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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment.

Science and Agriculture—The Press as an Educational Influence.

THE importance of the Press as an educational influence, and the wisdom of encouraging the application of science as an aid in the solution of agricultural problems, were the main points of the opening address of the Premier, Mr. W. McCormack, at the recent annual conference of the Queensland Country Press. It was a very fine thing, he said, to have country newspapers to give expression to local opinion and to advance the interests of the districts in which they circulated. The Press had an important function to perform in the social affairs of the community, perhaps more important than those in control sometimes realised. As a medium of education the Press had a far greater duty and responsibility than many other businesses. Those first entering upon the newspaper business were often prone to forget that there was a side other than the business side. Too much attention to the profit-making side of newspaper work could cause much degradation of modern thought, and newspapers, run merely to make money, could do an immense amount of damage generally.

The difficulties of pressmen, added the Premier, were many and varied. He thought, however, that a very real need for a better knowledge of economic problems of the world, and of Australia, existed. There never had been a time when there was greater need for agricultural development on scientific lines, and, consequently, one of the greatest functions of the Press in country districts was to educate the people in the application of science to agricultural production. They had been fortunate recently to secure the visit to Australia of men of great reputation in the

scientific world, who had pointed out the urgent need for agricultural research. They had reason to be proud of the Country Press in Queensland—there were some very fine provincial papers.

Mr. McCormack hoped that the Country Press would do more "boosting" of Queensland and its products. Queensland had much to be proud of in its great record of developed wealth and of the progress and energy of its people.

New Agricultural Legislation—Farm Produce Disposal.

TWO important amending measures, included in the sessional programme, have already been submitted to Parliament by the Minister of Agriculture and Stock, Mr. W. Forgan Smith. The first of these is a Bill to amend the Farm Produce Agents Act, and in the course of his second reading speech on the measure, Mr. Forgan Smith said that it had been found necessary as the result of further experience and the development of agricultural policy generally. The principal Act was passed in 1917, and its underlying principle was the supervision of farm produce agents in their dealings with farmers. Owing to the development of modern methods of organisation it had been found necessary by Parliaments all over Australia to make certain rules and regulations governing certain forms of trading.

This Bill would not, he explained, apply to the purchasers of produce, but only to agents for its sale. A farm produce agent was defined as—"Any person who acts as agent, broker, or factor for the sale of any of the produce defined in the Act."

The Bill provides for the payment of the proceeds of produce disposal within thirty days of sale, and also for other forms of business protection to the farmer.

Provision is also made for the prevention of wanton waste of farm produce in a marketable condition, and the amending measure contains many other general improvements on the principal Act. "It is intended to give further protection to farmers against illegal or wrong practices by certain traders in the community," said the Minister. "It will be welcomed by all those engaged in the industry, the majority of whom are carrying on business properly, and doing all the things that are provided for by this measure."

In the course of his reply at the conclusion of the debate on the Bill, Mr. Forgan Smith said that there was nothing in the new legislation that would be damaging in any degree to the legitimate trader. It said primarily that the farmer should be informed of the price at which his goods were sold, and that within a given time he should receive the amount realised, less the usual expenses. "Anyone who knows anything at all about business economics," said the Minister in conclusion, "realises that the best results are obtained by a large volume of production and quick returns. The greater the volume of production the less the average cost of production and the cost of sales become. . . . We are not compelling the farmer to send his produce to market; but we are providing a penalty for anyone who, in order to rig the markets, wilfully destroys produce of a valuable character and fit for human consumption. That does not affect produce that may be condemned by the Department of Agriculture or the Department of Public Health; but it prevents individuals working on behalf of speculators in produce creating an artificial scarcity, which is not to the benefit of anyone. The Bill is a protection to the farmer; it ensures for him a proper account of his transactions, and those engaged in the industry, the majority of whom are carrying on their business legitimately, will not be embarrassed in any manner of means by this measure."

Stock Foods.

THE other new measure introduced by Mr. Forgan Smith was the Stock Foods Amendment Bill, and on its second reading he said, inter alia, that its main aim was to bring about an improvement in the quality of mineral foods and stock licks, which in future would be recognised as stock foods. It provided for the labelling

of stock licks or mineral food, setting out the nature and quantities of the contents of the respective containers, with the object of enabling the farmer to make himself acquainted with the quality of the commodity he is using.

In discussing the subject with Dr. Orr, of the Rowett Institute, Aberdeen, and Sir Arnold Theiler recently, the Minister was impressed by those scientists with the importance of stock foods to the pastoral industry of Queensland and the necessity for the effective regulation and active encouragement of their use.

In nearly every country attention had been directed during the last three years to stock licks, or mixed mineral foods recommended by the sellers for the purpose of supplying animals with the constituents that are wholly or partly lacking in their ordinary food.

The Federal Pastoral Advisory Committee had also dealt with this matter, and he quoted the following passage from its report as presented to the Federal Parliament:—

"The question of sheep licks is one of considerable importance. Evidence goes to show that certain licks are of great assistance in helping sheep to maintain their condition in dry periods. This is a matter that should be investigated by the Council for Scientific and Industrial Research. It could be ascertained what ingredients and their percentages are most suitable for each district. Evidence goes to show that there are many licks sold, and some are of doubtful value. The Queensland Government has set a good example by providing in '*The Stock Food Act of* 1919' that, in respect of stock foods and fertilisers, an analysis of the contents shall be declared upon the label of the container, and details are furnished in the annual report of the department. It is recommended that the other State Governments should pass an Act on similar lines, requiring full particulars to be disclosed of the ingredients of stock licks and stock foods."

The Bill before the House had the support of graziers and stockowners' associations who had discussed this matter with him. Everyone would recognise that this was a matter of considerable importance to the pastoral industry, particularly in Queensland, and to stock-raising generally.

The Meat Industry Hall—A Lesson in Efficiency and Quality.

VISITING meat experts, who saw the display in the Meat Industry Hall at the Brisbane Show, declared it to be the finest exhibition of its kind they had seen, and they were familiar with the great meat shows in the Argentine and at the Smithfield Market in London. The exhibit was beyond doubt the most comprehensive single industry display in the Show. It taught a great lesson in efficiency, educated the public in the appreciation of the true value of meat, of the characteristics of different cattle breeds, the conformation of the modern beef steer, the necessity for herd improvement, and the entire elimination of waste. The producer learnt what could be done by better breeding, and the consumer the merits of different meats, joints, and "cuts." Every exhibit in the Hall was an object lesson of the wonderful value of the grazing industry in Queensland, and its still greater possibilities, if developed and controlled by modern ideas and practice. One section was set apart for a display of the subsidiary industries that maintained it. An extensive range of stock foods, fertilisers, and other by-products were impressively arrayed. Figures were quoted to inform the visitor of the improvement that has been made in the nutritive quality of stock foods through the application of scientific principles and discoveries. The question of suitable rations for stock was also made clear. Generally there was not a phase of the great stock-raising industry and of the great secondary industries of which it is the base, that was not presented in a simple, attractive, and impressive way. It was one of the most popular features of the whole Show, a striking lesson in quality of products, and efficiency in production, manufacturing, and organisation. Moreover, and this is the strongest point of all, it was made in Australia.

Bureau of Sugar Experiment Stations.

CANE DISEASES.

The following report (10th August, 1928), has been received from the Pathologist to the Bureau of Sugar Experiment Stations (Mr. A. F. Bell) :—

DISEASE SURVEY OF THE BEENLEIGH DISTRICT.

In 1926, one of the field officers of the Bureau reported the presence of Fiji disease on several farms in the Beenleigh district, this being our first record of the disease having become established in Queensland. This was a very serious discovery, and since that time periodic visits have been made to the district by the members of the staff of the Division of Pathology. Practically every farm has been carefully inspected and methods for the control of the various diseases found have been outlined. In the two years under review, the improvement in the disease situation is most noticeable, and it is no exaggeration to say that with 100 per cent. co-operation on the part of the farmers, the district will be free from serious diseases within a very few years. The efforts of the farmers to bring disease under control has been very satisfactory up to the present time, with the exception of the Eagleby district, which is in a bad condition, the farmers not taking active steps to bring about their own salvation. This is a district of small mixed farms, the cane often being inter-planted with fields of corn and sorghums, and, owing to the swampy nature of much of the land, the headlands and fields are usually over-run with weeds and grasses. These conditions are ideal for the harbouring of the insects which spread Mosaic disease, and which are suspected of spreading Fiji disease. Consequently the spread of these two diseases is so rapid that it appears that the Eagleby farmers can get control only by planting resistant varieties, and for this reason the planting of D. 1135 must be abandoned. Every field of this variety is more or less heavily infected with Fiji disease, and/or Mosaic, making seed selection impracticable. Once the serious diseases have been eradicated, or practically so, then the farmers can return to D. 1135 if they should so desire.

The major diseases present in the Beenleigh district are Fiji disease, gumming, and Mosaic; there are also some very minor leaf spots, and some indications of root disease, but the latter would probably disappear if the land were in any way well drained. The lack of good drainage is one of the main factors operating against the production of high tonnages, and will, no doubt, be the limiting factor in all but very dry years. Owing to the contour of the country it would be necessary for a large drainage scheme to be undertaken on a co-operative basis or by the Government.

Fiji Disease.

At the time of the first inspection of the district, in January, 1927, it was found that approximately 10 per cent. of the cane throughout the whole district was infected with Fiji disease and the losses were estimated at some 8 to 10 per cent. Further inspections were made in January-February, May, and July of this year, and it is now considered that the infection is less than 2 per cent. Since there has been very little reduction in the percentage infection in the Eagleby district it is evident that the control measures have been practised in the Alberton, Norwell, and Pimpama Island districts. In January, 1927, a little over 60 per cent. of the farms visited were found to be infected with the disease, while this number has not been materially reduced this year; nevertheless, the amount of disease on each farm has been greatly reduced.

Fiji disease is still the most common disease and the one responsible for most damage in this district. The symptoms are too well known to need repeating here, but a copy of a circular giving a full description of the disease will be forwarded on request to any one desirous of obtaining such. A strict watch for the disease should be maintained at all times and any diseased plants should be pulled out immediately they are discovered; when this disease is allowed to get the upper hand the results are disastrous. D. 1135, Purple Top (N.G. 64), and Green Baruma are found to be badly diseased wherever they are grown, and they should not be planted again until the disease has been practically eradicated. By far the most resistant canes are Q. 813 and H.Q. 285 (Milton), and the planting of these varieties is favoured by the Bureau.

Mosaic Disease.

Mosaic disease continues to be generally distributed throughout the area, but serious damage is confined to the eastern end of Eagleby. In the Pimpama Island and Norwell districts, this disease is found wherever Green Baruma is grown, and it is desirable that this variety should be discarded. In all other varieties control can readily be obtained by avoiding Mosaic-infected stools when cutting seed, uprooting of all diseased stools in the young cane, and keeping the fields clean. Mosaic is spread by an aphid which does not attack cane naturally but prefers corn and a number of related grasses; avoid growing these near cane and the spread of Mosaic will usually be avoided. In parts of Eagleby the percentage of infection is too high to permit of satisfactory seed selection on the farms, and it will be necessary for these farmers to go to Alberton, Norwell, or Pimpama Island for seed.

Gumming Disease.

Gumming disease is one of the most serious, if not the most serious, disease of sugar-cane, and it is, unfortunately, in this district now. The first symptoms of gumming are due to yellowish streaks on the leaves; these streaks are about a quarter of an inch wide and follow the direction of the veins of the leaf, that is, they run at an angle with the midrib. As the streaks become older, dead patches of leaf arise anywhere in the streak, but usually towards the margin of the leaf. In the latter stages of the disease gum may be seen oozing from the cut ends of the stems. Gumming can be spread by cane knives and also spreads from plant to plant during wet, windy weather, due to the scratching of the leaves, allowing the bacteria which cause this disease to pass in and out of the wounds.

From this year's inspections the disease appears to be confined to two small areas in Alberton and Stegelitz. In the Alberton district gumming has been found in D. 1135, Striped Singapore, and Purple Top; and all farms close to the cross roads (Ferry road) on the south side should not be used as sources of seed. At Stegelitz, gum has been found in D. 1135, near the Stegelitz wharf, and any farms in the vicinity are under suspicion. Under the circumstances we cannot practise seed selection, but the disease can be eradicated by growing the resistant canes—Q. 813 and H.Q. 5—in these areas. H.Q. 5 has proved somewhat susceptible to Fiji disease so that care must be exercised in the selection of the seed; H.Q. 285 (Milton), while resistant to Fiji disease, is susceptible to gumming and should not be grown in these areas. The importance of eradicating gumming cannot be over-emphasised and must be carried out before we can hope to introduce new varieties successfully. It is found that only about one cane in a hundred is risistant to gumming, so that once this disease appears it means the end of many good varieties.

Rat and Fox Damage.

A considerable amount of rat damage was noted at Pimpama Island, and there is also a good deal of damage throughout the district, stated by the majority of the farmers to be caused by foxes. A proportion of the cane is broken off, but much of the damaged cane is standing and bears an injury as though crushed between the teeth of a fairly large animal. This type of injury is frequently as high as 2 feet from the ground. The variety most damaged is the brittle H.Q. 285 (Milton), and the damage done certainly warrants some steps being taken to reduce the number of foxes.

Seed Selection.

The most profitable form of disease control is the planting of healthy seed, and all those farmers who are replanting Q. 813 and H.Q. 285, or who are replacing other varieties with these two canes, are advised to get their seed cane from one or other of the farmers listed below. These farms have all been found free from disease on at least two inspections made this year, but, nevertheless, a lookout for diseased stools should be maintained at the time of cutting the seed.

The following farmers have been issued with official permits for the sale of seed:—

Eagleby.—No cane suitable for sale as plants was found on this area, and the farmers are advised to get their Q. 813 and H.Q. 285 from Pimpama Island or Norwell. It would be an excellent move if the local association could arrange for some isolated hillside farm to be set aside as a clean seed nursery, and planted with cane from an approved farm.

Alberton.—Mr. A. Enkelmann, Ageston, Q. 813; Mr. Geike (late Mr. A. Schmidt), Q. 813.

Pimpama Island.—Mr. J. E. Enkelmann, Q. 813 and H.Q. 285; Mr. G. Breuer, Q. 813 and H.Q. 285; Mr. Ziltman (late Mr. W. Herbst), H.Q. 285; Mr. F. Haack, H.Q. 285; Mr. R. Brandt, H.Q. 285.

Norwell.—Mr. F. Arndt, Q. 813; Mr. C. Hamel (late Mr. A. Herbst), Q. 813 and H.Q. 285; Mr. C. G. Spann, Q. 813 and H.Q. 285; Mr. B. Herbst, Q. 813 and H.Q. 285; Mr. G. Drescher, Q. 813 and H.Q. 285; Mr G Pinnow, H.Q. 285; Mr. A. F. Brandt, H.Q. 285.

Rocky Point.—Mr. E. Riesenweber, Q. 813.

Stegelitz.—Mr. F. G. Maas, Q. 813 and H.Q. 285; Mr. Frank Maas, Q. 813 and H.Q. 285.

Introduction of Varieties.

Many farmers will, no doubt, wish to introduce varieties from outside districts, but attention must be drawn to the great danger of introducing new diseases by this means. Any farmer wishing to introduce another variety should communicate with the Bureau, who will advise him as to the safest source of seed.

ENTOMOLOGIST'S ADVICE TO CANEGROWERS.

BY EDMUND JARVIS.

"Army Worms" on the War Path.

Caterpillars of the well-known "Army Worm" (*Cirphis unipuncta* Haw.) have already been causing trouble, the young larvæ of this insect having been in evidence last month (August) at Queerah, and probably elsewhere. The caterpillar of this moth, when fully grown, resembles a cutworm in general appearance, from which, however, it may easily be distinguished by its being distinctly striped lengthwise. Its colour ranges from light greenish yellow to greenish black, and a narrow whitish stripe runs down the centre of the back and three additional stripes on each side of the body, of which the central one is dark and the others lighter. The lowest of these lines, situated just below the spiracles, is greenish yellow edged with white. The head is greenish brown and mottled with blackish, the under surface of the body being lighter than the upper, and more or less mottled.

These caterpillars usually feed at night time, hiding during the day amongst the unfolding heart-leaves of cane-shoots.

Their whereabouts, however, is betrayed by numerous pellets of excreta or powdery fragments of same scattered among the leaves or on the ground close to stems of affected plants.

Control measures are not often necessary, unless in cases of severe infestation, as these larvæ are attacked by several species of hymenopterous and dipterous parasites, predaceous enemies, and by a virulent disease known as "Wilt," which occasionally destroys 90 per cent. or more of the caterpillars.

When young cane is badly damaged and the larvæ are found to be still small or about half-grown (¾ inch long), the following poison-bait should be used:—Paris green 1 lb., thoroughly incorporated with 20 lb. of bran, to which is then added 2 lb. of molasses dissolved in sufficient water to reduce the bait to a thick but crumbling mass. Sprinkle this mixture in pieces of about the size of a walnut between the cane-rows, or in a furrow ploughed in front of the advancing caterpillars, applying same just before sundown. Another good method is to spray the plants with lead arsenate, in the proportion of 2 lb. arsenate to about 50 gallons of water. This strength, if correctly made, will not injure the leaves, and while in use should be kept well agitated.

The Beetle Borer Wakes Up.

As the season advances, accompanied by milder temperatures, the activity of the weevil-borer of cane will become gradually more noticeable. Inspection of cane growing in low-lying situations should not be overlooked, and growers discovering evidence of attack at the basal portion of sticks should lose no time in communicating with the Entomologist at Meringa Experiment Station, in order that parasites of this pest may be released on such affected areas.

Dangers Induced by "High Cutting."

In addition to such drawbacks as the reduction of plant vitality—owing to the failure of shoots springing from buds above ground to establish roots—high cutting has a tendency to encourage the spread of the smallest of our three moth-borers of cane, *Ephysterus chersæa* Meyr., the caterpillars of which show a preference for shoots which originate from buds above the ground. Growers should particularly note that high cutting of beetle-borer infested crops tends to leave quantities of these weevils and the grubs behind in the field after harvesting the cane, in the basal portions of the affected sticks, which otherwise would be killed during milling operations.

The Assistant Entomologist at Mackay (Mr. A. N. Burns) reports as follows for the month ended 12th August, 1928, to the Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby:—

Army Worms (*Cirphis loreyi* Dup.) Prevalent.

Outbreaks of more or less minor importance of the abovenamed species of army worm have come under notice at several places near the laboratory; in some instances young plant cane being affected, and one or two blocks of young ratoons. It is well for growers to familiarise themselves with these leaf-eating pests, which at times occur in such vast numbers as to completely eat to ground level large areas of young cane in a few days.

Where cane is only slightly affected as indicated by the leaves having been eaten, a search of the central portion of the shoot, or amongst the loose clods of earth immediately surrounding the plants, will reveal the presence of these caterpillars. Feeding takes place at night, the caterpillars sheltering in the above situations during daylight hours.

The chief damage is not done till these larvæ are about three-quarters grown. From then on till pupation they feed voraciously and almost continuously.

The eggs are deposited usually singly on the young shoots of the cane plants, and, on emergence, the young caterpillars immediately commence feeding. They grow rapidly, and after moulting several times reach the final or fully-grown larval stage. They then measure approximately 1⅜ inches (individual specimens vary considerably) in length, and are of a pale greyish or brownish-green colour, marked with five dark smoky-brown longitudinal bands in the dorsal and subdorsal areas. The central or dorsal one of these bands is the broadest, and is constricted and fainter in colour at the junctions of the segments. Laterally and almost centrally in each segment is a black spiracular marking. The head is brown, with a V-shaped marking, greyish green in the centre, the apex of the V being at the top of the head, thus making the V inverted. Legs yellowish brown, pro-legs and anal claspers greyish or pale brownish green.

Pupation takes place amongst the loose soil particles near the base of the cane plants, and a rough cocoon is formed by drawing together small lumps of soil, debris, &c., with silken threads. The enclosed chrysalis or pupa is dark reddish brown and measures about ¾ inch in length. The time spent in this stage is brief, ranging from twelve to sixteen days at this time of year.

The adult moth measures some 1⅜ inches across the expanded wings, and is coloured as follows:—Forewings above.—Pale ochreous brown with a pearly suffusion. Central area longitudinally from base to outer edge with an obscure streak, dark smoky brown; a few smoky-brown spots forming a faint interrupted line near outer edge from apex to lower angle. Hindwings above.—White, semi-hyaline or transparent, suffiused opalescent, pale pinkish. Forewings beneath.—As above, but lighter in colour, almost devoid of spots or markings, except for an irregular faint smoky-brown marking at outer end of cell. Hindwings beneath.—As above, but more obscure.

At the present time large numbers of this moth are being bred through at the laboratory from caterpillars collected in the field, and up to the present time no parasitised examples have come under observation. Since there appears to be little or no apparent natural control being exercised over this insect in the present generation, it is likely that large outbreaks will occur within the next few weeks. Where observed occurring seriously, control measures may be successfully applied as follows:—

Arsenate of Lead Solution Spray.—Affected cane may be quickly and effectively freed from attack by these caterpillars if sprayed with a cold-water solution spray

applied with a hand atomiser or orchard spray-pump, and in the proportions of 1 lb. of lead arsenate (either paste or powder form) to 25 or 30 gallons of cold water.

To mix this material take a small quantity of the bulk water and mix with the lead into a thin cream, then add this to the remaining water. It is well to keep the spray well agitated whilst applying, as the lead has a tendency to settle at the bottom of the container. Spray is best applied in the morning or early afternoon, when it can dry on the leaves. Once it has dried it is not readily washed off by rain.

Should the caterpillars be in excessive numbers and moving en masse, it is wise to spray a couple of rows of clean cane in front of their advance as well as the cane already being eaten.

Another effective method of artificial control is to plough a furrow in front of the advancing caterpillars, taking care to have the vertical face of the furrow opposite their advance. This causes an obstruction, consequently large numbers become concentrated in the furrow, where they may be readily destroyed.

The true "army worm," *Cirphis unipuncta* Haw., which usually occurs most freely in canefields, and greatly predominates over *C. loreyi*, is, fortunately, so far not in evidence in the Mackay and surrounding districts. It may be readily distinguished in the caterpillar stage from *C. loreyi*, as its larvæ are darker in colour, being a dark greenish black. The control measures described above apply to this and all other species of leaf-eating "army" or "cutworms" that occur in swarms or armies.

Prevalence of Large Moth Borers (*Phragmatiphila truncata* Walk.)

In last month's report mention was made of caterpillars of this borer having been found in mature canesticks. A particular field has been kept under observation, where fairly large numbers of these borers were found in the stick.

Infestation was observed to be worst in the cane adjoining headlands and along the outer rows. This cane has since been cut, and what young shoots have since sprung up have been carefully examined. Infestation in these varied considerably; it was estimated to be as high as 70 per cent. in three rows adjoining a roadway (as taken from affected shoots per stool for a certain distance), and over the whole field could safely be estimated at least at 20 per cent.

Large numbers in all sizes were collected for breeding at the laboratory, and to date none have yielded any natural parasites. Cutting out any affected shoots is the best and most practical way of dealing with this pest; any shoots cut out, however, should be cut away from the stool as near the point of attachment as possible. This was demonstrated clearly in collecting examples from the above field; more than half the specimens obtained occurred from fully 1 to 2 inches below ground level, in the extreme bases of the shoots, and even then some specimens were cut in half.

The earliest indications of shoots being attacked is a shrivelling of the central leaves, followed by "wilting" and complete dying in many instances. It is in this earliest stage that attacked shoots should be cut out and burned; if left till the central leaves are quite dead, the caterpillar will probably have moved and eaten its way into other healthy shoots.

Most of the infestation in mature sticks has been observed in this district to occur in H.Q. 426 and B. 208. In young plant or ratoon cane any variety may be subjected to attack; in this district, however, the severest infestation so far noticed has been in H.Q. 426 and Badila.

Beetle Borer of Cane (*Rhabdochnemis obscurus* Boisduval).

Fortunately this district is comparatively free from this pest, which causes so much damage to cane in the districts further north. Some examples of Badila cane brought to the laboratory last month for testing were found to contain larvæ of this beetle; so a visit was subsequently paid to the farm and adjoining ones that this affected sample of cane came from.

Although a careful search was made, the borer was located on only one other farm besides the one from which the affected sample of cane was brought, and in each instance the borers were found in Badila cane only. Infestation was very light, sticks here and there only being bored, and were in places where the cane was down through having been partly submerged during the floods in the late summer months. Rat damage was fairly bad, particularly near the headlands, where the grass was long and dense. In each instance the cane was growing along the river bank and was bordered by dense scrub and boggy ground. The borer damage was not severe enough to call for control measures.

FERTILISING EXPERIMENTS.

FOURTH SERIES.

Below are given some of the results of manures at the Mackay Sugar Experiment Station when cane brought a much lower price than at the present day. Even then, however, good financial results were shown from the use of manures.

The tonnages of cane per acre are high, but this was largely due to the excellent cultivation methods practised. None of this cane was irrigated.

Results of experiments made in 1902-3 with different fertilisers and lime, at the Sugar Experiment Station, Mackay. Cane used for experiment—Rose Bamboo or Rappoe. Plant Cane. Value of cane at mill, 20s. per ton.

Manure Applied per Acre.	Tons of Cane per Acre.	Increased Yield due to Fertilisers in Tons Cane per Acre.	Cost of Manures and Application.	Increase in Values of Crop due to Fertilisers.
			£ s. d.	£ s. d.
400 lb. Sulphate of Ammonia and Nitrate of Soda mixed	48·9	8·4	3 16 0	4 12 0
200 lb. Sulphate of Potash ..	49·5	9·0	1 16 0	7 4 0
2 tons Burnt Lime	46·7	6·2	6 0 0	0 4 0
300 lb. Superphosphate ..	43·2	2·7	1 10 0	1 4 0
No Manure	40·5	..	..	..

Results of experiments made in 1908 with mixed fertilisers at the Sugar Experiment Station, Mackay. Cane value at that time, 22s. per ton. Second ratoons.

Manure Applied per Acre.	Tons of Cane per Acre.	Increased Yield due to Fertilisers, in Tons Cane per Acre.	Cost of Manures and Application.	Increase in Value of Crop due to Fertilisers.
			£ s. d.	£ s. d.
Mixed Manure containing 3 cwt. Sulphate of Ammonia, 1 cwt. Sulphate of Potash, and 3 cwt. Superphosphate	38·8	14·7	5 0 0	11 3 4
No Manure	24·1	..	..	..

Results of experiments made in 1909 with mixed fertilisers. Cane value at that time, 22s. per ton. Third ratoons.

Manure Applied per Acre.	Tons of Cane per Acre.	Increased Yield due to Fertilisers, in Tons Cane per Acre.	Cost of Manures and Application.	Increase in Value of Crop due to Fertilisers.
			£ s. d.	£ s. d.
Mixed Manure containing 2 cwt. Sulphate of Ammonia, 2 cwt. Nitrate of Soda, 1 cwt. Sulphate of Potash, and 4 cwt. Superphosphate	35·95	16·09	6 13 0	11 0 11
No Manure	19·86	..	..	..

Results of experiments made in 1909 with mixed fertilisers at the Sugar Experiment Station, Mackay. Cane used for experiment, N.G. 24 (Goru). Third ratoons. Value of cane at mill, 22s. per ton.

Manure Applied per Acre.	Tons of Cane per Acre.	Increased Yield due to Fertilisers, in Tons Cane per Acre.	Cost of Manures and Application.	Increase in Value of Crop due to Fertilisers.
			£ s. d.	£ s. d.
Mixed Manures, 6 cwt. per acre, viz. :— Sulphate of Ammonia, Nitrate of Soda, Sulphate of Potash, and Superphosphate ..	49·0	23·2	4 10 0	21 0 4
No Manure	25·8	..	..	..

CANE PEST COMBAT AND CONTROL.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, has received from the Entomologist at Meringa (Mr. E. Jarvis) the following monthly report for the period of July to August, 1928:—

On the 19th July I visited Deeral, which is situated about 27 miles from Cairns on the North Coast Line.

Between Gordonvale and Aloomba the standing cane in many places showed evidence of having been more or less injured by grubs; such injury being apparent also amongst the young shoots of various ratoon crops, many of which were stunted or had failed to make uniform growth.

Much of the cane between Aloomba and Deeral appeared to be similarly attacked, but in many instances the sickly yellowish-green colour of plantations noticed near Fishery and Fig-tree Creek, where much of the growth was stunted, did not display characteristic signs of grub affection, the trouble having apparently resulted from defective drainage and indifferent cultivation. Much of this level cane area in the vicinity of Deeral—consisting of what is usually termed "palm land"—is inclined to be more or less swampy, and appears to be composed mostly of decomposed granite containing surface soil and humus, derived probably from the western slopes of the Bellenden-Ker range about 2¼ miles distant, the mountains of which are of granitic formation.

The area in question is bordered to the east near the Mulgrave River by belts of jungle land, supporting great numbers of an elegant species of palm (*Achontophoenix* sp.), the stems of which, although only 4 to 7 inches in diameter at the base, frequently attain a height of 50 to 70 feet or more, and may often be seen waving their crown-like canopy of leaves high above the general level of the scrub trees. Many growers believe that this class of country is no good for sugar-cane; and certainly, some of the crops grown on it would appear at first sight to justify such opinion.

Growing Cane on "Palm Land."

Upon visiting the selection of Mr. H. G. Lander, however, at Deeral, I was most interested to observe the methods by which he has succeeded in producing on this so-called "palm land," fine healthy crops of cane. The secret of his success must be attributed primarily to thorough draining of the ground, which has made possible the practice of good methods of cultivation. The excavating of more than 3½ miles in length of channelling, however, is no light matter, and must have entailed much strenuous labour, but has evidently proved well worth the trouble. The need for such work becomes imperative in view of the heavy rainfalls experienced at Deeral, where on one occasion, during the wet season of 1925, no less than 24 inches of rain was reported to have fallen in twenty-four hours.

Sugar growers in other countries have commenced to realise that drainage is almost, if not quite, as important as irrigation on flat lands. Much of the area between the North Coast Line and the Bellenden-Ker ranges cannot be expected to produce good crops of cane until it has been properly drained and well cultivated.

In order to be effective and obtain maximum results the drains should be made large and deep enough, and be carefully laid out as to grade and alignment, so that they will not become clogged, and will hold the ground water at a level that will allow plenty of feeding room for plant roots.

The plan adopted by Mr. Lander has been to cut several main open drains, forming a series of straight, parallel lines a few chains apart, which, commencing on the eastern boundary of his land, run in a due westerly direction. Connected with these open channels, which have a slight natural fall towards the Mulgrave River, are a number of cross drains, consisting of a layer of palm-tree trunks about 24 inches deep covered over by a couple of feet of soil. Many of the palms used are 40 feet or more in length, and being exceedingly hard and durable have been found to last several years in the ground. These cross drains are about 4½ feet wide by 4 feet deep, the longer open channels being slightly larger.

In this connection it may be mentioned that the depth of such drains happens to be a matter of no little importance, since it has a direct bearing on the aeration of soil so treated. When the surplus moisture is drained off in this way from low-lying lands inclined to be swampy, the air is then able to fill the interstices between soil particles to the full depth of the cultivation given. In addition to increasing the fertility of the land, such increased aeration provides ideal conditions for the treatment of grub-infested areas with soil fumigants. Most of the failures, indeed, experienced by our growers in the past to obtain the best results from the use of carbon bisulphide have been due to its having been applied to fields which were not sufficiently aerated to allow the toxic fumes to permeate uniformly throughout the depth of soil in which the cane-grubs were working.

Effect of Drainage on Cane Diseases

We know that defective drainage sometimes exercises a decided influence on the occurrence of certain fungus diseases of cane. Crops growing on poorly-drained areas, for example, are bound to suffer more or less from lack of vitality arising from indifferent cultivation and the presence at times of stagnant water, such adverse conditions—especially when obtaining on clay lands or heavy loams—often favouring the development of Rind disease and certain leaf fungi.

Chlorosis, again, which is an affection believed to be due to inability of the plant to take up a sufficient amount of iron, is known to be largely brought about by fungoid disease of the roots, induced by the abovementioned adverse soil conditions.

Many years ago, in Victoria (1900) a serious malady of wheat and other cereals known as "Take All," which at that time was responsible for very heavy financial losses, was ultimately discovered to be due to defective drainage of the wheat lands, and was successfully combated by improving the aeration of affected areas as far as possible and then applying a dressing of lime at the rate of not less than one ton per acre.

The importance of freely liming certain cane lands has repeatedly been stressed by our Director (Bulletin No. 3, General Series, Second Edition, revised, pp. 10 and 11, 1924).

With regard to the effect of lime on newly-drained land, the chief mechanical advantages derivable from such treatment of heavy soils would, of course, be an increased friability and porosity.

Effect of Drainage on Growth of Sugar-Cane.

The chief varieties grown by Mr. Lander are Badila, D. 1135, and Clark's Seedling, the most suitable of these being, perhaps, D. 1135. His heaviest crops, however (from 28 to 30 or more tons per acre), have been secured from Badila, carrying a c.c.s. of 16.0. Some trial plots of B. 147 and Black Innis (M. 189) were making good growth, the former variety stooling well, with many of the sticks about 10 feet high; while Black Innis showed canes from 5 to 6 feet in height.

At the time of my visit there were about 41 acres under cane, and an additional 13 acres under grass or other crops.

It was interesting to note that *Ceromasia sphenophori* has become established at Deeral, pupæ of this insect being found by us in cocoons of *Rhabdocnemis obscurus* Boisd. cut out of old butts of Badila canes. As no liberations had been made at this point of the line, these parasites had probably travelled from Babinda, aided by the south-easterly trade wind.

Various other matters of scientific interest which need not be mentioned here claimed attention, but I should like to take this opportunity of thanking Mr. Lander for hospitality extended during the occasion of my visit to his plantation.

FIELD REPORTS.

The Northern Field Assistant, Mr. A. P. Gibson, reports (21st August, 1928):—

MOSSMAN.

Weather and Crops.

For the first seven months of the year 66.26 inches were recorded; 37 inches of this amount fell during February; only 2.72 inches had fallen during the last three months.

Five thousand five hundred acres were harvested, which produced 76,698 tons of cane, from which 10,670 tons of sugar were bagged. Though 7,881 tons less cane were milled, the sugar manufactured was only 527 tons below that made in the year 1926. Superior mill work and a higher-quality cane were mainly responsible for the improved output.

Following were the major cane varieties milled, together with their respective areas grown and the percentage c.c.s.:—

Variety.	Area Under Crop.	Area Percentage.	Percentage, C.C.S.
	Acres.		
H.Q. 426	1,549	28·2	15·21
Badila (N.G. 15)	1,375	25·0	15·01
Q. 813	197	3·6	15·0
B. 147	314	5·7	14·22
Goru family	120	2·2	13·90
D. 1135	1,281	23·3	13·85
Black Innis (M. 189)	128	2·3	13·30
Mixed kinds	536	9·7	..

It will be seen that H.Q.426 still holds pride of place as far as tonnage and sugar are concerned. The district's average cane tonnage was over half a ton less than that of 1926.

Particulars of the four main areas harvested are given below:—

Place.	Area Harvested.	Tonnage Received.	Tons per Acre.
	Acres.		
Mossman	2,363	38,775	16·4
Miallo	1,629	17,835	10·9
Cassowary	896	12,271	13·7
Mowbray	612	7,817	12·8
	5,500	76,698	13·9

The Mossman sugar land is alluvial, patchy, scattered, and purely coastal. The district tonnage per acre could be raised by more judicious manuring, drainage, better crop husbandry, coupled with improved plant selection. Some farms are returning satisfactory yields, many are not. This, of course, applies more or less to all districts and all industries.

This Season's Yield.

Early in the year crop prospects were highly promising. Dry weather, cane grubs, field rats, and early tasselling reduced the early forecast from 90,000 to 80,000 tons.

Whyanbeel Creek section seems the present hope of the Mossman. Development is being speeded up; a permanent railroad, requiring many bridges, has been con-

structed some distance into this valley. The soil, though good, is patchy and rather broken. Some nice Badila crops were observed.

The Mossman area looked rather better than usual; this region produces fully half of the mill's annual supply.

Harvesting.

All the cane is fired prior to cutting. The merits and demerits of this practice have been many times discussed. Many small farmers harvest their own crops; by so doing costs are much reduced. Money is lost on the subsequent crop because of its very slow removal and the lack of time to properly cultivate, consequently smaller yields are cut.

Milling.

The factory is doing good work, and, though milling 37 tons of cane per hour, seems unable to keep up to the supply, therefore is working most of the time on a full yard of all burnt cane. For the week ending 28th July, 4,958 tons of cane were treated for 722.75 tons of sugar at 94 n.t. The mill average c.c.s. in cane was remarkably high, being 14.73 per cent.

Varieties.

It is improvident for small farmers to experiment with every new and old variety that can be got hold of. The importance of selecting healthy seed is ever being impressed on our growers; also the need of close study of the varieties suitable for their types of soils. The area generally cannot be classified as a Badila-growing one, nevertheless more of it could be profitably grown. H.Q.426 seems the best cane for the medium-quality land, and foremost in sugar content. B.147 is superior to D.1135 in quality, but is a poorer germinator. Q.813 is a good striker, a good disease resister, and a good sugar producer, but generally is unpopular, due mainly to its reclining nature; the growing of this kind might be extended with profit. 7R428 (Pompey) is really a poor land cane and a late maturer. There is a growing tendency to plant this kind on soils too rich for it, also to plant too early (September or October is time enough). This variety should be planted rather sparingly until its quality has been proved.

