage completed during last year to population in Queensland amounted to 1 to 3,400, as compared with that of the United States of America in the year 1924, viz., 1 to 7,400. This comparison is not intended to show that road work is being carried out more cheaply than in the United States of America, but to show that we are endeavouring to serve our vast areas and sparse population in the way most needed.

The report of the British Ministry of Transport 1926-27 indicates main road allocations of £18,050,000. It is worthy of note that maintenance costs in Great Britain have increased from £273 per mile in 1921-22 to £356 per mile in 1925-26.

It is common to read of the advocacy of the construction of hundreds of miles of roads paralleling our western railways. A moment's thought will convince most

people that the interest, redemption, and maintenance would be much greater than the possible return, and that road construction is much more urgently needed in other directions. This does not, of course, apply to the construction of bridges or flood crossings on the type of route mentioned, the want of which is often a serious drawback.

A bulletin setting forth the results of labours and investigation by the Commissioner's officers into the aspects of road building, trend of motor vehicle registration, census of traffic, road protection regulations, soil sampling and examination and its practical application to road building is in process of collation.

It may be asserted confidently that, with the technical staff available well seconded by an accounting and clerical staff which has given of its best, the maximum output of work consistent with economical design, construction, and maintenance has been achieved.

The Local Authorities have in most cases effectively supervised and aided construction under the direction of the Commissioner's engineers, who have maintained close touch with the Local Authorities and have made full use of the local knowledge so necessary for the practical solution of many phases of road building.

PLATE 9.—ISISFORD SHIRE.

Reinforced Concrete Bridge over the Barcoo River, near Isisford, on Isisford–Emmett Road, in course of construction.

Failures of work have been of a minor nature and have always been turned to profit by the avoidance of similar mistakes in future works.

The recording and investigation of any defects appearing is a most important matter if progress is to be maintained, for it would be idle to claim that all work executed under so great a scheme as the main roads one has reached the acme of perfection. In a few instances deliberate risk of surface failure has been taken on short sections with a view to ascertaining whether economy could be effected in paving thickness or by the use of local materials.

In the course of the Report the finished jobs and works in progress in different parts of the State, both in agricultural and pastoral districts, are interestingly reviewed, and a full list of them is included. The Report also contains much useful information as to specified requirements in respect to different classes of jobs undertaken by the Commission, as well as plans and plates showing the several methods of construction adopted.

PLATE 10.—PIONEER SHIRE.
A Bitumen-surfaced road through canefields, Mackay District.

PLATE 11.—PIONEER SHIRE.
Mount Ossa–Kungurri Road, which will serve recent settlement in sugar-growing country.

PLATE 12.—GAYNDAH SHIRE. GAYNDAH–GOOMERI ROAD.

Curved reinforced concrete low-level bridge over Barambah Creek, replacing an old crossing upon which traffic was regularly blocked for several months in the year. Maximum flood-level, 90 feet above stream bed.

PLATE 13.—KOLAN SHIRE. GIN GIN–MIRIAM VALE ROAD.

Black Gully Bridge, typical of many similar structures erected in the course of the year.

PLATE 14.—KOLAN SHIRE.
Gin Gin–Miriam Vale Road, showing a gravelled section.

PLATE 15.—CLIFTON SHIRE. TOOWOOMBA–GOONDIWINDI ROAD.
Gravelled section in the wheat area.

PLATE 16.—SHIRES OF TARAMPA AND CAMBOOYA.
Heifer Creek deviation, on the direct road between Clifton and Grantham.

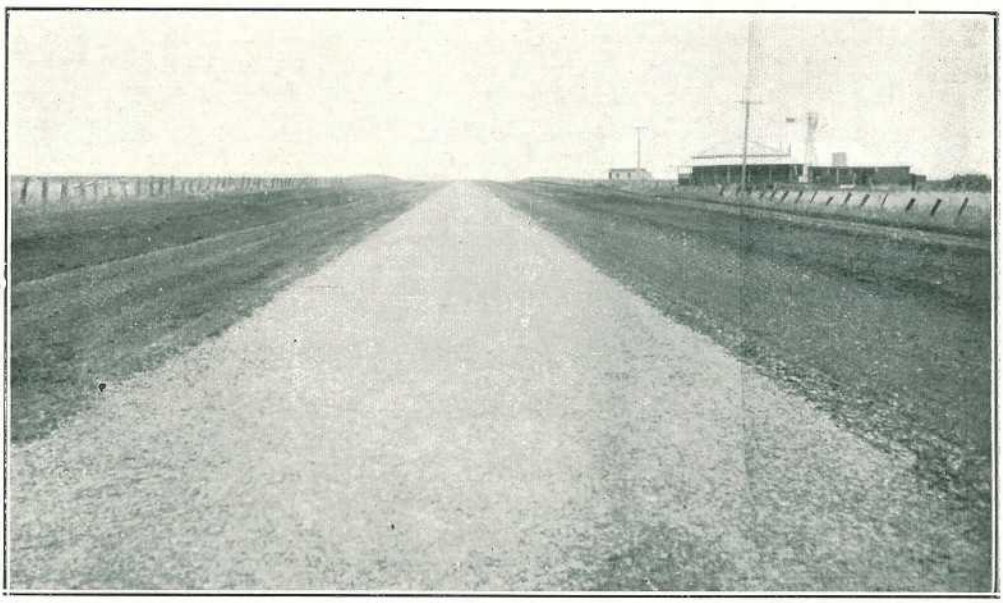


PLATE 17.—CAMBOOYA SHIRE. CAMBOOYA–GOONDIWINDI ROAD.
Heavy traffic—penetration bituminous macadam—section over black soil.

PLATE 18.—INGLEWOOD SHIRE.
Gravelled section, Inglewood-Texas Road.

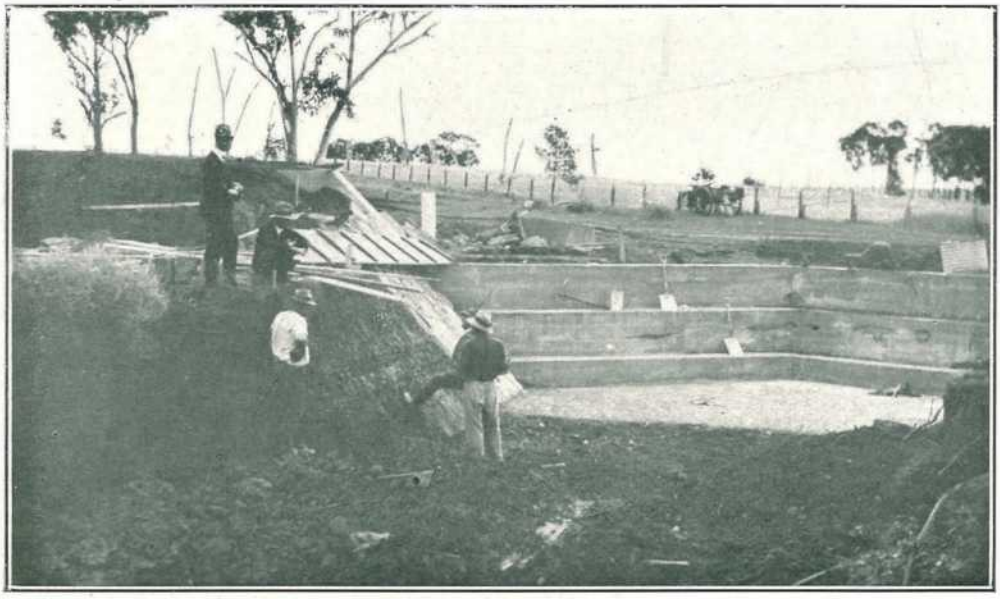


PLATE 19.—BUNGIL SHIRE. ROMA–NORTHERN ROAD.
Arresting creek erosion across road by V concrete drops.

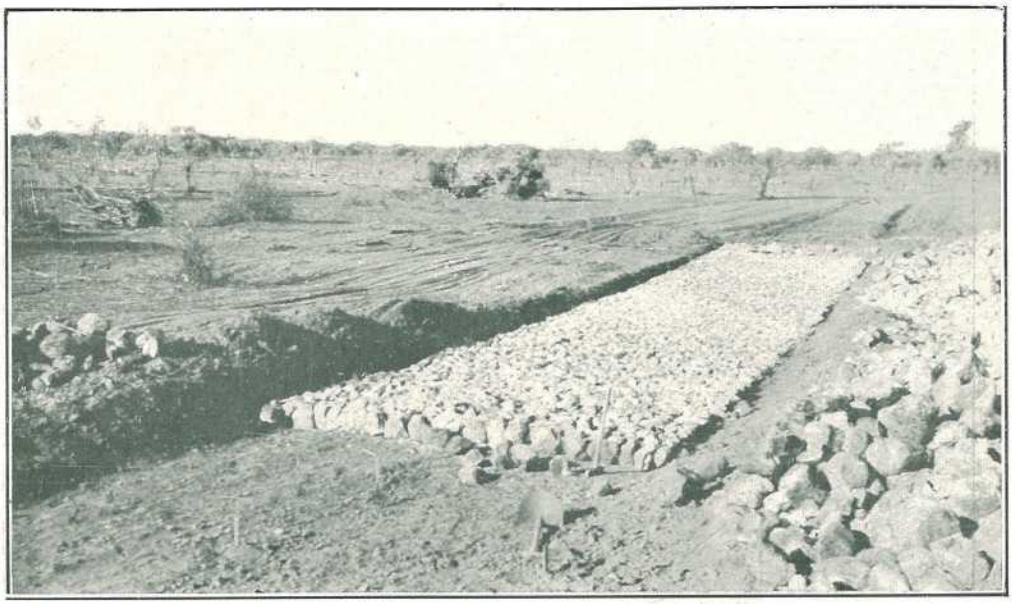


PLATE 20.—SHIRE OF BULLO. QUILPIE–EROMANGA ROAD.
Typical flood invert under construction.

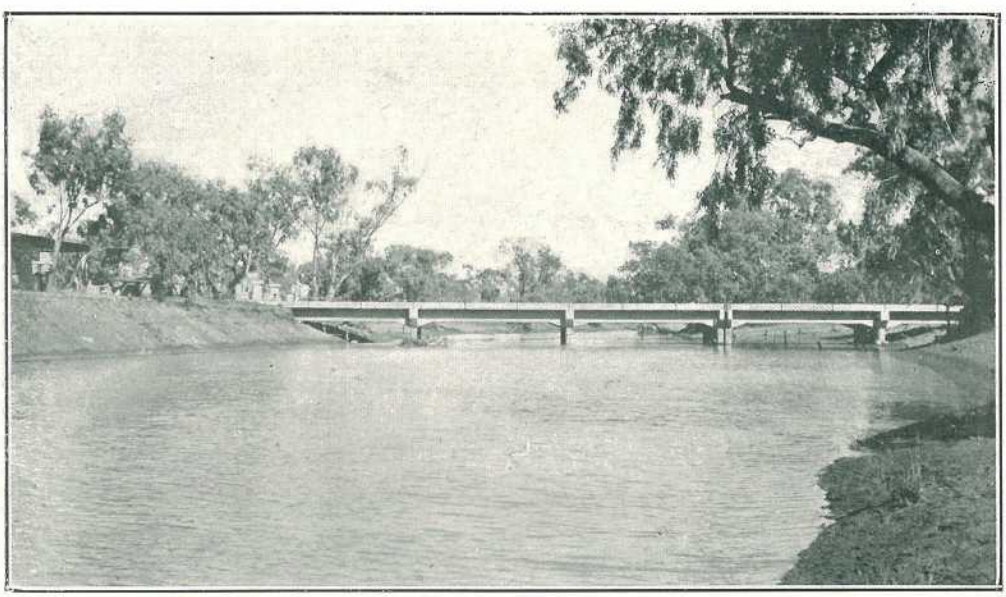


PLATE 21.—PAROO SHIRE.
Low-level reinforced concrete bridge over Paroo River at Eulo, on Cunnamulla–Thargomindah Road.

PLATE 22.—BEAUDESERT SHIRE.
Brisbane–Mt. Lindsay Arterial Interstate Road, showing intermediate course of metal now being covered with penetration bituminous macadam.

PLATE 23.—MAIN SOUTH COAST ROAD. COOMBABAH CREEK BRIDGE, SOUTHPORT DEVIATION.

PLATE 24.—MAIN SOUTH COAST ROAD, NEAR SOUTHPORT,
showing timber groynes and brush fences which have arrested wave action.

PLATE 25.—NERANG SHIRE. MUDGEERABA–SPRINGBROOK ROAD,
on which one-way traffic is regulated.

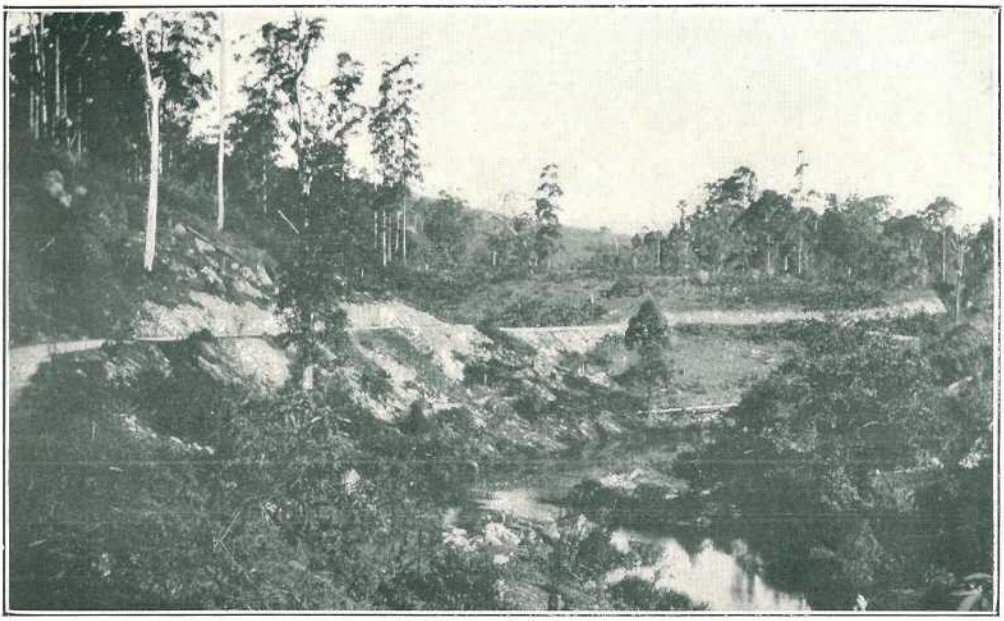


PLATE 26.—SHIRE OF NERANG. CURRUMBIN CREEK DEVIATION, which eliminates several creek crossings and steep gradients.

QUEENSLAND RAIN-FOREST TREES.

By W. D. FRANCIS, Assistant Government Botanist.

The tree which is the subject of this note and the accompanying illustrations is sometimes known as Yellow Tulip. This name originates from the remarkable resemblance of the bark to that of the Tulip or Tulipwood. The colour and markings of the bark are very similar in the two trees. In botanical terminology the Yellow Tulip is known as *Hemicycl'a australasica*. The Tulip or Tulipwood is *Harpullia pendula*. The Yellow Tulip is a very common tree in many of the rain forests or "scrubs" from Port Macquarie, New South Wales (J. H. Maiden) to Cairns in North Queensland. It also occurs on Lord Howe Island. It appears to be most common in the scrubs of the drier areas or on fairly dry ridges. The trees attain a height of about 90 feet, and a stem diameter of about 2 feet, but the majority of the trees met with are much smaller. The freshly-cut wood is pale yellow in colour. It is very finely grained, fairly heavy, uniformly coloured, and not highly figured. Mr. E. H. Swain ("The Timbers and Forest Products of Queensland," p. 322) states that the wood could be used in place of English Boxwoods for rules, gauges, and small turnery. He quotes Mr. R. T. Baker to the effect that it would make good heads for golf clubs. The wood is not comparable with Tulip in colouring or ornamental effect. The Tulip, which is also a native rain-forest species, will be illustrated and remarked upon in a future issue.

Photo.: W. D. Francis.]

PLATE 27.—YELLOW TULIP (*Hemicyclia australasica*).

A tree in the Kin Kin Rain-forest.

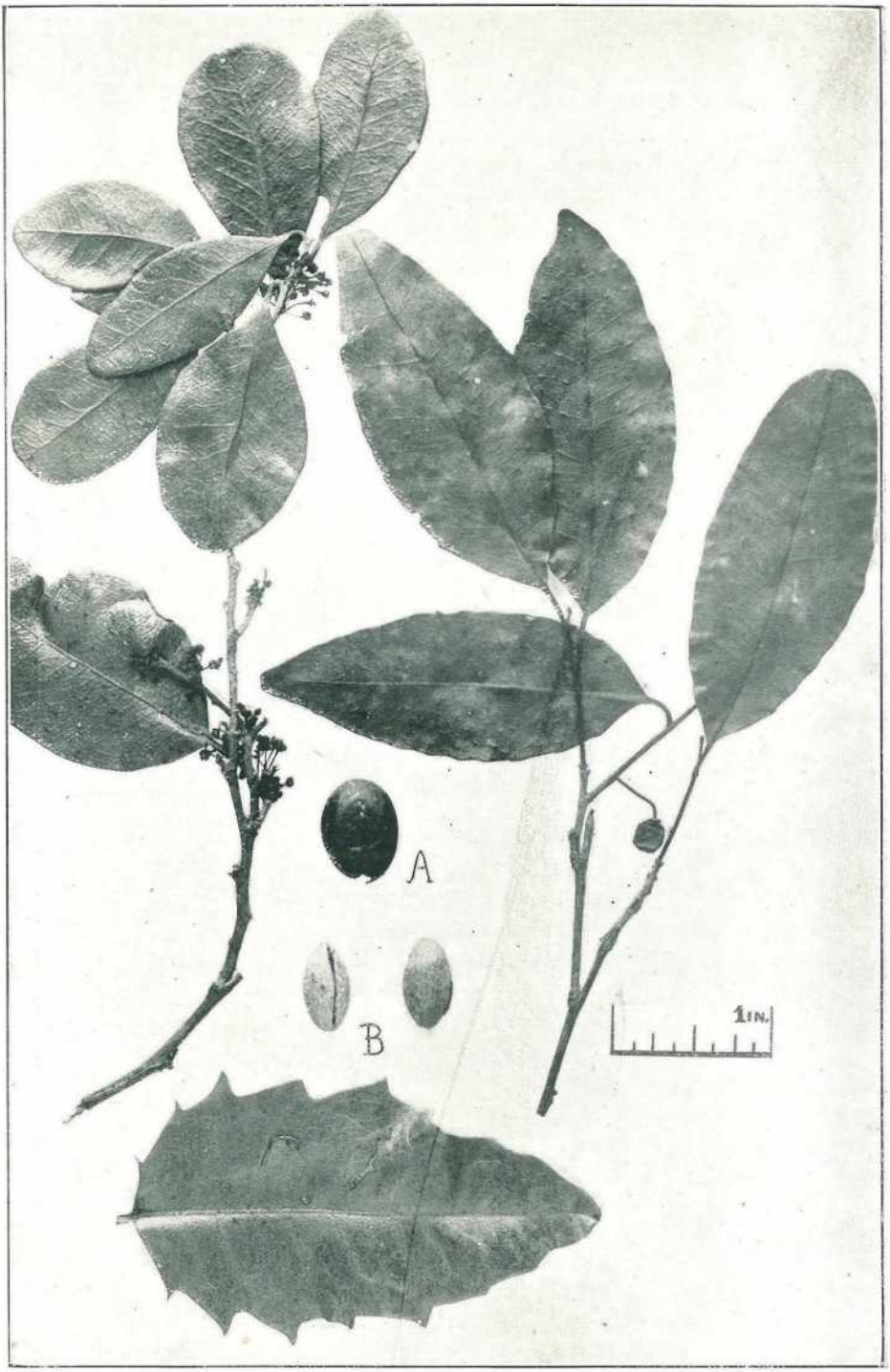


Photo.: Dept. Agriculture and Stock.]

PLATE 28.—YELLOW TULIP (*Hemicyclia australasica*).

The twig on left is flower-bearing; the one on the right bears an immature fruit.
The leaf below is from a coppice shoot.
A, dry fruit; B, hard, inner part of fruit containing the seed.

THE QUALITY OF QUEENSLAND BANANAS.

The Deputy Premier and Minister for Agriculture (Mr. W. Forgan Smith) made the following statement to the Press recently:—The statement attributed to Mr. Minns, of the Metropolitan Markets, Melbourne, regarding Queensland bananas, cannot be allowed to pass without some comment. His reference to bananas not being fit for pig food is the kind of broad sweeping statement that we are becoming used to from certain sources. The effort that was made by certain interests to prevent Queensland meat being sold in Victoria will be remembered. The Victorian State authorities have ample power under their domestic legislation to protect the public against the sale of any product unfit for human use.

Fruit is a commodity that is perishable in character, and in all markets throughout Australia and throughout the world large quantities have often to be condemned, and, no doubt, occasion for this arises with regard to every product.

Queensland imports potatoes, apples, and other products from Victoria, and quite frequently quantities have to be condemned on arrival here. These things happen in the ordinary course of events, and officers are employed by the Health and Agricultural Departments to protect the public in regard to food values of produce offered for sale. Victoria is a large fruit producer, and the fewer bananas sold in that State the greater demand there would be for their own locally grown products. This establishes a form of interest and causes propaganda to be used similar to that with which we became familiar in connection with chilled meat from Queensland. The Queensland Government suggested to the other States (Victoria included) that they should adopt certain minimum standards for bananas, and in every way we have helped within our constitutional powers to see that only suitable qualities are marketed.

Maintenance of Grades and Standards.

Farmers themselves, in regard to the production of all commodities, should exercise the utmost care in ensuring that grades and standards are maintained, and the highest possible marketing conditions established. It is interesting to note that much of the current public comment synchronises with the attempt by the banana growers' own organisation to establish a more orderly form of marketing which is designed to give the form of control that is necessary to maintain high standards. If this is carried out properly, a marketing and ripening system can be inaugurated which will cause many of the present difficulties to disappear, but in adopting such a system certain people who get a large rake-off under present conditions may be affected; hence the hostile propaganda that is at present being used.

Some Causes of Low Quality.

The reference in leading articles in certain newspapers to taxation and wages is quite beside the point, cutters and packers being the only ones covered by the basic wage in the banana industry, and very few men are employed as wage earners. Surely no one can argue that a protected industry should deny workers reasonable wages standards. The reference in the "Courier" leading article to the average income of banana growers is based on a broad arbitrary generalisation which trained economists would be very cautious in accepting. Time and again this Department has called attention to the causes of the difficulties from the point of view of production. These are—

(1) The attempt to grow bananas on land not suitable for the purpose;

(2) The harvesting of bananas on land of depleted fertility;

(3) Faulty methods of cultivation; and

(4) Faulty packing and inefficient methods of ripening.

Protect Queensland's Interests.

These phases of the industry can, of course, be unduly emphasised, for a large proportion of banana growers are alive to the position, and are producing and marketing bananas of good quality, and those men are making a fair living. With proper methods of cultivation and suitable land, and with proper marketing organisation, the industry can be stabilised and give a remunerative return to a large section of the population. Newspapers in their comments on this industry should guard themselves against being used for purposes antagonistic to Queensland interests.

Answers to Correspondents.

BOTANY.

The following replies have been selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.:—

Johnson Grass.

W.D.D. (Rosewood)—

Your specimen is the Johnson Grass (*Sorghum halepense*), introduced into Queensland many years ago and highly boomed as a fodder. There is no doubt that Johnson Grass provides a great deal of forage, but its habit of spreading by means of long underground rhizomes or runners renders it a pest in cultivation, and it is generally recommended that where it is desired to use it as a fodder that the field should be devoted to Johnson Grass and to nothing else. The grass is better suited to cutting than to feeding off. Like other members of the Sorghum genus (''family''), care must be exercised in feeding, as it contains a prussic acid yielding glucoside which has proved fatal to stock on one or two occasions in Queensland. Therefore, it is best, perhaps, to cut the grass and allow it to wilt for a short time before feeding. The same remarks, of course, apply to Sudan Grass, Imphee, and other members of the Sorphum genus.

Specimens Identified.

S.F.L. (Samford)—Your specimens are:—

1. *Smilax australis.* A climbing plant of the family Liliaceæ, belonging to the same genus (*Smilax*) as the sarsaparilla of commerce.
2. *Bæckea virgata.* Family Myrtaceæ. A small shrub common on the creek sides in South-eastern Queensland. It is also found in New Caledonia. The name ''Wild May'' is, I think, more commonly applied to an allied plant—*Leptospermum flavescens,* with somewhat larger flowers. The name, however, is quite appropriate.
3. *Polygonum lapathifolium.* Family Polygonaceæ. ''Smart Weed'' or ''Water Pepper.''
4. *Mallotus claoxyloides.* Family Euphorbiaceæ.
5. *Solanum sodomæum,* the Apple of Sodom or Devil's Apple. A native of the Mediterranean region naturalised in various parts of the world.
6. *Solanum aculeatissimum,* the Devil's Apple. A native of South America now naturalised in many parts of the world.
7. *Mezoneurum Scortechinii.* Family Leguminoseæ. Commonly known as Barrister or Wait-a-While; the latter name is applied to a good number of prickly vines.
8. *Homalanthus stillingiæfolius.* Family Euphorbiaceæ. I do not know a common name for it.

Wild Radish or Wild Turnip.