Graphs.

It is suggested that our chemists make graphs recording the weekly c.c.s. rise or falls of the major canes milled, together with the recorded rainfall. The value of this information is obvious to both grower and miller.

H.Q.285, Oramboo, Korpi, Nanemo, H.Q.409, and E.K.28 are worth-while canes, and the growing of them is worthy of more encouragement.

Pests and Diseases.

Field rats are working havoc in crops growing near the numerous freshwater grassy creek banks. This destruction, coupled with that of pigs and grubs, is a factor that has diminished greatly the season's tonnage and raised considerably the harvesting rates.

Weevil-borer destruction, which was severe at one time, is now hardly noticeable; the burning of all cane and the drier conditions appear to have subdued this pest.

Downy Mildew or Leaf Stripe is the major disease noted here, and is found largely in varieties B.147, D.1135, M.Q.1, and to a lesser degree in Badila and Q.813. This is a complaint spread mainly by infected seed and wind, therefore, it is recommended to start clearing fields from the windward side of the farm.

CAIRNS.

This area was recently reported on, therefore little of any consequence can be added. The weather still keeps dry; such conditions are ideal for the speedy crop removal and the advancement of all field work. The cane being straight and heavy is enabling the harvester to cut a greater daily tonnage, and, in consequence, most mills are over-supplied. The plant and new ratoon crop is coming along nicely despite the dry time. Rain is, however, urgently wanted to maintain the crop growth. B.156, removed from a Mosiac-diseased field at Highleigh and planted at Redlynch, produced the like disease, thus proving the danger and folly of planting such canes.

Mr. E. H. Osborn, Central Field Officer, reports (22nd August, 1928):—

HOME HILL.

The principal cane varieties grown are Badila (N.G.15), B.208, Clark's Seedling (H.Q.426), M.1900, Q.813, and E.K.28. The last two canes named are probably about the two latest canes introduced to be grown in any quantity, but E.K.28 stands right out on its own for financial results in suitable ground. Practically every grower has a paddock of it, and extra large areas seem to have been planted this year. Its ratooning qualities are sometimes questioned, but if ratooned at once, fertilised at the same time with 3 or 4 cwt. of a good manure, the results will pay—that is, of course, if the weather is not too dry or there is no water available.

As far as the writer can judge, fertilising will become a big factor on the Burdekin lands ere long, and it is just as well to wake up to it. The writer has been visiting the district for nearly eight years, and each year sees far more fertilisers (green or artificial) used.

The following results upon a 5-acre block of H.Q.426 on Mr. Peter King's farm, are of interest:—Plant cane, 160 tons; first ratoons, 157 tons; second ratoons, 189 tons cut at ten months old, the result of the first ratoons being fertilised with 2 cwt. of sulphate of ammonia.

Another paddock, 4½ acres, of N.G.15 (Badila) gave:—Second ratoons, 138 tons; third ratoons, 142 tons, cut at eleven months old. In this case the second ratoons were fertilised with 2 cwt. of Howe's Mixture and 2 cwt. of sulphate of ammonia.

The Mackay Experiment Station has forwarded some of the newer South Johnstone seedlings, and also some P.O.J.2714, to be tried out under local conditions. Their growth will be watched with much interest.

Tractors and Trucks.

The former are represented by practically every type of machine, and account for a great deal of work; unfortunately, it is in many cases, a rough class of work that it carries out, and it would not compare at all favourably with the ploughing insisted upon a few years ago, say with a good team drawing a double furrow plough. As for motor-drawn transport, it is now so very common that it looks as if horse-drawn cane wagons will be a thing of the past within a very few years.

The Home Hill Agricultural Show was held during last month, and the committee is congratulated on the very successful initial meeting. Large entries were received, and the cane exhibit was a really good one, but hardly as numerous in exhibits as one would have wished. Next year the writer hopes to see an exhibit of cane that will make Ayr look to its laurels, and that means a great deal.

AYR.

Very dry conditions were being experienced when this area was inspected, for only 31.24 inches of rain had been registered during the year. The two local mills, Pioneer and Kalamia, were doing good work towards reducing their respective totals of 116,000 and 148,000 tons of cane each, and no industrial dispute was causing any delay. As regards the crops that are being cut they are slightly under the original estimate. That is probably the result of too much dry weather and the very early and excessive arrowing of nearly all the varieties of cane. The density in each mill was steadily improving, and was then between 15 and 16.

Large acreages of young cane were noticed throughout the district. Of this the cane planted in March and early in April looked very well, but a great deal of the later-planted cane was indifferent, in fact, in many places was bad.

One of the best strikes noticed was a 20-acre March planted block of E.K.28, owned by the Kalamia Estates. The block had had two crops of green manure ploughed in, and the splendid growth and heavy stooling of the cane showed how the crop was benefiting by such treatment.

In the Pioneer area, several blocks of N.G.15, estimated at 70 tons per acre, were noticed; in one instance 12 acres were put down for 840 tons. Some magnificent crops of E.K.28 were also soon; in one or two cases it was evident that the land was too rich for such a cane, for N.G.15 nearby was in the vicinity of 70 tons per acre, and where such tonnages can be obtained Badila is the cane to grow.

Q.813 has been planted out to a certain extent locally, and as a quick grower, splendid striker, and generally high sugar content, it is hard to beat, but unfortunately is prone to lie down too easily, and also carries an undue proportion of

trash. The latter two reasons are always excuses for asking permission to burn, and, naturally, the mills want to cut as much green cane as possible.

Korpi.—A small twelve-month-old paddock of this variety, cutting probably about 35 tons per acre, was noticed upon Plantation Creek. As this cane has analysed very well upon this farm for the past two years, and now seems to be a healthy and vigorous-growing variety, this year's returns will be of much interest to local growers. It might be mentioned that most of it is being used for plants.

Of the new South Johnstone seedlings, Mr. Geo. McKersie, Clare road, has several of the most promising all growing vigorously alongside some especially heavy Hybrid No. 1 and B.208. Arrangements had been made, through the courtesy of the Pioneer Sugar Mill's management, to have same analysed for the Bureau of Sugar Experiment Stations, but such figures were not available before I left the area.

Fertilising.

Wherever fertilisers had been used, this year's cane shows the benefit of it. Several experienced growers, in speaking of the practice, expressed their belief that the average crop of fertilised ratoons would cut at the rate of about 20 tons per acre against, say, a return of 12 tons for non-manured crops. These figures certainly emphasise the writer's comments upon fertilisers in reference to Burdekin conditions.

During my visit to the district the Ayr Show was held, and it was certainly a splendid exhibit of cane—all first class—and practically every stick was worthy of a prize in any cane show in Queensland.

Mr. J. C. Murray, Southern Field Officer, reports (23rd August, 1928):—

BAUPLE.

Crops.

Crops are not heavy, but they are sound. As the cane is not rank and the cutting is not starting too early, the sugar content should be good.

Farmers were advised to defer planting until the end of August or the first week in September. The reasons for this are as follows, and these apply to all Southern districts:—(*a*) The soil is at present much below germinating temperature; (*b*) if plants lie in the ground longer than three weeks they are often then attacked by fungous growths; (*c*) if cane is planted too early heavy financial loss is caused to the growers by supplying, or, very often, complete ploughing out; (*d*) experience in the past, which is an effective basis for comparison, proves that any period before the end of August is a very risky one in which to plant. (Early spring planting is referred to.)

Some of the cane is arrowing; an approximate estimate would make the arrowed cane to be about 5 per cent. of the total. When a stick of sugar-cane is going to arrow it stops growing leaves and in their place produces a long spike, which might be called a flower-spike, and this in its turn has many small branches carrying a large number of flowers. This grows until it stands well above the leaves, when it finally expands, opens its flowers, and in some instances matures seeds. Cane which has flowered can only make further growth through the shooting of the eyes. Cane is generally at its maximum sugar value about six weeks after the signs of arrowing appear.

Local Fertilising Experiments.

Farmers are again recommended to carry out local fertilising experiments. It can be said quite earnestly that these experiments would be of great benefit to themselves, as the losses in sugar production are heavy through the misapplication of manures. The average grower knows quite a lot, in a practical way, about soil and the use of fertilisers and green manures, but he somehow does not realise that fertilising can be made an exact (and should be an exact) farming operation. But this exact information can only be obtained by three or four years of simple, local experiment. The fertilisers he uses for his experiments will finally pay for themselves, and the labour involved should not go beyond the ordinary routine of farm work. Information as to how to experiment can be obtained by reference to the annual report of the Bureau of Sugar Experiment Sttaions, from published field reports, and by asking any Bureau field officer for the information. One great evil of the hit or miss method is that many growers become discouraged through getting no results, and so neglect the essential and proper feeding of their soils. History shows that English soils reached a very low state, through lack of manuring, in the Georgian

periods. Byron it was who was moved to say, in reference to the failure of the wheat crops and cereals generally, "She fell, with oats, like Bonaparte." And so fertilising in Queensland must be done if the soils are to be kept productive, and although, with many farmers, it may be inexpedient to restore their soil at present, they can at least gather for themselves more accurate information about the needs of their fields.

NAMBOUR.

Weather and Crops.

Crops here are not heavy this year, the persistent rains during the growing period having the effect of considerably checking development. However, it is surprising, when the rainfall figures are looked at, that the cane did as well as it has done. The hill soils can naturally take more rain without injury than peaty river soils, but this is to a certain extent counterbalanced by the fact that river soils, being richer in vegetable matter, can stand more drought.

Cane varieties recommended to the growers are Q. 813, Q. 1098, Q. 822, Q. 812A, and H.Q. 285. There is also a striped sport of Q. 813 making a very good showing. Farmers can, on communicating with the writer, obtain more information about the above varieties. They are also reminded that it is very unwise in this district to transfer plants without a thorough inspection by a Bureau officer.

The following is a description of the Q. 813 sport:—Manner of growth—Erect. Stooling properties—Good. Root system—Small. Foliage—Erect, light green, drooping at tip. Description of stick—An equal distribution of parallel green and red stripes running from the base to the growing point, internode slightly barrel-shaped and lightly waxed; eyes prominent and reposing in long, deep eye-groove; leaf-sear prominent; wax-band heavy; root-band about half an inch wide, no noticeable aerial shoots. Shows no arrows as yet.

Farmers are recommended to discard such canes as those locally called "White Badila" and Mahona. Great care should be exercised in planting N.G. 15, N.G. 16, Black Innis, and D. 1135, mainly because these varieties are susceptible to disease.

DAMS AND DAUGHTERS—HOW A SIRE CAN INFLUENCE A HERD.

Evidence of the tremendous influence exerted by the herd-sire on the future herd is forthcoming in the following particulars received from a well-known Southland (New Zealand) dairy farmer.

Mr. W. Young, Otahuti, has been a keen supporter of the herd-testing movement in Southland since its inception three or four years ago. This breeder also realised that herd-testing could only accomplish its real purpose when used as the basis of culling and breeding operations. Quite early in his testing career, Mr. Young purchased the purebred Friesian sire Bainfield Topsy Prince, by Prince Pietertje of Bainfield—Topsy 10th—and placed him at the head of his herd. The first of the daughters of Topsy Prince to come into profit were milked and tested in the herd last season. A week or two ago Mr. Young received his final return for the season under Association test, and the figures opposite the names of the first-year heifers make interesting reading. Bainfield Topsy Prince sired nine heifers which in their first season averaged 267 lb. of fat in 239 days. That is a splendid performance, but when the individual records of daughters and dams are compared, the records are even more striking. Here are a few of them:—

No. 1.—Dam under test yielded 268 lb. fat in 229 days—daughter by Bainfield Topsy Prince under test yielded 285 lb. fat in 231 days.

No. 2.—Dam under test yielded 208 lb. fat in 209 days—daughter by Topsy Prince under test yielded 253 lb. fat in 241 days.

No. 3.—Dam under test yielded 338 lb. fat in 255 days—daughter by Topsy Prince under test yielded 331 lb. fat in 241 days.

No. 4.—Dam under test yielded 286 lb. fat in 262 days—daughter by Topsy Prince under test yielded 290 lb. fat in 248 days.

No. 5.—Dam under test yielded 185 lb. fat in 255 days (since culled)—daughter by Topsy Prince under test yielded 253 lb. fat in 234 days.

Mr. Young had experiences on the other side of the picture, however, as the following cases show:—

No. 1A.—Dam under test yielded 444 lb. fat in 259 days, whilst her daughter by a purebred Shorthorn bull yielded only 165 lb. fat in 235 days.—"The New Zealand Farmer."

MEALY BUG ATTACKING PASPALUM GRASS IN THE COOROY DISTRICT.

BY W. A. T. SUMMERVILLE, Entomological Branch.

IN November, 1926, this Department was notified that the Paspalum grass in part of the Cooroy district was being attacked by a "disease" which appeared to be killing off many acres of grass on the pastures.

An inspection was at once carried out, and it was ascertained that a small scale insect, belonging to the group commonly known as mealy bugs, was responsible for the damage. At that time the insect was confined to one patch of about 10 acres on two adjoining farms to the south-east of Cooroy township. From information supplied by owners of the holdings it was learned that the injury was first observed in February of that year. At that time it was confined to a small patch in one paddock. The insect then began to spread rapidly, and, so far as had been observed, steadily throughout the year.

On returning to the district twelve months later it was found that several more farms were affected, and by this time (November, 1927) at least six pastures were being attacked. The heaviest damage was now being shown in the West Cooroy area, a distance of about 5 miles from the original infestation. Meanwhile, very little improvement had taken place in the south-east part, but the area attacked had not appreciably increased. In all cases the outbreak occurred in isolated patches of a few acres.

One feature of the attack was that in every case the insect was confined to the northern slopes of ridges, and nowhere could any trace of the depredator be found on the southern aspect. The northern side is protected from the south-east winds which, as a general rule, blow fairly strongly in these parts. The northern aspect also is more exposed to the sun than is the southern.

The Injury.

The first symptom which is noticed is that the grass, instead of being the normal green or at worst an unhealthy yellowish green as it is in most old pastures, begins to turn purplish at the tips and along the margins of the leaves. This symptom is not characteristic of mealy bug attack only, but is also found in other cases of nutritional disorders.

In the case of mealy bug damage the purple-coloured area soon extends and may ultimately embrace the entire leaf and sometimes the leaf-stalk as well. The leaf usually presents a somewhat crinkled appearance along the margins. Soon the plant becomes completely withered and brown. In most cases the whole upper portion dies and no sign of life is manifested by the plant.

The insects never penetrate the surface of the soil, but examination of affected plants will disclose their presence on the leaves and stalks almost to the ground level. Usually they are found clustered together as near the base of the leaf-stalk as they can get. In the most severely attacked plants the whole base is covered by the white mealy and filamentous secretions cast off by the insects. The number of insects

feeding on a single plant varies greatly, and from half a dozen to thirty or more may be observed. In the thick matted grass, where the attack is actually always most severe, the presence of the insects may be completely concealed from a casual observer.

The insects are frequently found sheltering under any object such as a piece of wood or manure, and on turning over such the whole lower surface may be found to be whitened by the insects and their secretions.

Some idea of the damage done may be obtained when it is stated that a patch, say 5 or 6 acres, subjected to the ravages of the insect for about two months, can be picked out from a distance of 7 or 8 miles as a brown-coloured plot in striking contrast to the healthier green of the surrounding ridges.

The insect spreads fairly rapidly. In one instance, in the course of ten months, a paddock of over 12 acres was transformed from an ordinary pasturage into a practically bare field. The insect may be spread in various ways, but probably the quickest dissemination is the result of the strong breezes which usually sweep over the ridges in the affected areas. In fact, at times when endeavouring to collect living material, we were greatly handicapped, for on disturbing the upper dead leaves the wind caught the insects and whirled them away before we were able to collct many.

Host Plants.

Paspalum grass (*Paspalum dilatatum*) was the only plant on which the insect was found to feed in the pastures. Moreover, Rhodes grass (*Chloris gayana*) growing in a badly affected field was left quite untouched. However, when subjected to tests, it was found that not only will the insect live on Rhodes grass, but can change over from Paspalum to Rhodes at almost any stage of its life cycle and continue to thrive and reproduce. In addition to this the mealy bug survived for many weeks on Kikuyu (*Pennisetum longistylum*), and there is nothing to suggest that it will not breed on that grass. However, there is no doubt that Paspalum is much preferred. No Dicotyledons were found to support the bug.

The Insect.

The specific identification of the insect is not yet known. Specimens have been referred to an authority on the group, but it will be some time before his decision is received. The insect is referable to the genus *Pseudococcus* of Signoret, but more recent workers on the group have altered the classification a great deal, and it is quite possible that our species will prove to be placed in another genus, possibly *Macrocerococcus* of Leonardi.

As has been stated the insect belongs to a large group commonly called mealy bugs. The popular name is given on account of the white floury secretion with which the body of many of them is covered. The particular species with which we are dealing is a typical member of the group. The larvæ and adult females are covered during the greater part of their lives by this snow-white secretion, which, in addition to covering the whole upper surface of the body in the form of a powder, also takes the form of slender filaments projecting in all directions from the upper surface and sides of the body.

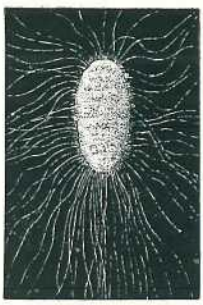

FIG. 2.

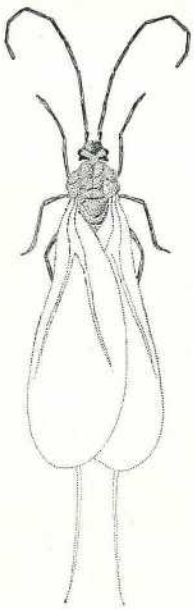

FIG. 1.

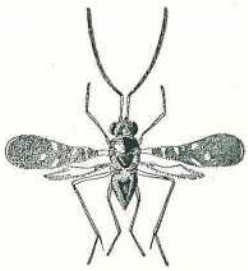

FIG. 3.

FIG. 5.

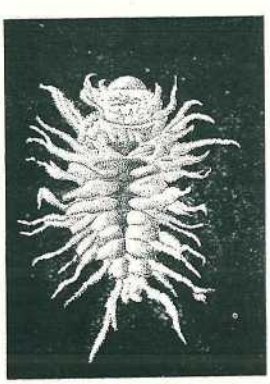

FIG. 4.

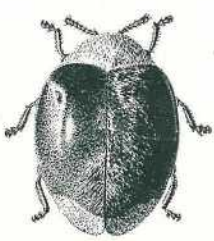

FIG. 6.

J.W. Helmsing 1928.

PLATE 50.—PASPALUM MEALY BUG.

Fig. 1.—Mealy Bug. Adult Male x 23. Fig. 2.—Mealy Bug. Adult Female x 3. Fig. 3.—Chalcid Wasp (*Leptomastix gattatipennis* Gir.). Adult Female x 6. Fig. 4.—Ladybird (*Cryptolaemus montrouzieri* Muls.). Larva x 6. Fig. 5.—Ladybird. Pupa x 6. Fig. 6.—Ladybird. Adult x 6.

The Larva.

The adult female does not lay a typical egg, but the young larva is born in a single investing membrane. The exact significance of this membrane is not quite clear. It is closely apposed to the insect, and in no way suggests a typical chorion. If it is not a chorion the female must be considered viviparous.

The period over which the young are actually extruded varies. In cases observed the operation was spread over from three to seven days. As the time for reproduction approaches the female becomes more compact and loses most of her filaments. The young, sparsely wrapped in long white filaments, are ejected by the female in pairs at intervals of about half an hour. After remaining quiet for about five minutes a slight swaying movement of the head is commenced. This motion causes the membrane to rupture at the anterior end. Soon the movement becomes stronger, and the antennæ, heads, legs, thorax and finally abdomen, are freed, and the membrane passes off at the anal end. This takes approximately thirty minutes, and the young larva is then capable of crawling about. It remains for some time crawling over the body of its mother, and eventually goes off and soon settles down to feed on the plant.

The young larva usually chooses a position close to the midrib of the leaf, and generally on the under surface, for in such a position it can most easily obtain a good supply of food material. The larva at first is scarcely visible to the naked eye, being a dirty-green colour and measuring slightly less than one seventy-second of an inch in length. In this stage it is quite bare of any secretion. After a short period of comparative activity, lasting from one to three days, during which they disperse over the plant, the young insects settle down to feed, and from that time on they rarely move any distance. The floury secretion is soon produced, and in cases examined filaments appeared after eight to ten days. As the larva grows the filaments increase in number and length until ultimately those on the posterior end, which are the longest and most numerous, reach a length of over one-quarter of an inch, while those on the sides and in front are slightly shorter. The full-grown larva is somewhat slug-like in appearance, and the maximum length is about one-quarter of an inch. If the mealy matter be brushed off, the body is seen to be elongately oval and of a dirty-creamy colour.

The mouth parts are of a specialised type, the various parts (mandibles, maxillæ, labium, and labrum) being formed into a piercing and sucking beak.

Adult Female.

The adult female (Plate 50, Fig. 2) differs very little in external appearance from the oldest-stage larva. In fact, it is not possible to distinguish these two stages macroscopically. The well-developed legs are retained throughout life, while the antennæ, which in the young larva are composed of six joints, in the adult female are nine-jointed and fairly conspicuous.

The adult female does not die immediately after completing reproduction, and in some cases it has been observed to survive for a period of over two weeks after that time. As regards the time taken to complete the life cycle we have not very many records, but these show that the period is very long for this class of insect. The longest complete record

is that of one female which was born 20th February and began to produce young on 4th May—that is after seventy-three days. A number of others gave a period of sixty-five days or just over nine weeks. This was the minimum period observed, the average being 70·4 days. Our evidence goes to prove that the female does not feed after its young have begun to appear.

Each female is capable of giving birth to a large number of offspring, and in laboratory experiments the figures obtained show an average of approximately 250 per female.

It was also observed that the females are capable of reproducing without having first been fertilised by the male insect. It is not known how many generations can continue to reproduce parthenogenetically, but in laboratory work females produced in this manner gave rise to a second generation without having been fertilised.

Development of the Male.

The male (Plate 50, Fig. 1) is in some respects strikingly different from the female. The larvæ which are destined to give rise to males are at first practically identical with those which produce the opposite sex. Apart from microscopical differences, the outstanding feature is that the male produces a distinct pupal or resting stage. This stage has not been found in the case of the females.

The male larva reaches a maximum length of about one-twelfth of an inch, and then remains stationary in this respect for a long time. Ultimately it covers itself with a compact mass of the usual floury secretion. From this time on the development differs considerably from that of the female. Soon two small wing-pads are developed on the mesothorax, and in the final stages the antennæ become much longer and the anal characters somewhat altered.

Unfortunately none of the males with completely known records actually emerged, so that the period of development is not known.

The Adult Male.

From the pupa emerges the adult male—a delicate creature scarcely more than one thirty-second of an inch long. It possesses a single pair of fine gauzy wings which are usually folded flat on one another along the abdomen. These wings are a creamy white in colour and almost twice as long as the body, and so when the insect is at rest or crawling about the folded wings obscure the abdomen from sight. Two long white filaments, which are borne at the posterior end of the abdomen, project beyond the wing-tips and are very conspicuous. The antennæ are long, and, as a rule, are held close to the sides of the body. They consist of nine joints, the basal one being the smallest.

The adult males are difficult to obtain owing possibly to their minute size, and probably they are produced in much smaller numbers than the females. This last is concluded from systematic field observations and also from laboratory breeding work.

Allied Insects.

Several members of the mealy bug group are known to affect grasses both in Australia and other countries. The study of our Australian

species is by no means complete, but several closely allied species have been recorded as associated with Australian-grown grasses. In 1912 an undetermined species of *Dactylopius* was recorded as attacking Rhodes grass in North Queensland. In 1921, W. W. Froggatt listed a species *Dactylopius herbicola* Maskell from *Aristida vagans* in New South Wales, and in 1927 another species of *Dactylopius* was found damaging Paspalum at Eumundi.

Distribution.

As far as is known at present the species under discussion is confined to the Cooroy area, but it cannot be taken as definite that this is the limit of its distribution. In fact, that is by no means probable.

Means of Control.

In dealing with the control of an insect, one of the primary considerations is the abundance or otherwise of natural enemies. At the time of the first outbreak of the mealy bug in 1926 a thorough search was made for its natural enemies. It was found that these were very scarce; in fact, in the patch of 10 acres systematically examined, less than half a dozen individuals were discovered. Those found were of two kinds—ladybirds of the species *Cryptolæmus montrouzieri* Mulsant, and a small chalcid wasp, *Leptomastix guttatipennis* Girault. Shortly afterwards a colony of about 150 of the Cryptolæmus ladybirds was liberated in the affected field.

In December, 1927, another examination for parasites was made, and this time the same two species were found in fairly large numbers, and undoubtedly doing much good in checking the mealy bug. In addition to these, two other chalcid wasps were found, but we have not been able to prove that they are parasitic on the mealy bug, though they are closely related to known coccid parasites.

In order that these two definitely useful insects may be recognised the following short descriptions are included.

The Ladybird.

The ladybird, *C. montrouzieri* Muls., is one of the best known of our useful insects. Its good work is recognised not only in Australia but also in America, where its value is counted in hundreds of thousands of pounds per annum.

The adult beetle (Plate 50, Fig. 6) is elongately oval in shape, and is about one-fifth of an inch long by one-eighth of an inch broad. The general colour of the upper surface (dorsum) is black; the head, which is very small, the thorax, and the posterior tips of the wing covers (elytra) are salmon red. The entire upper surface is clothed with fine hairs. The under surface is coloured somewhat similarly, the head, abdomen, and prothorax being yellowish red, while the meso- and meta-thorax are blue-black.

The larvæ (Plate 50, Fig. 4) are flat, rather long-legged creatures of a brown colour. The younger larvæ are practically bare of secretion, but in older stages the body is covered by a white flocculent secretion, and in the half-grown stage it is difficult to separate them readily on general appearances from the larval stages of the mealy bug. In the

full-grown state they can be easily picked out, as the secretion of the ladybird is much more coarse and does not extend into the long delicate filaments characteristic of the mealy bug. The legs of the larvæ are rather dark in colour and can readily be observed. The larvæ move fairly quickly and can be seen wandering about or sucking the body of a mealy bug.

The pupæ (Plate 50, Fig. 5) are seldom found. They usually lie hidden close to the ground. In form they are oval and are covered with a fine floury secretion, the presence of which tends to mask the actual structure and appearance of the brown-coloured pupal case.

The eggs have not been found by us in the grass. They are usually laid on the bark of trees in a bunch of six to twelve or more. They are orange-coloured, elongate, and tapering to a point at both ends.

The Chalcid Wasp.

Leptomastix guttatipennis Girault (Plate 50, Fig. 3) is a minute chalcid wasp. It has two pairs of wings, the hind pair being very delicate and transparent. The fore wings are a deep purplish black, with the extreme base almost transparent and with five clear spaces, three along the fore margin and one on the hind margin opposite the last clear space near the fore margin. The fifth clear spot is in the centre of the wing just outside the marginal spaces. The extreme tip is also clear. In addition to these there is a light spot placed on the fore margin midway between the last and second-last clear spots.

The body, which in the female measures just under one-twelfth of an inch, is of a general purplish colour. The head is brown. The insect moves in a peculiar jerky manner, with its wings either held flat along the abdomen or at an angle of about 45 deg. to the body, and its antennæ held erect in front.

Chemical Measures for the Control of the Pest.

The insects draw all their food from beneath the epidermis of the plant by sucking up the sap with tubular mouth-parts. The sap thus being taken from the interior of the leaf or stem, it is obviously useless to attempt to control the pest by application of stomach poisons to the surface of the plant.

Destruction by the use of chemicals is therefore limited to the use of such substances as would kill by affecting the respiratory organs or by direct contact with the body.

The habits of the insect as outlined above and the manner of growth of the host plant would render effective application of contact insecticides an extremely difficult task, and the cost in time, labour, and chemicals would be very great.

General Considerations.

In making recommendations we have given consideration not only to the mealy bug problem but also to the health of the pastures, inasmuch as this may be related to insect injury in general.

It has been recognised for a long time that generally the most important offset against insect attack is to maintain the plant in a

vigorous, free-growing condition. Anything which interferes with a good supply of food, or in any way prevents the roots or other organs from combining in their function of distributing food materials throughout the tissues, at once renders the plant more susceptible to the ravages of its insect enemies. Authorities on scale insects have pointed out that those insects in particular, with very few exceptions, seem to avoid a free-growing plant.

Of the factors predisposing to unhealthy conditions in plants, it will be agreed that bad drainage and unsuitable soil conditions are amongst the most important.

Pasture, while it is utilised to the utmost limit, in most cases is left absolutely unattended, and yet it is really a most important crop, supplying as it does all the milk, meat, &c., which the herd directly or indirectly produces. These facts do not seem to be recognised by Queensland dairy farmers generally, but in places where this aspect has been realised the attention consequently given to the pastures has been followed by results which have much more than repaid the farmers for their work.

While some grasses might be expected to retain a vigorous growth for many years, the manner of growth of Paspalum would hardly give that impression. It has a rather deep root-system and grows in clumps or bunches with numerous leaves near the ground but very few on the weak spreading stems. The normal habit of Paspalum growing in pasture lands is to form a thick matted clump which soon becomes root-bound. Under such conditions it is scarcely to be expected that the grass will continue to grow in very good health. Analyses of Cooroy soils have shown that the physical condition as indicated by the capillarity is poor. From that fact good drainage would not be expected, and yet the Paspalum, which has a tendency to become root-bound, is left untended for ten or more years growing in these soils. In all cases where the injury to the Paspalum was noted the pastures varied from ten to fifteen years in age, and had been given scarcely any attention since originally laid down. During this time there has been a continuous and practically unrelieved drain on the plant-food materials in the soil, the root system has gradually become less and less efficient, and the matted growth of the leaves has to a large degree prevented the sun's rays from penetrating to ground or more obscure aerial portions of the plant. These adverse conditions have undoubtedly led to a considerable reduction in the vigour of the Paspalum. The falling-off in the carrying capacity of the land which is often complained of in the district is one of the most noticeable effects. In the old undisturbed pastures it is obvious to even a casual observer that the grass is not in a healthy, free-growing condition. In general the fields present a yellowish appearance, and the response to favourable weather conditions is very disappointing.

The unhealthy state of the grass and the probable primary cause have now been pointed out, together with the fact that some insects, especially coccidæ, are partial to weakened plants. It is therefore recommended that the health of the pastures be given immediate attention.

With the object of determining the best method of renovating old Paspalum plots, the Agricultural Section of the Department has been carrying out certain experiments, and though the work has not yet been completed, the experimenter (Mr. C. S. Clydesdale) reports that "The

two plots established at Maleny and Cooroy go to prove that the ploughing up of old root-bound Paspalum pastures is undoubtedly the quickest way of giving them new life." As regards actual amount of grass produced, it may be of interest to know that at Maleny the average yield of air-dry grass per acre was 1·19 tons on unploughed ground and 2·78 tons on ploughed, while at Cooroy the proportions were 1·60 to 2·10 tons. Examination of the plot at Cooroy demonstrated that the ploughed area had a much more healthy appearance than the unploughed parts, and was quite free from mealy bug, though close to a badly affected field.

Recommendations.

In the case of a field infested by the mealy bug, the best procedure is to burn off first and then plough. The ploughing need not be a very good one, the main purpose being to tear up the old root-bound clods and to expose the soil to the sun and air. By ploughing to a depth of 4 inches this should be fairly well accomplished.

This ploughing will also help to kill off the mealy bugs owing to their relatively long life cycle of nine or ten weeks. However, we strongly recommend that the ploughing should not be postponed until the mealy bug or some other insect asserts itself.

Probably the best method would be to work on a few acres at a time. This area could be protected if necessary by a temporary stake fence for the short period it will need to be left undisturbed.

It may be borne in mind that the insects appear to prefer the sunny and protected northern slopes, and it would be advisable, perhaps, to attend to these portions in the first instance. At all events such sites should be kept under observation for signs of damage as described above.

As regards the best time to plough, this is dependent on whether the mealy bug is present or not. If the insect be noticed on a small patch there is, of course, no point in waiting and thus allowing it to spread, especially if the grass can be burnt. In the case of larger areas already affected, burning and ploughing in the late winter or early spring should be followed by the best results. The farms in the Cooroy district are mostly on rather hilly country, and it will, of course, be necessary to give the ploughed ground time to settle down before the heavy summer rains commence.

If ploughing is being carried out simply for the renovation of an unaffected pasture, the time of the year is purely a matter for the farmer to decide on his own experience or that of an expert agriculturist.

Summary of Control Measures.

The mealy bug is subject to the depredations of a number of natural enemies, and in normal circumstances these may be relied upon to prevent their host from assuming pest proportions.

Now, however, the unhealthy state of the Paspalum in the Cooroy district has rendered the coccid injurious to a high degree. We therefore recommend that the affected grass be first of all burned off to destroy, in part at least, any mealy bugs present, and that the health of the grass throughout the pastures be then restored by a cultural method outlined.

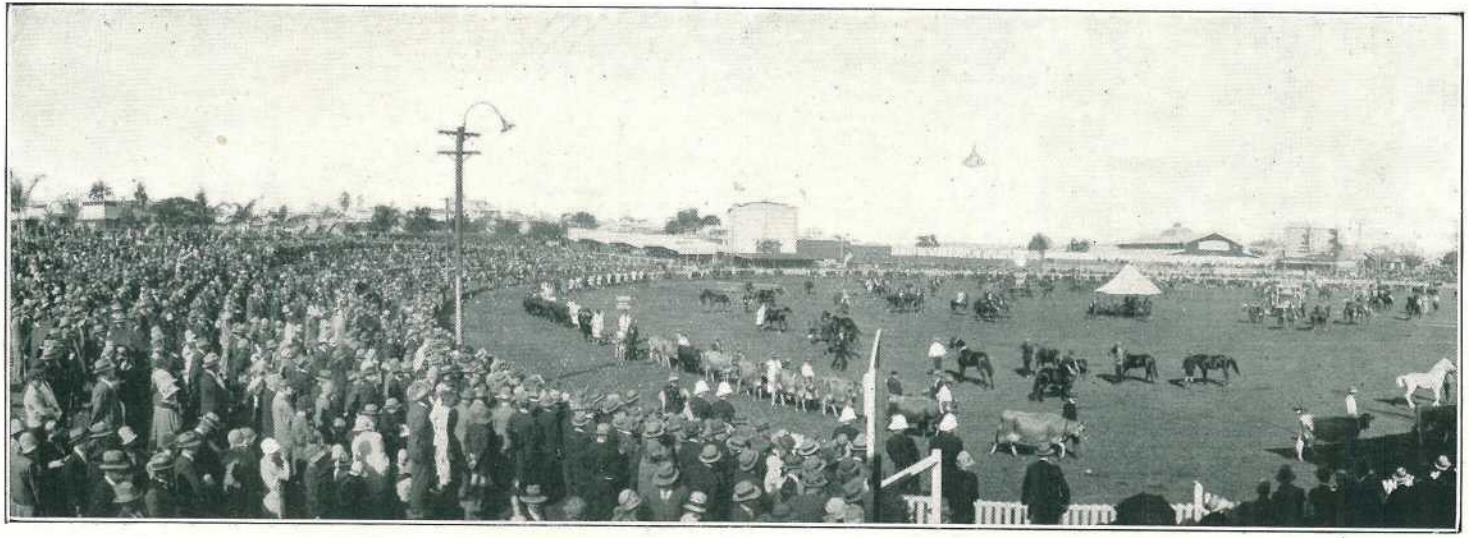

PLATE 51.—THE GRAND PARADE.

ROYAL NATIONAL EXHIBITION.

QUEENSLAND'S BIGGEST AGRICULTURAL EVENT—AN INDEX TO INDUSTRY—A MIRROR OF THE STATE'S IMMENSE RESOURCES AND THE GREAT WORK OF OUR COUNTRY PEOPLE IN THEIR DEVELOPMENT—PRODUCTS OF RICH PROVINCES, OF FARM AND FIELD, OF SOIL AND TOIL, ESTABLISH HIGH STANDARDS OF HUSBANDRY AND DEMONSTRATE THE VALUE OF THE STATE'S CONTRIBUTION TO THE COMMONWEALTH IN REAL RURAL PROGRESS—THE MARCH OF MODERN SCIENCE AND ITS EFFECTIVE AND ECONOMIC APPLICATION TO AGRICULTURE—THE MECHANICAL ROAD TO PROSPERITY—EVERY EXHIBIT A PAGE IN QUEENSLAND'S HISTORY.

This year's Brisbane Show, held on the 6th August and following days, gave proof again of Queensland's rich endowment in climate and soil, and of her productive and recuperative capacity.

All our major, and most of our minor industries, were represented at Bowen Park, where, day after day, many scores of thousands saw, appreciated and appraised the extent to which Queensland depends on agriculture.

The huge daily crowds were distinguished by a general air of prosperity.