C.H. (Proston)—

Your specimen is *Raphanus raphinistrum,* the Jointed Charlock or Wild Radish, also commonly known as Wild Turnip and by other names. The weed is a common European one that is now widely spread over the cooler parts of the world. It is not known to be poisonous, but like other members of the turnip and cabbage family, if eaten in quantity it will cause hoven or bloat if the animals have fairly empty stomachs.

Dodder.

J.M. (Nanango)—

Spraying infected patches of Dodder with a dip mixture should be successful. Spraying of Dodder in other places has been done with success. This plant can be spread by grazing stock eating the plant containing the seeds, the seeds afterwards germinating; the plant can also be spread by broken parts being carried about from one place to another. It is hard to say how it has got into your place, but the particular sort of Dodder you sent is quite commonly seen as a pest growing over weeds, &c., in paddocks and along railway lines. Keeping the paddock closely grazed or cut would assist in eradicating the Dodder if the plant proves troublesome.

FORAGE POISONING IN ANIMALS.*

SYMPTOMS AND CAUSES.

Though forage, or fodder, poisoning is microbic in origin like anthrax, tuberculosis, &c., it differs from those diseases in that it is not necessary for the microbe to attack the animal directly; that is, to invade its body. The microbe is in the feed, and it is there that it does its deadly work (states a bulletin written by Dr. H. R. Seddon and Mr. G. Edgar, and issued by the New South Wales Department of Agriculture). The microbe, moreover, does not cause any disease in living plants, but attacks them only after death, usually growing and multiplying with the microbes that produce decomposition.

The particular microbe that causes forage poisoning is *Bacillus botulinus*. Four distinct types of it are known to exist, and while the symptoms produced by all are identical, differences exist in the poison produced by each type. Horses are most commonly attacked, because they are fed more on prepared fodder than other animals. However, cases in cattle are by no means uncommon, and even sheep and pigs may be affected at times.

Inability to swallow food is the most important symptom of the disease, and one on which chief reliance is placed for diagnosis. As might be expected, there are various degrees of poisoning, depending on how much toxin the animal has absorbed. The acute type follows on the taking into the system of a large quantity of poison, and its onset is sudden and course rapid. Careful observation will reveal listlessness, slight inco-ordination in gait and clumsiness in eating. Then follows the typical symptoms of "paralysis" of the tongue, and the muscles which perform the act of swallowing, salivation being marked at this stage. The duration of these symptoms varies. Sometimes they are manifested for several hours, even a day or more, but in others they may be of much shorter duration, and particularly if they occur at night, or at other times, when the animal is not under close observation, they may escape notice altogether.

Following the paralysis of the tongue and throat, the animal loses co-ordination of the limbs, and usually soon goes down. This may, in fact, on account of the non-observation of earlier symptoms, be the first thing noticed in very acute forms of the disease. There are no manifestations of pain, but the animal struggles ineffectively to regain its feet, these efforts ultimately passing to a paddling action with both the fore and hind limbs. This action is not continuous, but occurs at somewhat frequent intervals after the animal goes down. Affected animals are usually constipated, owing to a certain degree of paralysis of the muscles of the walls of the bowels. The temperature is usually lower than normal, except in cases where the animal becomes distressed to some extent from struggling, but it is never high. Respirations are slower, but the pulse rapid. Affected animals may lie on the ground for one to three or four days, depending upon the amount of poison (toxin) that has been absorbed. Finally, however, death supervenes, the animal being conscious almost to the end.

A chronic form of the disease has been termed "sleepy staggers," and such indicates very clearly the symptoms shown by an animal. It is dull and listless, and shows a distinct disinclination to move; when made to do so, it is noticed that the gait is laboured, the feet not being lifted clear of the ground, and the step is short. Salivation and nasal discharge are fairly profuse, and though swallowing is extremely difficult it is not entirely suspended. The animal is able to swallow small quantities of food provided it is moist, but has great difficulty in swallowing dry food. Mastication is extremely slow, and a proportion of the food drops from the mouth. Animals suffering from this form may live for weeks and gradually waste away, the abdomen assuming a pronounced "tucked-up" appearance. A very small number of chronic cases recover, but convalescence is very prolonged. It must be emphasised, however, that all stages intermediate between the acute and chronic types of the disease may occur.

It is said that any kind of fodder may at times be infected with the microbe, and though it may be found in pastures as well, the experience in Australia is that in the great majority of cases, animals which have been fed on some form of conserved fodder—hay, chaff, grain, or silage—are affected. It is found, however, that certain of these fodders are more liable than others to be dangerous, and to realise why this should be it is necessary to review what is known of the causal microbe; where it is found, how it may get into fodder, and how it grows and produces its poison therein.

* From the "Pastoral Review" for October, 1928.

The microbe may be found in soil, dust, or water, and ordinarily lives therein, gaining its nutriment from dead (decomposing) vegetable material. It is not capable of directly attacking plants or animals in the living state. The writers of the bulletin state that no exact knowledge is available as to how common it is in the soils of New South Wales, but such examinations have been made in other countries (and are being made in Australia), and give grounds for the belief that it is far from uncommon. This is supported by the fact that cases of the disease have been met with in recent years in the Young, Warren, Coonamble, Gundagai, Murwillumbah, Inverell, Riverina, and Narrabri districts of New South Wales.

Being in the soil, the microbe easily gains access to such fodders as hay, chaff, and silage, per medium of the dust raised from the surface soil. It then requires suitable conditions of moisture and warmth in order to multiply. The microbe is microscopic, and even when multiplying in fodder does not produce any recognisable changes. Conditions which favour its growth, however, also favour the growth of other micro-organisms, particularly moulds, and thus it is frequently found growing in mouldy fodder. This, however, is not entirely a chance arrangement, for whereas ordinarily this bacillus can grow only in the absence of air, it can grow in fodder exposed to air if it has a mould growing over it. Thus mouldy fodders are more liable to contain the microbe and be dangerous.

Silage is specially liable to be attacked, owing to two factors—(1) its high moisture content, and (2) its liability to become mouldy. As is well known, a well-prepared pit or silo of silage shows no mould through the greater part of the stack, but only on the surface, and it is just this mouldy surface layer which is liable to be dangerous. If silage be exposed, however—particularly if a pit be opened and exposed to the weather—the exposed part, previously sound, becomes mouldy, and, if it has been contaminated by soil containing the microbe, is liable to contain the poison and to be dangerous. The point is that good, wholesome silage is not likely to be harmful. Damaged mouldy ensilage may be dangerous, and should not be fed.

While closely-cropped grass is not likely to be dangerous, tussocky grass, particularly the rank growths found near creek beds or on inundated land, may easily contain much dead material, both leaf and stalk, and such clumps may be somewhat damaged and mouldy about the butt. Also in harvest fields, where winnowing is carried out in the paddock, the site of the winnowing operations may be a danger spot. When rain has fallen the sprouted grain is readily sought by any animals which may be grazing in the paddock, and as they nose about in search of it are likely to gather some decomposing harvest refuse. Such material offers most suitable conditions for the multiplication of the poison-producing microbe, and there are several cases on record of the disease having been contracted under these circumstances.

There are two other facts concernng the poison that must be borne in mind—namely, that among poisons it is ranked as one of the most powerful, and that it is soluble in water.

In consequence of the latter it is easily washed from that part of a stack where it was produced to some other part, and thus it may be found that fodder which appears quite sound itself may, by havng been overlaid with damaged fodder and exposed to rain, have had sufficient of the poison washed into it to cause the disease. A further point is that as the poison is so powerful, sufficient to cause mortality may be produced in small "pockets" of mould in the fodder, such pockets being so small and infrequent as to be easily overlooked.

It is not always possible to determine how the fodder has become harmful, and frequently it is impossible to detect the microbe in the suspected material. The issue is further complicated by the fact that in common with other bacterial poisons, but unlike such poisons as strychnine and arsenic, this poison produces its effects only after an interval of some days, usually three to seven. Thus, it is not the feed the animal ate the day before it became ill, but that eaten a week before, that contained the poison.

In the absence of any reliable means of telling if fodder is infected with the microbe or otherwise, owners of stock should, as far as possible, see (*a*) that only sound stuff is fed, (*b*) that where fodder is badly damaged, such damaged portions are burnt, and (*c*) that in order to minimise such loss of fodder, proper care is taken in the protection of stacks, &c., from (1) the effects of wet weather, and (2) attacks by mice.

At the present time there is no method that can be relied upon for the successful treatment of affected animals. It is possible to immunise animals against the condition by means of an antitoxin, but such is very costly and the immunity of short duration, and, with the disease affecting such comparatively small numbers of animals, and being of uncertain occurrence, immunisation is not a practical measure for the control of the disease.

THE PRACTICAL APPLICATION OF METEOROLOGY TO AGRICULTURE.*

WEATHER FORECASTS—CLIMATOLOGY—WIRELESS ON THE FARM.

The progress, attained since the war, in the technique and distribution of weather forecasts, and in the use of meteorological apparatus adapted to agricultural needs, has convinced the rural population of the older countries of the advantages which they can derive from the two principal branches of meteorology—weather forecasting and climatology.

Since its formation, in 1921, the French National Meteorological Office has seen, each year, a growth in the demand for information on the part of agriculturists, viticulturists, horticulturists, agricultural syndicates, &c. For the first time in France, the establishment of a close collaboration between agriculturists and meteorologists is in a fair way towards realisation. Meteorologists now know exactly what is required by agriculturists, who, in their turn, know more precisely what they may expect from meteorological science.

The subjoined account of the way in which meteorology is applied to agriculture in Europe is therefore of especial interest to Queensland farmers.

I. WEATHER FORECASTS.

Principles of Weather Forecasts.

FORE-KNOWLEDGE of the weather of to-morrow and the following days is of the utmost interest to the farmer, especially in certain seasons. The question of weather forecasting has occupied the attention of agricultural circles from remote times, though it was not until the second half of the nineteenth century that it was solved scientifically. In 1857, the French astronomer, Le Verrier, concluded that it would be possible, from daily meteorological charts, to predict some hours in advance the arrival of atmospheric disturbances, and, in consequence, probable changes in weather. The principle of scientific forecasting of weather has made much progress since that time. Wireless, in particular, has allowed the construction of more complete charts, through rapid centralisation of observations, not merely from the whole of Europe and Northern Africa, but from ships at sea, especially those in the Atlantic. This last information has the immense advantage of giving information of the arrival of disturbances from the Atlantic, to which France is specially exposed by reason of its geographical situation on the West of Europe.

There were three principal stages in the successive improvement of the technique of weather forecasting—

(1) Up to 1914, forecasts were based almost exclusively on the examination of isobar charts. These charts show the zones in which pressure decreases from the outside to the centre (depression) or increases from the outside to the centre (anti-cyclone). The track of depressions or anti-cyclones can be followed on charts drawn up every 12 hours; their position 24 hours later can be deduced, and, in consequence, the weather they will bring to the district under consideration can be forecast. These deductions, unfortunately, are not always correct. The movement of depressions which, in general, takes place from west to east is not always very regular. The track curls and turns back, the speed is variable and, like that of anti-cyclones, the track is influenced by many factors. It is the resultant of all these factors which determines the movement of pressure centres, and the difficulty of forecasting will, therefore, be understood.

(2) During the war, this method was improved by adding to it the method of barometric variations. There are drawn on charts, lines of equal variations, that is to say, lines passing through all the points at which

*Translated and summarised by Mr. W. R. Black (Ministry of Agriculture and Fisheries, U.K.) from an article by Mons. J. Sanson (Chief of the Climatological Service of the French National Meteorological Office) in "La Grande Revue Agricole," March, 1928, and reprinted from "The Journal of the Ministry of Agriculture," (Great Britain) for October, 1928.

barometric pressure has varied to the same extent during the determined period. These lines show zones of increase or decrease and their track is much more regular than that of depressions or anti-cyclones which they accompany and their speed is fairly constant in each season. A study of their evolution furnishes valuable indications for the forecasting of isobar situations.

(3) There is a striking connection between the zones of variation of pressure and cloud systems. The study of cloud systems is the latest improvement made in the meteorological services of France for weather forecasting. If cloud charts are drawn up it is seen that clouds are grouped in large extended masses which are well-organised and move in a system known as the cloud system, which has four parts: (*a*) A front composed of high clouds partly covering the sky. This first part heralds the approach of a zone of low pressure. (*b*) A centre formed by a uniform veil of clouds of average height accompanied by low clouds giving continuous rain. This centre coincides with the zone of low pressure itself. (*c*) A tail with the sky alternately almost clear and very cloudy from the debris of clouds at all heights, giving a succession of showers, storms and fine weather. This tail accompanies the arrival of the zone of high pressure. (*d*) On the borders of this system, there are margins in which there are only high or average clouds. Cloud systems move most often in a series coming from the south-west, from the west or from the north-west. In the interval between two cloud systems the sky is clear or has local clouds which appear in the morning and disappear at night, but continuous fine weather is only experienced in general in zones of high pressure which are not touched by zones of variations.

It is by the combined study of isobar charts, charts of variation in pressure, and charts of cloud systems that rational forecasts of weather can be made.

Distribution of Agricultural Warnings by Wireless.