The Brisbane Exhibition is certainly a breeder of optimism as well as an exemplar of opulence. Each year the Show keeps on expanding. Each year it gives to us new lessons of hope on a background of accomplishment. Each year is recorded yet another notable advance.

The Royal National Association is a fountain of progressive ideas. It is a strong educational force, and no one will deny its importance as a factor in our agricultural progress. It stands for better stock, better farming, better business, and bigger returns to the man on the land, and all these points were emphasised again most strikingly at this year's Exhibition.

The Show presented impressive evidence of how town and country are linked in industry; how the application of sound principles work out in modern farming practice; how stock can be improved by selection, breeding, and feeding; of the extent to which agriculture is becoming mechanised; and how essential science is to husbandry.

BRILLIANT weather, with the exception of one wet day, favoured the Royal National Association for its 1928 Exhibition which was opened officially by His Excellency the Governor, Sir John Goodwin, on the 8th August, in the presence of a large crowd, which included many notable visitors from other States.

A National Asset.

This year's Show was one of the most successful from every point of view. "It is a magnificent exhibition, and more than a Show. It is a national asset," declared the Governor, and in that opinion everyone present willingly shared.

The Court of the Department of Agriculture and Stock which, it is hoped, will one day be housed in a pavilion of its own, was once more the centre of agricultural interest. Other outstanding pavilion features were the display of the State Forestry Service; the comprehensive district exhibits; the one-farm efforts; the competitive entries in the agricultural produce section and the Rural and Technical Schools' array of examples of skilful and useful craftsmanship. Other noteworthy

displays were those of the Meat Industry Committee, the Agricultural High School and College, and, if it may be classed as an exhibit, the Farm Boys' Camp.

There was a suggestion of genius behind the idea of bringing a number of boys from different farming districts in the State, to the Show as the guests of the Royal National Association. They were accommodated on the grounds and everyone who saw them at work studying types and classes was impressed with the bright intelligence, exemplary conduct and keenness of these sons of farmers, who seemed one in the spirit of service and eager inquiry. Schools all over the country are teaching the farmers of the future the value of the use of scientific methods in every phase of farming. They are showing that those methods apply to stock breeding as well as grain production. They are showing that science points the way to independence, and these fine lads saw object lessons in everything they viewed in their tireless quest for information.

In the Departmental Court the value of science in the paddock as well as in the laboratory was demonstrated by State experts who know their job and the newest developments of it. The exhibits show what can be done, but the Departmental demonstrators are able to tell the farmer the best, cheapest, and quickest way of doing the work. Research results from official investigations into many forms of animal and plant diseases and pests were revealed. To the man on the land to-day it is evident that science is as essential as the plough and the harrow.

Out in the grassed arena the grand stock parade presented evidence that the Australian breeder knows and does what is best in animal husbandry. The cattle, both beef and dairy, were distinguished representatives of their respective breeds, and would command attention and win distinction in any show ring.

In the machinery section every exhibit was a pointer to prosperity along the modern mechanised route.

More and more is the Brisbane Show coming to be regarded as an index to Queensland industry. It is a powerful elevating influence concentrating on quality, and quality alone. It is a wonderful object lesson in the development of new types of stock and the elimination of inferior characteristics.

A Working Model of the State.

The Show, too, might be described as a working model of the whole State. It was a demonstration of the fact that a nation must stand on two legs—secondary as well as primary industry—and it illustrated the inter-dependence of each. As the manufacturer is ready to learn from the producer of his raw material, so the farmer was out to learn something of the processes involved in transforming that material into the marketable commodity; he was out to learn something of industrial economics, business organisation, and commercial progress, and in all these things he saw how little, in these days, can be left to chance.

Interests have widened enormously in recent years and as an educational force the growth of the National Association and its activities must be even greater. Agricultural progress is, of course, its first and most important consideration. This is as it should be, but in its pageant of Queensland factory industries and the skill of Queensland workers in the John Reid Hall, the Association gave fitting recognition of the wisdom of bringing town and country together and proving industrially as well as personally their mutual reliance, as well as the essential inter-relationship of rural and urban production.

The cattle parade, as already suggested, provided the most obvious example of the Exhibition's educative value. In the ring and in the stalls the farmer was able to learn more about judging and selecting a beast than he would learn in a year of text-book study. There he saw the representatives of every breed up for judgment or the stockman's critical scrutiny. He saw the cow that would fill the bucket as well as the eye, and was able to appreciate the breeder's combination of cream-can value and show-ring beauty. In this the Show was a spur to enthusiasm, an incentive to balanced enterprise.

A Queensland Institution.

There is another side to the Brisbane Show and that is its social value—the annual gathering of farmers from every district in the State's immense territory, men from the tropic north and "The Fruitful Granite" on Southern highlands yet white with winter's snows. From the western plains they also came to exchange a year's experiences and pool their knowledge and reach collective conclusions with settlers from the coastal jungles.

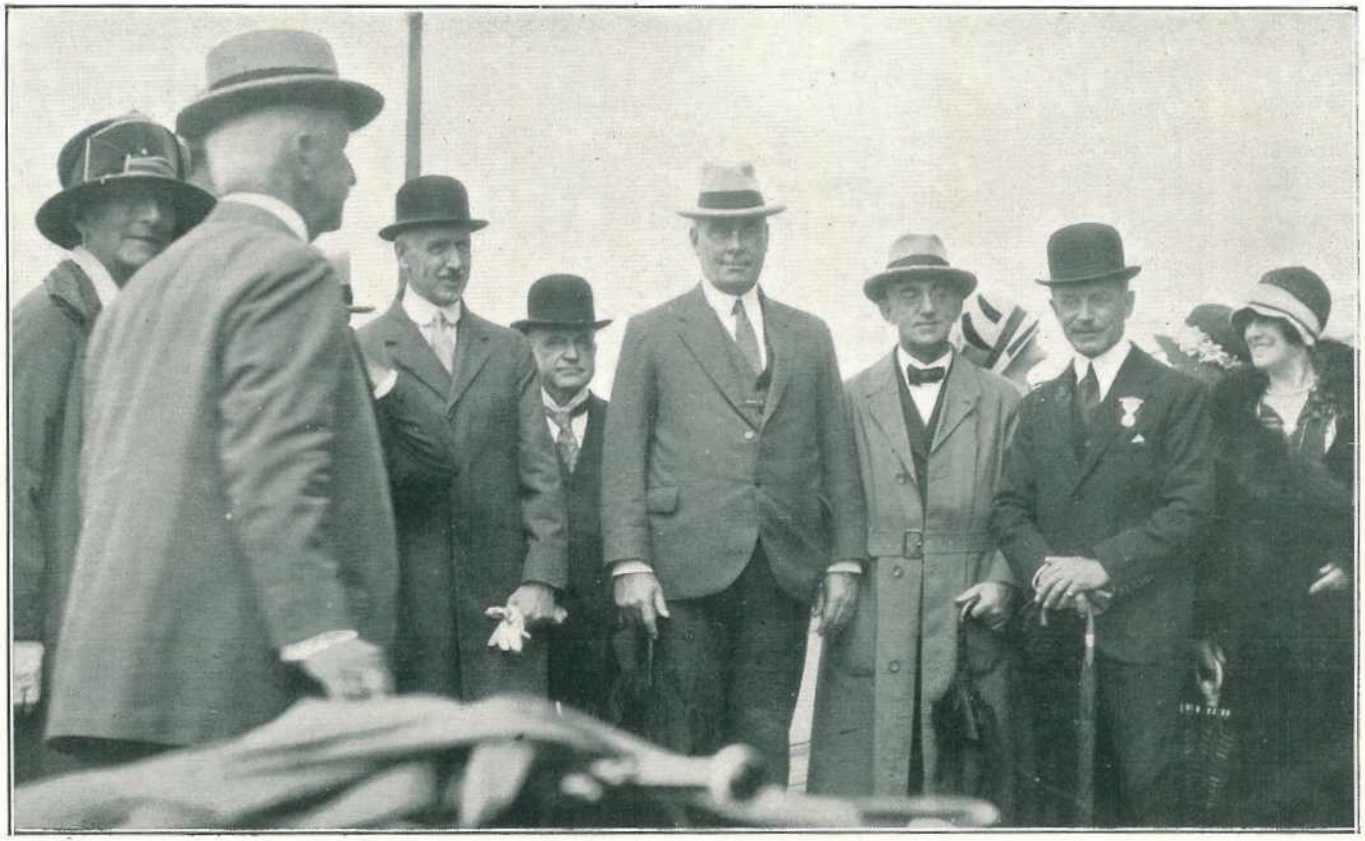

PLATE 52.—AT THE OPENING CEREMONY.

In the background, from left to right, are His Excellency the Governor, Sir John Goodwin; the Chief Justice, Hon. James Blair; the Premier, Hon. W. McCormack; the Minister of Agriculture and Stock, Hon. W. Forgan Smith; Mrs. James Blair; and His Excellency the Governor-General of Australia, Lord Stonehaven. In the foreground is the President of the Royal National Association, Mr. E. Baynes; next to him is Lady Goodwin. Others included in the group, but not caught by the camera, are the Prime Minister (Right Hon. S. M. Bruce) and Mrs. Bruce, Mrs. Forgan Smith, and the Leader of the State Opposition, Mr. Arthur Moore.

Thus the Brisbane Exhibition goes on from success to success, breaking yearly every previous attendance record. This Queensland institution, for it is nothing less, is one of the most impressive signs of our agricultural advance, one of the most encouraging indications to the farmer himself of how essential is his work to our national welfare. It represents the marvellous development of his industry not only in its range of interests, but also in its methods since the not far distant days when the first Queensland pioneers drove in their tent pegs on Oxley Creek, or turned the opening furrow below Bulimba Point.

It is, too, something more than encouragement the farmer gets, it is the inspiration that comes from the other man's success. He weighs and measures the reasons. He realises that the farmer who never conserves a ton of fodder is out of date. He accepts the evidence of the Exhibition, of his own eyes, that better bulls mean better herds and bigger returns. He appreciates the paradox that to stand still is to go back, that co-operation in industry—the co-operation of the producer with the manufacturer, the commodity board, the scientist, the engineer, and, not least of all, the consumer—of which the Show in itself is a simple demonstration, is the principle that when fully applied will lighten our common tasks, ensure our common good, and add enormously to our common wealth.

THE OPENING CEREMONY.

"I CAN say, frankly and unreservedly, taking this Show in a large sense, considering all the facts, all the exhibits, and all the conditions, it is my honest opinion that you could not have a more extensive, varied, and excellently managed Show in the whole world. I have seen many shows, and I have never seen, in any country, one which excelled or even equalled this."

The foregoing statement was made by His Excellency the Governor (Sir John Goodwin) in officially declaring the Exhibition open.

His Excellency thanked the President of the Royal National Association (Mr. Ernest Baynes) and the members of the Council for their kind words of welcome. He said it was a very great pleasure indeed for Lady Goodwin and himself to be there. They always visited the Show with the very keenest pleasure every year.

"I am delighted with all sections of the Show," said His Excellency. "There are magnificent cattle exhibits, both dairy and beef, and the agricultural products and fruit exhibits challenge comparison with any Show in the world. There are so many exhibits here which merit our unqualified admiration that it is impossible for me—and it would be invidious—to mention them specifically. The value of this Show, from an educational point of view, is inestimable."

His Excellency congratulated all those concerned on the magnificent results they had achieved. Much time, care, and devotion had been given to perfecting the Show in every detail. He was sure that the expenditure of time and money and energy would be repaid with enormous interest "in the future of this great State."

The State's Continued Prosperity.

His Excellency the Governor and Lady Goodwin were welcomed by the President of the Royal Agricultural and Industrial Association (Mr. Ernest Baynes) on behalf of the council and members. Mr. Baynes also extended a welcome to His Excellency the Governor-General (Lord Stonehaven).

"It is pleasant to record the continued prosperity of the State as indicated by the phenomenal increase in the live stock sections, necessitating the provision of largely increased housing accommodation for sheep and dairy and beef cattle," said Mr. Baynes. "Including the district fruit and one-farm displays, we have no fewer than twenty district exhibits on view this year—a wonderful record. The exhibit of tropical and sub-tropical fruit shown by the fruit growers of the Blackall Range, the North Coast, and the Redlands is an eloquent indication of what our State is capable of producing, whilst displays made by one-farm exhibitors have never been surpassed either in Brisbane or in any other part of the Commonwealth."

"The machinery and motor car exhibits can best be described as superb," Mr. Baynes went on, "and they will undoubtedly prove of immense interest to visitors. The ring events promise to be very much more attractive than they have been for many years past, whilst the Meat Hall, with its lavish display of beef products, will prove a revelation to those who did not have an opportunity of inspecting it last year."

Included in the gathering besides the Governor of Queensland, Sir John Goodwin, and Lady Goodwin, were the Governor-General of Australia; the Governor of Victoria, Lord Somers; the Prime Minister of the Commonwealth, the Right Hon. S. M. Bruce and Mrs. Bruce; the Premier of Queensland, Hon. W. McCormack; the Deputy Premier and Minister of Agriculture and Stock, Hon. W. Forgan Smith and Mrs. Forgan Smith; the Leader of the Opposition, Mr. A. E. Moore; the Chief Justice, Hon. James Blair and Mrs. Blair; the President of the Royal National Association, Mr. Ernest Baynes and Mrs. Baynes; the Public Service Commissioner, Mr. J. D. Story; the Under Secretary for Agriculture and Stock, Mr. E. Graham and Mrs. Graham; the Assistant Under Secretary, Mr. Robert Wilson; the Director of Agriculture, Mr. H. C. Quodling; the Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby; the Chief Inspector of Stock, Major A. H. Cory; the Director of Fruit Culture, Mr. George Williams; the Chief Supervisor of Dairying, Mr. C. McGrath; the Agricultural Chemist, Mr. J. C. Brünnich; the Government Entomologist, Mr. Robert Veitch; Mr. W. A. Affleck; and the Secretary of the Royal National Association, Mr. J. Bain.

OFFICIAL LUNCHEON.

INSPIRING ADDRESSES.

At the annual luncheon which followed the official opening ceremony, inspiring addresses were delivered by the Governor-General (Lord Stonehaven), the Governor (Sir John Goodwin), the Prime Minister (Mr. S. M. Bruce), and the Premier (Mr. W. McCormack). The dominant note of the speeches was the immense educational value of this year's show, all the speakers expressing the view that its effects would be far-reaching and of incalculable benefit in making for greater efficiency in production. Many Federal and State members of Parliament, and members of the Royal National Association, were included in the distinguished assemblage.

The Spirit of Sportsmanship.

Lord Stonehaven said that the most important people were the exhibitors, and he was glad to think that the real sense of true sportsmanship was as great as it was. It was impossible, by looking at them, to find out whether they were winners or losers. That was an immense national asset. All the exhibitors were entitled to congratulation, not merely those who were taking prizes home and sharing their satisfaction with their neighbours in the district they came from, but also those who would not take any prizes, but would take home a determination to bring back prizes next year. All were entitled to congratulation, because they were supporting that splendid national movement which centred in the Show opened that day in Brisbane. Then they had Mr. Baynes and his colleagues on the Royal National Council. No words could adequately express the service which they rendered to the community by organising that splendid show. (Applause.) He was sure they must be satisfied, for this year at any rate—not satisfied for good and all because he thought they were the kind of people who would never be satisfied—with the splendid progress the Show had made. Then they came to the Premier, who must be proud of seeing so splendid a display of the products of his State, and so splendid a demonstration of the ability and determination of the people, for whom he was the elected leader, to get the utmost value out of their splendid inheritance.

Signs of Progress and Prosperity.

"When you come to the Prime Minister," added His Excellency, "he looks at it from the point of view of one of the six States of the Commonwealth for whom he is entitled to speak in the Councils of the Empire as a whole, and I am sure it must be to him an immense satisfaction to register the progress evidenced by the Show. Then come the Governor of the State and myself, who look at the Show manifestly from a rather more distant point of view. The Governor's horizon is bounded by the limits of Queensland. Last, and least of all, I come to myself, and I look at it from the point of view of one who is concerned perhaps primarily with Imperial questions, and going round, as it is my duty, privilege, and pleasure to do, to the different States, it is most gratifying to register, day after day, and year after year, signs of progress and prosperity of which this Show is such a splendid example. The Governor and I share one thing in common. We are both entitled by a Show such as this to report to the King a message that will gratify him. First of all, the abiding loyalty of the people of Queensland—(applause)—and secondly of the splendid way in which they are developing the magnificent resources of the State."

The Show as a Stage.

His Excellency went on to say that he regarded the number of exhibits (7,328) as a wonderful performance, but numbers without quality would not give a fair indication of the products and possibilities of the country. Both in quality and in number he thought they were entitled to be thoroughly proud of the picture that the Show presented. He looked upon the Show as a stage, because, though from the point of view of the organisation, it was an end in itself, yet it was not really an end. Looking at a review of the past gave them confidence that the future would produce, as a necessary corollary, and an extension of the Show, a constant stream of products from Queensland; first of all, in the great markets of the capital cities of the Commonwealth, where they would find a ready and greater number of customers directly they could provide them, and, above all, in the great market of the Empire in London. How great that market was, he thought, was not sufficiently or not thoroughly realised. When it was realised that Britain imported 2,000,000 tons of sugar a year, and that less than one-half of that came within the Empire, yet in Queensland they had got undoubtedly the best sugar growing country in the world,

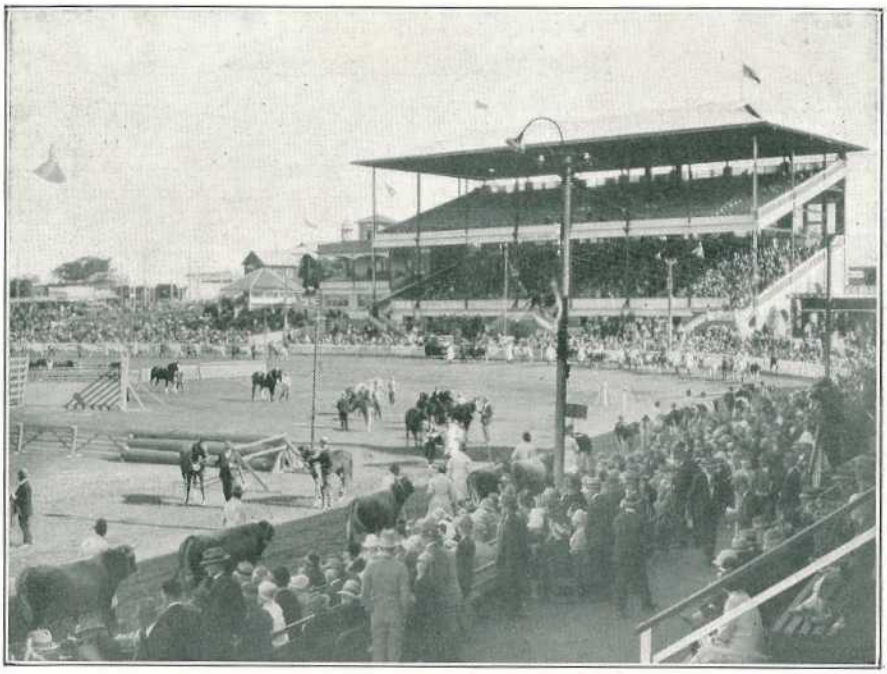

PLATE 53.—THE RING AND PART OF THE CROWD.
The Brisbane Show is one of the big social events in Queensland's year.

he knew at once, that they had in their minds the difficulties which might keep them out of the market at home at present; but he asked them to think of the difficulties which they in the old country were confronted with in facilitating Queensland's entry into that market. Difficulties only existed to be overcome.

Keeping Business within the Family.

"If you know that you have got that market," continued His Excellency, "and, remember, it is not only the richest and best market in the world, but generous to its customers, you will appreciate its value. You will find there men of your own kith and kin. From two points of view they would prefer to buy what they cannot produce themselves from the Empire, rather than outside. I think you can look forward to the future with confidence. Firstly, we want to keep whatever business we have got within the family; and, secondly, from a purely business point of view, we would sooner buy from the people who buy from us, than buy from people whose purchases in our market are very small. (Applause.) Taking

also the market of fruit: Only one half of the fresh, dried, and canned fruit that we import comes from the Empire. This is another big field. Then, there is the question of butter, bacon, and cheese. From States bordering on the Baltic we imported last year £30,000,000 worth. You may say, 'What are your farmers doing to allow that state of things?' I suppose the farmers in the old country were doing, and are doing, exactly the same as you are doing in this country. They have not yet discovered the proper means of taking advantage of the market which lies within their gates. Once organised to take advantage of it, I am firmly convinced that when you tackle this problem you are going to solve it. I am getting on in years, yet I have every hope of living long enough to see our markets in the old country predominantly served either by home supplies or by those from other parts of the Empire. (Applause.)

"From that point of view this show of yours is a most encouraging experience.

Progress Every Year.

"You see progress every year. Last year I remember being tremendously struck with your meat exhibit. This year the meat exhibit really is, I suppose, 500 per cent. better, and it is something that should be widely known and appreciated. I was struck last year by the class of juvenile judges, and you have extended that admirable principle by your camp for farm boys. It is really an admirable and excellent idea. (Applause.) In the meantime, you have provided for the holding of your exhibition under the best possible conditions, by wise spending a large sum in extending your buildings and improving facilities, and you have a very generous lot of prizes—£9,000 in money and £1,000 in trophies. That is splendid work, and I hope that I can make you realise how it appeals to us in the old country."

Building up Australia.

In conclusion, His Excellency said that it was a great privilege to play any part, however small, in the great development that has taken place in this part of the Commonwealth, because by building up Queensland they were building up Australia, and by building up Australia they were building up the Empire. No man and no woman ever had a greater birthright than that of being a citizen of the Empire, because the Empire stood for all that was best in human life. Education was the main element in enabling people to form a right judgment, and by the great part the exhibition played in the work of education it was rendering great service, both directly and indirectly, to themselves and the Empire, which could not be exaggerated. (Applause.)

An Extraordinarily Impressive Show.

In proposing the toast of the State Governor (Sir John Goodwin), Mr. Baynes said that during the short time His Excellency had been in Queensland he had travelled extensively, and had become acquainted with citizens throughout the State. His Excellency had done his best to become closely acquainted with the people on the land and in industries, and by his kind sympathy to those who were having rather a bad time in the drought area he had endeared himself to all. (Applause.) He did not know anybody who had a greater admiration for the men and the women in the back-blocks than Sir John Goodwin. (Applause.)

His Excellency, in reply, said that the Show this year was an extraordinarily impressive one, and, excellent though it was last year, yet one noticed with pleasure and admiration the many marked improvements which had taken place, not only in the general arrangements at the Show Grounds, but also in the increased number and improved quality of many of the exhibits. Some wise man once said "inaction means deterioration," and that was absolutely true. One could not stand still, and there was certainly no sign of lethargy in the Royal National Agricultural and Industrial Association of Queensland; it steadily advanced from success to even greater success. The cattle exhibits—both beef and dairy—appeared to him to be of an extremely high standard, while he understood that the total entries for all exhibits in the Show numbered more than 7,000.

A Tribute to the National Association.

"Personally," added His Excellency, "I say frankly, and without hesitation, that I have never in my life seen a Show which has been better organised or managed, nor one which has shown such an amazing variety of exhibits of the very highest quality.

"I think that it would be invidious were I to mention any particular exhibitor or exhibit, much as I have admired many of them, but I should like to emphasise two points. Firstly, as regards such exhibits as the district and one-farm sections. These appear to me to be of immense importance and value, not only from the view of promoting healthy rivalry, but also as showing to the people of the cities in an attractive form the amazing resources and products of the country districts of the State. I realise the immense amount of work, time, and expense involved in staging such exhibits, but when looking at them I have felt strongly that the men and women who have done the work, even if they have not been successful in gaining awards, have nevertheless performed a great service to the State of Queensland, and are big-hearted, right-minded citizens."

An Educative Force.

In conclusion, His Excellency added: "Now, I should like to say a few words on a subject in which I take a very great interest, and which I believe to be of immense importance as regards the future of Queensland, and that is education. This Show is far more than solely an exhibition of stock, agricultural, and industrial products, important though these are; it is an educational factor which is of inestimable value. The farm boys' camp wheh has been instituted this year, the attendance of the

PLATE 54.—MR. BRUCE WAS THINKING SERIOUSLY OF QUEENSLAND AS THE QUEEN STATE OF THE COMMONWEALTH.

students from Gatton College, and undergraduates from the University, the young judges' competition, the school competitions, and many other factors, bear striking evidence as to what this association is doing as regards education, and I should like to mention the splendid schools' exhibit, which has been organised by the Education Department. When one goes round this Show and sees the magnificent live stock, the agricultural produce, the secondary industries in the John Reid Hall, the forestry and meat exhibits, and when one also considers the care and attention which are being so wisely directed towards the education of the rising generation, one cannot but feel that, great as Queensland is, she has an even greater future ahead."

Raising the Standard of Efficiency.

The Prime Minister (Mr. Bruce) said it was a great satisfaction to him to be permitted to attend for the second time this Exhibition. He always liked attending Agricultural Shows, because he felt that there was a great bond of sympathy between those who had the management of them and himself. They were both attempting to do the same job, and that was to raise the standard of efficiency in Australia.

Building up Australian Sentiment.

The Queensland Show served two great ends—one was that it was a stimulation to increased efficiency, and the other that it brought to the dweller in the city a greater knowledge of the possibilities and resources of this State.

What was required was a greater recognition of those resources, and greater optimism. Every one had the idea that the Australians were an optimistic people. He did not agree with that view. We were not sufficiently optimistic about our own country. We were not prepared to tell everybody in the world that Australia was the greatest country of the earth, and that the State of Queensland was the greatest of them all. However, we were gradually building up in Australia that spirit to some extent. He could instance the State of Western Australia, which he recently visited. When he went there for the first time, five and a-half yars ago, the people spoke continuously of their troubles, and cursed the Government both of the State and the Commonwealth. They also cursed the tariff, the Navigation Act, and everything in the land. But five and a-half years had gone by, and on his recent visit to Western Australia he found that the people had forgotten all these troubles because they were so busy in telling everyone that Western Australia was the greatest State in Australia,

PLATE 55.—THE CROWD WAS INTENSELY INTERESTED IN THE GRAND STOCK PARADE.

A section of the immense daily gathering on "Machinery Hill."

that there was no limit to the wheat she could produce; in fact, that she would in the future be able to produce more wheat than the whole of the rest of Australia put together. They declared that it was only a matter of time when they would have a population as great as all the other States combined. He had a sneaking belief that Western Australia was quite right, and that some day she would be the greatest State; but unquestionably Queensland was the State with the greatest possibilities of the whole Commonwealth to-day.

The Spirit of Optimism.

They wanted that spirit of optimism to prevail throughout Australia. He had such a belief in Australia that he considered it was highly necessary to advertise its potentialities. Once having seen the country, they could not fail to realise that it was the greatest country in the world.

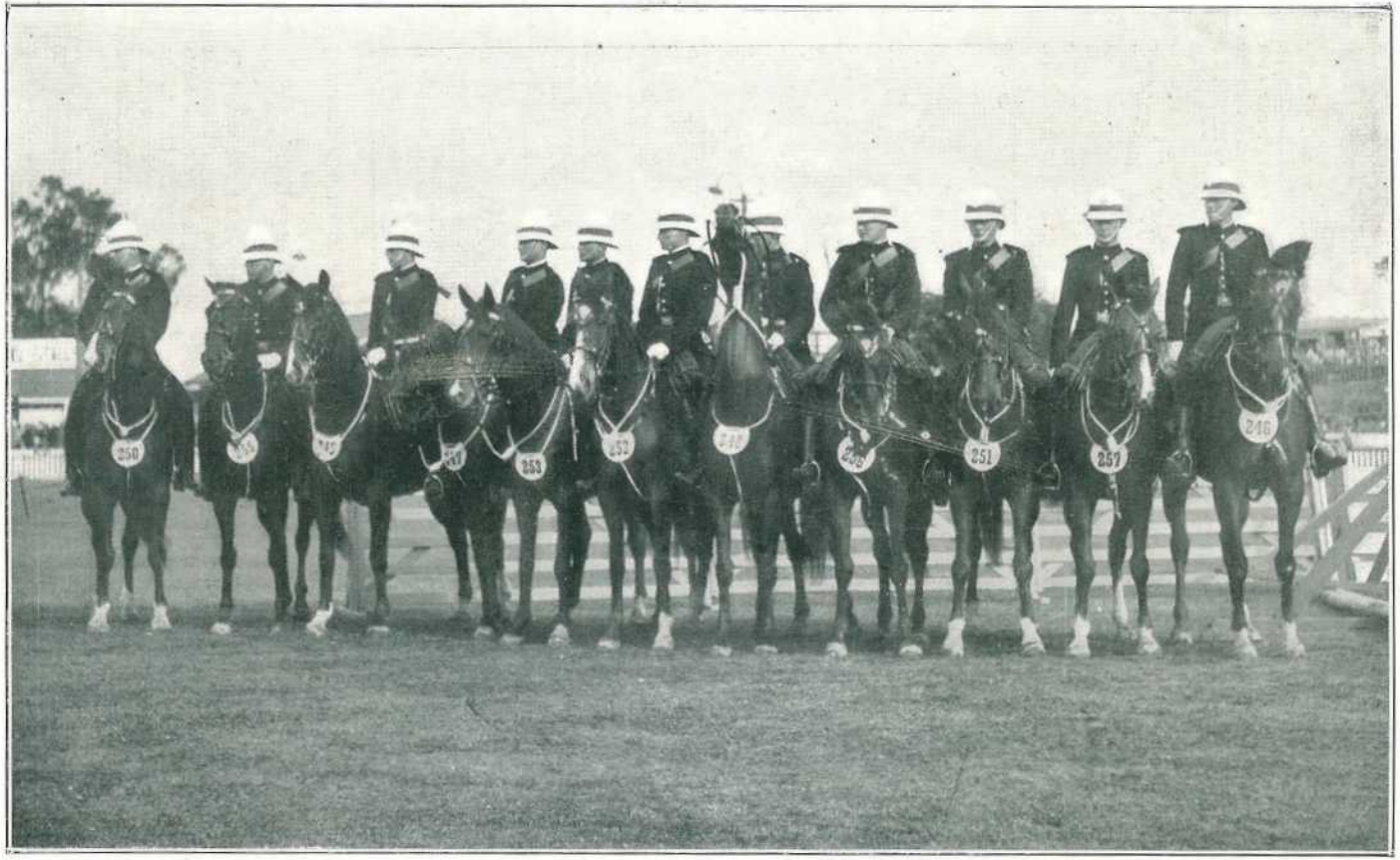

PLATE 56.—TROOP OF MAGNIFICENT REMOUNTS.

The Queensland Mounted Police is noted for its all-round smartness, efficiency, and expert horsemen. These horses were bred on the Government Remount Station in the Central District. The Police competition was a very popular ring feature.

Another great object that this Show would achieve was in demonstrating that the greatest requirements in Australia to-day were to improve efficiency of production and the marketing of its produce. That was the solution of the problems that faced Australia to-day. Australia had tremendous difficulties. The greatest of them was the fact that the expanding production had become too great for the home market to absorb. They therefore had to go into the markets of the world and compete with other countries. Many people declared that this could not be done successfully. They started to talk about the tariff, and said that it was such a deterrent to the producer that it would be impossible to compete on the markets of the world. There might be something in that, but we could concentrate on getting the tariff on to a scientific basis by which the producer would be placed in an advantageous position.

Efficiency in Production.

"It is not the tariff, nor the policy of any Government that prevents us to-day," said Mr. Bruce, "from competing in the markets of the world. It is the need for greater efficiency in production. Your Show is doing a great deal to educate the people of Queensland to achieve that efficiency.

"I have been told that the way in which we can solve all the problems of our export trade is by reducing wages in Australia. The amount we can save by doing that is incomparably small compared to what we can accomplish by improving efficiency and bringing it up to the standard on which it should be. That can be done in Australia. Hitherto we have never taken the trouble to increase efficiency. Things have been too easy. We have had too fertile a land and too wonderful a climate. Now, when we have grown to manhood, and have to seek our markets in competition with the rest of the world, we have to abandon that atmosphere of not worrying very much, and we have to rely upon our efficiency. We have to recognise that we have greater advantages than any other country. There is no body which is doing more to help in that than the Royal National Association of Queensland, and I would like to pay my tribute of admiration to them for what they have achieved."

Mr. Bruce went on to say that the present year was memorable in regard to the advancement of science in our primary industries, which were the basis of our national development and prosperity. During the present year they had received a visit from three distinguished scientists. One was Dr. Orr, the head of the Royal Institute of Aberdeen, who was noted as an expert on the subject of animal nutrition. They had also had a visit from Sir Arnold Theiler, who would be the head of the Animal Health Bureau, which was being established in Britain as a result of last year's Agricultural Conference. They had also had a visit from Sir John Russell, who was probably the world's greatest expert with regard to soil and fertilisers. These three men had seen this country, and each one had expressed the opinion that Australia had the greatest opportunities from a pastoral and agricultural point of view of any country in the world.

A Tribute to the Queensland Government.

Mr. J. P. Bottomley (hon. treasurer of the Royal National Association of Queensland), in proposing the toast of "The State Parliament," coupled with it the name of the Premier (Mr. W. McCormack). On behalf of the association, he expressed his thanks to the Premier for the assistance that the Government had rendered during the past few years, which had enabled the association to effect so many improvements. He appreciated the action of the Minister for Education (Mr. T. Wilson) in arranging for his department to stage such a wonderful exhibit, which clearly showed what the educational system in Queensland embraced.

Mr. McCormack, in responding, congratulated the president of the association and his council upon the very fine Exhibition this year. It was an interesting Exhibition, and should prove a great enlightenment to the people who had come here from the Southern States. He took this opportunity of telling those visitors that Queensland was not the kind of State they were inclined to believe it to be. They heard a good deal of criticism from the people in the Southern part of Australia, and he agreed with the Prime Minister that they should boost their State more in the South than they were doing. They should not allow the Southern criticism of Queensland, which could produce almost every commodity that man required, to pass unobserved. This Exhibition possessed a very fine educational value, and no doubt compared favourably with similar shows in other States and other countries. Queensland was not a very old State, and it had not the huge population possessed by other countries. It had not even a population as great as New South Wales or Victoria. It had a wider area, and more difficult problems to meet in regard to transport and climatic conditions, yet in spite of these difficulties they were able to produce a magnificent Exhibition such as this.

Embargo on Queensland Meat.

"There is another aspect," continued Mr. McCormack, "that we must remember, and which we want to impress upon the Southern people. We can produce many things that they require, and they can manufacture many things that we require; but we find that in some States there is a decided objection to giving us the opportunities that we should possess of selling our primary products in those Southern markets. In the course of the last month I have been endeavouring to help a match manufacturing industry in Victoria to get the trade in Queensland, instead of allowing that trade to go to Sweden. The Victorian company can produce an article of equal value, and at the same price, as the imported article. This is not a matter that requires tariff intervention. It requires the sympathy of our own people, who should show a preference for goods made in Australia. On the other hand, unfortunately, the State of Victoria, from which we are getting this article, is putting an embargo on the meat which we should produce and sell in the Southern States. I hope those Southern visitors who are here to-day, whether they be in high positions of State or

PLATE 57.—IT WAS A GOOD STORY.

Mr. Forgan Smith, Lord Stonehaven, and Mrs. Blair, reflect the spirit of Australia.

citizens who are visiting our Show, will do everything they can to bring closer together the peoples of our Commonwealth States, so that we may sell to the Southern States the things that we produce, and take from them the manufactured articles that we need."

Queensland Industries.

Mr. McCormack, continuing, said that he believed the Brisbane Show furnished the finest opportunity to exhibit to the people, not only of this State but also of the Southern States, the indusries upon which this State relied. It also showed them what Queensland could do in primary production, and it gave to the world at large an idea that Queensland was quite as forward as other countries in the world.

Mr. McCormack concluded by saying that the whole of the Queensland Parliament —and he thought he could speak for all parties—were anxious to assist those men who had given their time and money to make this Show such a great success. (Applause.)

PLATE 58.—MAIZE WAS ONCE MORE KING.
The Central Trophy in the Departmental Court illustrating the practical results in Grain Improvement achieved by Departmental Plant Breeders.

THE COURT OF AGRICULTURE.

REPRESENTATION AND REVIEW OF DEPARTMENTAL ACTIVITIES.

The Department of Agriculture and Stock was represented this year in its Court in the Exhibition Pavilion by a well-organised and artistic display, educational in aim, designed to represent the work of a number of field and technical officers, and to serve to illustrate by the meticulous care taken in the arrangement and technique of the exhibits that a high standard of departmental efficiency has been reached in dealing with the many and varied problems of primary production. A country's progress in agriculture and stock raising is dependent now more than ever on the linking of science with practice. Proof of the soundness of this assertion was observed throughout every section in the Departmental Court. These sections embraced a varietal display of sugar-cane; maize breeding and seed selection; a wheat exhibit; broom millet and sorghums; separate wool and cotton displays; native grasses; weeds and suspected poisonous plants; an entomological exhibit; vegetable pathology; a dairying exhibit; the work of the Yeerongpilly Stock Experiment Station and of the Pure Seeds Branch; pig raising and poultry exhibits; a varietal display of Townsville-grown potatoes, and a similar class of exhibit of cassava grown in the Mackay district; and "Queensland Agricultural Journal" Information Bureau.

CEREAL CROPS—NEW TYPES EVOLVED.

Maize

A pyramidal trophy of maize, which thrives in Queensland practically from the Tweed to Cape York, was the central feature of the Court of Agriculture, and illustrated definitely the fact that the solution for market gluts and low prices is largely a greater utilisation of the grain for stock feeding and for manufacturing purposes, lines of development on which America commercialises upwards of 3,000,000,000 bushels per annum. Mounted on this trophy was a wide range of educational texts, describing concisely and clearly the maize improvement project, one of the many branches of Departmental field work administered by the Director of Agriculture, Mr. H. C. Quodling.

Evidence of the successful application of scientifically designed seed selection and of the work of Mr. C. McKeon, Assistant Instructor in Agriculture, who specialises in this branch, was observed in the wide range of samples staged. Several varieties of yellow maize, the subject of the improvement work, were shown, and it would be difficult to visualise a greater perfection than that attained in the samples set out as they were in juxtaposition to a wealth of information of undoubted educational value. The significance of this seed improvement work and of its practical application was readily appraised by the type, character, and productivity of the several varieties shown, prominent among which was the more recently evolved Departmental "Durum" variety, especially bred and developed to meet the requirements of the Atherton Tableland, where a hard, mould-resistant type of grain is necessary. In this particular district seed maize is being grown on an isolated area under Departmental control, and progressive plans have been formed for the early distribution of seed supplies for the express purpose of rapidly bringing "Durum" maize into general cultivation. The samples shown indicated a rather extraordinary bushel weight, up to 62 lb. as against the usual standard of 56 lb., the grain being bright amber yellow, hard, sound, and attractive in appearance.

Trade prejudice by interstate and oversea buyers against red corn has recently been observed, and growers would be well advised to plant strictly yellow varieties in lieu of red or red-tinted maize, otherwise similar difficulties in effecting sales will have to be met next year.

Wheat.

This comprehensive display occupied the full width, about 70 feet, of the top of the Court, and its arrangement, which was in the hands of two officers of the Field Branch, Mr. C. S. Clydesdale, Assistant Instructor in Agriculture, and Mr. S. Smith, Field Assistant, was designed to illustrate the increasing popularity of the crop as a complement of two other staple industries—sheep raising and dairying. Last year approximately 4,000,000 bushels were harvested in Queensland, and phenomenal yields were obtained over the larger portion of the Darling Downs. Many crops ranged from 40 to 50 bushels an acre, the record yield being 66⅔ bushels, which was harvested near Allora. As no fertilisers were used, the results serve to demonstrate the inherent richness of Darling Downs soils. Prominence was given to contributory factors in maintaining high productivity, and an educational presentation of these was set in sequence on placards on which the underlying principles of cultivation

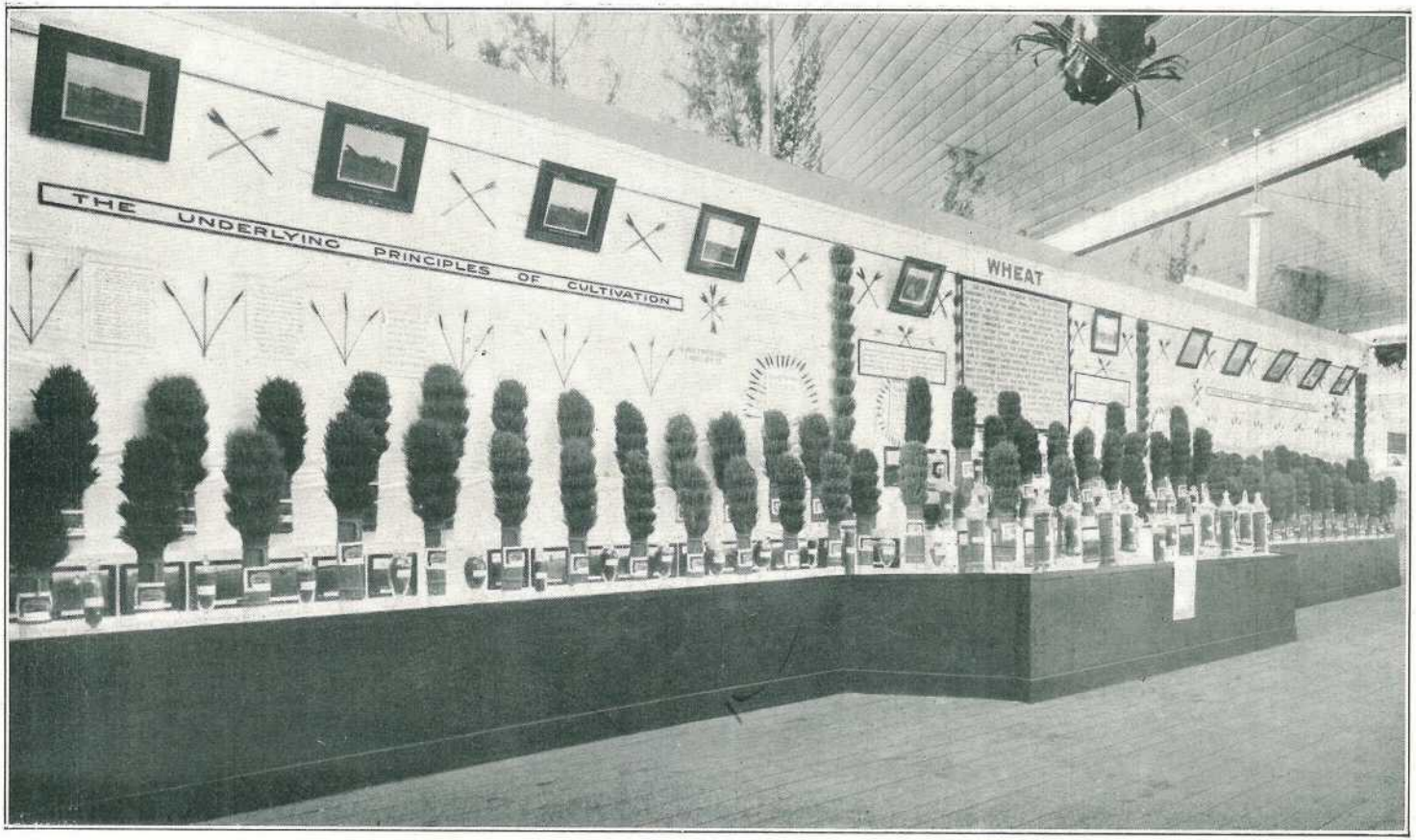

PLATE 59.—WHEAT WAS ONE OF THE STRONGEST FEATURES OF THE DEPARTMENTAL COURT.

Through systematic breeding the Department has evolved prolific wheats suitable to Queensland conditions of, mainly, summer rainfall. This work has been a most important factor in quadrupling our grain yield.

"Mountain or river or shining star,
There's never a sight can beat—
Away to the skyline stretching far—
A sea of ripening wheat."

and soil moisture conservation were tersely described. Experience has shown that, although the annual rainfall in the Queensland wheat belt is higher in the aggregate than that in parts of the Southern States where, contrary to a crop each season here, a year's fallowing may precede the planting, there is an ever-present necessity in Queensland for an improvement in farming practice by the more systematic preparation of land to absorb and conserve the summer rainfall which must be stored and held in the subsoil.

Another very important feature of the wheat exhibit was the display of new varieties bred at the Roma State Farm, which were subsequently grown in different districts under the supervision of officers of the field staff. Upwards of fifty selected strains in sheaf and grain were exhibited; these were from plots at Jandowae, in the Dalby district. By a continuity of this experiment and observation work, progressive field demonstration plots are carried on, the more highly rust-resistant and productive varieties being tested out under field conditions. Selected varieties are gradually brought into cultivation, this work being linked up with that of the Wheat Board.

Photographs of the Departmental classification scheme were shown, giving information as to the character of grain, time of maturity, and the suitability of different varieties for different soils and districts, all with a view of affording information to growers in concise form.

Last year one of the new Departmental wheats, "Duke of York," a Bunge-Gluyas-Cretan combination, returned 77·25 bushels for each bushel sown on a small field, grown and harvested under field conditions.

The 1927-28 Field Crop Competition was illustrated by a series of photographs of the fifty-one competing crops, and reference was made also to the district prizes won and the Royal National Championships, the judging of the crops having been entrusted to the Department.

Many other features of interest were included in a display which provided an excellent advertisement of the potentialities of this great State.

OTHER PRODUCTS.

Broom Millet and Sorghums.

Grouped in the form of a wall and bench display were a number of samples of broom millet and Nigerian sorghums. The former has attracted much attention in the last few seasons, and is now marketed under the Pool system. Evidence has not been wanting of some laxity on the part of growers in the classification and preparation of this useful household commodity. Much text information was also given on the growing and marketing of this crop.

The sorghum samples shown were grown in Departmental plots in Central Queensland under the District Agricultural Instructor, Mr. G. B. Brooks, who is engaged in testing and seed selection work with the more recently imported varieties, which made extraordinary growth under the forcing conditions met with in the recent wet season. This group belongs to the non-saccharine class, and on this account the fodder is inclined to be pithy. The grain, however, is large, and in suitable situations the crop should prove an acquisition for a variety of purposes.

Saccharine sorghums forming the subject of comparative fertiliser trials at Yeerongpilly, conducted by the Instructor in Agriculture for Southern Queensland, Mr. A. E. Gibson, afforded proof of the very high fodder yields obtainable in a favourable season, and illustrated also the economic value of saccaline as a green fodder and ensilage crop. Planted on 10th October last year, the crop was cut and weighed on the 21st and 22nd December, representing growth made in two months and a few days; the highest aggregate return from one of several plots was 35 tons 9 cwt. 15 lb. per acre. In a ratoon cutting from the same plot on 28th March this year a yield of 30 tons 14 cwt. 1 lb. was obtained, or an aggregate yield of 66 tons 3 cwt. 16 lb. per acre.

Cassava.

At the Royal National Show in 1926 and 1927 a special feature was made of this crop in connection with the production of power alcohol, the Department having introduced 1,000,000 cuttings from Java for planting out in the Mackay district, principally at Sarina. The wet season militated generally against the success of the crop. Experiment work is still in progress. Samples of a few of the varieties of cassava taken from the Departmental experiment plots were on exhibition, with an accompanying record of yields which indicated that the plant is capable of high returns. Up to the present there is not sufficient data to determine whether cassava can be grown at a profit for the extraction of power alcohol.

Northern-Grown English Potatoes.

An important section of the experimental work dealt with by the Northern Instructor in Agriculture, Mr. N. A. R. Pollock, is that of demonstrating the best and most suitable varieties of potatoes as a food crop for the North. The special features associated with the production of thirty-six varieties on Mr. A. W. Hughes's farm, in the Townsville district, were set out.

To the Southerner potato-growing is not usually associated with the tropics, yet the quality of the tubers exhibited and the yields obtained, up to 8¼ tons per acre, compare more than favourably with the production of temperate regions.

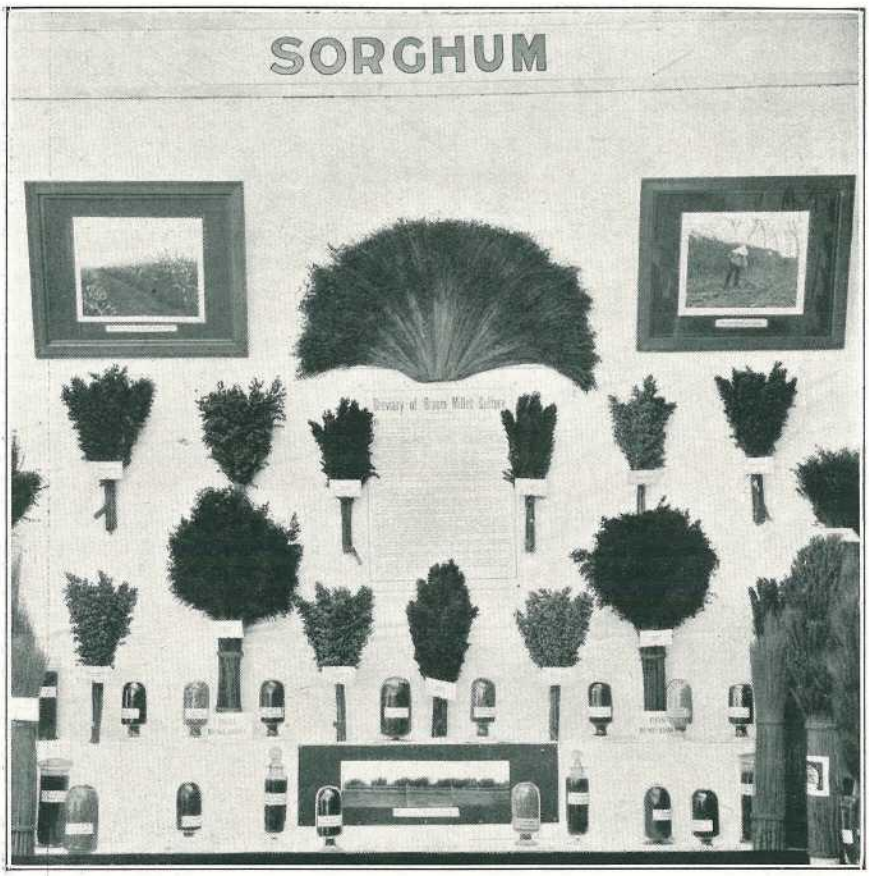

PLATE 60.—FODDER CROPS WERE STRONGLY FEATURED IN THE DEPARTMENTAL DISPLAY,

And panels like this gave point to the aphorism that half the breeding of a beast goes down its neck.

The Department, in an effort to popularise potato-growing in the North, has conducted trials on the Tableland in the summer and in the coastal districts in the winter months for several years with such marked success that the area under crop in these localities has shown so substantial an increase each succeeding year as to permit of a forecast in the near future that production will be sufficient to supply all Northern requirements. With summer crops on altitudes of 2,000 feet and upwards and crops on lower coastal altitudes during the cooler parts of the year, the market should be well supplied.

Growers on the tropical coast experience a difficulty in securing seed sufficiently forward for planting towards the end of March, which is considered the earliest period for safe planting, seed from the Tableland crops rarely being fit until late April or May.

The crop, of which the samples shown were representative, was grown from seed produced on the coastal areas of the North last year, being harvested in September, held in Townsville until the first week in November, when it was placed in cold storage at a temperature between 34 and 40 degrees Fahrenheit until the 23rd March, and planted on the 2nd of April with a resultant strike of 100 per cent.

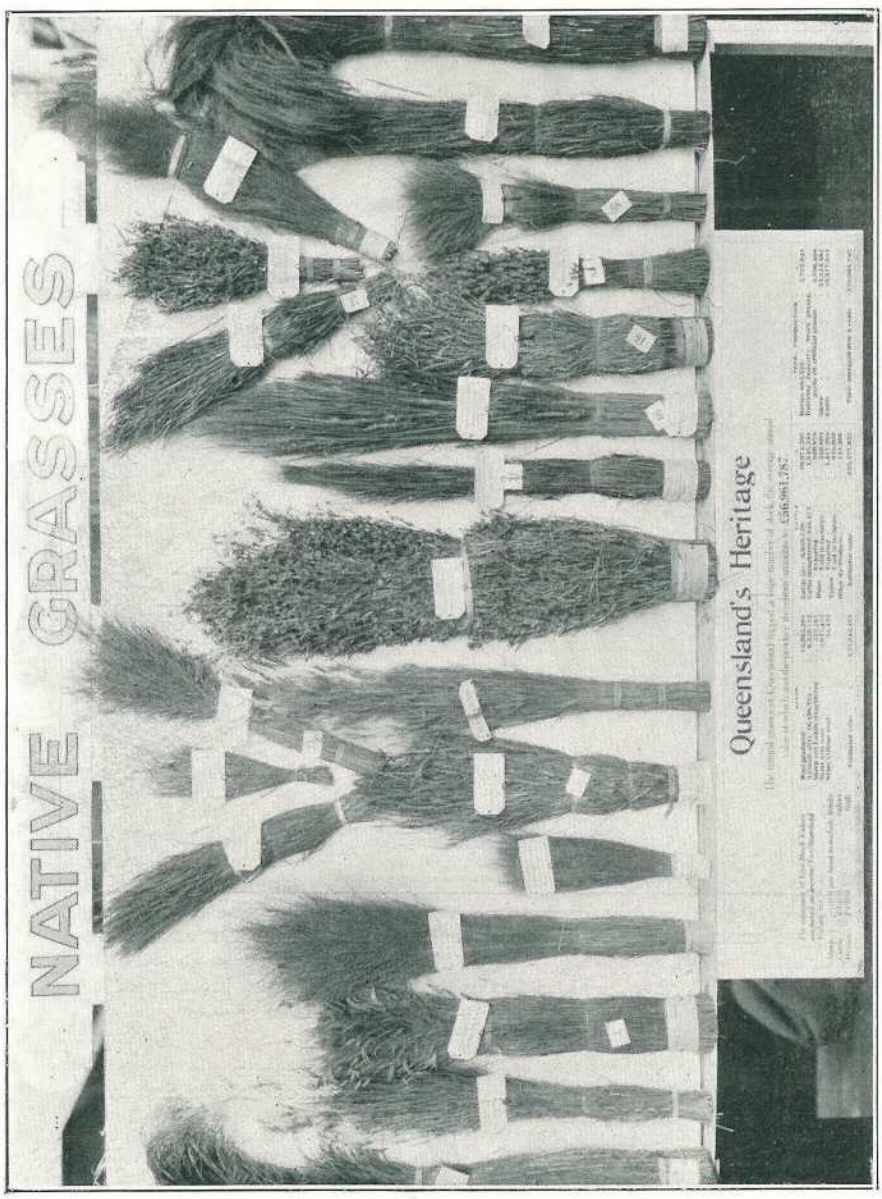

PLATE 61.—SAMPLES OF QUEENSLAND'S PASTURES PANELLED IN THE AGRICULTURAL COURT.
The value of Wool alone exported from Australia over a five-year term approaches £300,000,000, and practically all this wealth was derived primarily from indigenous grasses and edible herbage.

The success attendant on the cold storage of this seed suggests an equally favourable result in a similar treatment of commercial lots, whereby a glut in the market may be obviated and prices kept within reasonable bounds.

Interspersed with the Potato varieties were printed cards containing notes on potato culture, precautions to be taken against damage from disease, and formulæ of standard fungicidal and insecticidal sprays.

The display with the different colours of the many varieties of tubers, each with an identification card, not only formed an attractive picture, but with the information made available afforded one of those educative efforts in the whole Court.

Queensland's Wealth in Natural Pastures.

An exhibit of exceptional interest to pastoralists and graziers every year is the comprehensive collection of native grasses staged by the Department. Artistically designed posters called attention to the annual value of wool, beef, and dairy products produced in the State, and, as the aggregate value of these make the grand total of nearly £57,000,000, the great importance to Queensland of good pastures is at once apparent.

Queensland natural pastures are unrivalled, as the collection of grasses staged bore testimony.

There is no doubt that, with the extension of the grazing, the better grasses in some of the more closely settled areas have been eaten out, allowing coarser, less palatable species to take their place; the problem of pasture improvement is therefore worthy of keen research. Much can be done by judicious stocking and conserving and propagating the better species, such as the Mitchell grasses, Flinders grass, native Panicums, and other nutritious grasses.

In this year's exhibit, among the Andropogons were the far-famed Blue grass and the Satin Top, the former being one of the very best for fattening and grazing purposes. The genus Astrebla comprises the highly esteemed Mitchell grasses, of which four very distinct kinds are found in Queensland. Their chief characteristics are not only their drought-resisting properties, but also the rapid way in which they respond to falls of rain after long periods of dry weather, their value in this respect being nothing short of marvellous. Among the Star grasses, to the same genus of which belongs the imported Rhodes grass, are several sorts esteemed for their fodder value. The genus Anthristiria contains the well-known Kangaroo grass, and a near ally of this is the Flinders grass, which, in a green and dry state, is so much relished by stock. Quite an array of native Panicums were on view, most of these grasses possessing high feeding values. Beautiful grasses and at the same time useful in the native mixed pasture are various species of Eragrostis or Love grasses. The Button grass and the Crowsfoot are cosmopolitan species; the first mentioned is a most valuable sheep grass. Brown Top bears a good reputation among stock-owners. Several species of native Paspalums were shown, some being of high food value, particularly for tropical parts. The native sorghums are coarse grasses, but when cut both horses and cattle relish them.

Visitors to the Court were informed by poster that the Department is always willing to identify and report on any specimens of grasses and other plants. Specimens may be sent to the Department of Agriculture and Stock or direct to the Government Botanist.

QUEENSLAND'S WEALTH IN WOOL.

The Departmental wool exhibit was made up of fleeces selected from different localities in Queensland. They were not the best that could be produced, but were typical of the wool grown in the respective districts.

Many of the fleeces were labelled to indicate either yield, spinning quality, or counts, in order that they might educate in these matters those interested. Numerous cards on the different exhibits illustrated the terms commonly used in the trade.

The Departmental Wool Scheme.

Samples of the different named classes, illustrating the classification of farmers' wools under the Departmental wool scheme, were shown. Those shown indicated the standards aimed at and which are maintained during the process of classing. Three hundred and seventy bales last season represented sixty distinct classes, in which the prices ranged from 7d. to 25½d. per lb.

When the wool is first received it is weighed and valued. Sixty per cent. of the value is advanced to the grower free of interest. This advance has been designed to assist the farmer financially until his wool is sold. The amount of wool to be sold at each sale, which is held in Australia, is decided by the National Council of Wool Selling Brokers, who drew up rules whereby brokers undertake to offer wool in the strictest rotation of its arrival at the stores. The amount to be offered for sale in any particular centre also is decided. Each broker sends particulars to the central collecting house of the wools received by him on the previous day. When the allotted number of bales is reached, that day automatically becomes the closing date for the catalogue, and a new list is opened for the next sale. Thus the closing date may be several months ahead of the sale. Owing to the small quantities of wool being received by the Department, and the number of classes these small quantities have to be sorted into, it may take a long time to get a sufficient accumulation to form a bulk line. Therefore, if the farmer has an advance of 60 per cent., he can better afford to allow the Department sufficient time to form bulk lines, thereby avoiding sales under star lot conditions, which are not in the best interests of the grower. It is this

PLATE 62.—FLEECES FROM QUEENSLAND FLOCKS.
A Study of "Counts" and Classes in the Departmental Court.

unavoidable delay that causes dissatisfaction amongst some clients who do not understand the difficulties under which the Department works. The proper classification of wools in Australia is what has given confidence to buyers, and should baling the wool regardless of quality, yield, and colour be allowed, Australia's good reputation as a woolgrower, and consequently satisfactory prices, would suffer. In order to support those growers who can produce bulk lines of even quality, the Department is prepared to send an officer to any holding and instruct the grower how to class his own wool, also his sheep. Advice through correspondence and practical instruction on the holding is always available to those interested in sheep anywhere in the State.

That Queensland wool can be manufactured successfully in Queensland was illustrated by the exhibit of manufactured articles supplied by the Queensland Woollen Manufacturing Company, Ipswich, which showed each process from the raw to the complete.

QUEENSLAND'S GREAT SUGAR INDUSTRY.

The varieties of sugar-cane exhibited by the Bureau of Sugar Experiment Stations included a number of varieties from Hawaii, West Indies, Java, India, Mauritius, Fiji, and Queensland. The Queensland canes included a number of new varieties raised from seed at the Sugar Experiment Station at South Johnstone. Up to the present about 22,000 of these seedlings have been propagated, but many of them, of course, are weeded out in the process of selection. Commercial trials of the best of them are now being undertaken, also experiments as to their disease-resisting qualities.

Sugar-Cane Propagation.

The Sugar Experiment Station at South Johnstone, near Innisfail, has, during the past six years, been engaged in the direction of raising cane from the seed found in the arrows. This requires the utmost care, as the seed is very minute and has to be most carefully handled. Specially prepared boxes of soil are used, which have previously been sterilised. The cane arrows, when mature, are gently broken off, spread over the soil, watered, and then covered with glass plates. When germination takes place, a large number of minute shoots like grass appear. When these have made further growth they are carefully pricked out into pots or boxes and are ultimately removed to the field. Several of them which were taken from Badila cane have corresponding characteristics, and it is trusted that a cane equal to the Badila will be discovered.

Testing of Cane Varieties.

Before any cane varieties are allowed to leave the experiment stations they have to pass chemical and commercial trials through plant, first ratoon, and second ratoon crops. Each variety is tested not less than four times in the course of the sugar season, so that records are obtained giving farmers and millowners information as to whether canes are early or late, and whether or not their sugar contents are sufficiently high to warrant their adoption. This is combined with agricultural trials in the field, so that it may be determined whether such varieties are good croppers. They are further keenly watched for evidence of disease, and no affected canes are allowed to go into distribution. When varieties have passed these trials they are carefully examined and packed before being sent to growers living at a distance from the stations, and all canes are distributed free to canegrowers. The worthless varieties are discarded. Information of this kind could only otherwise be secured by growers and millers at the cost of much time and money and the rejection of many useless canes by the mills, which would be accompanied by severe loss to the growers.

Full descriptions of the varieties exhibited appeared on the cards attached to the canes, which also gave the commercial cane sugar content. Many of these canes at present are undergoing chemical and field tests, while others have passed the probationary period and are being distributed to growers. These varieties, however, comprise a very small part of the number of new and tested canes that have been distributed from the Experiment Stations during the past twenty years.

Soils, Cultivation, and Fertilising.

Work at the Experiment Stations also comprises the study of soils, cultivation, and fertilising. It is sought to introduce improved methods of cultivation, liming, fertilising, rotation of crops, and conservation of moisture. Growers are taught the principles of cultivation methods by visits to the Experiment Stations, also by lectures and addresses delivered in the various sugar districts, and by the issue of bulletins. It may be claimed that this work has been highly successful. The Sugar Experiment Stations analyse soils free for canegrowers, and give advice by personal interviews or by letter on the requirements of the soil in the way of application of lime where necessary, green manuring and fertilising, and the treatment of the land by proper soil handling. Upwards of 1,800 cane soils so far have been analysed. Cane samples also are tested free of charge, so that growers may know the best time at which to cut their cane. Field officers move around amongst the farmers, giving advice on cultural operations.

Investigation and Research.

Investigation and research work in connection with the most serious pest of the sugar-cane—namely, the grub—is now being carried out by the Bureau of Sugar Experiment Stations in a systematic manner, and numerous bulletins have been

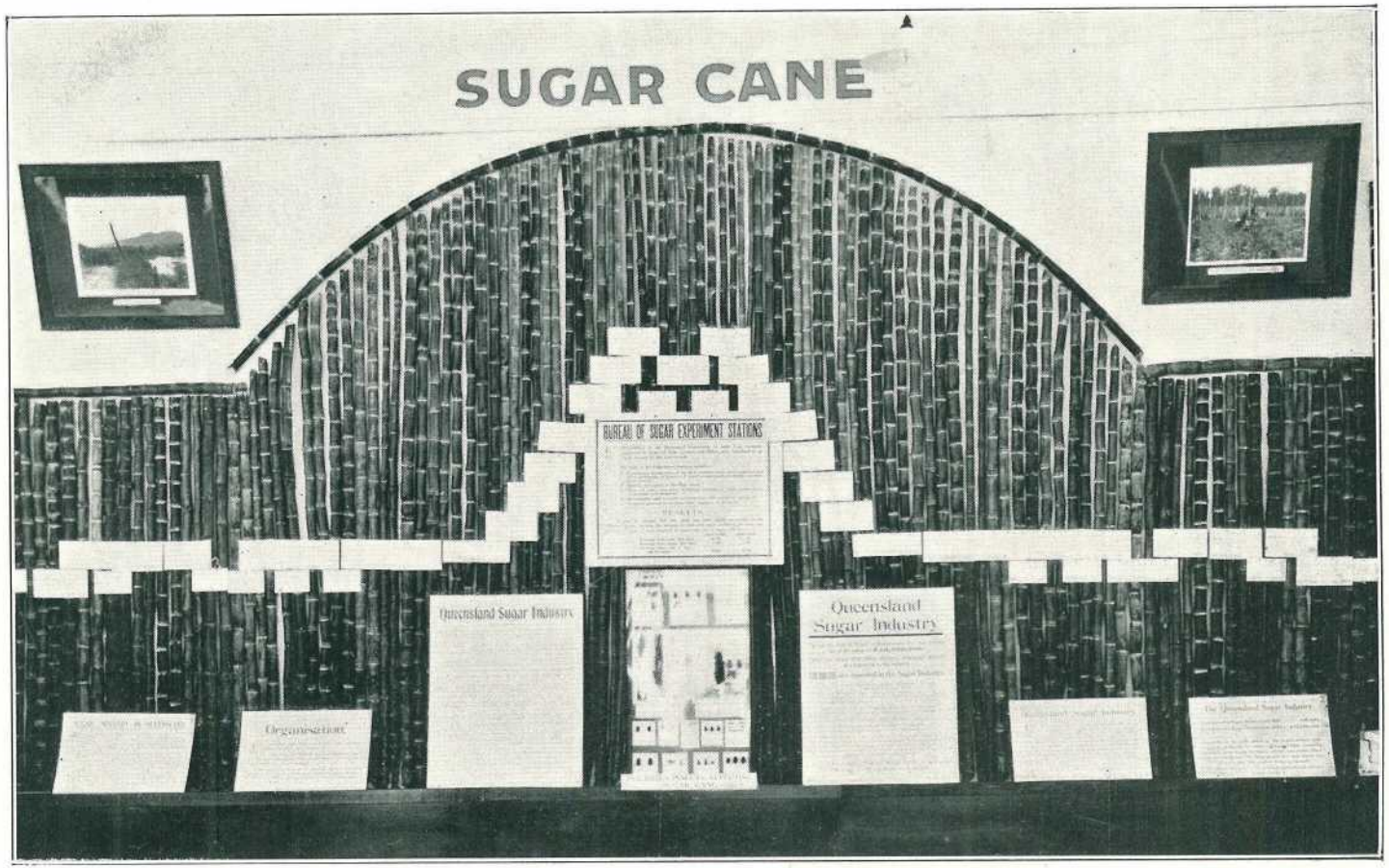

PLATE 63.—A WHITE MAN'S INDUSTRY IN A WHITE MAN'S LAND.

Canegrowing is the most profitable of Queensland's agricultural enterprises. It gives employment to an army of Australian workers, and is the only sugar industry in the world carried on entirely by white labour. In this bay in the Departmental Court the scientific and economic value of the work of the Bureau of Sugar Experiment Stations was strongly represented.

issued upon the subject. The entomological laboratories are situated at Meringa (near Cairns) and at Bundaberg. Chemical fumigants are being successfully used in the destruction of cane grubs. A pathological staff also has been established to deal with diseases in cane, and travelling pathologists are advising cane farmers on disease questions.

National Significance.

The work of the Sugar Experiment Stations in promoting the agricultural welfare of Queensland in relation to the sugar industry cannot be over-estimated. When it is remembered that this industry is the greatest agricultural one in Queensland, and will produce about 507,000 tons of sugar this year, estimated at a value of about £10,000,000, it can be seen how highly necessary it is that it should be assisted and encouraged in every possible way. Apart from its economic value, however, it has a deep national significance, and has already played a very large part in peopling the North.

The Sugar Belt.

Apropos of the sugar industry, it is to be noted, on reference to a map of the State, that the land in Queensland used for sugar-growing is included in a long, narrow, coastal belt. Parts of this belt are separated from each other by considerable tracts of non-sugar country. The latter, owing to a deficient rainfall or comparative unsuitability of soil, are not used for canegrowing. This belt is included between latitudes 16 degrees and 28 degrees south, and the bulk of the staple is grown within the tropics.

Rainfall in Sugar Areas.

The Queensland rainfall, fortunately, is highest during the summer period, at which time the cane plant makes its maximum of growth. The following are average rainfalls in the principal sugar-growing districts:—Cairns, 92.65; Johnstone River, 160.88; Herbert River, 84.91; Mackay, 66.67; Bundaberg, 44.40. Cane grows best when the relative humidity of the atmosphere is high, and this is the case during the wet season in Northern Queensland.

Queensland's sugar production in 1867 was 338 tons, and in 1925 reached 485,000 tons, the record crop to date.

The yield of cane and sugar per acre is improving, due to better methods of cultivation and growth of superior cane. The mills also have largely increased their efficiency, and over £2,000,000 have been spent during the past five years in improving existing mills, while, in addition, the Queensland Government has erected the most up-to-date sugar plant in Australia, in the Tully River district.

DAIRYING INDUSTRY.

The Dairy Branch again arranged its usual comprehensive and instructive display which occupied three bays at the northern end of the Court of Agriculture. The centre was devoted to dairy products generally, in which butter and cheese predominated.

An interesting portion of the display was that showing the chemical constituents, in their exact proportions, contained in 1 gallon of normal milk. The constitutents of 1 lb. of butter and 1 lb. of cheese were also shown.

Cheddar cheeses, both coloured and white, were exhibited in the several sizes made—namely, large export (80 lb.); medium (40 lb.); loaf (10 lb.); and picnic (1 to 5 lb.); Roman, Edam, Luncheon, and Processed.

Varieties of cheese were also exhibited as well as a new rindless Cheddar block cheese. These cheeses were all made in Queensland. The new cheese, however, has not yet been placed on the market.

Samples of both butter and cheese in progressive stages of manufacture were on view.

By-products, such as casein, skim milk powder, lactose, were not overlooked. The multiple uses for casein were also featured. Butter packed in tin containers for the Eastern market lent attractiveness to the exhibit.

Herd testing was given prominence. Full equipment for carrying out this important branch of the work was on view, both as required by the dairyman and the official herd tester. Comparisons were drawn between the profitable and unprofitable cow.

The "Better Bull Scheme," instituted by the Department, whereby dairymen are assisted in securing approved sires for their herds, was a feature in this section.

Balanced rations suitable for milch cows were shown in proper proportions. An outfit necessary for carrying out the Methylene Blue Reduction Test was also shown. This test is invaluable to milk graders at cheese factories for determining the quality of milk, and should attract considerable attention from those interested in milk and cheese production.

One bay was devoted solely to bacteriological specimens as they apply to the many phases of the industry. This section was worthy of close study, as an appreciation of bacterial influences in relation to dairying is of paramount importance in the elimination of secondary grades of produce. The specimens were of absorbing interest to dairy farmers and all others connected with the industry.

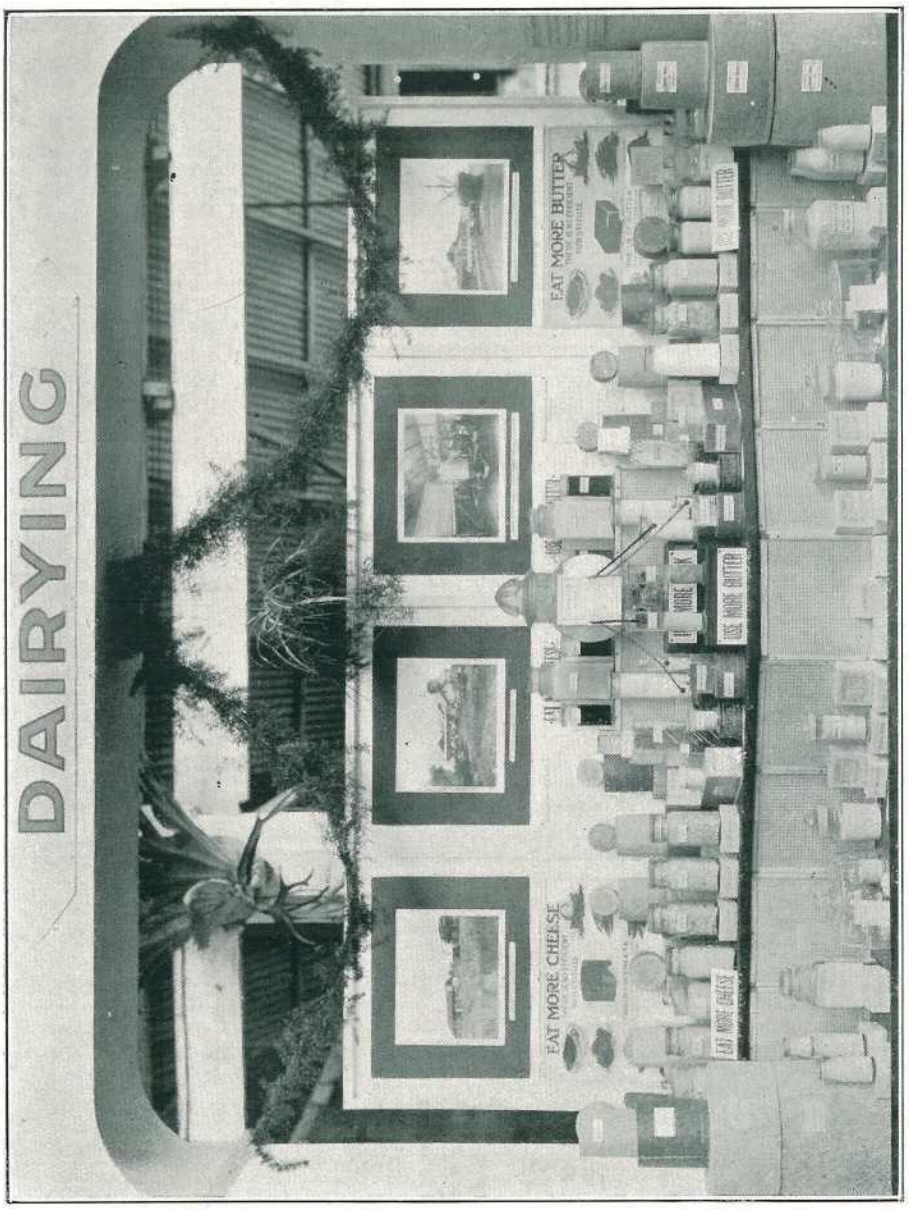

PLATE 64.—A REPRESENTATION OF WHAT THE DAIRY INDUSTRY MEANS TO QUEENSLAND.
This great enterprise ranks now next to Sugar in aggregate annual value.