Once these weather forecasts are made out, they must be brought to the notice of agriculturists as quickly as possible. Great progress was made in this direction in 1922, when the National Meteorological Office began to distribute its bulletin four times a day by wireless from the Eiffel Tower. These warnings contain, for each of the 12 regions into which France has been divided for the purpose, information on the general character of the weather, wind, rainfall, temperature, and the possibility of dangerous phenomena for agriculture—such as frosts, storms, hail, &c.

Since August, 1927, a further improvement has been introduced into the distribution of these agricultural warnings. The Compagnie Francaise de Radiophonie decided to issue each day, at 7 p.m., an agricultural meteorological communiqué specially adapted to the needs of farmers in the north of France and in the neighbourhood of Paris. This communiqué is drawn up by a group of agricultural experts and practical agriculturists with a high reputation in agricultural circles. They are in daily contact with the forecast service of the National Meteorological Office, and are thus kept in touch with all modifications in the weather situation revealed by the charts mentioned above. Being in full possession of all the facts, they can make such comment on the forecasts drawn up by the National Meteorological Office as will be of use to the rural population, and draw conclusions enabling the latter to employ their time to the best advantage on the morrow (e.g., in cultivations, ploughing, manure-spreading, irrigation, harvesting, &c.). The commentators also report on the need for preventive treatment when the atmospheric conditions are favourable to the development of fungus diseases, or for protective treatment when there is a likelihood of frosts, or for increasing the dressings of certain manures to counteract excessive humidity or drought; the commentators also give advice of a more general kind adapted to the climate of each region—for example, the use of a certain variety of wheat or the possibilities of a catch crop. In short, they give agriculturists, in an assimilable form, the means of drawing the maximum profit from the weather forecasts of the National Meteorological Office.

This innovation could not have been better received in rural circles, and it is hoped, as a result of this initial success, that it will not be long before the regional stations of the National Meteorological Office are provided with sufficient staff and material to enable them to participate in this service. Farmers in all parts of France could thus benefit from communiqués specially drawn up for their respective regions by meteorologists who know the local climatology well, and who work in the closest collaboration with practical agriculturists of the country.

II. CLIMATOLOGY.

(a) General Application of Climatology in the Improvement of Crops.

Weather forecasting is not, as generally thought, the only branch of meteorology which can be useful to agriculturists. There is a second—Climatology—of which many agriculturists are unaware, which can, however, render them considerable service. A precise knowledge of climate, that is to say, of the meteorological elements not solely of the air in which we live, but of the air at the surface of the soil and in the soil, can play a capital part in agriculture for the following reasons:—

(1) It will help to increase yields by facilitating the choice of varieties of crops best adapted to the climate; varieties resistant to cold in the east, or drought in the south; early varieties in regions where the heat of July causes "burning" to be feared; varieties of which the critical periods (earing of cereals for example) coincide to the maximum of probability with favourable meteorological phenomena.

(2) It affords a powerful aid in the application of preventive treatment against fungus diseases. Two kinds of conditions are needed for the development of these diseases, those favourable for the fungus and those predisposing the plant to disease. High temperatures, drought, and a high exposure to sunlight are factors propitious to fungi attacking the plant, which is already weakened by a partial withering of its tissues; they form, on the contrary, a powerful obstacle to the development of the propagative organs of the fungus, whose existence they menace. On the other hand, a soft and humid weather favourable to the fungus produces the maximum of turgescence in the tissues of the plant, which is thus better able to resist fungus attack. In order to produce an epidemic it is necessary that these two opposite kinds of conditions must immediately succeed each other, leading, in the first place, to predisposition of the plant to attack, and then to the development of the fungus before the plant can react. Thus at the beginning of the warm weather the plants wither in the day time; now if, in the course of the night, temperature is lower and a mist is produced (an element propitious for the propagation of fungus spores) the fungus attacks the plants, which will not have had time sufficiently to regain their turgescence and the epidemic will break out. On the basis of these data, and from the observation that potato blight always travels from west to east, one can, in certain conditions of temperature and humidity, and with observation posts judiciously placed, announce the probable advance of this disease in a given region and advocate the necessary preventive treatment.

(3) It will sometimes allow measures to be employed to counteract certain atmospheric phenomena which are particularly dangerous at certain times of the year—use of artificial clouds against spring frosts, formation of societies intended to prevent or insure against hail.

(4) It will assist the rational use of manures. It is known, for example, that lack of water in arable soil impedes nitrification. In very dry regions the extensive use of easily soluble manures may remedy this to a certain extent. In districts with abundant rainfall, where fungus diseases and storms are particularly to be feared, dressings of potassic and phosphatic manures will be increased. These same manures will induce vegetative activity in regions where winter cold and spring frosts lead to the risk of damage to advanced crops. The climatology of the country will be also utilised to fix the dates of spreading manures; for example, the application of potassic manures will be the earlier the drier the climate, that of nitrogenous manures on grass will be carried out as far as possible on dry days at the end of February when rain is imminent. Liming and marling will be done in the dry periods of autumn.

(5) It is indispensable when new crops are tried. Thus, in France, an increase in the area under sugar beet is very desirable. Before this crop is grown in certain departments, their climatology must be known; in particular, whether the distribution of average quantities of rain over the summer months will permit of the advantageous acclimatisation of this crop. Sugar is produced as much through the water in the soil as from the carbonic acid in the air. Evaporation from the leaves of beet is considerable, and may reach 350,000 to 500,000 gallons of water per acre, corresponding to a rainfall of about 20 in., which must be spread over half a year (May to October). It must be ascertained, therefore, that the rainfall can satisfy the need of this crop for water.

(6) Finally, certain meteorological data can be instanced which are of service to agriculturists, e.g., the monthly and annual distribution of rainfall and the amount of maximum falls in the case of the construction of cisterns; the system of winds in the case of the installation of a mill or an air-wheel; and extremes of temperature, duration of frosts and their intensity, in the case of heating in glasshouses.

(b) Study of a Particular Climatological Factor, e.g., Influence of Rain in Agriculture.

Among the climatological phenomena having an important effect on agricultural production, rainfall seems to take first place, and it seems useful by way of example to study, in some detail, the role of rainfall in agriculture. The amount of rainfall is expressed in inches, a precipitation of 1 in. correspondidng to 4.7 gallons of water (i.e., 47 lb.) per square yard, i.e., 22,500 gallons per acre. In France, the average quantity of rain received annually varies according to district, the minimum in the neighbourhood of Paris and the maximum in the neighbourhood of the mountains.

Fertilising Effects of Rainfall.—The physical and chemical effects of rainfall are well known. Minerals in the soil are rendered soluble, without which they cannot be utilised for the formation of plant tissues. It is, also, through rainfall that fermentation indispensable to plant life takes place in the soil. There is one point to which particular attention must be called, namely, the fertilising effect of rainfall due to the ammoniacal or nitric nitrogen which it contains in quantities far from negligible. Determinations carried out in France and Belgium have shown that rain contains, on the average, .0002 per cent. of ammoniacal nitrogen and .00007 per cent. of nitric nitrogen. Winter rainfall is, in general, richer in nitrogen than summer rainfall. It is seen that rain brings in an average year some 13 lb. of nitrogen per acre in the region of Paris and more than 26 lb. in the wetter districts of the country. In Germany and in Italy, the average quantity of nitrogen brought per acre by rainfall has been found to be about 10 lb., and in England about 7 lb., of which three-quarters are ammoniacal nitrogen and one-quarter nitric nitrogen, while, in the United States, it is as large as 20 lb., of which 13 lb. are ammoniacal nitrogen and 7 lb. nitric nitrogen. Rainfall is about 10 times richer in nitrates in tropical regions than in temperate climates. The proportion of ammonia is also much higher, which explains the luxuriant vegetation on certain African soils which, from their composition, would be considered as poor. These quantities of nitrogen furnished by rain are much superior to those given in manures, especially in France.

Thus, in some degree, rainfall supplies manure, but the reverse is sometimes the case, and manure can, at least in part, replace water. In order, for example, in the case of wheat, for the plant to manufacture 1 gr. of dry matter it has been established that 0.53 pints of water are necessary in unmanured soil and only 0.35 pints in the same soil with average manurial dressings. The transpiration of cereals is, in fact, diminished by the use of manures, and, varying with the dressing of the latter and the nature of the soil, the quantity of water required to produce 33 bushels of wheat per acre, weighing 71 lb. per bushel, has been reduced from 24 in. to 8 in.

Disadvantages of Excessive Rainfall.—(1) Potash salts are retained by the absorptive power of the soil and suffer only insignificant losses from rainfall. No loss is to be feared so far as concerns soluble phosphatic manures. It is different, however, with nitrates, which are in danger of being lost in drainage water through abundant rainfall in autumn and winter. This point must, however, not be exaggerated. The loss of nitrates in the sub-soil is much less rapid than is often imagined; thus after a rainfall of half an inch, it was found that nitrate only descended a few tenths of an inch in the soil, while the humidity produced by this rain falling on a dry soil had penetrated in one day to 2½ in. Further, in warm weather nitrate may be brought back quite quickly by capillarity from a considerable depth to the surface. Nitrate 10 in. deep in the soil was thus returned to the surface in a fortnight. During this season, capillarity causes the water in the soil to rise to replace that lost in evaporation. This water brings with it dissolved products deep in the soil, products which thus come to be concentrated in the neighbourhood of the roots of plants. Too deep a burying of nitrates following rain need not be feared when the manures are applied in spring, even if they are ploughed or harrowed in. As, however, nitrates are subject to denitrification in very humid soils, it is advisable, where too heavy rains or a high humidity are to be feared, to replace nitrates by ammoniacal manures. Sulphur, and, above all, lime, are lost through rainfall in larger quantities than any other manurial element. Losses of lime, naturally more important in a rainy climate than in a dry district, attain on the

average in France 3 to 4 cwt. per acre per annum; in very rainy years they have even reached 4¾ cwt. The practice of liming is, therefore, absolutely necessary, as lime is an indispensable element in the nutrition of plants equally with nitrogen, phosphoric acid, and potash.

(2) Soils which are too wet, i.e., which contain more than 40 per cent. of their weight of water, are, in general, impermeable to air, and thus any gaseous exchange between the soil and the atmosphere is rendered impossible. There results a stoppage of respiration of plant roots, leading to asphyxiation of the plants and a lowering of the temperature of the soil harmful to their growth. The water (which is a bad conductor of heat) remaining in the top layers of the soil is not replaced by air, and, in consequence, these layers, although superficially warm in spring, cannot transmit this warmth to the lower layers, which remain cold. There results, among other things, from this lack of warmth, the impossibility of production of carbonic acid gas in the soil, an indispensable element in the development of the plant, as a complement of carbonic acid gas in the atmosphere. Soils which are too wet lack air and are cold, but it is possible by drainage to aerate and warm them. Experiments have shown that the average temperature of a drained soil can be 6 deg. C. higher than that of an undrained soil.

(3) The substances necessary for the nutrition of plants, concentrated in the neighbourhood of the root hairs, penetrate these latter with the soil water by capillarity and endosmosis and ascend through the plant cells under the impulse of these forces. Their ascension and their absorption are considerably increased by transpiration, which leads to the consumption of an enormous quantity of water compared with that strictly necessary for the tissues. Thus fertilising elements from the soil reach right to the leaves. If the soil is too dry, transpiration is greater than absorption and plants wither, but, if the soil is saturated, the plants are "gorged" with water and their vegetative apparatus is developed to the detriment of their reproductive apparatus. In this latter case, in effect, the substances in the soil are diluted to too large a degree with liquid, and, since the roots can only absorb a certain volume of water, the plants are deprived of a certain amount of their nutrients, notably phosphates, without which it is impossible for them to live normally. On the other hand they have other nutrients at their disposal in greater quantity, particularly nitrogen brought down in the rainfall. There results an exaggerated growth of the vegetative organs, a diminution of precocity, and a marked tendency to the invasion of fungus parasites. This can be remedied by increasing the potassic and phosphatic dressings.

(4) The year 1927 showed once more that, while abundant summer rain has not always a bad effect on the quantity, it has on the quality of the crop. For wheat, in particular, it has been established that rain at harvest does not lead to the germination of the grain in the sheaf unless accompanied by a sharp fall in temperature such as is produced at the time of a storm. Such fall of temperature is not an obstacle to germination as one would be tempted to think, but, on the contrary, the determining cause. The damage to the crop is the greater the longer the temperature remains below the normal after rainfall; and inversely the damage is the smaller the more rapidly the thermometer regains the average for the season. In regions where rainfall is abundant during the months of July and August, it is to the interest of farmers to select varieties of wheat which are resistant to this special effect of summer rains.

Correlation between Rainfall and the Yield of Wheat.

The preceding considerations show the important part played in agriculture by rainfall. It has long been known (it is found for instance in the Bible) that harvests are intimately dependent on rainfall. For the central region of France, in particular, the following rules have been drawn up on the relation between rainfall in the quarter April, May, June and the yield of the wheat crop:—

(1) If the rainfall during these three months is below average, the yield will be above average so long as the temperature is not more than 1 deg. C. above the average. If the temperature is more than 1 deg. C. above average, the crop is damaged by burning.