STOCK EXPERIMENT STATION EXHIBIT.

In the Dairy Branch of the Agricultural Court, one section was largely devoted to illustrating the necessity for absolute cleanliness in all phases of the dairying industry, and sterilisation of those utensils used for holding milk and cream. This section was arranged by the Government Bacteriologist, Mr. C. Pound, and his staff at the Stock Diseases Experiment Station at Yeerongpilly.

The display demonstrated clearly the extent of bacterial growth which results from careless methods of milking, as compared with milk drawn at a dairy where

PLATE 65.—PANEL ILLUSTRATING THE DEPARTMENTAL HERD TESTING SCHEME.

Every farmer who hopes and works for better returns must realise the practical benefit of herd testing in the quest for increased production.

perfect cleanliness is the rule. Specimens of milk drawn direct from the cow under hygienic conditions were shown as remaining for several weeks free from contaminating organisms. Tube cultures of the various germs that are detrimental to the keeping properties of milk, butter, and cheese, also those which impart unpleasant flavours and aromas, were displayed.

Contagious Mammitis.

The exhibit would have been incomplete without mention of this disease, which is of special significance to those engaged in dairying. Diagrams of streptococci (the causative agent of this disease) were shown, and full information regarding value of autogenous vaccines in treatment of the disease were fully described.

In connection with the Beef Industry exhibit, a section was arranged solely for the purpose of elucidating the intimate relationship of the science of bacteriology to the preservation of various food products, but more particularly with regard to the processes of freezing, chilling, salting, smoking, drying, and canning of meat and meat products.

A section of a highly instructive nature was devoted to the cattle tick pest, illustrating the life-history of the parasite, and standard methods for its complete eradication; also the latest maps, charts, and other valuable information, illustrating the practical applications and marvellous progress of the work in the United States of America and other countries faced with similar problems.

PIG RAISING.

As a result of the progressive instructional campaign of the Instructors in Pig Raising attached to the Queensland Department of Agriculture and Stock, considerable attention has been focussed upon the business of pig farming, both as an adjunct to dairying and to other branches of agriculture. Production is increasing, quality is improving, and with brighter seasonal prospects returns to the producer are much more lucrative than in days gone by.

PLATE 66.—THE ECONOMIC VALUE OF PIG RAISING WAS STRONGLY ILLUSTRATED IN THIS AGRICULTURAL COURT PANEL.

The educational value of departmental work is demonstrated in "the goods delivered."

The exhibit of pork products at this year's Exhibition surpassed any previous attempt, and in the Meat Industry Hall and the Court of the Department of Agriculture and Stock were arranged very attractive and educational displays.

A prominent feature of the departmental display was the comparison between various grades of bacon, the objective being to fix the attention of farmers on the urgency of producing nothing but the very best quality article it is possible to market. Our tastes are becoming more refined, the popular heavy-weight fat bacon of years ago has gone for ever. The demand nowadays is for prime quality meaty bacon only. Beautifully coloured and attractive posters pictured the class of pig products demanded on modern markets.

POULTRY RAISING.

In the Departmental Poultry Exhibit a strong point was made of the economic production of eggs. It was pointed out that the three principal essentials for egg production are stock, feeding, and housing. Illustrations of birds of high fecundity were not numerous, but they depicted the breeds most commonly used for egg production in Queensland. Egg-laying competitions, it was indicated, are among the means used by breeders to ascertain the breeding qualities of stock, while at the same time they make known to those desiring stock birds the breeders from whom they can be procured.

The modern methods of incubation were well illustrated by a representation of a hatching plant with a capacity of 18,000 eggs. From plants such as these, farmers who keep poultry as an adjunct to other rural industries may obtain chickens

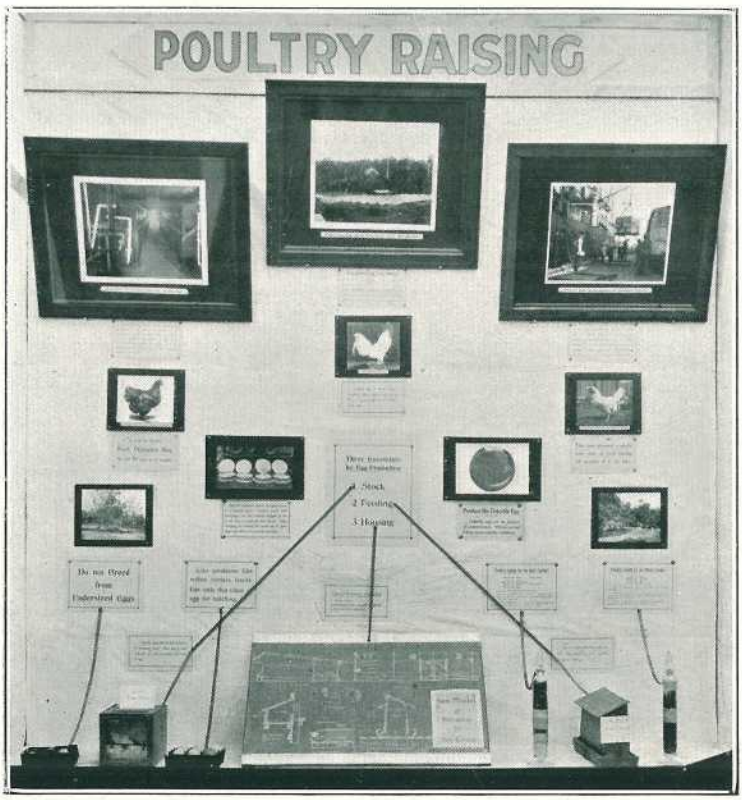

PLATE 67.—THE POULTRY PANEL IN THE COURT OF AGRICULTURE.

The Poultry Industry is developing rapidly in Queensland, and is approaching the status of a staple enterprise. Its annual value is advancing towards £1,000,000.

during the most desirable period of the year, and as these outfits are generally operated by specialists the quality of chickens so purchased is, as a rule, superior to those hatched on a farm where attention to detail is not possible to so great an extent.

A strong feature was also made of the necessity of breeding birds that will produce not only numbers of eggs but eggs of suitable size. The use of a trap nest was suggested for the purposes, and one of simple design was exhibited.

A very neat model of a scratching shed for 200 birds was also exhibited. This model was made by the boys of the Nambour Rural School from plans prepared by the Department of Agriculture. This type of house was suggested as useful to the small poultry farmer or those keeping poultry on a limited area of land. The principal point about these houses is that they are readily cleaned—an essential to the maintenance of health among birds kept on a limited area.

The development of the poultry industry has necessitated overseas export of eggs. The activities of the Queensland Egg Board in this direction were represented. Export has now become the practice of all States producing poultry, and an indication of the development taken place in the industry in Queensland is evident from the following figures, approximately correct:—1925: 2,000 cases; 1926: 6,000 cases; 1927: 8,000 cases. For this season it is anticipated that export will reach as high as 16,000 cases.

Feeding was another strong educational feature, and rations were suggested which included foods that can be grown on a farm and fed in conjunction with skim milk.

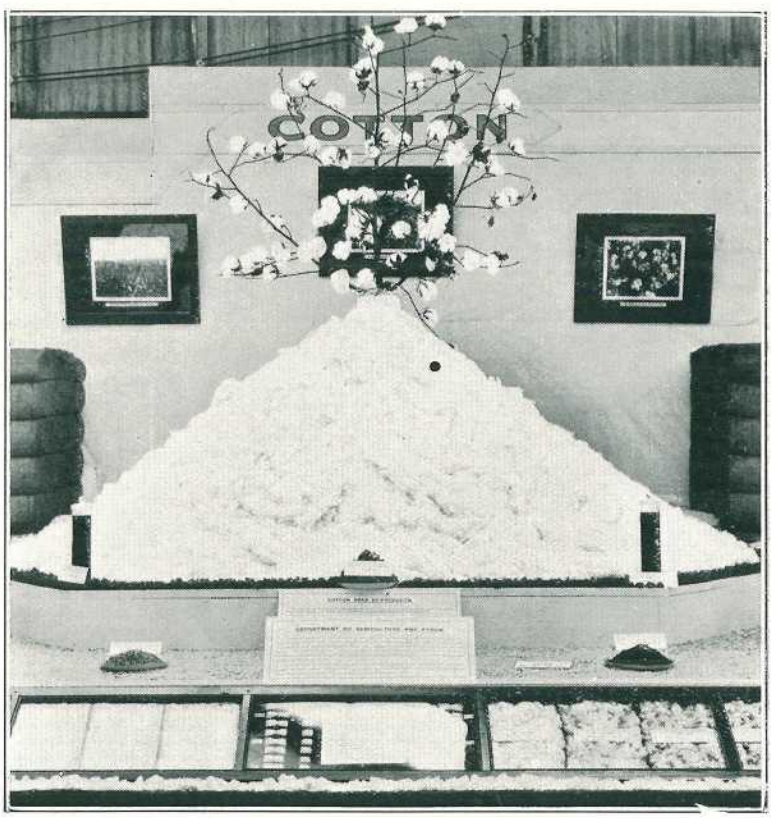

PLATE 68.—THE "WHITE HOPE" OF CENTRAL QUEENSLAND.

The Cotton Industry in this State is becoming firmly established, and this beautiful Trophy illustrated the wide scope there is for its development; also the excellent quality of the Queensland product.

COTTON.

The exhibit of the Cotton Section was prepared so as to present a comprehensive display of the range of activities in which the Department of Agriculture and Stock is engaging in the endeavour to establish the cotton-growing industry in this State. The different displays were arranged so that one might obtain an idea of the various phases of the operations connected with plant breeding and cultural investigations, and in the grading of the crop at the ginneries.

The visitors to the Court of Agriculture saw illustrations of the various characters of the seed and fibres which the cotton breeder has to study in the evolving of a suitable type of fibre. In addition to these exhibits, a complete set of grades of seed cotton and the corresponding lint grades were presented in conjunction with an illustration of the different staple lengths used in classing Queensland cotton at the ginneries. An instructive display of the cotton-seed by-products was also included.

WEEDS AND POISONOUS PLANTS.

A representative collection of weeds was a very interesting feature of the Departmental Court. Many of these weeds have been introduced with seeds of economic plants from abroad, and so demonstrate the necessity for the Pure Seeds Act now in force in the State and through which the farmer is well protected. Some have been introduced with straw packing; others, such as Khaki weed, with imported fodders; others, such as the Wild Heliotrope and the Billy Goat weed and Lantana, were imported as garden plants; and others again, such as the Box Thorn and Prickly-pear, for hedge-making. Some, such as the Galvanised Burr, are native plants, which, being left untouched by stock and seeding freely, have taken possession of some Western pastures and stock routes to the exclusion of useful grasses and herbage. Among the collection were some of these, such as the Mustard weed and Fish weed, that give a very offensive taint and taste to milk and butter. Some, such as the Thorn Apple or Stramonium and the Stagger weed, are known to be poisonous or harmful to stock. The question of plants poisonous or injurious to stock is one of the most complex that faces the veterinarian and chemist alike, and one that calls for searching scientific investigation in the State. Representative specimens were shown of the White wood, now regarded as the cause of "Walk-about" in horses in North Queensland, the Northern Territory, and the Kimberley district of Western Australia; the Heart-leaf of Desert Poison Bush; Lantana, which causes the disease known as "Pink-nose" in cattle; Caustic Creeper; and the Fuchsia Bush, which contains a prussic-acid–yielding glucoside. Farmers were informed of the willingness of the Department to report free of charge on any specimens of weeds, suspected poisonous plants, and other growths submitted by them.

PLATE 69.—THE KING OF THE RING.

ENTOMOLOGY AND PATHOLOGY.

The investigational work carried out by the Entomological Branch of the Division of Entomology and Plant Pathology was well illustrated in an extensive series of exhibition cases dealing with the life histories of the more important Queensland insect pests. Exhibition panels of more than ordinary interest were those illustrating the life histories of the Queensland fruit fly, the banana thrip, the Rutherglen bug, and the Codling moth. Among other pests dealt with were the potato tuber moth, the pumpkin beetle, the bean fly, and the army worm. Exhibition cases of general entomological interest were those dealing with giant insects, stick

PLATE 70.—THIS PANEL, IN THE DEPARTMENTAL COURT, ILLUSTRATED MOST IMPRESSIVELY THE SERVICE OF THE SCIENTIST TO PRIMARY INDUSTRY.

insects, and insect galls. One very interesting exhibit was a case containing the stomach contents of some of our commoner insectivorous birds.

Each case dealing with an insect pest contained a series of paintings, accompanied by actual specimens of each stage of the insect's life cycle and illustrations of typical injury, were also supplied. Fresh and preserved plant material was also drawn upon to illustrate the nature of injuries inflicted by banana insect pests. Particular attention in this exhibit was paid to the banana weevil borer.

A small panel also showed the ingredients and the method of mixing various poisons used in insect control work.

The Pathological branch of the Division this year was represented by an extensive series of framed photographs and paintings showing the characteristic features of some of the commoner Queensland plant diseases. Another valuable feature of the pathological exhibit consisted of a large series of preserved plant specimens showing typical cases of disease.

PLATE 71.—HOW QUEENSLAND FARMERS ARE SERVED BY SCIENCE.
A Panel in the Departmental Court.

FARM BOYS AT THE BRISBANE SHOW.

AN EDUCATIONAL HOLIDAY.

Twenty-five boys from farms in different parts of Queensland were the guests of the Royal National Association for Show week. Their visit under the guidance of mentors expert in all the phases of rural industry proved not only a happy holiday for them, but also an eye-opening education. Many had not previously attended a Brisbane Exhibition, so to them it was a wonderful experience. A manager (Mr. T. L. Williams) and a matron (Mrs. Thomas) looked after their welfare at their Showground camp. They were accommodated in a specially-erected building with dormitory, bathroom, reading room, and other necessaries for their comfort. The boys were present at the judging of each class accompanied by experts who explained

PLATE 72.—THE JOURNAL ALCOVE WAS A CLEARING HOUSE FOR DEPARTMENTAL INFORMATION.

everything to them. Lectures were arranged for each day. His Excellency the Governor, Sir John Goodwin, and the Minister for Agriculture and Stock, Hon. W. Forgan Smith, were among those who visited their camp and delivered inspiring addresses.

All the boys are members of pig, poultry, or calf clubs at their respective schools. The personnel of the party and the schools they represented were:—Maurice O'Donnell (Allora), Thomas Verrall (Aratula), William Evans and George Christison (Boonah), Henry Coupe (Clifton), Aubrey Benson (Cloyna), John Howell (Coalstoun Lakes), Martin Tobin (Dallarnil), John Gray (Enterprise), Walter Neuendorff (Frenchton), Percy Kajewski (Glencoe), Ronald Ritchie and Lionel Grady (Kin Kin), Dudley Beattie (Lagoon Pocket), Fred. Bampton (Mapleton), Arthur Berlin (Marburg), Charles Burgess and Dudley Bellotti (Merlwood), Sam. Franklin (Merrimac), John Titmarsh (Milora), George Nahrung (Miva), Thomas Wilson (Mooloolah), Colin Stenzel (Mount Alford), Ivan Perry (North Arm), and Albert Granz (Norwell).

The Governor's Advice.

His Excellency the Governor lunched one day with the boys and each one was presented to him personally. Addressing them, Sir John Goodwin said:—"I am pleased to have the opportunity of having luncheon with the boys who have come from the country schools, and I am pleased that the National Association has given you the opportunity of learning something that will be of value. It would be wise not to waste one minute of the time that is before you; but, of course, there must be some pleasure. I am going to attend every day and learn something, so take my advice and go closely into every section, because it is a chance of gaining knowledge that you will not regret. There will be something to learn that will be of value to every boy in the country. I hope you will all go home well pleased with the experience you have had. On what you will learn will depend the future of Queensland, for Queensland is a country of primary production."

QUEENSLAND AGRICULTURAL COLLEGE.

WORK OF STUDENT FARMERS.

The reputation of the Queensland Agricultural High School and College, Gatton, as an academy of scientific and practical farming, was greatly enhanced by its exhibit at the Exhibition. It was of considerable educational value, with its extensive notes on the exhibits, the display being situated in a roomy marquee near the John Reid Industrial Hall.

The object of the display was to indicate the lines along which most progress can be made in agricultural and pastoral pursuits. With the co-operation of the Produce Merchants' Association, a display of prime, good, and faulty lines coming into the Roma street markets was provided to show where faults lie, why produce does not meet the requirements of the market, and the difference in prics obtained from good and unsatisfactory lines. There is a necessity throughout Queensland for growing best possible varieties in districts, and plant breeders are working with the object of evolving varieties of maize and other crops which will give a greater yield. Two varieties of maize were exhibited to emphasise this. There were also displays of work done by students, who do sufficient leather, tinsmithing, blacksmithing, and carpentering work to make them handy with tools on the farm. Methods of lubricating farm machinery were indicated, and attention was drawn to the fact that heavy depreciation occurs through lack of lubricants and the use of the wrong kind. The service of science to agriculture was pointed out, and, in particular, the value of superphosphates to Australia. The possibility of improvements in the butter and cheese industry was illustrated. A collection of fine photographic views of the college and its work also were on view.

Interesting comments by Sir John Russell on college soils and the favourable comparison of Queensland wheat soils with those of Canada and Poland were given. The live stock section of the exhibit was a prominent feature. In it was emphasised the necessity for breeding and feeding. Good and bad types of sheep and pigs were shown as examples, and in the application of this to cows it was observed that the average cow yields three boxes of butter a year, and a good cow nine. Bees and fowls were included.

THE AWARDS.

DISTRICT EXHIBITS.

"A" GRADE.

THOUGH there were only three districts competing in the "A" Grade of the District Competitions, which comprises products and manufactures, North Coast and Tablelands of New South Wales, Wide Bay and Burnett, and South Coast of Queensland, there was, nevertheless, as much interest manifested as in former years. The possible points allowed over the range of classes and sections was 1,585, out of which the North Coast and Tablelands of New South Wales were awarded 1,269, thus winning first prize and the Chelmsford Shield. Wide Bay was only 37 points behind, which shows how close was the competition. Details:—

—	Possible Points.	North Coast and Tablelands of N.S.W.	Wide Bay and Burnett District	South Coast of Queensland.
DAIRY PRODUCE—				
Butter	90	84½	83½	84
Milk and by-products	40	35	20	25
Cheese	60	55	50	57
Eggs	20	15	17	10
Totals	210	189½	170½	176
FOODS—				
Hams and bacon	50	40	43	45
Rolled and smoked beef and mutton	20	15	18	20
Smallgoods and sausages	10	7	10	8
Fish—Smoked, preserved, or canned	10	5	9	6
Canned meats	25	23	20	25
Lard, tallow, and animal oils	20	15	16	16
All butchers' by-products	10	7	8	10
Honey and by-products	20	18	19	14
Confectionery	10	10	8	6
Bread, biscuits, scones, and cakes	10	8	8	9
Totals	185	148	159	159
FRUITS, VEGETABLES, AND ROOTS—FRESH AND PRESERVED—				
Fresh fruit	60	48	56	54
Preserved fruits, jams, and jellies	30	30	26	24
Crystallised and dried fruits	20	19	18	..
Preserved and dried vegetables	10	9	9	10
Fresh vegetables	20	18	15	19
Table pumpkins	6	6	4	5
Potatoes, English and sweet	40	30	28	35
Roots (including meals)	14	10	13	10
Cocoanuts, peanuts, and other nuts	10	5	8	3
Totals	210	175	177	160

DISTRICT EXHIBITS ("A" GRADE)—*continued.*

—	Possible Points.	North Coast and Tablelands of N.S.W.	Wide Bay and Burnett District	South Coast of Queensland.
GRAIN, ETC.—				
Wheat	50	45	25	20
Flour, bran, pollard, macaroni, and meals	10	5	8	3
Maize	50	45	35	30
Maizena, meals, starch, glucose, and corn-flour	10	4	7	6
Oats, rye, rice, barley, malt, pearl barley, and their meals	30	20	15	10
Totals	150	119	90	69
MANUFACTURES AND TRADES—				
All woodwork	30	28	29	28
All metal and ironwork	30	25	27	28
Leather and all leather work and tanning	20	20	15	18
Manufactures—Woollen and cotton fibre	30	25	15	20
Sheet metal work	10	8	8	9
Artificial manures	10	2	7	9
Brooms and brushes	10	8	1	6
Manufactures not otherwise enumerated	15	12	13	14
Totals	155	128	115	132
MINERALS AND BUILDING MATERIALS—				
Gold, silver, copper, and precious stones	25	19	22	..
Coal, iron, other minerals, and salt	30	20	26	10
Stone, bricks, cement, marble, terra-cotta	20	5	15	10
Woods—Dressed, undressed, and polished	25	22	22	22
Totals	100	66	85	42
TROPICAL PRODUCTS—				
Sugar-cane	60	46	44	50
Sugar—Raw and refined	20	12	18	8
Rum, other spirits and by-products	10	8	9	8
Coffee (raw and manufactured), tea, and spices	10	5	10	5
Cotton (raw) and by-products	30	18	23	15
Rubber	10	..	10	..
Oils (vegetable)	10	10	10	..
Totals	150	99	124	86
WINES, ETC.—				
Wines	15	8	5	3
Aerated and mineral spa water, vinegar, and and cordials	10	7½	6½	6
Ales and stout	10	..	8	..
Totals	35	15½	19½	9

DISTRICT EXHIBITS ("A" GRADE)—*continued.*

—	Possible points.	North Coast and Tablelands of N.S.W.	Wide Bay and Burnett District	South Coast of Queensland.
TOBACCO—				
Tobacco (cigar and pipe), in leaf	20	12	15	15
HAY, CHAFF, ETC.—				
HAY—Oaten, wheaten, lucerne, &c. ..	30	28	15	20
Hay in sheaf	5	4	3	4
Grasses and their seeds	10	9	7	4
Chaff—Oaten, wheaten, lucerne, &c. ..	50	42	39	33
Ensilage and cattle fodder	20	10	15	9
Sorghums and millets	10	9	7	6
Commercial fibres	15	13	10	13
Pumpkins and green fodder	12	8	7	10
Broom millet	10	6	6	9
Farm seeds	15	7	9	10
Totals	175	136	118	118
WOOL, ETC.—				
Scoured wool	40	40	36	35
Greasy wool	60	60	52	53
Mohair	10	8	10	8
Totals	110	108	98	96
ENLARGED PHOTOGRAPHS	5	5	3	2
EFFECTIVE ARRANGEMENT—				
Comprehensiveness of view	20	16	17	18
Arrangement of sectional stands	25	19	16	18
Effective ticketing	10	10	7	8
General finish	25	23	18	21
Totals	80	68	58	65
Grand Totals	1,585	1,269	1,232	1,129

DISTRICT EXHIBITS—*continued.*

"B" GRADE.

Honours for the B Grade district exhibit for primary products were won this year by Brisbane Valley, which scored 1,044½ points out of the possible 1,305. This makes the third year in succession in which that district has headed the list.

The districts represented included the Northern Darling Downs, Oakey, Mount Larcom, Kingaroy, Brisbane Valley, and Nanango. The interest in this competition was in no way less than that shown in the A Grade Division. Northern Darling Downs was second with 915, and Kingaroy was third with 874. Details:—

—	Possible points.	Northern D.D. District.	Oakey.	Mount Larcom.	Kingaroy.	Brisbane Valley.	Nanango.
DAIRY PRODUCE—							
Butter	90	83½	84	83	84	82	83
Cheese	60	60	55	42	48	48	50
Eggs	20	12	10	6	12	16	15
Totals	170	155½	149	131	144	146	148
FOODS—							
Hams, bacon, rolled and smoked beef and mutton	50	40	35	38	38	39	33
Fish—Smoked	10	6	3	9	4	7	4
Lard, tallow, and animal oils	20	15	10	14	15	20	18
Honey and by-products	20	15	11	10	14	18	12
Confectionery (home-made)	10	7	7	6	4	10	7
Biscuits, bread, cakes, scones (home-made)	10	7	9	9	10	9	9
Totals	120	90	75	86	85	103	88
FRUITS, VEGETABLES, AND ROOTS (Fresh and preserved)—							
Fresh fruits	60	46	20	48	44	53	40
Preserved fruits, jams, jellies (home-made)	30	27	25	25	25	27	23
Crystallised and dried fruits (home made or dried)	20	17	15	12	13	13	14
Preserved vegetables	10	9	8	9	6	9	6
Fresh vegetables	20	15	16	15	16	17	15
Table pumpkins	6	4	3½	4	4	5	5
Potatoes, English and sweet	40	10	15	11	12	35	28
Roots and their products, including meals	14	10	3	3	6	9	5
Cocoanuts, peanuts, and other nuts	10	6	5	3	9	8	6
Vegetable seeds	10	4	5	5	9	5	9
Totals	220	143	115½	135	144	188	151
GRAIN, ETC.—							
Wheat	50	40	30	44	10	20	25
Flour, bran, pollard, macaroni, and meals	10	9	7	3	5	3	6
Maize	50	30	30	25	40	44	35
Maizena—meals, starch, glucose, and cornflour	10	9	2	2	4	6	6
Oats, rye, rice, barley, malt, pearl barley, and meals	30	18	14	25	18	20	15
Totals	150	106	83	99	77	93	87

DISTRICT EXHIBITS ("B" GRADE)—*continued.*

—	Possible Points.	Northern D.D. District.	Oakey.	Mount Tarcom.	Kingaroy	Brisbane Valley.	Nanango.
WOODS—							
Woods, dressed, undressed, and polished	22	15	5	20	20	22	22
Wattle bark	15	10	5	5	10	12	12
Totals	40	32	20	10	30	34	34
HIDES (1) AND HOME-PRESERVED SKINS FOR DOMESTIC USE ..	15	13	15	5	15	13	8
TROPICAL PRODUCTS—							
Sugar-cane	60	6	1	12	14	22	8
Coffee, tea, and spices ..	10	5	..	7	7	5	7
Cotton (raw) and by-products	30	18	15	20	20	27	17
Totals	100	29	16	39	41	54	32
MINERALS—							
Gold, silver, copper, and precious stones	25	15	..	18	20	20	13
Coal, iron, and other minerals and salt	30	15	10	20	22	23	14
Totals	55	30	10	38	42	43	27
TOBACCO—							
Tobacco, cigar and pipe, in leaf	20	12	5	20	10	12	5
HAY, CHAFF, ETC.—							
Hay—Oaten, wheaten, lucerne, &c.	30	20	18	22	18	25	14
Hay in sheaf	5	4	4½	4	4	4	3
Grasses and their seeds ..	10	8	6	8	7	9	8
Chaff—Oaten, wheaten, lucerne, &c.	50	29	30	30	29	45	32
Ensilage and cattle fodder ..	20	5	5	10	11	12	8
Sorghums and millets in stalk	10	7	9	5	7	7	8
Commercial fibres, hemp, and flax	15	9	3	8	6	13	4
Pumpkins and green fodder ..	12	9	9	6	8	10	9
Broom millet	10	7	7	7	7	8	7
Farm seeds	13	8	9	7	8	11	9
Totals	175	106	100½	107	105	144	102

DISTRICT EXHIBITS—("B" GRADE)—*continued.*

—	Possible points.	Northern D.D. District.	Oakey.	Mount Larcom.	Kingaroy.	Brisbane Valley.	Nanango.
WOOL, ETC.—							
Scoured wool	40	37	34	35	34	37	35
Greasy wool	60	60	56	54	52	54	50
Mohair	10	10	8	..	8	8	7
Totals	110	107	98	89	94	99	92
ENLARGED PHOTOGRAPHS	5	5	4	4	2	5	2
LADIES' AND SCHOOLS' WORK AND FINE ARTS—							
Needlework and knitting ..	25	12	9	14	8	22	9
School needlework	5	2½	2½	1	1	4	2
Fine arts	5	5	5	5	3	5	1
School work—maps, writing, &c., by pupils in the district							
Totals							
GENERAL POINTS—							
Effective arrangement, comprehensiveness of view ..	80	55	59	69	65	73	55
Grand Totals	1305	915	774½	854	874	1044½	851

DISTRICT FRUIT CONTEST.

The display made by the various fruit-growing centres was one of the main attractions of the Exhibition for those interested in products of the land outside of general agriculture. Palmwoods secured first prize, with 175 points; Redlands, with 158⅔ points, was second; and Buderim, with 154, third. The North Coast district thus won first and third positions. Gayndah fruit-growers entered the competition for the first time, claiming that their main objective was to make known the quality of the citrus fruits grown in their district. It must be gratifying to them to know that in those fruits the decision of the judges was more in their favour than with the other competitors, for they secured 33½ out of the possible 35 points, defeating Montville by half a point. In general display Gayndah was awarded 19 out of the possible 20 points. Details of the decisions:—

—	Possible Points.	Buderim.	Cooran.	Montville.	Palmwoods.	Redlands.	Woombye.	Gayndah.
Bananas	35	27	33	23	29	20	21	..
Pineapples	35	25	17	23	32	34	32	..
Citrus	35	29	22	33	33	28½	28	33½
Custard apples	10	7	..	7½	8	9	7½	..
Papaws	10	7	9	7	8	8	8	..
Strawberries	10	7	7	7½	10	8½	7½	..
Other fruits	10	7	6	7	8	8	7	..
Grading and packing ..	35	28	24	27⅔	31	27⅔	25⅓	..
General display	20	17	14	18	16	15	17	19
Totals	200	154	132	153⅔	175	158⅔	153⅓	62½

PLATE 73.—WHAT SCIENTIFIC AND INDUSTRIAL RESEARCH MEANS TO THE MEAT INDUSTRY WAS WELL ILLUSTRATED.

THE MEAT INDUSTRY.

AN EXCELLENT EXHIBIT.

AN EDUCATIONAL EYE-OPENER—ECONOMICS OF MEAT PRODUCTION—MARKETING PROBLEMS—QUALITY IN LIVE STOCK—NEED FOR BETTER ORGANISATION—THE POLICY OF THE QUEENSLAND GOVERNMENT.

One of the most impressive object lessons ever given to the public of Queensland of the value of the pastoral industry was presented in the Meat Industry Hall at the Brisbane Show.

At the official opening of the Hall some notable addresses were delivered. The hope was expressed by the Premier, Hon. W. McCormack, that the meat people and representatives of the Government would get together and devise some scheme of organisation that would improve greatly the position of the meat industry. The following abridged report of the proceedings will interest all concerned in Queensland's progress.

THERE was not a phase of the pastoral industry, or of the manufacturing enterprises that depend upon it for raw material, that was not illustrated either in kind, diagram, or other forms of vivid representation within the Meat Industry Hall. The Meat Exhibit was one of the most impressive features of the 1928 Brisbane Show. At a glance one was able to see on a large contour map the distribution of live stock throughout Australia and the scope for the extension of the pastoral industry, particularly in this State. Each section was an exhibition in itself of interest to the housewife, the craftsman, and the general public, just as great as it was to the grazier. A striking object lesson in skill and economy was presented at every turn. For instance, the enormous waste caused by careless branding was brought home to the stockman, as well as the respective values of different grades of beef that illustrated the economic loss that is caused by careless breeding. Bad branding alone costs Queensland £150,000 a year in damaged hides. The lesson of the exhibit was that the present value of the industry in raw and by-products, £9,000,000, might be doubled by the practice of sound economy in every department. Methods must be reviewed, herds must be improved, and the economics of meat production must be studied more closely and applied more earnestly in order to bring the industry to the position of high efficiency that it should, in a country like this, rightly occupy.

The Meat Exhibit proved that this State is capable of producing the very highest quality of beef and mutton, and that by the reasonable co-operation of all concerned the live stock industry may be placed on such a basis that it will become a much greater factor in our development and an asset of enormous and ever-increasing value.

SPEECH BY THE PREMIER.

The gathering at the official opening ceremony in Show week, which was performed by the Premier of Queensland (Hon. W. McCormack), included many notable people in pastoral and commercial circles.

In the course of his address the Premier expressed the hope that the meat people and representatives of the Government would get together and devise some scheme of organisation that would put the meat industry on a better footing.

Referring to the Victorian embargo on Queensland chilled meat, Mr. McCormack said: "Victoria has put a foolish embargo on our meat; but we need not worry about that. They must have our meat. The people in the cities of the South will not allow any Government to prevent them from getting clean, wholesome food at reasonable prices merely to bolster up some local group of people who are handling stock."

The Premier added that the people who were concerned with the export of chilled meat to the South would show them exactly what Chicago showed the Eastern States of America when a contest occurred there between the chilled beef and the cattle killed locally. There could be only one ending. The State producing the cattle and killing

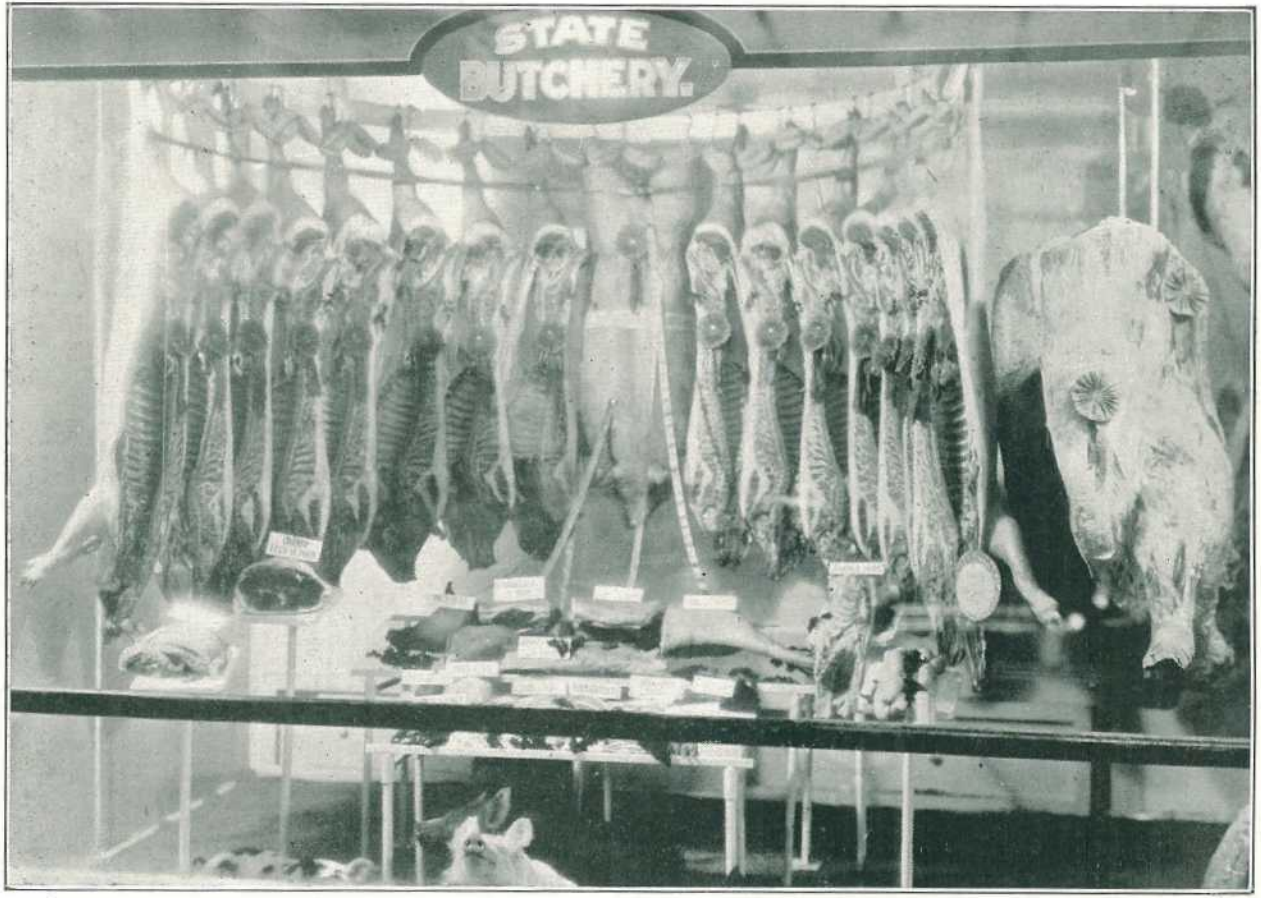

PLATE 74.—FOOD FOR THE MILLION.
A bay in the Meat Hall which was one of the most outstanding features of the Show.

PLATE 75.—"CUTS" AND "JOINTS" OF QUEENSLAND BEEF IN THE MEAT HALL, EXHIBITION.
This interesting and educative display proved an irresistible attraction to housewives at the Show.

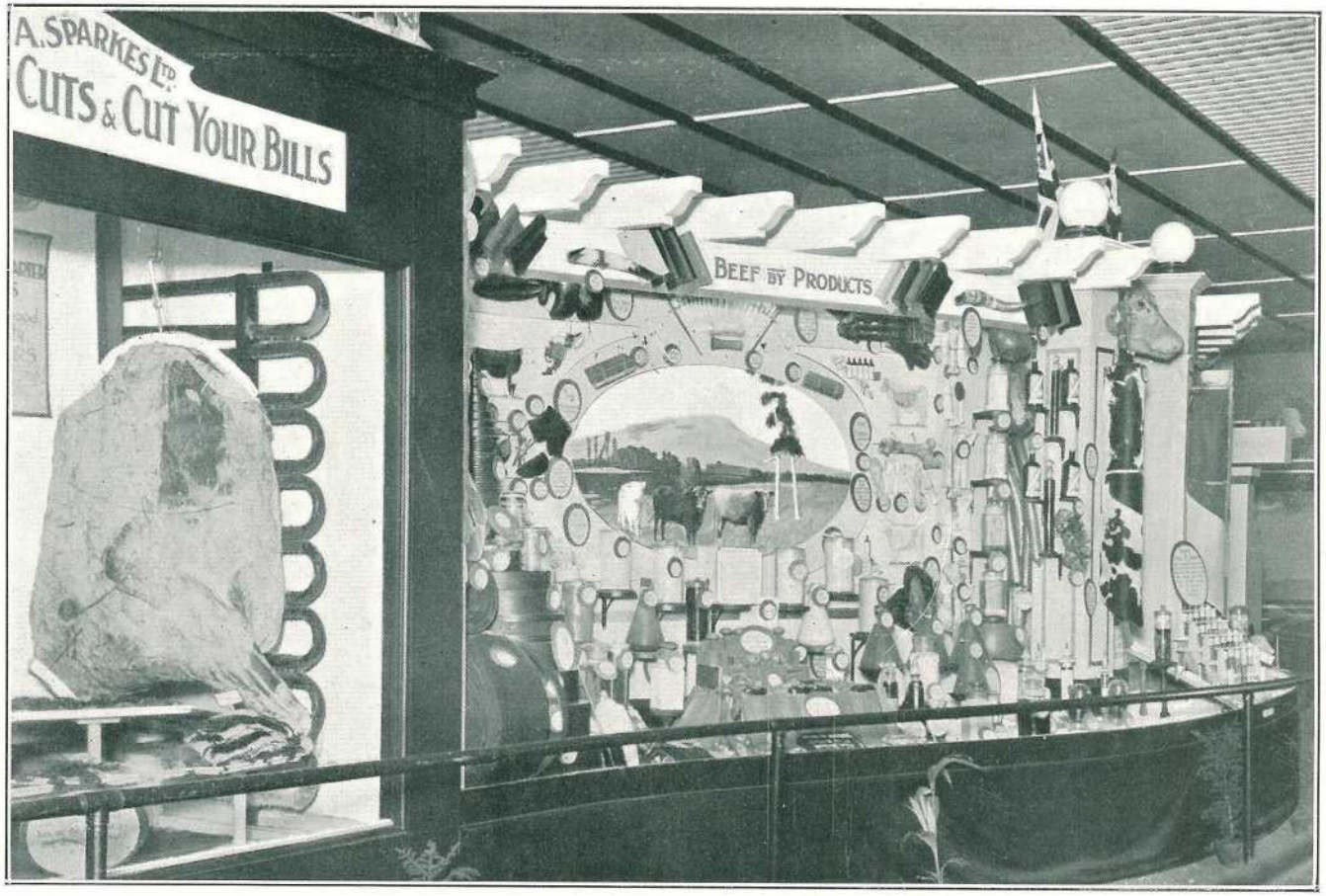

PLATE 76.—THE ECONOMIC IMPORTANCE OF QUEENSLAND'S CATTLE INDUSTRY WAS DEMONSTRATED STRIKINGLY IN THIS BAY IN THE MEAT HALL.

it under proper conditions and transporting it 600 or 1,000 miles need have no fear of its ability to market good meat in the Southern capitals. He hoped the exhibits of by-products would convince everyone that Australians were not getting the best out of the industry. He had visited the meat markets in other parts of the world, especially Smithfield. He was astounded at their methods of handling meat, and was disappointed that Australia was not getting an opportunity of selling in that splendid market. He went through some of the largest meatworks in America—notably Swifts —and he realised, after looking through their by-product department, that Australia had much to learn. That was no doubt one of the reasons why Mr. Sunners had been given an opportunity of seeing the wonderful things that are being done in the United States, so that he could give us the benefit of his skill and knowledge.

Improving the Industry.

"There is a growing tendency, and fortunately so, on the part of many of our people and institutions," continued the Premier, "to raise the general average of the initiative and skill put into our productive and industrial activities. An exhibit of this nature exemplifies this tendency, and is to be highly commended, and I must congratulate those responsible for it. It also serves to indicate that the meat industry is essentially different from most of the businesses with which the public are acquainted. It is the reverse of most manufacturing processes, because, instead of assembling a number of raw materials of known cost into one product, one raw material is separated into many products of undetermined cost." Mr. McCormack said he had been told that the outside value of the by-products, before reaching the subsidiary industries, could possibly amount to £6,000,000, but that, owing to a large percentage of the killing being carried out under circumstances which did not permit of efficiency, the actual value would no doubt be considerably less. It was obvious that the efficiency and development of these subsidiary industries played an important part in determining both the value of live stock to the producers and the cost of meat and other necessities to the consumers, as well as in the economic welfare of the State. Although the producer was far removed from the household distribution of his products, it was nevertheless a subject of great importance to him. In most countries there was a gradual change taking place in the public demand for meat. In Weddell's "Review" on the chilled and frozen meat trade of Great Britain, special emphasis was given to the popular demand for smaller joints, and the objection on the part of the public to those parts of the carcass that required extra trouble in cooking, which was resulting in a wider margin between the value of hindquarter and forequarter cuts of beef. A recent visitor to Queensland, and one who was an authority on marketing, stressed this phase of the meat situation, and stock breeders and distributors would need to take notice of that fact. While there may be always a market of a sort for all classes of

Important Changes.

Within the last decade an entirely new set of economic circumstances had been created, and of the several branches of agricultural and pastoral production the beef cattle industry had been chosen for special investigation, because of its great economic importance, both to the State and the Commonwealth. Associated with the production of beef was the development of a large portion of the State which was essentially cattle country. He was convinced that the profitable utilisation of that land hinged on the successful marketing of the beef it was capable of producing. The Government was asked to solve some of these problems, but it could not perform miracles, nor could it devise an easily applied solution of the difficulties facing the industry.

No Short Cut to Prosperity.

Efficiency in its broadest sense must be applied to every function and every purpose of the business. There was no short cut to prosperity, and the industry was reaping what it had sown. Now was the time to plan for the future. The Government was desirous of helping the industry in every way possible to enable it to overcome the many problems. The Premier traced the history of the meat industry from the beginning of the slump period in 1921 to the appointment of the Beef Commission last year, and he outlined its principal recommendations.

Queensland Government Policy.

It must be realised that the cattle industry of Queensland was of signal importance to the Commonwealth. Several of the other States, such as New South Wales, Victoria, and South Australia, were to-day depending on Queensland very largely for supplies of cattle and beef. It was obvious that the development of the Queensland industry was wrapped up with the devolpment of the chilled beef trade with the

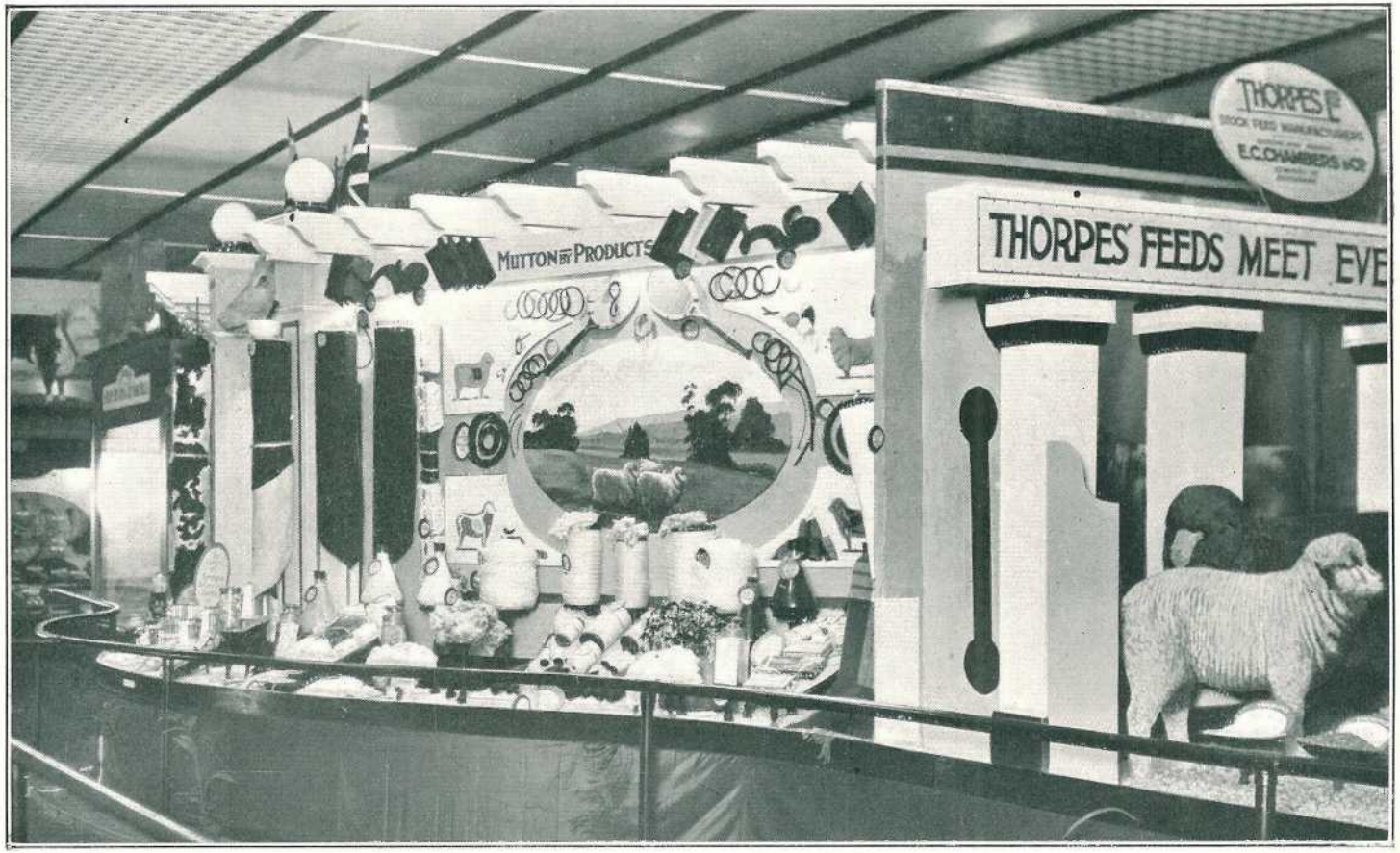

PLATE 77.—A PANEL IN THE MEAT HALL SHOWING THE PLACE OF SHEEP IN THE ECONOMY OF THE COMMONWEALTH.

Southern States. It was not to be supposed, however, that this was a matter for the Government to develop, but where it could help the industry in working out its problems it was the Government's duty to give that help. Before the industry could place itself on a competitive basis with the southern States and with the other exporting countries of the world, some serious attention must be given to the industrial stage. The Government intended to proceed with such questions as tenure and the eradication of pests, but that was obviously insufficient. While the Government had no intention of establishing any industrial unit as a State enterprise or anything of that nature, some reconstruction of the industrial stage must take place. On that question the Beef Commission has made definite recommendations, taking as a starting point the establishment of a public abattoir for Brisbane, which should be vested in an independent board, upon which the producers and consumers would be represented. At the present time authority was vested in the Brisbane City Council to establish an abattoir for Brisbane, and properly so, if the intention was to handle meat for local consumption only. When the complexities of the industry were realised, and the importance of such an institution fitting in with the needs of the industry, it was doubtful if such an institution could serve its best purpose either under municipal or Government control. The Government, however, was prepared to consider the question of assisting the industry by establishing an institution which would meet the needs of the city area, and at the same time help the cattle industry by centralising killing, provided the principal parties concerned, the cattle producers, desired it, and were prepared to support it. No expression of approval or otherwise had come from those vitally interested, so far.

Need for Centralisation.

The principle of handling a large volume of business through the one institution, as was done in other countries, was either right or wrong, and the fact that such countries had succeeded on that principle should be sufficient for us to acknowledge that the method of this country, where the volume was split up over innumerable small units, was wrong. Apart from that aspect, there was the further question of the hygienic preparations of the products. If the killing were centralised, there should be no problem in that direction. It would make possible some system of domestic grading of meat, which appeared to be a justifiable recommendation, and one which would not only guarantee the quality of the product to the consumer, but would undoubtedly create the demand for the better article. The problems of the industry were quite apparent, and they must be solved in conjunction with all other features, such as question of tenure, eradication of pests, minimising of live stock losses, and so on.

Commonwealth Interest.

Dealing with the Commonwealth interest in the matter, Mr. McCormack said it was clear that the development of the surplus-producing areas of Queensland were absolutely essential to Australia as a whole. It was unthinkable that the industry should be allowed to languish. The consumption of meat within the Commonwealth amounted to about 1,000,000,000 lb. a year. There was a wide disparity in prices between those paid in the surplus-producing areas and the prices paid in the Southern capitals, which showed that it was possible for meat prices to climb to a high level in this country, as they had in other countries when consumption had overtaken, or was approximately equal to, production. It was quite safe to say that, in the absence of the surplus production of cattle in Queensland, the price of meat to the consumers of the Commonwealth would substantially increase, and even were it only a matter of ½d. per lb., this additional cost to the country would amount to at least £2,000,000 per annum. Seemingly, then, the problem of the industry was that the Governments of the States in which cattle-raising was of primary importance should carry out, from the State point of view, those measures which would ultimately lead to a higher state of efficiency within those States. Having done this, the question led up to a Commonwealth issue. The Government of the State had taken the necessary action to direct the affairs of the industry along these lines, which it believed offered the only commonsense solution. It was to be expected, however, that as the ways and means of improving the status of the industry were afforded to all branches engaged within it, that they themselves would co-operate in seeking its advancement, and a simple practical recommendation had been made whereby the various branches of the industry would organise within themselves to promote its welfare. Again, it was quite apparent that any form of Governmental organisation in an industry with so many parts would not be of any avail; but looking at countries where the live stock and meat industry had tackled its own affairs, the result indicated that when the job was

PLATE 78.—AN EXCELLENTLY ARRANGED BAY IN THE MEAT HALL,
Showing the wide range of Pig Products manufactured in Queensland.

tackled by those engaged in it, with sympathetic Government assistance, progress could be made, and that form of organisation—the voluntary form—was to be highly recommended and supported. If these States producing the surplus cattle followed the recommendation given, the co-operation of the Federal Government could be expected. Queensland, therefore, to fully utilise its cattle country, and to serve its purpose in the Commonwealth, and as the exporting State of Australia, should take the lead along the lines that had been suggested, and if such proposals were given the whole-hearted support of all branches of the industry they could be assured that the Queensland Government would do its part.

Live Stock Cattle Bred for Quality.

Mr. Ernest Baynes (president of the Royal Agricultural and Industrial Association) said the difference between the modern show and the old-time show was reflected, chiefly, in the great improvement in the live stock exhibits. Live stock was now being bred more for quality. Not only by-products, but by-products from by-products, with the help of science, also were being availed of to the best advantage. Even the tail hair was being put to economic uses. As the by-products, through established grades, were securing better markets, so the main product—meat—also should be graded and identified to create a demand for the better grades. Such a policy would stimulate the breeding of better types of animals, and would give the consumers a higher grade of meat. The exhibits in the Meat Industry Hall presented a very vivid picture of the extent of the live stock industry and its subsidiary industries. He congratulated Mr. E. F. Sunners and Mr. R. Gailey and their staffs on their great achievement. The exhibit was a credit to them, to the exhibitors, and to Queensland.

Mr. John Hiron (acting chairman of the Royal National Association) briefly introduced the Premier, and congratulated everyone who had been responsible for the exhibits. "It is an education," he said, "and reflects great credit on everyone who has taken part in it. It shows how important the meat industry is to Queensland and to Australia."

Market Decentralization.

Major H. Shenton Cole (representative of the London and North-Eastern Railway) gave an address on "The Distribution of Australian Products in the North of England." He appealed for direct shipments of primary products to Hull, the natural gateway for 12,000,000 people.

Mr. J. P. Bottomley (council steward) hoped the meat men would avail of the Premier's invitation and get together, with a view to improving the industry.

Mr. A. J. B. McMaster (United Graziers' Association), in moving a vote of thanks to the Royal National Association, said the cattlemen had already decided to confer with the object of making suggestions to the Government for the improvement of the industry. He had listened with much interest to Major Cole's address, but he could not understand why the big exporting countries, which had been shipping for centuries, did not go to Hull. Was not London, after all, the best market? After a long period of blackness, the cattlemen were just about to emerge to a brighter future. He felt sure they would receive practical help from the Government. Mr. McCormack had said that if he gave them the land free it would not solve their difficulties. That was quite true. The fact that the Government created an atmosphere of hope was in itself a great help.

Mr. John Hiron moved a vote of thanks to Mr. E. F. Sunners and Mr. R. Gailey, their assistants, and all those who had staged the exhibits and helped to make it a success.

Mr. E. F. Sunners, in response, said the exhibit was an exemplification of co-operative effort. With such a spirit it was simple to make such a successful show.

A USEFUL AND INTERESTING JOURNAL.

A Gordonvale (North Queensland) farmer writes (12/1/28):—"The 'Queensland Agricultural Journal' is not only useful to the farmer, but should be interesting to any lover of Nature, as the articles are very instructive, lucid, and give good material for thought."

PHOSPHORUS IN THE LIVE STOCK INDUSTRY.

By

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This paper was published originally in the "Journal of the Department of Agriculture" of the Union of South Africa (No. 5, Vol. VIII., 1924), and was reprinted in the "Queensland Agricultural Journal" for March, 1925 (Part 3, Vol. XXIII). In response to numerous inquiries, due to the awakened interest in the subject as a result of Sir Arnold Theiler's recent visit to this State, and to meet the wishes of a large number of stockowners in Queensland, another reprint is now presented.—Ed.

I. INTRODUCTION.

The article upon "The Cause and Prevention of Lamsiekte," which appeared in the Journal for June, 1920,* reviewed the recently-discovered significance of phosphorus in the etiology of the disease lamsiekte in cattle. At that time it was already realised that phosphorus-supply also played an important rôle in the *nutrition* of stock over wide areas of the Union, and experiments were therefore instituted to determine the extent to which it entered as an economic factor in beef production. A weighbridge was installed on the farm *Armoedsvlakte* at Vryburg, where the previous lamsiekte research had been carried out, and an extensive series of experiments planned. Some of these have had to be curtailed on account of locust depredations, drought, and the prevailing financial stringency; but others were successfully carried through, with results so striking that broadcasting to every cattle farmer in the Union is now fully justified.

Phosphorus is unquestionably a limiting factor in the growth rate of cattle, and a dominating factor in the maintenance of live-weight under ordinary conditions of veld grazing, so that the nutritional aspects of the investigations now altogether overshadow the original problem of disease. Since the areas over which the nutritional factors apply are far wider than those over which lamsiekte occurs, the annual financial gain to the stock-raising industry in the future can easily be made far to exceed the annual financial losses from lamsiekte in the past. Indeed, by focusing attention upon specific nutritional deficiencies of South African veld, the disease can almost be said to have been "a blessing in disguise."

Increase of milk yield of cows, better calves at birth, more rapid growth of young stock, and superior fattening of adult cattle, all follow simple bone-meal feeding, and agricultural propagandists might well carry the phrase "Bone-Meal for Beef" as slogan cry over all the phosphorus deficient areas of the Union.

The following diagram (Fig. 1) summarises the phosphorus problem as it affects, in varying measure, a very large proportion of the total acreage of South Africa; phosphorus deficiency being a general characteristic of South African soils, although the precise degree of deficiency in different districts remains to be mapped out.

* The "Journal of the Department of Agriculture," Union of South Africa.

The various ramifications of this diagram are best considered separately.

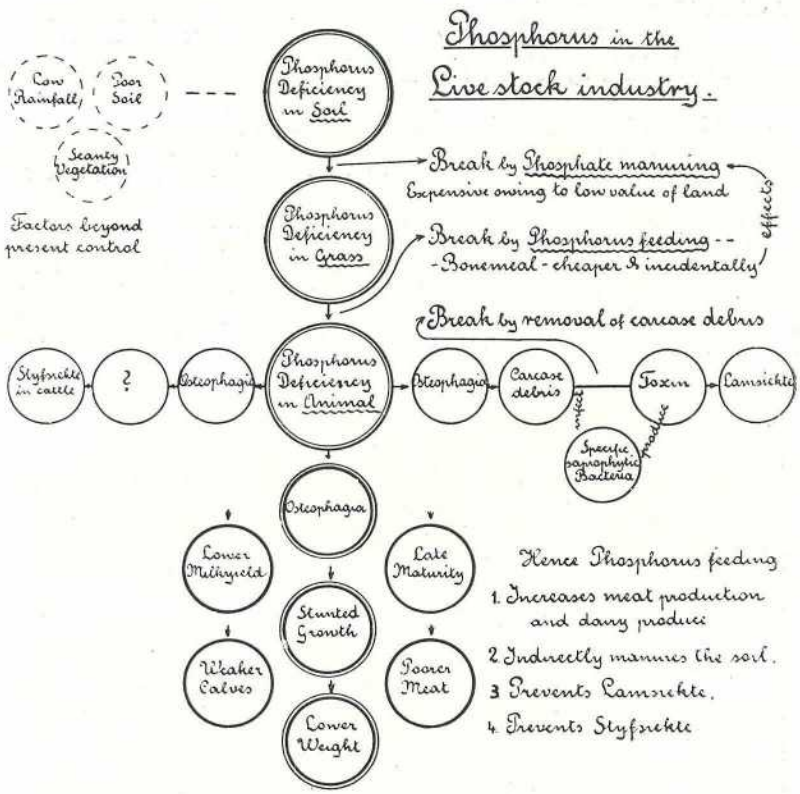


FIG. 1.

II. LAMSIEKTE.

With regard to the disease lamsiekte little need be said, since the article of June, 1920, dealt with it in considerable detail. It need merely be noted that its position in the diagram explains it as an *indirect* consequence of phosphorus deficiency, the *direct cause* of the disease being a "ptomaine poisoning" brought about by infection of carcass debris with a specific toxicogenic saprophyte; an anærobic bacterium, reminiscent of, but not identical with, *Bacillus botulinus*. If the causal organism is missing, or if there is no protein substrate, from which it can produce its toxin, there can be no lamsiekte, however acute the phosphorus deficiency of the vegetation may be. Hence there are wide areas of the Union over which one or other manifestation of phosphorus deficiency is apparent, but over which lamsiekte never occurs. If, on the other hand, there is no phosphorus deficiency in soil or vegetation, no "pica" (depraved appetite, or more specifically "osteophagia") is manifested by the cattle and they leave decaying carcass debris alone, however much of it may be scattered over the veld. They therefore never ingest the toxin and never contract lamsiekte. Hence there are areas in which both organism and substrate may be present, and yet in which the disease is unknown, simply because the soil is not deficient in phosphorus.

Lamsiekte may therefore be prevented *either* by cleaning the farm of all carcass debris *or* by feeding phosphorus compounds to the cattle. *Both* are recommended; the first on general hygienic grounds, the second for the reason that the cost of feeding bone-meal is *repaid many times over* in the improved condition of the cattle, quite irrespective of the insurance provided against the disease.

As the diagram indicates, the same result can be achieved by phosphatic manuring of the soil, but, as will be shown later, the cost is prohibitive for just those areas over which lamsiekte is most rife.

III. STYFSIEKTE.*

Again, with regard to this branch of the diagram (Fig. 1), little need be said at present, beyond stating that the disease styfsiekte is now under special investigation on the farm of Mr. Richards, *Shepstone*, in the Ermelo district; and that it can quite definitely *be prevented by feeding bone-meal* or other material containing sufficient digestible phosphorus.

It may indeed turn out to be an extreme form of phosphorus deficiency, a real "aphosphorosis"; or a mixed deficiency disease in which low lime as well as low phosphorus plays a part; or there may be an hitherto unsuspected link in its etiological chain.

It occurs on some phosphorus deficient soils, but not on others; is prevalent, for instance, on the Ermelo High Veld where lamsiekte is unknown, but absent at Vryburg where lamsiekte is prevalent. There is, therefore, an unknown factor, denoted by an interrogation mark in the diagram; which, however, will not disturb the practical farmer so long as he is satisfied that he can control the disease by *bone-meal feeding*. He can do this, easily and effectively, and in the process enormously *improve the condition of his cattle*.

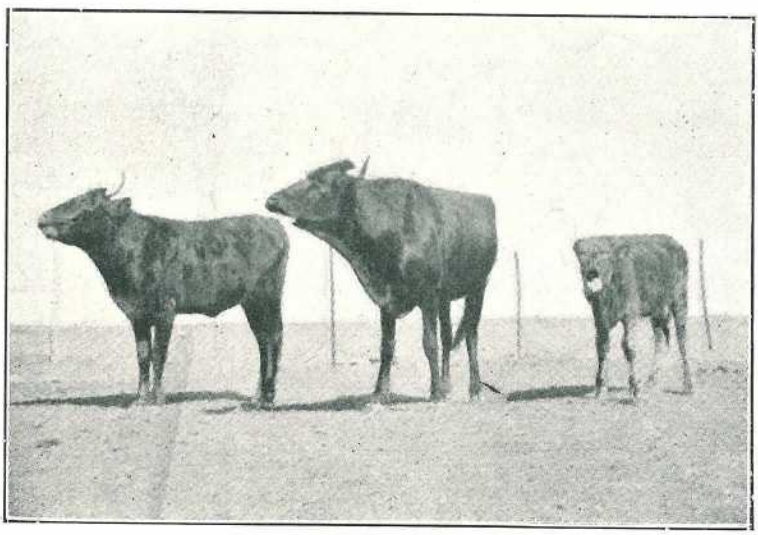


FIG. 2.

IV. PHOSPHORUS DEFICIENCY IN THE ANIMAL.

So much, then, for the side branches of the diagram, ending with disease. The direct chain of events, commencing with poor soil and ending with poor beef, may now be considered. The lower part of Fig. 1 is of more interest to the cattle farmer, and may therefore be dealt with first, leaving consideration of soil and vegetation to the end.

Osteophagia.—This is the most obvious outward sign, or clinical symptom, of phosphorus deficiency in *cattle;* and although not infallible, is a very valuable indicator of such deficiency in the majority of veld-bred bovines. Curiously enough it is not shown to the same extent by other animals; is, for instance, only feebly manifested by sheep.

Osteophagia is a specific form of "pica" or "depraved appetite," showing itself as a special predilection for bones. In extreme cases "osteophagia" may pass over into "allotriophagia," in which specific discrimination is lost and the animal will chew any sort of rubbish at all. In its milder forms the abnormal appetite is quite finely adjusted, and only the best sun-bleached bones are eaten. In its more aggravated forms, any putrefying bones may be eaten, and it is not an uncommon sight to see "extreme cravers" crowding round the rotten carcass of a dead animal. The accompanying photograph (Fig. 2) shows "typical osteophagia" in the three animals. The attitude of all three is quite characteristic, and with the middle animal

* Stiff or starch sickness.

the white bone is clearly visible, sticking out of the left side of the mouth. The sound of "bone chewing" is usually easily distinguished, and if presented in the flesh these cattle would make quite a musical trio.

Owing to the nice discrimination displayed in typical osteophagia, it is possible to sort out a herd, for experimental purposes, into "marked cravers," "slight cravers," and "non-cravers." This is simply done by first offering sterilised "rotten bones"—*i.e.*, bones still possessing a distinctly putrid odour. The animals which will chew such bones are entered up as showing "marked osteophagia." The remainder of the batch are then driven over to another corner of the "testing kraal" and allowed access to "sweet bones"—*i.e.*, bones which have been well bleached in the sun, and which no longer possess a putrid odour. Any animals which will chew such bones are entered up as showing "mild osteophagia"; and the remainder, displaying no predilection for bones at all, recorded as showing "no osteophagia."

Fig. 3 illustrates a small scale test, using boxes for the test bones.

Four of the animals are clustering round the boxes. A fifth (extreme right) has taken a bone and is obviously chewing it with relish. The sixth, presenting a "scornful posterior" on the left, is apparently a non-craver. The method of "testing for osteophagia" can of course be varied to suit circumstances and, as succeeding charts will show, has proved of enormous value in investigating phosphorus deficiency in cattle.

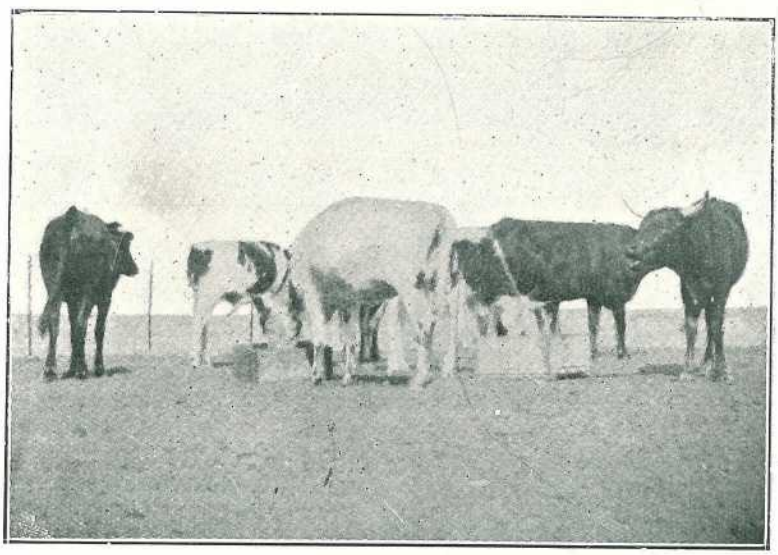
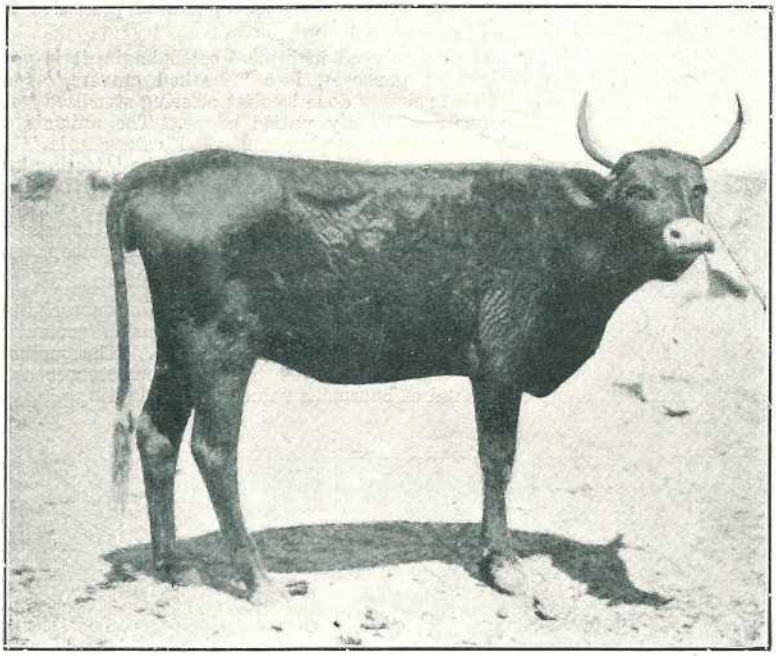


FIG. 3.

Live-weight, condition, and growth.—The osteophagia just discussed would represent little more than an interesting curiosity to the farmer but for the fact that it is the precursor of disease and the index of defective nutrition in his cattle. Indeed, the South African farmer has not only known "pica" all his life, but has treated it as normal. In spite of the lamsiekte article of June, 1920, many farmers still disregard its significance, and it is one of the express objectives of this present paper to convince them that osteophagia means not only danger of disease, but consistently poor beef production. The next illustration (Fig. 4) shows two animals of the *same age* (about three years), both restricted to natural veld grazing, but one given an allowance of 3 oz. of bone-meal per day for about 15 months before the photographs were taken; and the other not.

The upper animal is a lean heifer taken in the attitude of osteophagia. It is obviously stunted in growth and poor in condition. The lower animal displays a creditable corpulence, shows no osteophagia, and is well grown for a veld-bred ox. Fifteen months before both were about the same weight, and the *only difference* in feeding was the *bone-meal ration*. This comparison is certainly selected, but as the following charts show, the *average* gains in live-weight from simple bone-meal feeding are quite extraordinary.



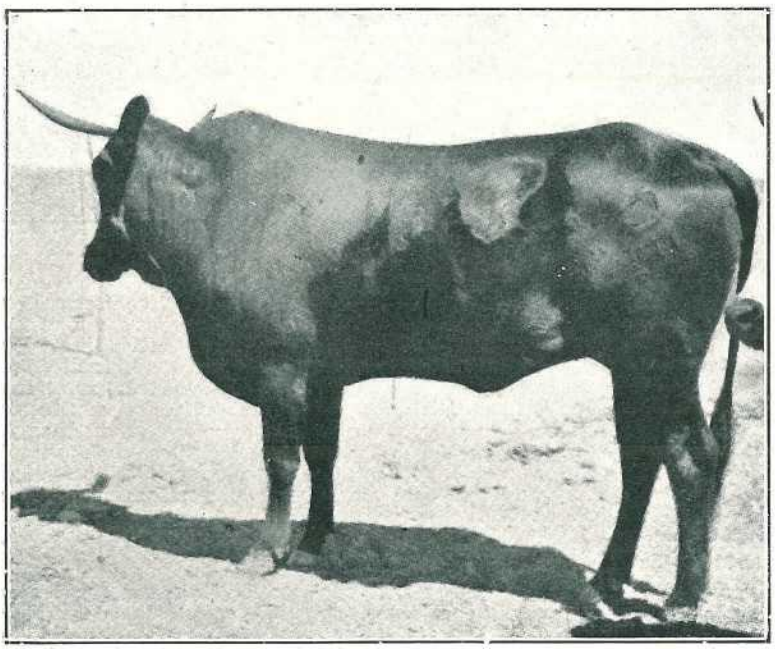


FIG. 4.

Gains of a Mixed Herd.—Fig. 5 charts the average weight of two similar batches, *fifty in each,* of mixed cattle of various ages from about two to seven years, one receiving a bone-meal ration, the other not. Both lots *average* about 700 lb. per head; a figure normal for a miscellaneous lean herd in the Vryburg District at the end of winter. Apart from the bone-meal ration both lots were *confined exclusively to natural veld grazing,* and the large number in each mob completely precludes fortuitous variation. The difference is therefore *solely attributable to the bone-meal:* 3 oz. per head per day, excluding Sundays, although as subsequent experiments have shown, the same results could have been obtained on less.

The experiment was commenced in June, a time at which the Armoedsvlakte veld had reached the dry winter stage. The grass was meagre, and owing to shortage of grazing, both lots diminished in weight until the end of September, although the bone-meal lot *lost less* and were at that time 25 lb. per head heavier. The first green grass of the season then began to appear on the dry veld and both batches commenced to pick up in condition. By May the control lot had fattened up to an average weight of about 800 lb. and the bone-meal lot to approximately 900 lb., the actual superiority averaging 105 lb. *per head.* This, it must be emphasised, is practically all extra butcher carcass. At the same time the *whole* carcass weight of the superior animals is worth more per lb. owing to its better quality, deposition of fat between the muscular fibres making for more tender saleable meat. Merely from the gross weight point of view, however, the control cattle gained 14 per cent. over a period of eight months, while the bone-meal cattle gained 29 per cent., or more than double.

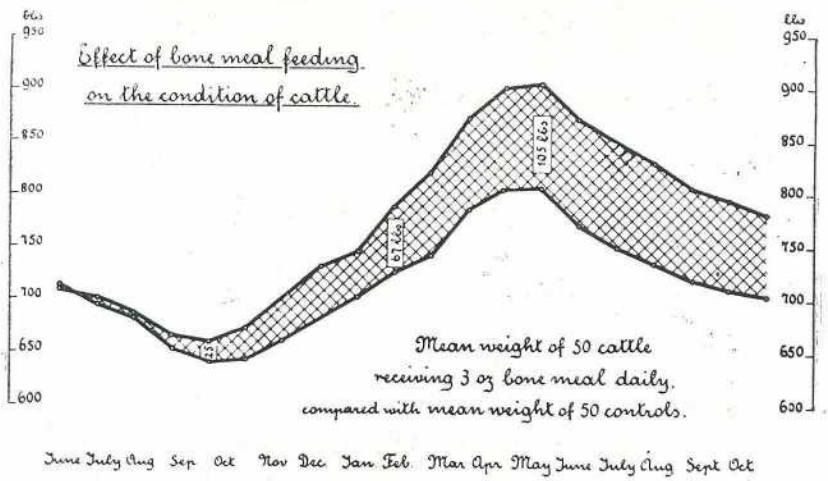


FIG. 5.