(2) If the rainfall during these three months is above average, the yield of wheat is below average.

Analogous conditions have been found in the north of Italy and in Ohio, where a diminution of rain in the spring is accompanied by an increase in the yield of wheat. On the contrary, in the south of France and the southern part of the Italian Peninsula, the effect of rainfall is quite the opposite.

III. RADIO METEOROLOGICAL INSTALLATION OF AN AGRICULTURAL HOLDING.

The preceding considerations suffice to show the importance for the agriculturist on the one hand of the reception of short-term weather forecasts, and on the other of a knowledge of climatological elements not only for his region, but also for the precise spot where his holding is. He can thus take account of the repercussion of atmospheric factors on his crops and seek for means to diminish the disastrous effects of certain of them.

It is indispensable in the first place that wireless receiving sets should be multiplied in country districts, for agriculturists can thus receive, beside the regional weather forecasts sent out each day at a fixed hour, special warnings of atmospheric conditions favourable to the development of fungus diseases, of spring frosts, or of particularly violent hailstorms.

In the next place, every important holding should have besides a barometer, the variations of which will complete the forecast data, a small meteorological installation comprising several simple pieces of apparatus which stand rough usage, which cost little, and which give sufficiently precise data. Until 1927, such instruments did not exist. This regrettable gap has now been filled by the National Meteorological Office on the demand of a seed selection society in the Paris district which desired to possess a meteorological station; and at the present time agricultural meteorological "posts" on that Office's model are being multiplied throughout the country. The installation comprises:—

(1) A screen of very small dimensions containing maximum and minimum thermometer, psychrometer* and evaporimeter.

(2) A rain gauge.

(3) An actinometer for the determination of the intensity of solar radiation, and sunshine recorder.

(4) An outside evaporimeter to determine evaporation at the level of the plant.

(5) A maximum and minimum thermometer placed a few centimetres above the soil in order to obtain the temperature at the soil level.

(6) A soil thermometer to measure the temperature at 40 cm. depth.

(7) Three special soil thermometers to determine the temperature of the soil at depths of 30 cm., 60 cm., and 1 metre.

The whole of this apparatus costs about 1,500 francs (at present, £12), but for many agriculturists a smaller installation would be sufficient; that employed in the Department of Seine-et-Oise, with the collaboration of the Meteorological Commission of that Department, may be instanced as especially interesting. On a dozen holdings there has been installed a meteorological "post" comprising only a rain gauge, outside evaporimeter, maximum and minimum thermometer to measure the temperature of the open air at a few centimetres above the ground, and a soil thermometer at 40 cm. depth. A meteorological post, composed of these four pieces of apparatus, gives very complete information on the temperature of the air and the soil in the layers affecting plants, as well as of rainfall and evaporation—which are two phenomena which ought not to be separated. The price is only 200 francs, since rain gauges are generally lent free by the Departmental Meteorological Commissions to persons who express the wish to have them, the only condition imposed being that they undertake to carry out observations regularly every day and forward a summary every month.

*A combination of two thermometers, the bulb of one of which is coated with muslin kept moist with water. The difference in the readings is used in the calculation of the humidity of the atmosphere.

THE CULT OF THE COLT.*

By "U 9 L."

IV.

DRIVING—LEADING—MOUNTING.

We've handled the colt to our heart's content, and perhaps bored him with our ceaseless attentions; we've picked up his feet repeatedly till the poor chap's doubtless wondering what it's all about, and on the near side and the off have we moved freely till the colt doesn't know which way we're coming at him. We've led him about till he almost regards himself as part of our shadow, and between us we've formed a bond of friendship. Now we'll drive him in reins. Some people prefer the roller for this, running the reins through the rings on it, but I fancy the old saddle once more. You see, the saddle is his companion for life, and he's got to get used to it. If you tie a strap loosely under his belly, each end of that strap attached to a stirrup iron on either side, that will keep those irons in place. And if you run your driving reins through those irons it keeps the reins down and serves even better than the rings on the roller. See? And though it doesn't serve any special useful service, it's not a bad plan to have those same old flapping bags decorating the colt even while we drive him in reins. It all helps to civilise him. Let's drive him.

Some breakers like great long reins, things reaching from here to there. I don't know why, but many of them do. I like reins as short as they may be so long as they allow me room to stand well clear of the colt's rearguard attentions, should he have any inclinations in that direction. You see, those reins are a dead weight on the colt's mouth. The longer they are the heavier they are. No matter how lightly you try and handle him, with those long reins, it's a leaden drag on the youngster's jaw, and that isn't good for his future perfection, if he is to have any. However, take your choice. I've known breakers drive their colts all over the place, through gates, into the garden, round by the stables, under the clothesline, and up to the kitchen door. I've heard that acclaimed, too, as being the mark of the good breaker. It's certainly painstaking, if nothing else. In fact, I'm prepared to say without reserve that it creates a good impression in over 90 per cent. of cases when a breaker drives his colt good and plenty. I'll go further than that and state it creates too good an impression—on the colt! It doesn't matter how light you may be in the hands, or what delicacy of touch is yours, you can't preserve that daintiness over a long length of driving rein. I've seen, and so have you, a breaker driving his colt about the house, looking round with that self-satisfied smirk so apparent in many men, and veritably he's longing for someone to step out with a camera. And all the time there's nearly half that 30 feet of driving reins dragging on the ground. Tell me, and be impartial when you make judgment, is that sort of thing conducive to a light mouth in a colt? And then tell me if you regard a light mouth as a thing to be desired. When I say "light" I don't mean giggle-headed, please bear in mind. "Light" means responsive, which is, or which should be, the point at which we aim. Having said that much, you'll now be prepared for me to make the revolutionary statement that I don't believe in excessive driving in reins. I don't! I'll do a few figures of 8, teach the colt to stop and start a few times, and I'll undertake to say I won't spend more than a quarter of an hour on the driving process, not wasting one minute of it, and I'll do my mouthing, and do it lightly, when I'm on the thing's back. I have finished, even though I've told you more of what I dislike than of what is to be done.

Be Prepared for Quick Action.

Now, straight on top of his driving, and while the impression is still fresh on him, we'll lead our colt on horseback. This has to be done some time, and the advantage of doing it before we ride him is to accustom him to a man being on top of him, if only by proxy, as it were. This is where the work of our old coacher is necessary, and this is where that wise old horse, having an inkling of what is coming, tries to hide himself or play some other trick in an attempt to dodge his work. From the horse's point of view, it's a rotten job. We leave the old saddle and all the other gear on the youngster, and in place of the bridle we slip a halter on his head. Then we pull him up beside the coacher, on the off side of him, of course, and pass the shank of the halter under the coacher's neck. Bear that in mind, will you, as it gives you an added leverage out of all proportion to what it would appear to make.

* From the "Pastoral Review" for June. Previous notes on this subject, by the same interesting and well-informed writer, were reprinted in the March, August, and October (1928) Journals from the February, April, and May (1928) numbers of the "Pastoral Review."

Take the shank under your coacher's neck from the off and bring it up his near side to where you'll take it in your hand. As soon as ever you swing on the old horse the youngster will bound away. He can't help it. He's not used to having a mounted man right on on top of him, and he's not yet accustomed to us appearing from nowhere all of a sudden. That's just hinting delicately it's a wise move to be prepared for quick action as soon as you swing on the old horse, and also to be brisk in changing and holding the shank.

Five Minutes' Fight.

But, bless you, that colt isn't frightened for long—not if our other work on him has been good, anyway. He'll strain back a bit, prick his ears, look up at us and snort. But he'll soon know it's a friend he's used to who's on top of the coacher, and though he mightn't come willingly he'll come to you if you've taught him good work in the leading exercises. Away you go. You don't! As soon as you move on the coacher the colt tries to pull away. Bear in mind, will you, that the whole of the colt's life to the present has been one incident after another to teach him to run from a mounted man. You've got to break down his instinctive dislike, his life's training, and his desires—that's the little task waiting you in teaching a colt to lead on horseback. The wonder is, really, that a man can do it at all. But after two bits and a little more that colt comes confidently to the side of the old horse, and if you do your work well and with judgment and tact it's running freely beside you, extending the glad hand of friendship as it does so. Five minutes' fight, ten minutes' pride and pleasure—that's the first lesson epitomised. You lead him round the big yard, out in the open if you wish—though I always leave that till later, and then you have him standing beside you. This, apart from teaching to lead, is the real object of the first lesson.

As the colt is standing beside you, and moving your old coacher over on to him as he tries to edge away, you lean over the youngster and rest some part of you, if it's only your hand, on his saddle. Gradually you become more familiar and lean right over, slapping him down the ribs on the off side, and then you lift your right leg free and throw it over the colt's back. He mightn't take all this lying down and in an even spirit. But you're on top of the old horse, you're safe, and all you're trying to do is to let the colt know that it's quite the proper thing for a horse to have a man on top of him, that it's done in quite the best circles, and that you're merely introducing the thin edge of the wedge of horsemanship. You keep adding familiarity to intimacy, and shortly the colt doesn't mind what you do, so long as you do it quick and keep within the bounds of reason. Our object achieved, we take him to the round yard again and prepare for the next lesson.

Use of Martingale Condemned.

This time when we take off the old saddle, it and the colt may kiss each other a last farewell—they're divorced for ever. We put on our proper saddle now, one with good gear all through, and we're particularly careful as we saddle him that the thing rides right, that the girths are as they should be, and that the crupper is just so. Part of the breaking process is that a colt must stand a crupper, and though it may never be used again it's got to go on regularly while he's attending school. A breastplate's not a bad idea, though I see little use in it if a horse is shaped within reason at all, and I won't hold with a martingale. No, sir! If a man's hands are so bad that he can't keep a horse's head down then it's better for him to go and play marbles than get in his own road and spoil better horses than he is a man. That's my idea, which may, or may not, be right. A martingale destroys the delicacy of touch, forces a horse's head in an unnatural position, and in its own way it also destroys a rider's hands. Thanks, all the same, but I'd sooner not have one if you don't mind. A man may please himself about single or double reins on his bridle, about the type of surcingle and other portion of his gear. There's only one axiom: let them be strong and clean, and there are a dozen maxims which laud simplicity.

Use of Spurs Evidence of Bad Horsemanship.

Spurs? Positively and finally, once for all and for ever, No! Spurs may, or they may not, be necessary at some later stage of the colt's life. But the man who dons spurs when first riding a colt is a fiend, an idiot; a murderer in embryo, and a thing unfit to mix in decent company and with horses. Honestly, I don't know why a man should ever use spurs. That is, provided he always rides his own breaking. To a horse accustomed to spurs, they're more or less necessary, particularly on a cattle camp, but for ordinary work, and a man riding a horse which is his for a number of years, then I always look on spurs as being a reflection on the lack of horsemanship of the rider. We'll have another word of two to say about those abominations later. Now we'll get on with the colt.

Prepare to Mount!

In what yard are you going to mount him? We each have our individual fancies, and I prefer the big yard. The only reason I take the yard at all is because the colt isn't yet mouthed properly. I've never yet mouthed a reputedly bad horse to ride it in a yard, preferring the open, and for the same reason I like as much space as possible round me when I get on the colt. Let's mount. The youngster is standing there, so burdened with new experiences that its brain's in a whirl and its content to take whatever might come next, accepting it as part of the regular routine. After putting the reins over its head the first thing to do is to follow the golden rule: stand in close. Get in till you're hugging its shoulder with your body, gather the reins in your hand, not too tightly and yet so you have command of them, place your foot in the iron, your knee in its shoulder, a grip of the pommel, and on you swing in one movement, and not in a jerky progression of uneven propulsions. Come back and do that over again, will you? This isn't any attempt to break the speed record. This is a steady mount we're practising. We want to accustom the colt to us climbing on his back, and we want to do it as carelessly as possible while yet preserving a margin of safety for ourselves.

SOME USEFUL TREES.

Here is a brief list of useful shade and fodder trees of value to the stockowner:—

Wilga (*Geijera parviflora*).—A small tree widely distributed in western areas, especially on red soils and heavy alluvials. The trees are shapely and ornamental, being usually trimmed round the bottom by sheep. They make excellent shade trees, and are very hardy and drought-resistant.

Rosewood or Boonery (*Heterodendron oleæfolium*).—A small to medium sized tree, but sometimes little more than a shrub. At times there is a danger from poisoning, especially when the leaves are wet with dew or rain. Very hungry sheep should be fed with caution, and if possible other material fed as well. Some cutters adopt the practice of lopping a day before feeding, thus reducing the risk of hoven.

Kurrajoing (*Brachychiton populneum*).—This is without doubt the most popular tree with landowners in the western division, being extremely useful as a fodder tree and providing in addition good shade and shelter. Owing to its deep rooting habit crops may be grown practically to the base of the trunk. Propagation from seed is not difficult.

Belah (*Casuarina lepidophloia*).—A useful fodder tree, although the woody and somewhat astringent branchlets have sometimes a bad effect, particularly if fed without a mixture of more succulent species. A useful shade, shelter, and ornamental tree.

Supple Jack (*Ventilago viminalis*).—A small to medium sized tree with a 30-ft. height, which generally shows a preference for light drift soils or sandy loams. Often a rather poorly-shaped tree with sparse foliage, but becoming much more dense after lopping. It suckers freely, and is regarded as a most useful fodder tree, some pastoralists ranking it with Kurrajong.

Whitewood (*Atalaya hemiglauca*).—A small to medium sized tree with a scaly and friable bark. This tree, especially if pruned, is of ornamental appearance, and provides a certain amount of shelter. It is frequently used as a drought fodder, but recently investigations have shown that it is poisonous to horses, although apparently not affecting other stock.

Wild Orange (*Capparis Mitchelli*).—A small tree or large shrub, often of bushy and spreading habit, and found chiefly on clayey loams. The larger trees provide very useful shade and shelter, forming an attractive, rather dense growth, and they are ornamental in appearance.

Quandong (*Fusanus acuminatus*).—A shrub or small tree. The fruit is edible, and is often much sought after. Useful as an ornamental or small shade tree, and with some value as a fodder.

Gruie or Colane (*Owenia acidula*).—A small tree with a milky juice, frequently found on sandy ridges. The tree is very ornamental, provides good shade, and is useful as a fodder.

Wild Lemon (*Canthium oleifolium*).—A shrub or small tree, confined mainly to red soils and sandy ridges. It provides fair fodder during droughty periods. Sometimes known as Myrtle tree.

General Notes.

The Quality of Queensland Bananas.

The Minister for Agriculture and Stock (Mr. W. Forgan Smith) informed the Press recently that reference had recently been made to the quality and quantity of bananas produced in this State, and that mention had also been made of the economics thereof. In connection with these matters the Minister stated that a great deal of attention and assistance had been given to this industry by Departmental officers. A very material increase has taken place in both the area of land under banana cultivation and in the quantity of fruit produced since the import duty had been imposed, and it is for growers to recognise that the continuance of the duty demands that their product must be satisfactory both in size and quality. An attempt was made to prevent undersized bananas being exported, and, under regulation, grade standards were prescribed, but a difficulty had been met in the enforcement of the standards of bananas intended for the interstate trade as the application of grade standards conflicts with section 92 of the Constitution of the Commonwealth. With a view of protecting the bananas from frost, many growers have selected land on the top or slopes of hills where the soil is not all that could be desired for banana production. In many cases this soil has rapidly become impoverished, and has failed to grow bananas of satisfactory size and quality. There has also been a rigid adherence to the Cavendish variety of banana, and while this variety had much to commend it, it does not produce such a large fruit or carry so well as the Gros Michel, which is worthy of greater attention by growers.

An examination of ripening arrangements indicated that the methods followed in the maturing of fruit are not in accordance with the best modern practices, and the result is that the fruit is not presented attractively for sale. To these phases of the industry increased attention must be given in the immediate future.

He had no doubt that much of the propaganda against the Queensland banana industry was inspired by vested interests in the South, and by merchants who desire to introduce a policy of free trade in the particular lines of commerce in which they are engaged.

Agricultural Project Clubs.

It is as well that we should remember that the success of a club is determined not by the number of members, but rather by the *work* done by the members. Interest in the work, knowing why a thing is done, the introduction of labour-saving devices, record keeping, costing, &c., are the things that count. For instance, there is little use in having charcoal in a sty if the member does not know why it is there. The child member of a club should be able to answer questions concerning his work, and if he is in charge of a pig then, as a pig club member, he should know its starting age and weight, its breed, its approximate weight and value at the time of the home visit, the increase it is making per day, the points of a good bacon-pig, and wherein his animal falls short of the standard; he should be able to estimate the dressed weight from a given live weight, and know the price of a baconer over the scales.

In regard to the marketing of his animal he should know the weights of a prime baconer (95-120 lb.)—i.e., the weights that command top price, who sets this standard, and the reasons for it. It would be as well to point out to the club member that the weights that command top price vary; for instance, in New South Wales the weight is 105-130 lb., in Victoria 110-135 lb., while in other countries 200 lb. is the standard. He must realise that, if he is to be successful, he must study the requirements of the market.

A meeting of each club might be reserved for a discussion on "Time saving and making farm work easier." The child only needs a start in that direction. If he commences to think on such lines regarding his club work, he will apply the idea to his school work, and later to his work in life.

A school period might be set apart for club work, and the work done entered in the Work Book. In the Work Book under the heading of Club Work might appear entries such as "Explanation of marking system," "Building of sty and run," "Rations for feeding," "Value of record keeping." During this period the child should be encouraged to take the lead in all discussions. The Club Meeting could be held once or twice a month during school hours, the members electing their own chairman and secretary. The subject for discussion should be fixed some time ahead, so that children will have ample time to collect information.

The teacher should occasionally take a leading part in the meeting, giving a short address on record keeping, costing, and the value of saving time on a particular work by quicker methods or by the use of labour-saving devices. He could then invite the members to think the matter over in connection with their club work and try to put the ideas into practice. Members could be given the opportunity at a later period of addressing other club members, telling them of the labour or time saving device they have employed.

Non-Club Members of upper classes could be permitted to take part in these meetings. They may be interested in the work; often the fact that they are not active members is due to circumstances over which they have no control.

Club Work may be correlated with the Mental Arithmetic, Composition, and Geography lessons.—"Education Office Gazette."

Canegrowers' Defence Fund Levy.

Following is the result of recent referendum on this question:—

Against the levy	1,522 votes.
For the levy	1,424 votes.
Majority against the levy	98 votes.

The levy was to be credited to the Queensland Cane Growers' Council Defence Fund. The proposal now lapses.

A Beautiful Prayer.

"Thou, O Lord, providest enough for all men with Thy most bountiful hand. But whereas Thy gifts are made common to all men, we through our selfishness do make them private and peculiar. Set right again that which our iniquity hath put out of order. Let Thy goodness supply that which our meanness hath plucked away. Give meat to the hungry and drink to the thirsty; comfort the sorrowful, cheer the dismayed and strenghten the weak; deliver the oppressed and give hope and courage to them that are out of heart. Have mercy, O Lord, upon all forestallers, and upon all them that seek undue profits or unlawful gains. Turn Thou the hearts of them that live by cunning rather than by labour. Teach us that we stand daily and wholly in need of one another. And give us grace by hand and mind to add our proper share to the common stock."—From "Queen Elizabeth's Prayer Book."

Cotton Board.

An Order in Council has been approved providing for six representatives of growers on the Cotton Board instead of five representatives as previously. The State has accordingly been divided into six districts, from each of which one representative will be elected. The six districts are—

District No. 1.—Comprised of areas served by the railway stations north of Bundaberg to Rockhampton, the Boyne Valley Branch excepting Barrimoon and Kalpowar, beyond Rockhampton to Emu Park and Yeppoon, beyond Rockhampton to Westwood on the Central Line, and all lines and branches north of Rockhampton.

District No. 2.—Comprised of the areas served by the railway stations from Boongarry to Mount Morgan and Muruguran and the Central Line and branches west from Westwood.

District No. 3.—Comprised of areas served by the railway stations from Rannes to Theodore and from Rannes to Thangool, inclusive.

District No. 4.—Comprised of areas served by the railway stations on the North Coast Line from Mungar Junction to Bundaberg and branches thereof (including the Gayndah Branch), and Barrimoon and Kalpowar on the Boyne Valley Branch.

District No. 5.—Comprised of the areas served by the railway stations on the North Coast Line from Brisbane to Antigua and branches (including the Nanango-Tarong-Proston and Windera Branches), Brisbane to Grandchester, and all branches between those stations including the South Coast Line and branches and Cleveland Line.

District No. 6.—Comprised of the areas served by the railway stations from Laidley to Toowoomba and Branches on the Southern and Western Line and all branches beyond Toowoomba, Western Line and Branches beyond Toowoomba, Southern Line and branches beyond Toowoomba, and South-Western Line and branches beyond Toowoomba.

Nominations will be received until 17th January, 1929, as Growers' Representatives on the Board until 31st December, 1931, and each nomination must be signed by at least ten growers in the district concerned.

Talagai Holding—A Correction.

By an Order in Council dated 16th August, 1928, "Talgi Holding," near Capella, was declared to be a sanctuary for animals and birds. This should have read Talagai Holding, and an amending Order in Council has now been approved.

Carriage of Bananas to Railway.

Regulations have been approved under "*The Fruit Marketing Organisation Acts, 1923 to 1928*," providing that bananas for carriage to railway station, siding, or other place of railway despatch, shall be carried either in—

(*a*) A vehicle specially constructed and used for such purposes only and so fitted and kept as to protect any such bananas from rain and sun or contamination by dust or other means; or

(*b*) A vehicle provided with a dust-proof and weather-proof covering such as a tarpaulin or similar contrivance, which covering shall only be temporarily opened or removed for the addition of further loads of bananas en route or on arrival at the railway.

A penalty of £20 is provided for a breach of this Regulation (No. 165).

School for Project Club Members.

A school of not more than twenty boys who have done successful work as members of State Schools' Agricultural Project Clubs will be held at the Queensland Agricultural High School and College from the 28th January to the 9th February, 1929.

Applicants for enrolment in the school may be members of calf, poultry, pig, or other clubs. Railway passes will be granted by this Department to the boys selected to attend the school.

Head teachers are requested to bring to the notice of the Club members in their schools the fact of the projected holding of the school, and to invite applications from members of their clubs. They are then requested to consider the applications and note against each applicant a summary of his claim to selection. They should forward the names of the applicants before the 28th November, and accompany them by a recommendation as to the boy whom they would recommend for admission as their school's representative in the school.

A course of instruction in Agriculture will be afforded the members of the school, the work undertaken including talks and demonstrations in Animal Husbandry, Agriculture, Dairying, and Elementary Science. A feature will be made of such items as the necessity for having the most efficient animals and plants on farms; the benefits arising from Herd Testing; the importance of Weed Control and Moisture Conservation in Queensland farming; illustrations of the methods of decreasing costs of producing crops and stock by proper farm management; the various breeds of stock; methods of feeding; balancing rations for farm stock. Opportunity will be taken also to show as much as possible of the various processes such as butter-making, cheese-making, ice cream-making, and so on.

Staff Changes and Appointments.

Messrs. M. J. Cross and A. C. Euston, of Glastonbury, via Gympie, and Mr. N. L. Miles, of Zillmere, have been appointed Honorary Inspectors under the Diseases in Plants Acts.

Messrs. M. P. W. Button, A. J. McCullough, R. F. Hobler, and A. Cowan have been elected Members of the Windorah Dingo Board, and Mr. J. A. Kidd, of Windorah, has been appointed Government Representative on that Board.

Messrs. J. T. Barnes, J. Drynan, C. J. C. Philp, and R. Woods have been elected Members of the East Moreton Dingo Board, and Mr. J. T. Yore, of Glenmore, Beaudesert, has been appointed Government Representative on that Board.

Mr. J. A. Weddell, Assistant to Entomologists, has been appointed Assistant Entomologist, Department of Agriculture and Stock, as from 6th October, 1928.

The resignation of Mr. N. Devine, of Chudleigh, Daymar, as Honorary Inspector of Stock, has been accepted as from 1st January, 1929, as tendered.

The appointment of Mr. L. A. Downey as Assistant Instructor in Pig Raising has been confirmed as from 5th June, 1928.

Messrs. F. G. Connolly, Assistant Instructor in Fruit Culture, and W. Jost, Inspector of Slaughter-houses, will be retired from the Public Service as from the 30th June, 1929.

Mr. A. McGregor Henderson, Redland Bay, has been appointed a Member of the Arrowroot Board until 14th April, 1931, vice Mr. P. P. Outridge, resigned.

MEASURING THE FLOW.

An inquiry from Beech Forest (Vic.) with reference to the measurement of the flow of streams so as to ascertain the amount of power available shows that hill country residents are waking up to the stored-up energy lying at their feet. A minimum of five-horse power may be taken as sufficient to justify an instalment for converting this power into work. This can be obtained from about 250 cubic feet of water per minute falling from a height of 10 feet, or 50 cubic feet of water per minute falling from a height of 50 feet. The power of small streams may be measured in a simple and sufficiently accurate way by anyone who can use carpentering tools. A temporary dam of sandbags, logs, or stone and earth should be placed across the stream at right angles to the flow, leaving room in the centre for the measuring notch or weir (Fig. 1). The width and depth of the opening in the weir is determined by the size of the stream, and can be ascertained by experiments with a rough model. It should be large enough to allow all the water to flow through the notch, and small enough to cause a still water pond to form for several feet behind the weir. For obvious reasons the measuring should be done in summer time, when the amount of flow is at its lowest. The stream running down from a higher level empties into the pond, which in turn should be emptying itself through the opening in the board at the same rate as the stream is keeping the pond full. This weir

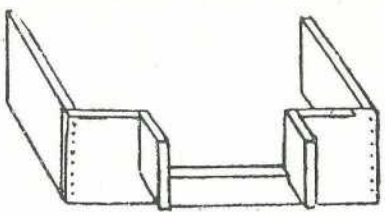


Fig. 1.