Of further general interest in this curve is the *winter fall* in live-weight of animals confined to the poor pasture of a drought season; a common experience in Bechuanaland and all regions of low rainfall. As will be shown later, the feeding value of the grass after the seed has fallen is at best not really high. During the past season the available supply was scanty in proportion to the stock carried by the farm, and the young grass of the ensuing year delayed by drought. Both batches lose in condition, the controls dropping back to their initial average weight of 700 lb. shown at the commencement of the experiment and, therefore, showing practically no commercial profit for the year's grazing. Although the bone-meal lot also lose about 100 lb. per head in weight, through simple semi-starvation on the poor winter pasture, they nevertheless *maintain the advantage* gained during spring and summer, survive the winter 100 lb. heavier than the controls, and are ready to increase that advantage still further the moment the veld improves.

In a good year the winter loss may be avoided, although it is rare to find animals in this region actually gaining appreciably in weight during the months June to September. In all these areas of poor soil and low rainfall, however, where it is exceedingly difficult to grow and store winter feed for stock, a winter loss of anything from 5 to 20 per cent. in live-weight, according to season, has to be faced; and the gains only counted upon during the spring and summer months. This point, so disadvantageous to a beef export trade, will be referred to again in discussing the composition of the vegetation.

Gains of Young Oxen.—If bone-meal feeding is commenced earlier in life the difference in live-weight is still more pronounced, since growth as well as fattening is enhanced by removal of the phosphorus "limiting factor." Fig. 6 summarises the results with young oxen, weighing about 650 lb.

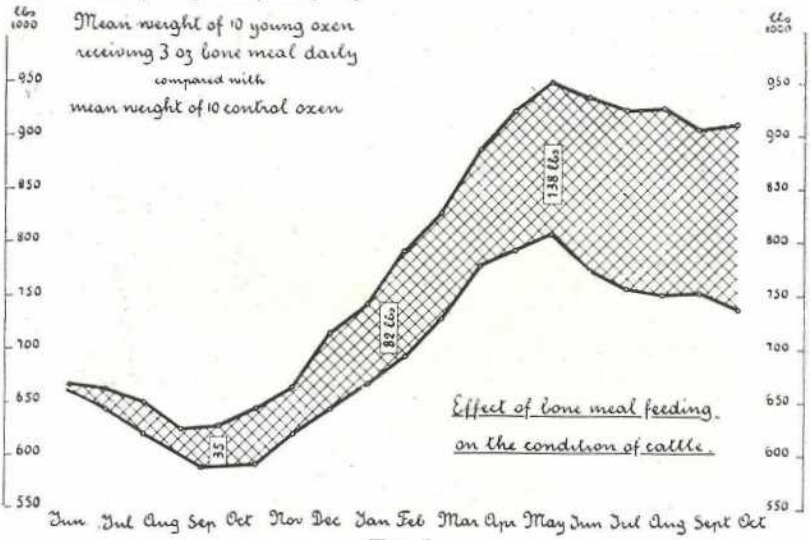


FIG. 6.

As with the previous mixed herd, both batches lose weight from June to September, owing to the poor quality of the winter pasture. The lot receiving bone-meal, however, make better use even of the poor veld, *lose less*, and at the turning point of spring are still 35 lb. heavier per head. Fattening up, and growth, then proceeds upon the new veld vegetation, and by May even the controls have increased to about 800 lb., or by 21 per cent. The bone-meal lot increased to 950 lb., 42 per cent., or *twice as much* as the lot receiving no bone-meal; showing a clear superiority of 138 lb. per head. Calculating upon the initial weight, this represents an extra gain of over 20 per cent. within a year, solely as a result of bone-meal feeding. The real extra profit is still higher, since on a keen competitive market the superior animals find a ready sale, while the controls run the risk of "kaffir meat prices." An auctioneer's valuation showed an extra cash value of £3 per head in favour of the bone-meal lot, as against an actual expenditure of six shillings (55 lb.) for bone-meal. A glance at the next photograph, Fig. 7, showing a selected individual (the youngest) from each lot, will leave no cattle farmer at variance with the auctioneer.

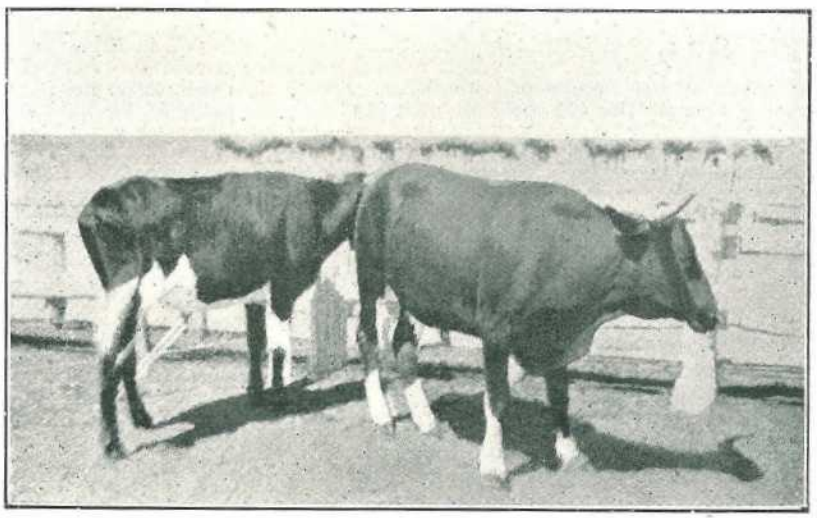


FIG. 7.

A year before, these two animals were approximately the same weight. The difference in butcher quality and in market value is obvious.

Regarding Fig. 6, it may be noted further, that during the latter period May-October the "winter loss," already discussed, is again apparent, but is less pronounced than in the preceding year. The point of interest is that during this winter the bone-meal batch practically retain their gain and so indirectly increase their lead from 138 lb. to 170 lb. per head.

Specific Influence on Growth.—When bone-meal feeding is commenced still earlier, and the influence of phosphorus upon *growth* is allowed fuller play, the

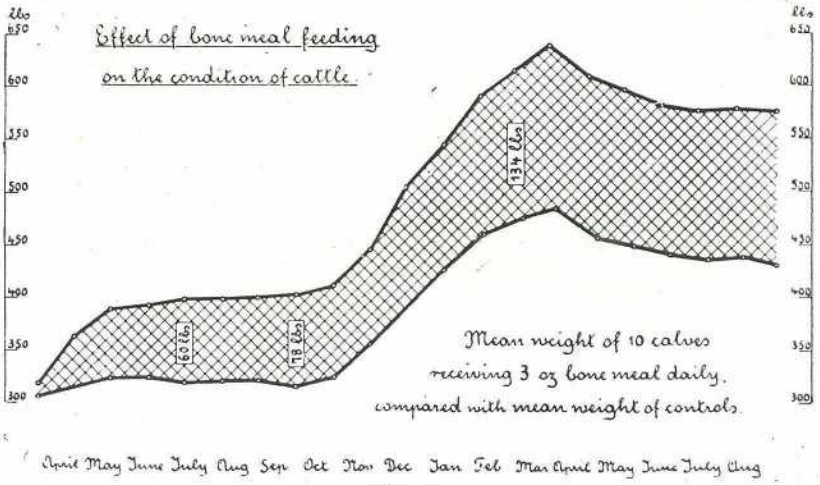


FIG. 8.

results are still more striking. Fig. 8 shows the curves obtained with calves from 9 to 18 months old, in an experiment commenced in April, 1921. These calves commenced at an average weight of 300 lb. On the quantitatively sufficient, but

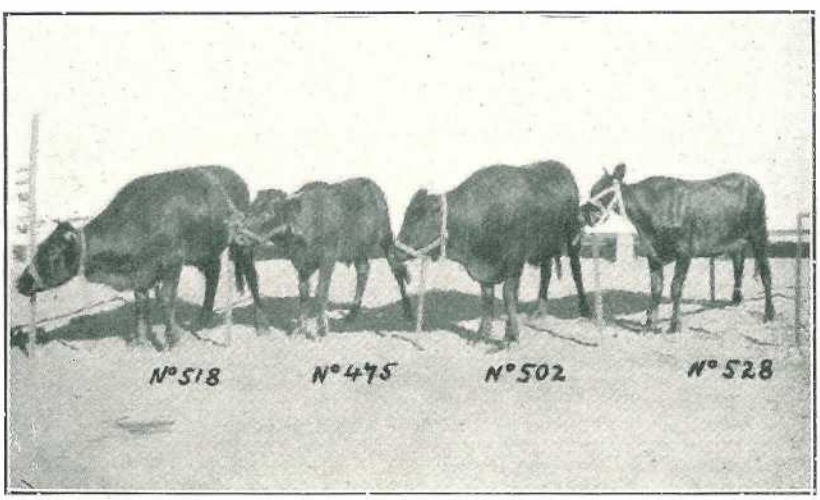


FIG. 9.—Showing Influence of Phosphorus on Growth of Cattle, otherwise restricted to Natural Grazing.

Weight.	No. 518.	No. 475.	No. 502.	No. 528.
January, 1922	310 lb.	319 lb.	304 lb.	297 lb.
May, 1923	755 lb.	465 lb.	726 lb.	451 lb.
Increase	445 lb.	146 lb.	422 lb.	154 lb.
Bone-meal ration ..	3 oz.	Nil	3 oz.	Nil

phosphorus deficient, veld vegetation of April and May, the controls make practically no progress, while the bone-meal batch gain 60 lb. per head; 20 per cent. in two months. From June to October the amount of winter grass was sufficient to keep both lots from falling off in weight, and allow the bone-meal lot to increase their lead to 78 lb. per head. From October to April the new grass provided relatively abundant feed, of better (less deficient) phosphorus-content during the earlier period of growth, and even the controls increase to 480 lb. The bone-meal lot, however, increase to well over 600 lb., the actual superiority being 134 lb. per head. During this period there can be no doubt that the lack of phosphorus in the grass is the *limiting factor* in the growth of these calves, a fact which will presently be correlated with analyses of the grass over these months of the year.

Calculating on the basis of the initial weight of 300 lb., the actual increases are 60 per cent. for the controls, but 105 per cent. for the lot receiving the bone-meal ration; the latter having more than *doubled their weight.* The bone-meal batch also increased more in *size.*, i.e., in skeletal development, so demonstrating the specific effect upon growth. As pictorial illustration of this the following photographs are of great interest. Fig. 9 shows four animals *not* selected because they make a pretty picture, but originally picked out on the basis of similarity in weight, age, and appearance, over a year before the photograph was taken. The exact experimental protocols are included in the legend to the plate.

It will be noted that No. 518 has increased more than *three times as much as* No. 475 in sixteen months, although actually the smaller animal at the commencement. No. 528 is similarly stunted by comparison with No. 502, its phosphorus-fed fellow. Subsequent experience has shown that results nearly as good can be obtained with less bone-meal than actually used in this experiment, although a liberal ration is always surer. These animals are *representative* of the general results of phosphorus feeding, now recorded for hundreds of cattle; more representative than the dramatic differences shown in Fig. 4 and Fig. 7, but sufficiently striking to convince any progressive farmer of the need for bone-meal feeding on phosphorus deficient soils. Although bone-meal is here used as source of phosphorus, wheaten bran or other palatable, digestible, phosphorus rich supplement, serves the same purpose. This point will be mentioned again in discussing the phosphorus-content of the veld vegetation. (Fig. 24.)

Is the Amount of Phosphorus required to Prevent Osteophagia the Optimum for Growth?—When the Armoedsvlakte feeding experiments were commenced, the two functions of bone-meal were kept in view:—(*a*) Prevention of lamsiekte by obviation of osteophagia, and (*b*) improvement in growth and condition by obviation of nutritive deficiency of the pasture. Shortly afterwards (1921) an attempt was made to measure the phosphorus requirements of different classes of animals by determining the minimum amount required to prevent osteophagia, and to estimate the phosphorus deficiency of the veld at different seasons of the year by noting the variations in amount of phosphorus required to supplement it, correlating the latter with actual analyses of the vegetation. "Osteophagia Equilibrium" experiments were then devised, in which the daily ration of bone-meal was varied every week upon the basis of a weekly test for osteophagia. If during any week the craving for bones disappeared, the daily ration of bone-meal was dropped slightly. The moment the craving returned, the ration was raised slightly. In this way the cattle were kept just on verge of osteophagia, and the actual amount of bone-meal required to maintain this "equilibrium" charted against season (or time) for cows, calves, growing stock, and adult oxen. The results are given below.

It was then found that, although osteophagia is an excellent *general guide* to phosphorus deficiency, and a *certain indication* of susceptibility to lamsiekte in presence of the other essntial links in the the etiological chain of that disease (Fig. 1), it is by no means infallible as a measure of the need for phosphorus in nutrition. Although osteophagia nearly always (with the exception of a few "habitual" or "chronic" cravers) indicated nutritional need for phosphorus, quite a number of animals (especially young stock) failed to display osteophagia even when their nutritional need could be readily demonstrated by a dietetic experiment. Furthermore, osteophagia only appeared (in general) at a level of deficiency distinctly below the optimum requirements from the nutritional point of view. Figs. 10 and 11 illustrate this. The animals are young calves originally selected from the stock at disposal, on the grounds of *uniformity* in age, size, weight, and appearance. They belong to a "skeletal development" experiment, and will finally be slaughtered for study of their bones. Fig. 10 compares a control receiving no bone-meal with a similar individual receiving "just sufficient" bone-meal to prevent osteophagia, and with a third, originally similar calf, fed upon "excess" bone-meal (3 oz.). The legend supplies the detailed protocols.

As will be seen, the increase in weight over sixteen months is 166 lb. for the control; 295 lb. for the animal receiving just enough phosphorus to prevent osteophagia, 15 lb. of bone-meal in all; and 352 lb. for the animal receiving excess bone-meal, 75 lb. in all or 3 oz. per day except Sundays. It is quite obvious that the amount of bone-meal required to prevent osteophagia effects an enormous improvement in growth, but is not quite the *optimum*. It has the effect of almost doubling the rate of increase, and yet a further supply allows of a further increase of 57 lb. over 295 lb., or approximately a further 20 per cent. The precise additional amount of bone-meal required to produce the optimum effect is not yet known. The actual amount supplied to No. 560 was five times as high as that supplied to No. 559. The 3-oz. daily ration is obviously unnecessarily high, and even 1 oz. (25 lb. total) might have proved sufficient to effect maximum improvement. Experiments are now in progress to determine the *most economical* amounts of bone-meal for various classes of cattle as distinct from the "most beneficial." The "bone-meal bill" is an important item with ranching farmers, who are little concerned with the manurial value of the phosphorus after the animal has done with it; and in some cases it *may* pay to take a "good return" in beef on a small bone-meal bill, rather than the "maximum return" on a higher initial outlay. The probabilities, however, are that the optimum live-weight and optimum economy will lie very close together; and

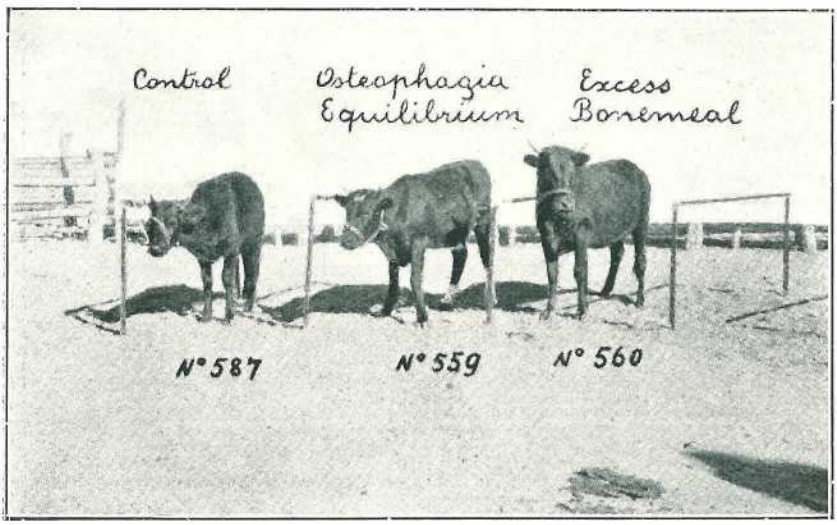


FIG. 10.—Showing that the Amount of Phosphorus required to prevent Osteophagia and so protect against Lamsiekte is not the Optimum for Growth.

Weight.	No. 587.	No. 559.	No. 560.
January, 1922	224 lb. ..	237 lb. ..	226 lb.
May, 1923	390 lb. ..	532 lb. ..	578 lb.
Increase	166 lb. ..	295 lb. ..	352 lb.
Total bone-meal supplied	Nil ..	15 lb. ..	75 lb.

that when the former is more accurately determined than it has been in the past series of experiments, the latter will prove close enough to render distinction superfluous.

The companion picture, Fig. 11, illustrates the second point, *i.e.*, that some animals may never show osteophagia at all, and yet profit enormously by bone-meal feeding.

The legend explains itself. Control calf No. 568, rather over a year old when the experiment started and in its third year when photographed in May, 1923, increased 225 lb. in weight in sixteen months on the natural grazing without bone-meal. No. 569 was to have got as much phosphorus as it "asked for" in the osteophagia tests; but since it *never showed craving* it never got any bone-meal. It behaves exactly like the control, increasing to about the same weight on the natural pasture, and remaining far behind No. 571, which got excess of phosphorus whether it asked for it or not. At the commencement of the experiment, No. 571

also showed no osteophagia, but being liberally supplied with bone-meal, never got a chance of developing it. Whether it would have developed osteophagia if it had not been so fed remains doubtful; probably it would not, since a fair proportion of the calves in this experiment only developed the bone-eating habit after two years. At any rate it got bone-meal (by the "crush method" described below) and made more than twice the gain in weight of either the control or the "osteophagia equilibrium" animal, which *would* have received at least *some* bone-meal if it had reflected its requirements by displaying craving.

Requirements of Different Classes of Cattle.—The next chart, Fig. 12, shows the varying amounts of bone-meal required to prevent osteophagia in different classes of cattle, as determined by the method of "osteophagia equilibrium" just described.

It may first be noted that the amount of phosphorus required varies with the season of the year, falling as the richer young grass of spring becomes available, and rising again as the grass matures. This point will be more fully discussed in considering the chemical composition of the pasture (see Fig. 23).

Glancing at the curve for adult oxen, it is apparent that phosphorus requirements are lowest for animals which made demands only for *maintenance*, but not for growth or reproduction. For this class of stock 6 oz. to 9 oz. of bone-meal per week provide sufficient phosphorus to prevent osteophagia, even during the worst

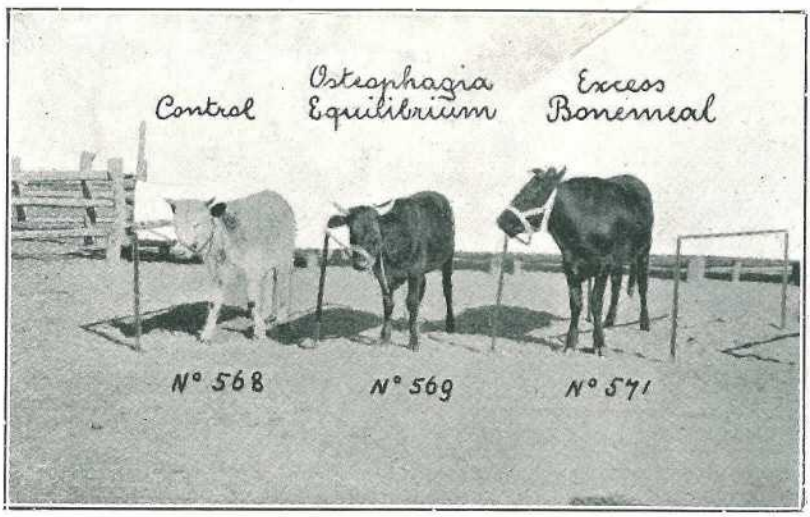


FIG. 11.—Showing that Nutritional Deficiency of Phosphorus is *not always* reflected as Osteophagia.

Weight.	No. 568.	No. 569.	No. 571.
January, 1922	236 lb. ..	238 lb. ..	233 lb.
May, 1923	461 lb. ..	472 lb. ..	714 lb.
Increase	225 lb. ..	234 lb. ..	481 lb.
Total bone-meal consumed	Nil ..	Nil ..	75 lb.

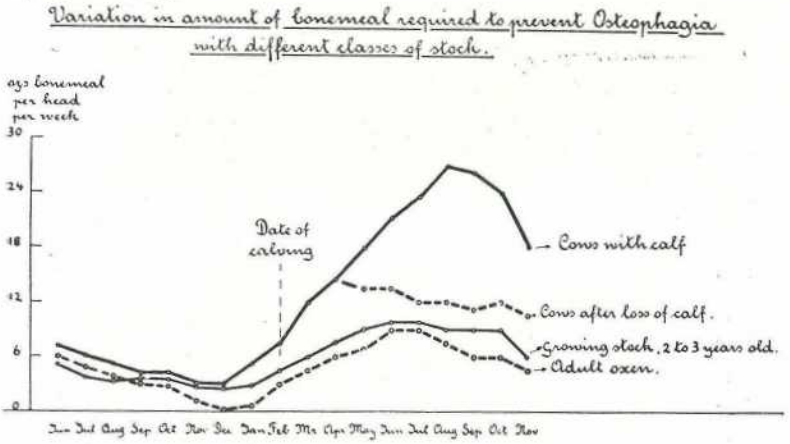
No. 569 received no bone-meal simply because it never showed Osteophagia.

period of the year (winter grazing, May to August); while during the period of very young grass practically no bone-meal is needed, the proportion of phosphorus in the vegetation itself (Fig. 23) being then sufficient for mere maintenance.

With young growing stock the requirements are a little higher than for oxen, apparently varying from 2 oz. to 10 oz. per head per week according to the season of the year, i.e., according to the stage of growth of the grass. Expressed upon the basis of live-weight, the difference "per 1,000 lb." would be even more marked, but for the present the curves are purposely left to reflect "classes of stock" irrespective of weight: for three reasons—(1) that the ranching farmer thinks in terms of class and age rather in terms of individual weight, (2) that the experimental animals were "stunted" to begin with, and "potential capacity to grow" is more important than initial weight, and (3) that the *ratio* of "phosphorus" to "energy value" of the grazing, which remains the same irrespective of the weight of the animal and

the weight of food eaten, is probably the most important factor (see below). The curve therefore reflects the fact that *growing stock* require slightly more bone-meal than adult oxen, in spite of the fact that the latter are larger and heavier animals; further, that they require it all the year round.

Coming now to the curve for *breeding cows*, the difference in phosphorus requirements is shown as very much greater, and it is apparent that the main demand for the extra bone-meal is for *milk production*. The first part of the curve shows that the extra demand for the early period of pregnancy is not great, the amount of bone-meal being only about 2 oz. per head per week higher than for oxen. During the last two months of pregnancy, however, the demand increases and at the time of calving is considerably higher than for oxen. Thereafter the requirements for bone-meal increase rapidly owing to the *combined factors of season* and *lactation;* increasing age of the grass being accompanied by decreasing phosphorus-content (Fig. 23); and milk production requiring relatively much phosphorus for the manufacture of casein, a *phosphoprotein*. In August as much as 28 oz. of bone-meal per week are required to prevent osteophagia; an average of 4 oz. per head per day, or nearly 5 oz. per "week day" if the routine of administration excludes Sundays (see below).



Composite chart for an average year, semi-diagrammatic, interpolated from miscellaneous data of "Osteophagia Equilibrium" experiments.

FIG. 12.

The sharp fall in the curve after July or August is to some extent due to the appearance of a few green shoots on the deeper rooted plants, but mainly due to natural *drying up of the milk flow*. About this time the calves are largely fending for themselves, and natural weaning commences. If the mothers still have sufficient milk they give it; if not, they discourage their offspring, with hoof and horn, and only the most persistent youngsters secure appreciable quantities.

If, for any reason, the cow loses her calf she naturally "goes dry" soon after, and her phosphorus requirements fall in proportion. The broken branch-line of Fig. 12, showing "cows after loss of calf," is interpolated from several cows which lost their calves from one to three months after birth. The bone-meal requirements at once diminished, and the fact that they remain higher than for oxen is probably due to the fact that the cows are recuperating a previous drain upon the system; in less measure to the fact that they may be again nourishing a calf *in utero*.

Summarising the lesson of this chart (Fig. 12) it may be stated that in general, for conditions of the Armoedsvlakte type, oxen require a supplement ranging from nil up to 1½ oz. of bone-meal per head per day (excluding Sundays), depending upon the season of the year and the state of the veld; growing stock ½ oz. up to 2 oz.; heifers much the same, but increasing to 2 oz. as they become breeding cows and rising to 5 oz. during the lactation period. This is for *prevention of osteophagia*, prevention of lamsiekte, and marked improvement in condition. For *optimum* growth and condition, the quantities recommended would be distinctly higher, and

more uniform throughout the year. Each farmer has to be guided by his own experience on his own farm in deciding how much bone-meal he can profitably feed, but as a basis upon which to work the following figures should prove a useful starting point: 1 oz. per day for calves up to 18 months; 2 oz. to 3 oz. for the remainder of the growing period; back to about half this for old oxen for mere maintenance of good condition; up to 5 oz. for cows with calf at foot. For dairy stock of *high milk yield* the owner should cheerfully go up to 8 oz. unless he is using supplementary rations containing wheaten bran; in which case he can reduce his bone-meal allowance by about 1 oz. for every 1 lb. of bran he feeds. For such stock, which give an *immediate return* in milk sold off the farm, he will find that it pays to go on increasing his phosphorus ration until he is satisfied that he is getting the maximum milk yield from cows maintained in good sleek condition. A "staring coat" at least deserves trial on a higher ration. If his cows are kraaled or stalled in such a way as to render collection of manure at all feasible, it should be remembered that a large proportion of the phosphorus goes out in the dung and that this will work wonders with any land he has under cultivation (*cf.* Pot. 56, Fig. 26).

Influence on Milk Yield.—That milk production imposes a severe strain upon the phosphorus reserves of an animal is a well-known fact. Indeed, recent American work goes to show that a lactating cow is usually in "negative phosphorus balance"—i.e., may lose phosphorus from her own reserves (skeleton) even on an ordinary

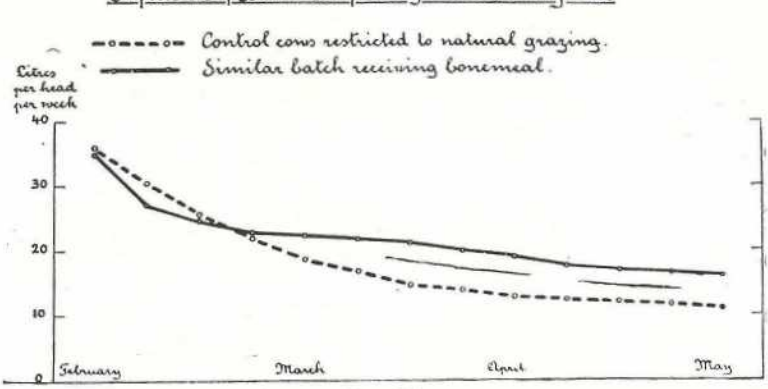


FIG. 13.

ration. On the phosphorus deficient veld of Armoedsvlakte the strain is reflected through osteophagia in the manner just discussed. On the Ermelo high veld it is reflected in the same way, but is further demonstrated by the prevalence of "styfsiekte" (stiff-sickness) amongst cows at or after, calving; and by the tendency to recover from that disease if the calf is taken away and the milk flow allowed to dry up. It may, however, be demonstrated directly on the *milk yield itself*, as shown in Fig. 13.

This chart shows the *immediate effect* of phosphorus upon milk production. Ten ordinary veld cows were selected and milked from alternate halves of the udder on alternate days, leaving the other half for the calf. The data so obtained were doubled for "total yield," and preliminary records kept for a few weeks. They were then divided into two batches of five in such a way that the total yield was approximately the same for both. Both lots were restricted to the ordinary veld grazing, but one was given a ration of bone-meal (8 oz., to ensure experimental excess) and the other not. The milk yield at once responds to the phosphorus supplied, and the bone-meal batch averages about *40 per cent. more milk*. Low phosphorus is therefore a *limiting factor in milk production*. The actual milk yields shown, 35 litres per week, or about 5 litres (about nine pint bottles) a day, dwindling to half this after a few months, are low owing to the nature of the stock; ordinary Afrikander crossbreds giving merely enough to bring up their calves on the veld, and doing even this under adverse conditions of food supply. With *dairy stock* the differences would unquestionably be much more striking, when expressed in litres or gallons, and experimental data for the benefit of the dairy farmer are now being acquired. It is practically certain that these experiments will show a very substantial profit upon the monthly milk bill for every ounce of bone-meal fed.

The data of Fig. 13 only show the benefit derived by the sucking calf as an *immediate result* of feeding bone-meal to the mother. Either Fig. 4 or Fig. 7 will convince the reader of the much greater benefit derived from more prolonged phosphorus feeding. The superior heavier animal (if a cow) is obviously going to supply much more milk than the stunted one. A single year's continuous bone-meal feeding works wonders with both mother and offspring. Precise statistics in this direction are now being acquired.

Weight and Vigour of Calf at Birth.—Such statistics are at present limited since, as mentioned in the introduction, drought and locust depredations reduced the stock-carrying capacity of the Armoedsvlakte veld and compelled curtailment of some of the most interesting experimental work. Nevertheless, the meagre existing data point unmistakably to the fact that the calves born of phosphorus-fed mothers average from 10 to 20 per cent. heavier than calves born of controls. They are also stronger, get more milk from their mothers, and so get a *better start in life*. It is not desired to labour this point, however, since it is one of the wise provisions of nature that during the period of gestation the mother sacrifices herself for her offspring; and many a scarecrow cow throws a fine calf. This is particularly noticeable in the styfsiekte areas, where the mother develops the disease mainly through the sacrifices she makes in nourishing her calf during late gestation and early sucking. The calf usually gets along quite creditably so long as the mother's milk holds out, a real "stunting of growth" becoming manifest only after weaning, when it has itself to rely upon the veld grass on which its mother bred it. Nevertheless, in spite of the capacity for maternal sacrifice, removal of phosphorus deficiency by bone-meal feeding of the cows gives a superior crop of calves.

Age of Maturity.—The phrase "crop of calves" may be used to recall the "late maturity" shown in Fig. 1. With the limited data at present available the influence of bone-meal feeding upon the number of calves born per annum from a given number of cows is difficult to state with precision. The available data suggest "reduced fertility" under phosphorus deficient conditions of nutrition, even with cows which have already borne their first calf and should be capable of annual calving thereafter; but alien factors have not been excluded sufficiently to allow of simple interpretation. That phosphorus deficiency *delays growth* has already been shown, however, and a study of Figs. 7 and 10 will probably convince most readers that it also *delays maturity* in the breeding sense. The data, unfortunately, are not yet sufficiently clear-cut for charting upon a numerical basis, and the question may therefore be left for a later article.

Quality of Meat.—This item of Fig. 1 has already been referred to, but owing to its importance in the beef trade, is worthy of emphasis under a separate heading. As earlier photographs show (*e.g.*, Fig. 7), phosphorus-fed cattle are much heavier, carry more meat and fat in proportion to skeleton and entrails, and therefore yield a *higher proportion* of their live-weight in the form of butcher's *dressed carcass*. In addition, they reach a profitable butcher-weight at an earlier age, their muscle-fibres are more liberally interlarded with fat, and their meat is therefore more *tender*. In short, they are nearer "prime condition" and fetch a higher price "per 100 lb. on the hoof." Indeed, the difference in *quality* may make all the difference between an animal saleable at any time on any market and an animal only saleable at all on a market short of first-grade meat. This question of *quality* is of obvious importance if South Africa is to compete on the markets of the world and realise her dream of a *beef export trade*.

V. INFLUENCE OF PHOSPHORUS UPON FOOD CONSUMPTION.

Figs. 4 to 11, bringing out the difference in meat production effected by phosphorus feeding, at once raised a very interesting question. Do cattle receiving bone-meal *eat more food* in putting on the extra weight, or do they *utilise their food better* without actually eating more of it? The experimental data charted in Fig. 14 partly answer this question.

In this experiment the cattle had to be stabled, since it is impossible to measure the amount of grass eaten in the process of grazing. Twelve half-grown cattle were taken from the veld and divided into two lots of six, in such a way as to give the same aggregate weights; averaging, as the chart shows, about 450 lb. per head. They were then so stalled that the food eaten could be accurately controlled, and fed upon a basal ration *low in phosphorus*, but *adequate in energy value*, and of "sufficient," although by no means liberal, *protein-content*. These conditions were fulfilled by giving a fairly high *fixed ration* of flaked maize, so-called "Fanko," a high-grade rolled maize endosperm sold for human consumption, and selected on account of its very low phosphorus-content as compared with its relatively high energy value ·001 P_2O_5 per unit starch equivalent). Teff hay of fair quality, but lower than usual

in phosphorus-content (varying around ·16 per cent. P_2O_5) owing to its origin from phosphorus-poor soil (Ermelo District), was then supplied *ad libitum* from over head racks, and the amount *voluntarily eaten* duly recorded. Both lots were treated in exactly the same way except for the supplement of 3 oz. bone-meal per head per day, to vary the phosphorus-content;* the periods of bone-meal feeding being indicated on the chart (Fig. 14) by continuous lines, as against dotted lines for periods during which no bone-meal was supplied. Since the hay was offered *ad libitum* the phosphorus intake of even the control cattle varied throughout the experiment, but since the fixed ration of fanko always contributed a considerable proportion of the total diet the cattle receiving no bone-meal always got *too little phosphorus*. Records for osteophagia and live-weight are also shown on the chart for

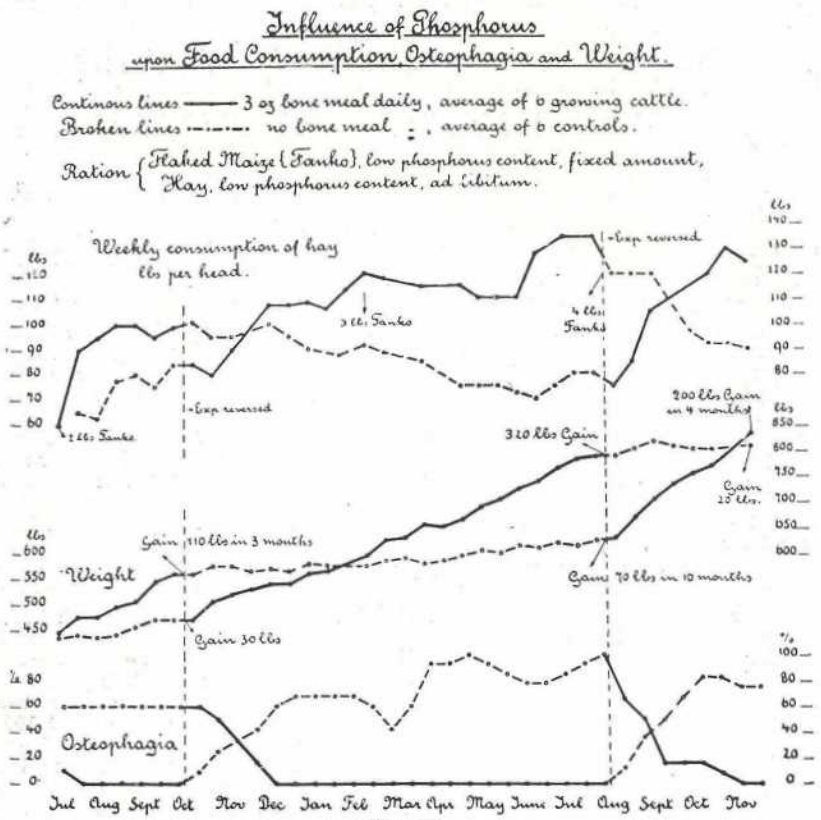


FIG. 14.

the whole period of experiment. The detailed protocols will be considered in a more technical paper, but even in a popular article the following features of the curves may be emphasised:—

(1) The cattle receiving bone-meal *eat more hay*, increase more in weight, and lose their osteophagia. For the first three months the controls retain their osteophagia, gain only 30 lb. per head in weight, and eat from 60 to 80 lb. of hay per head per week, or about 10 lb. of hay per day in addition to the 2 lb. of fanko. The cattle receiving bone-meal promptly lose their craving, eat 90 lb. to 100 lb. of hay per week, or about 4 lb. *more* per day, and gain 110 lb. per head in weight—practically *four times* as much as the controls receiving no bone-meal.

(2) At this point (October, 1922), the experiment was "crossed" in order to make quite sure of excluding potential idiosyncratic differences between the two groups—*i.e.*, the bone-meal was *taken away from one lot* and *given to the other lot*. The effect is very striking. Within a month the osteophagia curves and hay consumption curves cross—*i.e.*, *the osteophagia returns* and the *food consumption diminishes* in the lot from which the bone-meal was *taken away;* while osteophagia disappears and food intake rises in the lot to which the bone-meal ration was transferred.

* NOTE.—Other minerals sufficient in basal ration.