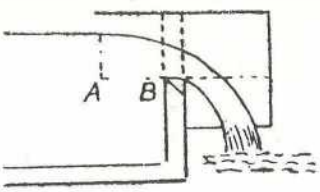


Fig. 2.

should be set at right angles to the flow, upright, and perfectly level. It must be built into the embankment, and into the bottom of the stream, so that no water can escape except through the opening. Fig. 2 shows a cross-section from which it can be seen that the lower edge of the notch is cut on a bevel with the sharp edge upstream. The wings on either side of the notch prevent the stream from contracting as it flows through the opening, which would upset the calculations. The depth should be measured at the point A (Fig. 2) back from the opening, where the water is at a dead level, and moving slowly. Every square inch of water flowing through the opening indicates approximately 1 cubic foot of water per minute. Thus, if the opening is 12 inches wide, and the water flowing through is 6 inches deep at A, 12 x 6 = 72 square inches of water, indicating 72 cubic feet per minute. With a fall of 37 feet through a pipe to a turbine this would develop about five-horse power —72 x 62½ (weight of 1 cubic foot of water) x 37 = 166,500 lb. of continuous pressure, practically equal to the work of five horses. Theoretically, a horse performs 33,000 feet lb. of work per minute. This method would be sufficiently accurate for an engineer to determine whether it would be worth while installing a turbine on a small stream—"Australasian."

If you like the "Journal," kindly bring it under the notice of your neighbours who are not already subscribers. To farmers it is free and the annual charge of one shilling is merely to cover postage for the twelve months.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staff of the Queensland Baby Clinics, dealing with the welfare and care of babies, has been planned in the hope of increasing their health and happiness and decreasing the number of avoidable cases of infant mortality.

WEANING THE BABY.

When a mother thinks of weaning her baby there are four points which she should take into consideration—

(1) The age of the child.

(2) The time of the year.

(3) The time required for weaning.

(4) The method of doing it.

The Age at which the Child should be Weaned.

The best time to wean baby is between the age of nine and twelve months. Up to that time his sole food should have been his mother's milk and, unless for urgent reasons, baby should never be weaned before that. The younger the baby is the greater are the risks that attend the process. Thus, a baby four or five months' old is much more likely to become upset or ill if weaned than one eight or nine months. If baby is less than nine months old when weaned, he should be given a feeding bottle, but if over that age it is better to teach him to drink out of a cup, or to use a spoon. If baby has been bottle-fed, when weaning time comes give him his food out of a cup instead of the bottle at first for one feed only during the day, so accustoming him to the change. Then later give the cup for two feeds, and the bottle for the remainder of the day, and so on.

Some mothers think that if they give a bottle feed instead of a breast feed in baby's early months, they will, in this way, make weaning easier. This should not be done. What they almost always achieve is the unnecessary early weaning of the child, for by substituting a bottle feed for a breast feed the mother's milk will diminish. Drinks of boiled water may be given to a young baby from a bottle, but a full feed should not be given while baby is on the breast.

When to Wean the Infant.

The second point is the time of year. Always, if possible, avoid weaning in very hot weather. This is sometimes difficult because Queensland has a long summer. If baby must be weaned during hot weather avoid the worst months. Here the worst months are probably not the hottest, but those during which dysentery or summer diarrhoea (gastro-enteritis, as it is often called) is prevalent. Every summer this disease appears and makes many babies ill. It appears early in summer, and is at its worst in November and December. For this reason, these are the most dangerous months for weaning baby. If he reaches nine months during this time, postpone weaning at least until January and then go very slowly and carefully.

Babies kept wholly on the breast until about fifteen or sixteen months old—i.e., until the cooler weather comes—are often very difficult to wean. Not infrequently they refuse absolutely to take other foods. The older the baby the more difficult he is to wean.

The Time Required for Weaning the Baby.

The third point is the time required for weaning. Unless absolutely unavoidable, the change from natural to artificial feeding should never be sudden. The mother who quite suddenly substitutes the one for the other doubtless does it with good intention, but it is an unkindness to the baby. The change from complete natural feeding to complete artificial feeding should never be made in less than two weeks; preferably take five or six weeks.

Method of Weaning.

The following is a practical plan for weaning after nine months. We will assume that the baby has been fed four-hourly, i.e., at 6 and 10 a.m. and 2, 6, and 10 p.m., so getting five feeds daily.

First Change.—Give baby oat or barley jelly by spoon at the 10 o'clock feed. Begin with one tablespoon of the jelly and give two or three teaspoons of cow's milk on it. Follow this by the usual breast feed and give breast feeds as usual for the remainder of the day. Do this daily for a week and make no other change during that time. A crisp crust may be given once or twice daily before feeds throughout the weaning period. Give it to him when he is hungry. About ten minutes before his feed is due, not between feeds.

Second Change.—Omit breast feeding at 10 a.m. Give instead first the oat or barley jelly, which may be gradually increased to two or three tablespoons, and follow this by about 6 to 8 oz.—about an ordinary cupful—of milk mixture. Make no further change during this second week. Pure milk should not be given to begin with; it is better to commence with about three parts milk to one of water and gradually increase to full strength.

Third Change.—Give the breast every eight hours—i.e., at 6 a.m., 2 p.m., and 10 p.m. Give oat or barley jelly at 10 a.m. and 6 p.m. followed by the milk, as in change 2. Do this daily and make no further change this third week.

Fourth Change and for the 4th week.—Give the breast at 6 in the morning, and 6 at night. At the other three feeds, give the milk mixture. Give oat or barley jelly at 10 a.m. before bottle, and at 6 p.m. before breast.

Fifth Change and for the 5th week.—Give the breast once only; at the 6 a.m. feed. Give milk mixture for all other feeds. Oat or barley jelly before 10 a.m. and 6 p.m. feeds.

Sixth Change and for the 6th week.—Discontinue giving breast at 6 a.m. Give milk only.

Baby is now entirely weaned, and it is probable that it has been achieved without his realising that any change was being made.

After weaning is completed, care is still required to establish the baby on suitable food. He should certainly not be allowed to share the family meals, and eat scraps of everything.

Remember that at this stage food tastes and habits are formed which may last a lifetime.

Important Points to Remember.

The following important points should be remembered by the mother:—

1. Teach baby to drink out of a cup at any time between nine and twelve months (if this has not already been done, and provided he has cut two teeth), and discontinue bottle feeding. Give the drinks from a cup, first at one feed (say, the 10 a.m.), then at two feeds in the day, and so on, thus discontinuing bottle feeding gradually.

2. Keep absolutely to regular meal times. Give nothing whatever but water and fruit juice between meals.

3. As baby takes more solid and varied food he needs less milk, but do not let him go without a drink at each meal. A healthy baby at this age can usually take pure cow's milk. Up to eighteen months milk in some form should be his principal food.

4. Introduce all new foods one at a time and a little at a time. Never make sudden changes. It is better to go too slowly than too quickly.

5. Teach baby to eat each new food that is good for him. Do not let him start the bad habit of refusing food because he does not like it. If persevered with, babies like almost anything that is good for them. They will not want the things which are bad for them if they have never tasted them. Do not let them get the taste for cakes and sweets.

6. Active exercise for teeth, jaws, and salivary glands is absolutely necessary. Baby must be taught to chew, not to bolt his food, and, as time goes on, to take more and more of his food in hard form. Remember that toast or crusts, with butter or dripping and a drink of milk, are just as nourishing and better for teeth and digestion than a basin of bread and milk.

7. Do not add too much sugar to baby's food. It is bad for the teeth and the digestion.

8. Cook all foods thoroughly and serve appetisingly. Add a little salt in cooking.

9. Children should not be continually urged to eat if they are disclined to do so. Under no ordinary circumstances should a child be forced to eat.

10. If there is any important article of a simple diet, such as milk, meat, cereals, or vegetables, which a child habitually refuses, this should always be given first at the meal, and all other food withheld until this is eaten.

11. Always give the most substantial meal in the middle of the day. Never give a young child a meal of meat and vegetables before he goes to bed at night.

Baby Foods.

The following foods may be given to baby, between the end of weaning and twelve months:—

More cereal jelly, slowly increasing up to 10 oz. daily. More crisp crust and toast; more fruit juice.

From twelve to fifteen months a considerable increase may be made in the diet, always remembering to give new foods one at a time and a little at a time.

Give more solid, dry, and hard foods, such as crusts, baked bread and toast, all to be taken with a little butter or dripping. Sweet biscuits should not be given. They are made from finely ground flour, which form a paste which lodges in the crevices of the teeth, where it is liable to set up fermentation and decay. Cereal jellies to be continued; towards the end of the time gradually mix some unstrained porridge into the jelly and, as time goes on, less and less need be strained. Give milk puddings, made with well-cooked ground rice or semolina. At this time a little egg may be given; perhaps half a yolk two or three times a week. Gradually introduce a little white. Give vegetable milk-broth, chicken broth, or mutton broth. All to be made with pearl barley or rice and to be well strained.

Vegetables.—Floury potato cooked in skin, spinach, cauliflower, carrot, &c., well cooked, rubbed through a fine sieve, and served warm with a little butter or meat gravy without fat.

Fruits.—Pulp of baked apple, or pulp of stewed prunes. Begin with only a teaspoonful and increase very gradually to one or two tablespoons. A little milk may be given with this. Gradually and cautiously some raw ripe apple may be given.

From 15 to 18 months.—Feed on same lines as for previous three months, but give more solid hard foods, including wholemeal bread, and milk puddings made with rice, sago, &c. Give a piece of raw ripe apple at the end of each meal. Continue training baby to chew thoroughly, and avoid giving much soft, mushy food. An egg, lightly boiled, may be given, but not more than three times a week. Light fish, steamed or boiled, may be given; also chicken, steamed or boiled and either well minced, or preferably chewed off the bone. Only a teaspoonful of either fish or chicken should be allowed at first, and the quantity very slowly increased.

An important point for the mother to remember during this period is that, though baby's first teeth are only now being cut, the second set of permanent teeth are forming in the gums. Their strength and durability depend very largely on the foods given, and the amount of work done by mouth and jaws at this time.

PRICKLY-PEAR—PREVENTION OF FURTHER SPREAD.

The Prickly-pear Land Commission, which took up duty in April, 1924, issued a statement setting out the policy which it was intended to pursue. Portion of that statement read as follows:—

"To clear Queensland of prickly-pear is at present quite impossible. The cost of the first clearing alone, even if practicable, would probably exceed £100,000,000. It is not to attempt the impossible, but to stop the further spread of pear, to do justice to the holders of pear lands, to encourage and reward their efforts in clearing, to make uniform and consistent and generally improve the administration of pear-infested lands, that the Commission has been appointed."

Four years have elapsed since the aim of the Commission was so stated, and the Commission in its annual report states that, except in the northern portion of the Commissioners' territory where the country is used solely for grazing cattle, the returns from which have not warranted heavy expenditure in pear-clearing, the further spread of pear has been definitely stopped.

There is considerably less pear in Queensland to-day than when the Commission took office, and the further spread of this pest has been effectively controlled.

Orchard Notes for February.

THE COASTAL DISTRICTS.

February in coastal Queensland is frequently a wet month, and, as the air is often heavy with moisture and very oppressive, plant growth of all kinds is rampant, and orchards and plantations are apt to get somewhat out of hand, as it is not always possible to keep weed growth in check by means of cultivation. At the same time, the excessive growth provides a large quantity of organic matter which, when it rots, tends to keep up the supply of humus in the soil, so that, although the property looks unkempt, the fruit-producing trees and plants are not suffering, and the land is eventually benefited. When the weed growth is excessive and there is a danger of the weeds seeding, it is a good plan to cut down the growth with a fern hook or brush scythe and allow it to remain on the ground and rot as it will thereby prevent the soil from washing, and when the land is worked by horse power or chipped by hand it will be turned into the soil. This is about the most satisfactory way of dealing with excessive weed growth, especially in banana plantations, many of which are worked entirely by hand.

The main crop of smooth leaf pineapples will be ready for canning, and great care must be taken to see that the fruit is sent from the plantation to the cannery with the least possible delay and in the best possible condition. The only way in which the canners can build up a reputation for Queensland canned pineapples is for them to turn out nothing but a high-class article. To do this they must have good fruit, fresh, and in the best of condition.

The fruit should be about half-coloured, the flesh yellowish, not white, of good flavour, and the juice high in sugar content. Over-ripe fruit and under-ripe fruit are unfit for canning, as the former has lost its flavour and has become "winey," while the latter is deficient in colour, flavour, and sugar content.

For the 30 or 32 oz. can, fruit of not less than 5 in. in diameter is required, in order that the slices will fit the can; but smaller fruit, that must not be less than 4 in. or, better still, 4¼ in. in diameter, and cylindrical, not tapering, can be used for the 20-22 oz. can.

Bananas for shipment to the Southern States should on no account be allowed to become over-ripe before the bunches are cut; at the same time, the individual fruit should be well filled and not partly developed. If the fruit is over-ripe it will not carry well, and is apt to reach its destination in an unsaleable condition.

Citrus orchards require careful attention, as there is frequently a heavy growth of water shoots, especially in trees that have recently been thinned out, and these must be removed. Where there are facilities for cyanidings, this is a good time to carry out the work, as fruit treated now will keep clean and free from scales till it is ready to market. Citrus trees can be planted now where the land has been properly prepared, and it is also a good time to plant most kinds of tropical fruit trees, as they transplant well at this period of the year.

A few late grapes and mangoes will ripen during the month and, in respect to the latter, it is very important to see that no fly-infested fruit is allowed to lie on the ground but that it is gathered regularly and destroyed. Unless this is done, there is every probability of the early citrus fruits being attacked by flies bred out from the infested mangoes.

Strawberries may be planted towards the end of the month, and, if early ripening fruit is desired, care must be taken to select the first runners from the parent plants, as these will fruit quicker than those formed later. The land for strawberries should be brought into a state of thorough tilth by being well and deeply worked. If available, a good dressing of well-rotted farmyard manure should be given, as well as a complete commercial fertiliser, as strawberries require plenty of food and pay well for extra care and attention.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

The marketing of later varieties of peaches and plums, and of mid-season varieties of apples and pears, as well as of table grapes, will fully occupy the attention of fruitgrowers in the Granite Belt, and the advice given in these notes for the two previous months, with regard to handling, grading, packing, and marketing is again emphasised, as it is very bad policy to go to all the trouble of growing fruit and then, when it is ready to market, not to put it up in a way that will attract buyers.

Extra trouble taken with fruit pays every time. Good fruit, evenly graded and honestly packed, will sell when ungraded and badly packed fruit is a drug on the market. Expenses connected with the marketing of fruit are now so high, owing to the increased cost of cases, freight, and selling charges, that it is folly to attempt to market rubbish.

During the early part of the month it will be necessary to keep a careful watch on the crop of late apples in order to see that they are not attacked by codlin moths. If there is the slightest indication of danger, a further spraying with arsenate of lead will be necessary, as the fruit that has previously escaped injury is usually that which suffers the most.

Fruit fly must also be systematically fought wherever and whenever found, and no infested fruit must be allowed to lie about on the ground.

Grapes will be ready for market, and in the case of this fruit the greatest care in handling and packing is necessary. The fruit should never be packed wet, and, if possible, it is an excellent plan to let the stems wilt for a day at least before packing. This tends to tighten the hold of the individual berries on the stem and thus prevent their falling off.

In the western districts winemaking will be in progress. Here again care is necessary, as the better the condition in which the fruit can be brought to the press the better the prospect of producing a high-class wine.

Where necessary and possible citrus trees should be given a good irrigation, as this will carry on the fruit till maturity, provided it is followed up by systematic cultivation so as to retain a sufficient supply of moisture in the soil.

Farm Notes for February.

Reference was made in last month's Notes to the necessity for early preparation of the soil for winter cereals, and to the adoption of a system of thorough cultivation in order to retain moisture in the subsoil for the use of crops intended to be raised during the season. The importance of the subject, and its bearing in relation to prospective crop yields, is made the excuse for this reiteration.

Special attention should be given to increasing the area under lucerne (broadleaf Hunter River), wherever this valuable crop will grow. Its permanent nature warrants the preparation of a thorough tilth and seed bed, and the cleansing of the land, prior to sowing the seed, of all foreign growths likely to interfere with the establishment and progress of the crop. Late in March or early in April is a seasonable period to make the first sowing providing all things are favourable to a good germination of seed.

Dairymen would be well advised to practise the raising of a continuity of fodder crops to meet the natural periods of grass shortage, and to keep up supplies of succulent fodder to maintain their milch cows in a state of production.

Many summer and autumn growing crops can still be planted for fodder and ensilage purposes. February also marks an important period as far as winter fodder crops are concerned, as the first sowings of both skinless and cape barley may be made at the latter end of the month in cool districts. Quick-growing crops of the former description, suitable for coastal districts and localities where early frosts are not expected, are Soudan grass, Japanese and French millet, white panicum, liberty millet, and similar kinds belonging to the Setaria family. Catch crops of Japanese and liberty millet may also be sown early in the month in cooler parts of the State, but the risk of early frosts has to be taken.

Maize and sorghums can still be planted as fodder and ensilage crops in coastal districts. In both coastal and inland areas, where dependence is placed largely on a bulky crop for cutting and feeding to milch cows in May and June, attention should be given to Planters' Friend (so-called Imphee) and to Orange cane. These crops require well-worked and manured land; the practice of broadcasting seed for sowing at this particular season encourages not only a fine stalk but a density of growth, which in itself is sufficient to counteract to some extent the effect of frost.

In most agricultural districts where two distinct planting seasons prevail, the present month is an excellent time for putting in potatoes. This crop responds to good treatment, and best results are obtainable on soils which have been previously well prepared. The selection of good "seed" and its treatment against the possible presence of spores of fungoid diseases is imperative. For this purpose a solution of one pint of formalin (40 per cent. strength) to 24 gallons of water should be made up, and the potatoes immersed for one hour immediately prior to planting the tubers. Bags and containers of all kinds should also be treated, as an additional precaution. "Irish Blight" has wrought havoc at times in some districts, and can only be checked by adopting preventive measures and spraying the crops soon after the plants appear above the ground. Full particulars on the preparation of suitable mixtures for this purpose are obtainable on application to the Department of Agriculture, Brisbane.

Weeds of all kinds, which started into life under the recent favourable growing conditions, should be kept in check amongst growing crops; otherwise yields are likely to be seriously discounted. The younger the weeds the easier they are to destroy. Maize and other "hoed" crops will benefit by systematic cultivation. Where they are advanced, and the root system well developed, the cultivation should be as shallow as possible consistent with the work of weed destruction.

First sowings may now be made of swede and other field turnips. Drilling is preferable to broadcasting, so as to admit of horse-hoe cultivation between the drills, and the thinning out of the plants to suitable distances to allow for unrestricted development. Turnips respond to the application of superphosphate; 2 cwt. per acre is a fair average quantity to use when applied direct to the drills.

Where pig raising is practised, land should be well manured and put into good tilth in anticipation of sowing rape, swedes, mangels, field cabbage, and field peas during March, April, and May.

SUBSCRIPTIONS TO THE JOURNAL.

Subscribers are reminded that when a cross is placed in the square on the first page of the Journal it is an indication that the term of their subscription ends with the number so marked, and that it is advisable to renew immediately if they desire the retention of their names on our mailing list.

To farmers, graziers, horticulturists, and Schools of Art the annual subscription—one shilling—is merely nominal, and the charge is only imposed to cover the cost of postage. To them, otherwise, it is an absolutely free issue. Members of agricultural and similar societies who are not actively engaged in land pursuits are asked to pay five shillings a year, while the annual subscription charged to the general public is ten shillings.

Farmers particularly are urged to keep their names on our mailing list, for through the Journal they may keep themselves well informed in respect to the activities of the Department, and other matters with which they are directly concerned. Instead of sending just the annual subscription along it is suggested that, when renewing it, they do so for a longer term. For instance, five shillings would keep their names on our subscribers' register for five years. By doing this they would obviously help to reduce clerical labour as well as avoid the inconvenience to themselves of posting annually the very small sum necessary to keep their names on our mailing list.

On another page an order form may be found, and for those whose annual subscription is about due what is wrong with filling it up now and posting it direct to the Under Secretary, Department of Agriculture and Stock?

ASTRONOMICAL DATA FOR QUEENSLAND.

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

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	January, 1929.		February, 1929.		MOONRISE. Jan., 1929.	Feb. 1929.
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5.1	6.49	5.26	6.46	11.14	11.14
2	5.2	6.49	5.26	6.45	11.43	11.47
3	5.3	6 49	5.27	6.45	...	0.0
					a.m.	a.m.
4	5.3	6.50	5.28	6.44	12 13	12.23
5	5.4	6.50	5.28	6 44	12.43	1.5
6	5.5	6.50	5.29	6 43	1.15	1.53
7	5.6	6.51	5.30	6.42	1.48	2.43
8	5.6	6.51	5 31	6.42	2 26	3.37
9	5.7	6.51	5.31	6.41	3 10	4.32
10	5 8	6.51	5 32	6 40	3.58	5 31
11	5 9	6.51	5 33	6.40	4.51	6.32
12	5 9	6.51	5.34	6 39	5 44	7.31
13	5.10	6.51	5.34	6.38	6.41	8.29
14	5.11	6.51	5 35	6 37	7.40	9.27
15	5.12	6.51	5.36	6.37	8.37	10.27
16	5.13	6 51	5.36	6.36	9.36	11.30
						p.m.
17	5.13	6 51	5.37	6.35	10.34	12.37
18	5.14	6 51	5.38	6.34	11.33	1.44
					p.m.	
19	5.15	6.51	5.38	6.34	12.34	2.49
20	5.16	6.50	5.39	6.33	1.38	3.52
21	5.16	6.50	5.40	6.32	2.46	4.51
22	5.17	6.50	5.40	6.31	3.56	5.43
23	5.18	6.49	5.41	6.30	5.3	6.26
24	5.19	6.49	5.42	6.29	6.7	7.2
25	5 19	6.49	5.42	6.28	7.4	7.37
26	5.20	6.48	5.43	6.27	7 53	8.9
27	5.21	6 48	5.44	6.26	8.32	8.40
28	5.22	6.48	5.44	6.25	9.10	9.11
29	5.23	6.47			9.41	
30	5 24	6.47			10.13	
31	5.25	6.47			10.43	

Phases of the Moon, Occultations, &c.

The times stated are for Queensland, New South Wales, Victoria, and Tasmania.

3 Jan.	☽ Last Quarter	4 34	a.m.
11 ,,	● New Moon	10 28	a.m.
19 ,,	☾ First Quarter	1 15	a.m.
25 ,,	○ Full Moon	5 9	p.m.

Apogee, 8th January, at 1·42 a.m.

Perigee, 23rd January, at 9.48 p.m.

The Earth will make its nearest approach to the Sun on the 1st, when its distance will be about 91,300,000 miles.

The occulation of three small stars in Aquarius, known as Psi 1, Psi 2, Psi 3, will form an interesting spectacle for amateurs between 8 and 10 on the evening of the 15th. These naked-eye stars are of magnitude 4·5, 4·6, and 5·2. They will disappear on the dark edge of the crescent-shaped Moon under conditions very favourable when using a small telescope or binoculars. As the time of disappearance will vary at different places it will be desirable to commence observations before 8 o'clock. Psi 1 is a beautiful coloured double star, one of the components orange-coloured, the other sky-blue.

When the Moon is passing Omikron Piscium, late in the evening of the 18th, an interesting observation could be made by the owners of telescopes in the latitude of Warwick and Toowoomba in noting whether the star will disappear or merely skirt the edge of the Moon.

The Moon will be passing Mars on the 22nd at 6 p.m., and it will be interesting for those with keen eye-sight to endeavour to see Mars in daylight. It will be 4 degrees to the north of the Moon, or nearly eight times the diameter of the Moon away from it. The Moon and planet will be in the north-east, on the opposite side of the sky to the setting Sun.

The Moon will pass 5 degrees to the north of Neptune on the 26th about 9 a.m. when Neptune will be quite invisible without a powerful telescope.

Mercury will rise thirty-nine minutes before the Sun on the 1st and sixty-five minutes before it on the 15th. Venus will set at 9·14 p.m. on the 1st and at 9·25 p.m. on the 15th. Mars will rise at 5·45 p.m. and set at 3·42 a.m. on the 1st. On the 15th it will rise at 4·35 p.m. and set at 2·42 a.m.

Jupiter will rise at 1·25 p.m. and set at 1·43 a.m. on the 1st. On the 15th it will rise at 12·34 p.m. and set at 11·51 p.m.

Saturn will rise at 3·50 a.m. and set at 5·34 p.m. on the 1st. On the 15th it will rise at 3·3 a.m. and set at 4·46 p.m.

The Moon will be in Leo on the 1st; in Virgo from the 2nd to the 4th; in Libra on the 5th and 6th; in Scorpio on the 7th; in Orphincus on the 8th; in Sagittarius from the 9th to the 11th (new Moon); in Capricornus on 13th; in Aquarius from 14th to 16th; in Cetus on 16th and 17th; in Pisces on 17th and 18th; in Aries on 19th and 20th; in Taurus from 20th to 22nd; in Gemini on 23rd and 24th; in Cancer on 24th and 25th; in Leo 26th and 27th; and in Virgo from the 28th to the 31st.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

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.