The weight curves respond in the same direction, and within four months the previously inferior controls have not only made up their leeway of 80 lb., but have actually surpassed the lot deprived of bone-meal. At the end of ten months they have gained 320 lb., or more than four times as much as the previously superior batch. Indeed, the latter remain almost stationary in weight for a considerable portion of the time.

(3) The experiment was then *crossed again*—*i.e.*, the bone-meal once more transferred from one batch to the other. The same behaviour is again shown. The "osteophagia" and "hay consumption" curves again cross in a few weeks, and the "weight curves" in a few months. The rate of increase in weight of the lot now deprived of bone-meal at once drops; indeed, only continuing to rise by 20 lb. over the first few weeks after the change, and then remaining practically stationary; so suggesting that the phosphorus in the basal ration was sufficient for bare maintenance, but not sufficient for growth or fattening. On the other hand the rate of increase in weight of the other batch, formerly without bone-meal, rises the moment bone-meal is given, and a gain of over 200 lb. is made in four months.

(4) The weight curves over the whole period of seventeen months thus indicate quite clearly that phosphorus (bone-meal) is a *limiting factor in growth* and also a limiting factor in "voluntary food consumption," or "appetite." Taking the upper curve (initially), it is noted that so long as phosphorus is adequate the average increase of the six cattle is 37 lb. per head per month from July to October, a normal increase for mongrel stock when the indifferent character of the diet is considered. With a better class of stock (beef breed) and a more varied diet, richer in protein, the rate of increase would naturally be much higher. When bone-meal is *withdrawn* this 37 lb. per month drops to 7 lb. per month—*i.e.*, the growth rate is reduced to *one-fifth*. Once more inserting the bone-meal ration, the rate of increase develops to 50 lb. per month, or over *sevenfold*. The fact that the rate from August to November, 1923, is about a third *faster* than in August, 1922, in spite of the fact that the cattle are now a year older, is interesting from the point of view of "retention of the capacity to grow." It looks just as if the "growth impetus" had been "held in check" over the whole year on the phosphorus deficient ration, and then "suddenly released" the moment the missing phosphorus was supplied, the subsequent enhanced rate of progress almost suggesting an attempt to make up for lost time.

The corresponding curve for hay consumption of this batch shows that, although more hay was certainly consumed during the periods of most rapid increase, the difference is *not sufficient to account for the extra body weight put on*. This is not quite so obvious from the long period of ten months during which the bone-meal batch were increasing, roughly, 1 lb. per day faster than the controls and eating, roughly, 5 lb. more hay per day in doing it, but is strikingly apparent for the last period, August-November, 1923. Dividing this period according to the week in which the food consumption curves crossed, the protocols are as follows:—

	Actual hay eaten per head in addition to fixed ration of 4 lb. fanko			Live Weight.			Average per head.		
—	14th Aug. to 2nd Oct	2nd Oct. to 27th Nov	Total.	14th Aug.	2nd Oct.	Increase.	27th Nvo.	Further Increase.	Total Increase.
	lb.	lb	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Lot A ..	724	956	1,680	625	750	125	835	85	210
Lot B ..	935	770	1,705	790	810	20	810	Nil.	20

FIG. 15.

It will be noted that between 14th August, when the bone-meal was taken away from Lot B and given to Lot A, and 2nd October, when the hay consumption curves cross, Lot B still continued to eat more hay, but only gained 20 lb. per head in weight, as against 125 lb. gained by Lot A eating 211 lb. *less* hay over the eight weeks. By this time the weekly hay consumption of Lot A had increased as that of Lot B diminished, so that in the following eight weeks the position is reversed, Lot A eating a total of 956 lb. per head as against 770 lb. for Lot B—a difference of 186 lb. of hay, accompanied by an increase of 85 lb. in live-weight. Over the whole period of sixteen weeks, however, Lot A have actually eaten 25 lb. *less* total hay than Lot B, but in this short time have not only made good their August arrears of 165 lb. in

body-weight, but actually show a gross gain of 210 lb. per head, passing Lot B by an average of 25 lb. There seems to be no escape from the conclusion that phosphorus-fed animals *utilise their food better* and put on more body weight per unit of food *consumed.*

In *both cases* the average energy value of the food is well *above maintenance requirements.* Taking even the last period during which the weights of the two lots were similar, Lot B consumed an average of 16 lb. of hay per day as against 16.8 lb. for Lot A. Adding the fixed ration of 4 lb. of fanko, completely consumed by both lots, the difference in total "fuel value," or "food value," of the two diets becomes very small. Making a *conservative* estimate from analyses of the ration, the "starch equivalent" for Lot A works out at about 8.8 lb. per head per day and for Lot B at about 8.5 lb.; or expressing it in terms of cereal for the benefit of the farmer, it may be said that Lot A ate a ration *equivalent* in food value to 49 lb. of maize-meal per week, while Lot B ate the equivalent of 47 lb. per week. The difference is small and both are obviously well above ordinary living requirements for animals of 800 lb. live-weight. There would, therefore, seem to be no escape from the conclusion that while Lot B maintained their weight constant over the period concerned, they actually ate food in considerable excess over maintenance needs, simply "combusting" the extra ration for *no useful purpose;* whereas Lot A, using roughly the same excess food, used it profitably for *carcass increase* at the rate of 1½ lb. per head per day.

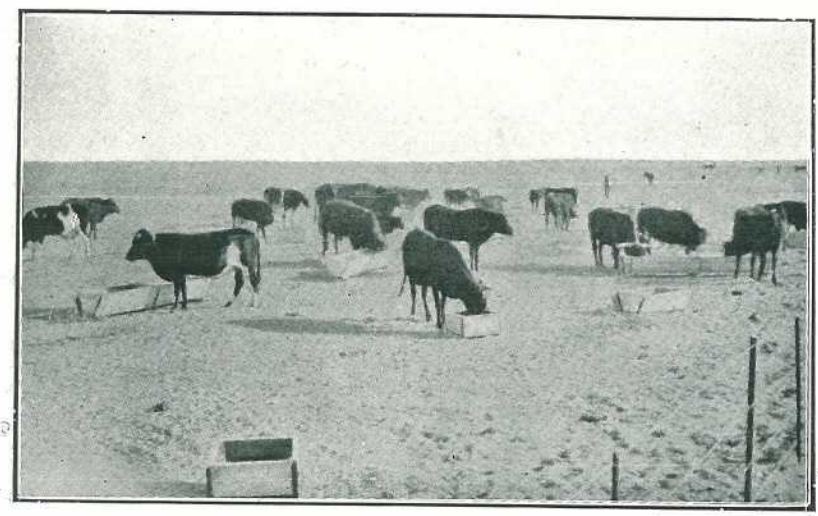


FIG. 16.

Mere "structural" requirements of phosphorus, for skeletal and general tissue development, could hardly account for the magnitude of the difference involved, an increase of 210 lb., or 33 per cent. in sixteen weeks, a good deal of which is *fat.* It therefore appears highly likely that phosphorus plays a specific role in cellular metabolism; has indeed what might well be called a *vitamin* effect, which facilitates utilisation of carbohydrate and protein in general tissue anabolism. One need only compare the behaviour of these cattle with that of laboratory rats on a diet deficient in vitamin B, stunted growth rapidly becoming normal the moment the missing factor is supplied. And after all, *what is a vitamin?* It has been defined as something which is necessary for life and health, but which does *not necessarily* contribute either to the structural framework or dynamic requirements of an animal. Phosphorus happens to contribute very largely to the structural framework, but it would seem to have a function quite apart from its use as a "building stone"; a function highly reminiscent of that which is commonly associated with the conception of the term "vitamin." This point is now being worked up in some detail, but provisionally it is not unreasonable to assume that a "growth impetus" responding with a weight increase of 125 lb. in seven week (Fig. 15), after being held in abeyance for ten months (Fig. 14), predicates more than a mere structural use of phosphorus; predicates a *functional use in intermediary metabolism.* As providing an analogy for the "functional" as distinct from the "structural" utilisation of phosphorus compounds, one might refer interested readers to the recent American work of Meigs

and Blatherwick. These authors adduce evidence to show that circulating "phosphatids" play an important part in the synthesis of caseinogen and fat in milk, quite irrespective of the personal requirements of the mammary gland itself. Why should phosphorus, in one form or another, not play an equally important part in the intermediary metabolism of protein and fat for all cells of the body, irrespective of their demands for phosphorus compounds as units in their framework?

But this is digression. The farmer is not interested in such speculation, and for him the lesson in Fig. 14 may be more simply stated:—*Cattle on a phosphorus deficient diet do not utilise their food economically. Even if they eat a lot they waste it, and do not give a profitable return in live-weight for it. If the deficiency is rectified by bone-meal feeding, they may eat more, but give a much better value in beef for all they eat.*

In passing it may be added that although the cattle of Fig. 14 did actually eat very much the same in terms of "calories" (energy, or heat, or, broadly, "food") during the last period of the experiment, it by no means follows that they would have done so under ordinary conditions of veld grazing. After all, even when without bone-meal they were "coaxed" by the fixed ration of fanko—*i.e.*, much food in small bulk. After polishing off the 4 lb. of this flaked maize, they presumably proceeded to fill their bellies comfortably with hay. If they had been dependent solely upon sparsely distributed poor grass, it is highly probable that the failing appetite of the phosphorus deficient batch would then have stopped short at consuming the bare amount required for mere maintenance. The fact still remains, however, that in this experiment, whether coaxed or not, they did actually eat more than required for maintenance; and did to all appearances digest all their food; and did, therefore, waste the excess quite literally in *gas* (carbon dioxide through the lungs), instead of utilising it, as did the phosphorus efficient batch, to form carcass increase.

VI. METHODS OF BONE-MEAL FEEDING.

Presuming that readers are now convinced of the advantages of feeding bone-meal, the present stage is perhaps suitable for indicating the methods generally adopted. Each farmer must be guided by his own experience in handling his own stock under the varying conditions of his own farm, but the following methods will be found serviceable:—

(1) *Along with other food.*—If supplementary rations are fed, as in the case of dairy cows and high-class stock, the simplest way is to mix the bone-meal ration with the concentrates. This method can easily be adjusted to individual cases—*e.g.*, the giving of most bone-meal to the heaviest milkers.

(2) *In troughs.*—The best way is to use a large number of small, cheap wooden troughs, so that each animal gets its share, and so that stronger animals cannot rob weaker animals. The simplest device is to construct kraals at the watering-places and pass the animals through these on their way to or from water. If twenty animals are passed through at a time, and twenty-one or twenty-two troughs supplied, each animal will immediately secure its ration and pass on. Another dose of bone-meal can then be emptied into each trough by a single operator, and the next lot of cattle passed through. The animals very soon learn what the troughs are for, and make straight for their bone-meal, so that no time is wasted. A few licks suffice to finish the ration of a few oz., and if the troughs are properly spaced, even the weaker animals manage to gulp down their allowance before stronger animals can rob them. Fig. 16 illustrates the method as originally practised at Armoedsvlakte.

Instead of using troughs, some farmers find it sufficient to place the ration in little heaps on the ground. The animals can be educated to run to the same spot each day.

(3) *By the "crush" method.*—In place of small troughs, it is often simpler to construct a long "crush"—*i.e.*, a double fence similar to that used as approach to dipping tanks. If the crush is just wide enough to allow animals through in single file, and is placed at the entry or exit of a kraal surrounding the watering-place, it becomes a very simple matter to dose each animal as it passes through. The animals *like* the bone-meal, and dosing is very simple. Fig. 17 illustrates one of the crushes used at Armoedsvlakte.

After a little experience the cattle get to know their job and actually put their heads over the side of the crush in anticipation of the bone-meal, as shown in Fig. 18.

If large spoons, or cigarette tins marked off in "oz. of bone-meal" are used, the dose can be varied according to the individual animal, and maximum economy effected. As an old ox comes along, he gets 1 oz., or even 3 oz., if he is known as a bad craver;

a growing steer or heifer is easily supplied with 2 oz.; a lactating cow with 5 oz.; and so forth, according to the experience of the stockmen. By this method, it is possible for one expert white man, with a native assistant and a "piccanin" to hold the bone-meal bucket to dose up to 200 animals an hour. Fig. 19 illustrates the method, as practised at Armoedsvlakte.

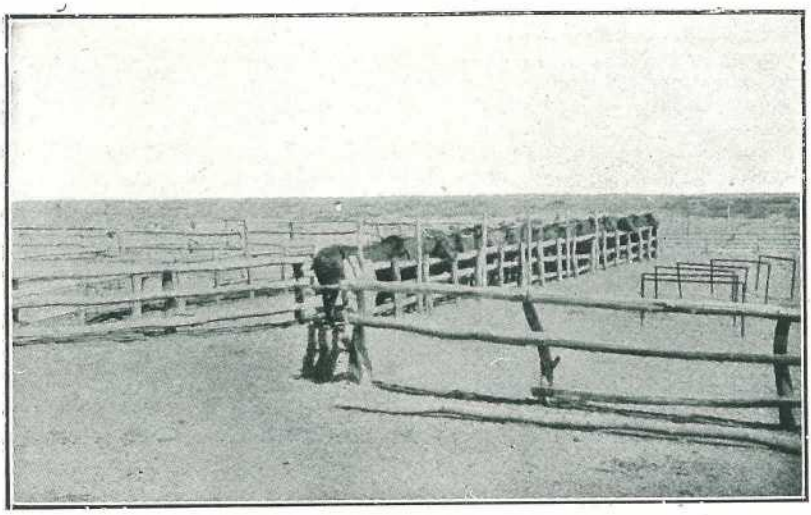


FIG. 17.

It is best to damp the bone-meal, or work it into a porridge with water, in order to prevent blowing about by wind. For the porridge form, a large tablespoon is useful. A few trials give the number of ounces per spoonful. The native assistant holds a horn and pulls the tongue aside, while the white man wipes off the dose on the back of the tongue. The animal blinks contentedly and passes on as if given a sweetmeat. This method is the ideal one for a rancher who has to handle thousands of cattle round relatively few watering places. If the camping system is such that only one

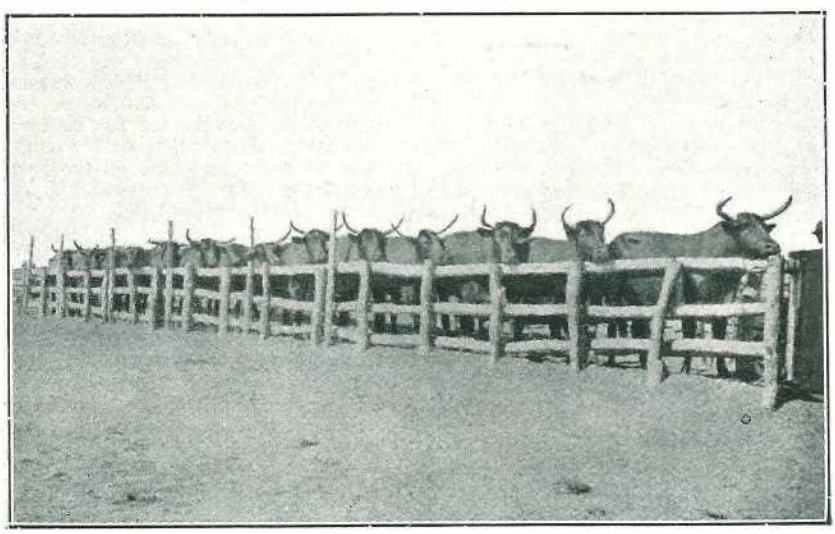


FIG. 18.

native herd-boy is available for one batch of animals, the system has to be modified to suit requirements; as, for instance, by placing the ration in a trough at the end of the crush and giving each animal time to finish its allowance before passing out. The point to be emphasised is that cattle *like* bone-meal and can be readily trained to take it by any system of dosing. Bone-meal "biscuits" are worth a trial in some cases.

(4) *As a lick.*—This is perhaps the easiest method, but it is the one most wasteful of bone-meal, since some animals will consume very large quantities if they have free access. There is one gourmand in the Armoedsvlakte herd who regularly helps himself to over 4 lb. of bone-meal at a session, when allowed unlimited access. It is quite a serviceable method, however, when the farmer does not mind using a large amount of bone-meal and treats all excess consumption as fertilising his pasture. If this method is used, it is still advisable to use a fairly large number of troughs, and it is essential to keep them constantly replenished, so that the weakest animals always get enough.

In general, it is advisable to give bone-meal as such, and not mixed with salt, the salt ration being given in separate troughs in the usual way. Many farmers prefer to mix bone-meal and salt together as one lick, but since the craving for the two

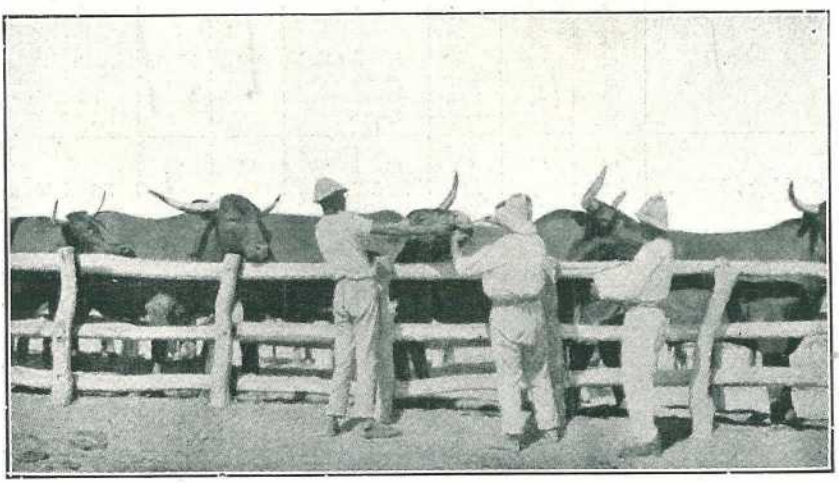


FIG. 19.

does not run parallel, and some cattle will adjust the amount they eat to their taste for salt, there is always the risk of their getting too little bone-meal. By keeping the bone-meal separate the amount supplied can be varied according to experience of the needs of the stock on any particular farm. If, however, the farmer still prefers to mix as one lick, the proportion should generally be two of bone-meal to one of salt, and never less than one of bone-meal to one of salt.

Frequency of Feeding.—Wherever possible the attempt should be made to feed the bone-meal every day except Sundays. If this is impossible, administration on alternate days—*i.e.*, three times a week, may be adopted. Feeding at longer intervals is of much less value and often does very little good at all. The reason for this is that the animal cannot store phosphate to any great extent, and that large doses at long intervals are not properly digested, but pass out in the dung. Hence every effort should be made to give the ration *at least* three times a week, and preferably oftener. Experiments have been carried out at varying intervals of feeding, and although the results are not charted here, it may be emphasised that it was found practically impossible to prevent osteophagia by feeding once a week, however much bone-meal was then given; and that even bi-weekly feeding proved wasteful and ineffective. At Armoedsvlakte, feeding, generally "dosing by the crush method," is conducted as a *daily routine*, Sundays being omitted in order to give the stockmen the usual day of rest. The question of feeding phosphorus compounds other than bone-meal is discussed under Fig. 24 below.

VII. DEFICIENCY OF PHOSPHORUS IN THE VEGETATION.

As mentioned earlier, the logical order of discussing Fig. 1 might well have been taken from mother earth as starting point; thence through the vegetation, and thence on to the effect upon the animals eating that vegetation. The order of interest to the stock farmer, however, is probably that actually adopted, taking first the effect of phosphorus deficiency upon the animal and leaving the less interesting considerations of soil composition to the end. There remain, therefore, the data upon phosphorus deficiency in vegetation and soil to be linked up to the defective nutrition of the animal.

Going back to Fig. 1, the following analyses of mixed grasses cut from the Armoedsvlakte veld at different times of the year are of interest. A considerable proportion of the total vegetation consists of bushes and of plants rarely eaten by stock, but since the main food of the grazing cattle is derived from the grasses, only the analyses of these need be considered:—

Proximate Analyses of Dry Matter of Armoedsvlakte Mixed Grasses.

Date.	Crude Protein.	Ether Extract.	N-Free Extractives.	Crude Fibre.	*Ash.	P_2O_5.	*CaO.	Estimated energy value. Starch = 100.	Ratio of Starch equivalent to P_2O_5.
	%	%	%	%	%	%	%		
10th Nov., 1919 ..	19·4	5·5	41·0	22·5	11·6	·60	·31	56	100:1·07
8th Dec., ,, ..	14·3	5·6	46·8	25·6	7·7	·32	·59		
15th Jan., 1920 ..	13·8	5·5	48·0	25·0	7·7	·22	·50	52	100:0·42
4th Mar., ,, ..	7·2	3·4	49·8	33·7	5·9	·24	·43		
19th April, ,, ..	4·9	2·4	51·6	35·0	6·1	·11	·46	32	100:0·33
11th May, ,, ..	4·1	2·2	52·9	34·9	5·9	·07	·50		
8th June, ,, ..	4·0	2·0	53·7	33·1	7·2	·09	·59	25	100:0·36
European figures for comparison.									
Rich pasture grass	20·5	4·6	45·9	19·0	10·0	·7	·9	60	100:1·16
Poor meadow hay	8·7	1·7	44·8	39·0	5·8	·4	·9	22	100:1·81

* Figures for Ash and CaO variable owing to contamination with dolomitic dust.

The data are expressed upon the *dry matter* of the plant—*i.e.*, after removing the moisture in a warm oven, in order to simplify comparison of feeding value and of phosphorus content.

The very young green grass of early spring (October to November), it will be noted, is highly nutritious and has a fairly high phosphorus content, but after the seed has fallen (April to May) the general feeding value, or "energy value," is reduced to less than half, and then approximates that of a poor European hay. The most striking feature, however, is the extraordinary low phosphorus content, averaging about .08 per cent. P_2O_5 or only one-fifth of that present in ordinary European hays. As the grass matures, carbohydrate formation in the plant proceeds so much faster than phosphorus absorption from the soil that the percentage of phosphoric oxide rapidly falls. The osteophagia, or craving for bones, illustrated in Fig. 2, is directly attributable to this; and the feeding of any suitable phosphorus compound rectifies the deficiency in such a way as to effect the miraculous improvement in growth and condition illustrated in Fig. 7, so long as there is grass enough to ensure a "full belly." In spite of the low general nutritive value of the winter grazing, the cattle can, provided there is *enough of it*, generally get through the winter without serious loss of weight, as shown by the lower curve of Fig. 8. Owing, however, to the fact that the soil is poor and shallow, and the rainfall low and seasonal, the grass covering of the veld is scanty. The vegetation grows in tufts surrounded by bare soil, and its "shade area" is considerably less than one-fifth of the total soil area. Fig. 20 gives an impression of the Armoedsvlakte veld calculated to depress any European observer. Fig. 21 shows cattle grazing over what is for Armoedsvlakte a good supply of grass.

The prevalence of bushes and the stony dolomitic soil are quite well shown. Fig. 22 shows a closer view of the food the cattle subsist upon and illustrates the tuft habit of growth with the bare soil patches between. All three photographs are from the collection of Dr. I. B. Pole Evans.

FIG. 20.—Armoedsvlakte Veld, 19th March, 1917.
Aristida congesta, with *Grewia incana*.

In a bad year, of subnormal rainfall, the available grazing during the dry winter may be so scanty that cattle have to expend much energy in roaming far from the watering-places (windmills and boreholes or wells) in search of food. Under such conditions the balance between energy derived from the poor quality grass, and energy

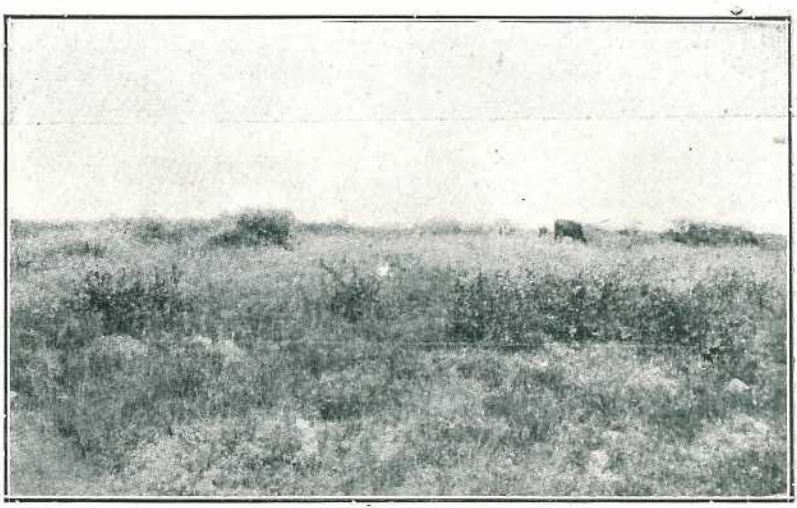


FIG. 21.—Armoedsvlakte, 19th March, 1917. Green. Luxuriant.
Aristida and *Eragrostis* veld, with *Grewia incana* and *Tarchonanthus camphoratus*.

expended in getting it, may be a negative one; so that loss in condition amounting to 15 per cent. of body weight during the winter is by no means uncommon amongst the herds of Bechuanaland farms. This "quality factor" is clearly brought out in Figs. 5 and 6. As mentioned under Fig. 5, a mixed herd may easily drop from 800 lb. per head to 700 lb. per head during the rainless winter months. If the rains are delayed much beyond the usual date, pronounced starvation, and even death from

"poverty," is not uncommon. In areas of higher or more evenly distributed rainfall the "quantity factor" of the grazing is more constant, and in such cases phosphorus deficiency of the grass may be the sole limiting factor in growth and condition of stock. Such areas are not uncommon over well-watered but heavily-leached soils in Natal.

In regard to the phosphorus deficiency shown in the foregoing table, it must be remembered that interpretation of analyses cannot be made merely from the "percentage P_2O_5"; but that the general feeding value of the vegetation must be considered at the same time. Since even the phosphorus of fully ripe hay is moderately well utilised by cattle, the ratio of "starch equivalent" to "phosphoric oxide" forms a better guide to the phosphorus deficiency than the actual percentage of phosphoric oxide itself.* Broadly speaking, the naturally grazing animal adjusts its food intake to its requirements for energy purposes and, as the grass deteriorates in value, does its best to make up for poor quality by eating increased quantity. With increased quantity of grass comes increased total phosphorus, so that a low "percentage P_2O_5" on a grass of low "fuel value" is much the same as a higher percentage in a better quality grass. This mode of expression "S.E.: P_2O_5" is adopted in the last column of the table of analyses, and renders it easy to realise that,

FIG. 22.—Armoedsvlakte, 4th May, 1916. Veld Green. Grasses in Flower. A fairly good year.

except for the period of young shooting spring grass, the Armoedsvlakte veld is *deficient all the year round.* The very young grass of early November has a ratio figure of 1.07 P_2O_5 per 100 Starch Equivalent, not far below that of European pasture; but the rapidly-growing green grass of January, still highly nutritious and containing 13.8 per cent. of protein, is already down to 0.42 "energy-phosphorus ratio"—a figure well below the phosphorus requirements of the animal, and therefore productive of osteophagia and stunted growth. Without definitely asserting a minimum phosphorus figure for normal nutrition of cattle, the ratio 100: 0.8 may be indicated as probably fairly near the truth. Such a figure would at any rate explain why phosphorus deficiency is practically unknown in Europe, and yet prevalent over an enormous acreage of South Africa.

* NOTE.—"Starch Equivalent" is, of course, simply the number of lb. of starch which is equal, as a source of energy, to 100 lb. of the food considered, and therefore forms a convenient measure for comparing different foods. Maize or oats could just as well be used as standard for comparison, but since such materials vary in composition and the staple cereal varies in different countries, it is better to take a pure compound like starch or sugar as unit. A still better unit is the "Calorie," the physical unit of heat, but the term "starch equivalent" is perhaps more easily understood by the South African farmer. "Phosphoric Oxide," P_2O_5 is, of course, the common expression used in comparing the amounts of phosphorus in different manures under the Fertilisers Act, and being familiar to the farmer is used here.

Seasonal Variation of Phosphorus Deficiency in the Grass as reflected by Osteophagia in the Cattle.—As just mentioned, the very young grass of early spring does, for a short period, contain sufficient phosphorus for normal nutrition. The period, however, is very short, and in general the cattle do not secure sufficient of this very young grass to benefit in any striking way. The practice of the country, wasteful, but nevertheless necessary in regions of cheap uncultivatable land, is to destroy the old standing grass of the preceding year by *burning* the veld. Part is left unburned to provide food remnants until the rains bring on the young green vegetation over the "burns," and the cattle are then transferred to the "burned veld." The new season's growth of "unburned veld" is therefore admixed with old grass of the preceding year. For the brief period of very young phosphorus-rich Spring growth, the extent to which the cattle receive an adequate "phosphorus intake" depends upon the proportion of new to old grass—*i.e.*, partly upon the proportion of burned to unburned veld. By the time the green grass over the burns is really abundant, most of it has reached the stage at which the percentage of phosphorus is rapidly diminishing. In practice, therefore, it usually works out that the veld is really *phosphorus* deficient the whole year round, but is not quite so bad in spring. Fig. 23 illustrates this, a chart correlating rainfall, phosphorus content of the vegetation, and extent of osteophagia, over the years 1919 and 1920. Osteophagia is here, as in Fig. 12, utilised as clinical symptom reflecting phosphorus deficiency in the animal.

In reading this chart it may be explained that rainfall is recorded as weekly totals on the scale indicated; phosphorus in the dry matter of the grass (dotted line) by weekly or fortnightly analysis of samples cut from a small paddock reserved for the purpose; osteophagia tested weekly by the method already described, and charted as percentage of the herd which showed craving for "rotten bones." The sequence of events is easily read from the curves. When the observations commenced in August, 1919, the veld showed so little green growth that grazing was confined to the old standing grass of ·08 per cent. P_2O_5 content. At this time 75 per cent. of the herd, recently introduced on the farm, showed osteophagia. Over the next two months the proportion of young green vegetation increased sufficiently to supplement the old grass appreciably, and there is a slow reduction in the extent of osteophagia, down to 50 per cent. During October slight rains fell, too small to be recorded separately on the chart, and therefore recorded as total for October. These were sufficient to bring on the new green grass of the *burned veld* to the point at which the cattle could subsist very largely upon it. As the dotted line shows, this young grass contained 0·6 per cent. P_2O_5 (expressed on the *dry matter*) and the response of the cattle was immediate. In four weeks the osteophagia had practically vanished. On 1st November heavy rain fell, nearly three-quarters of an inch, followed by lighter rains during the following week, but by almost complete drought and blazing sun for the ensuing six weeks. The effect of this was initial rapidly falling phosphorus-content, followed by partial wilting. Osteophagia promptly returned. The heavy subsequent rains of January and February effected only a slight transient reduction of osteophagia, since during this period the grass was growing rapidly, and its average phosphorus-content fluctuating towards the lower percentage characteristic of older plants. It is interesting to note, however, that further stimulation of very young growth by the later rains, did effect slight increase of phosphorus in the "average pasture," accompanied by slight reduction of osteophagia in February. Thereafter the phosphorus content of the grass fell steadily, and the extent of osteophagia remained consistently high for the rest of the year; right up to the following July and August when the deeper rooted vegetation (edible bushes) again began to show incipient green growth. In this year (1920), the herd, for various reasons, had to subsist upon *unburned veld, i.e.*, a mixture of the new season's growth with material qualities of old standing grass of the previous year. The *average* phosphorus-content of the total vegetation of course increased with the new season's growth, but owing to dilution with the old grass never exceeded 0·25 per cent. P_2O_5. Accompanying the rise to this figure came a corresponding fall in the extent of osteophagia to about 35 per cent.: chiefly manifested by the oxen and older growing stock and not at all by cows with suckling calves.

The two curves for the whole period of two years thus show:—

(*a*) That the extent of osteophagia in cattle varies *inversely* as the proportion of phosphorus in the grazing.

(*b*) That phosphorus deficiency is manifested the whole year round, but is least acute during early spring, and may indeed almost disappear for a very short time if sufficient of the very youngest new growth becomes available for the stock.

The last proviso is, however, rarely fulfilled in practice. A farm is usually stocked according to its "carrying capacity per morgen" averaged over winter and summer. Hence at the period of incipient green growth of high phosphorus content,

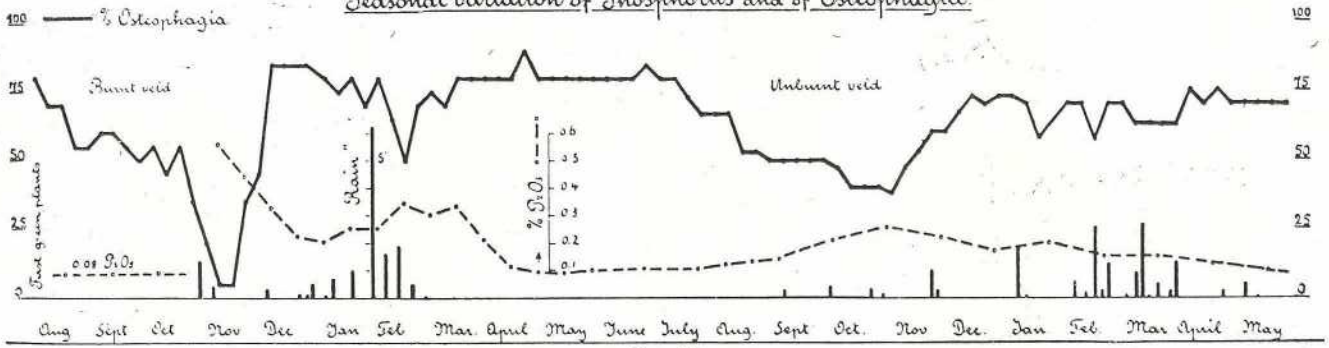

Seasonal variation of Phosphorus and of Osteophagia.
% Osteophagia
Burnt veld
Unburnt veld
Rain
% P2O5
Aug Sept Oct Nov Dec Jan Feb Mar April May June July Aug. Sept Oct. Nov Dec. Jan Feb Mar April May

FIG. 23.

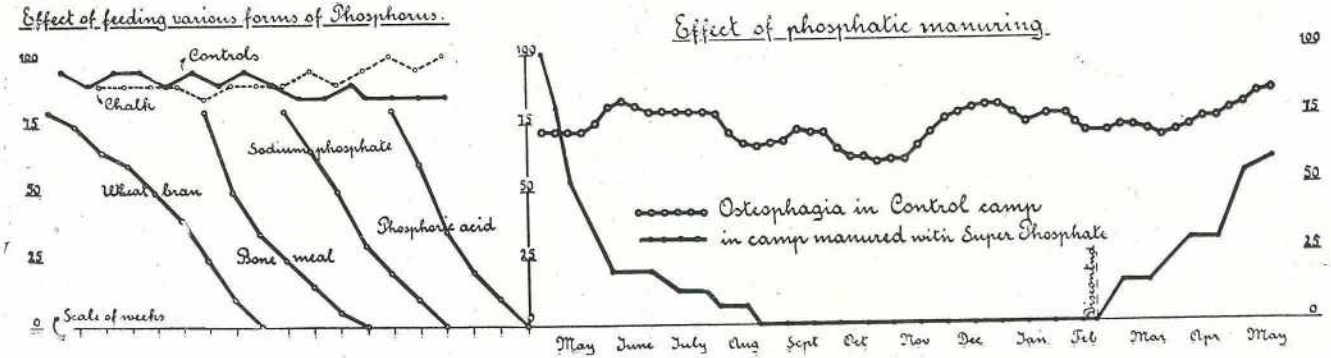

Effect of feeding various forms of Phosphorus.
Controls
Chalk
Sodium phosphate
Wheat bran
Phosphoric acid
Bone meal
Scale of weeks
Effect of phosphatic manuring.
Osteophagia in Control camp
in camp manured with Super Phosphate
Dipping
May June July Aug Sept Oct Nov Dec Jan Feb Mar Apr May

FIG. 24.

the new vegetation is not yet capable of supporting all the cattle. As the new grass develops to the point of supporting the whole herd, independently of the old grass of the preceding year, it also diminishes in phosphorus content. The broad result therefore is that the cattle suffer from phosphorus deficiency all the year round; and continuous bone-meal feeding, varying somewhat with the season if desired, is therefore recommended.

Effect of feeding Various Forms of Phosphorus.—The next chart, Fig. 24, shows the effect upon osteophagia of supplementing the deficient vegetation, either directly through the mouth by feeding various phosphorus compounds, or indirectly by phosphatic manuring of the pasture.

The curves on the left show the rapid reduction of osteophagia produced by feeding four representative phosphorus compounds; wheat bran supplying phosphorus in organic form associated with relatively little other mineral matter; bone-meal supplying it in the form of calcium phosphate; sodium phosphate supplying it combined with another base; phosphoric acid eliminating the base altogether, and thus pinning down the deficiency quite definitely to phosphorus and to nothing else. It may be added that phosphoric acid is *not* a good form of phosphorus for practical use since, being a "fixed acid," it tends to disturb the base-acid equilibrium of the body. The best and *cheapest* form is bone-meal, which has the added advantage of being *palatable*, of satisfying the specific craving, and of offering least trouble in administration. Many other, including ground rock phosphate, have been tried, but have either proved too costly or too difficult of digestion, and in some cases (superphosphate) productive of digestive disturbance. Ground mineral phosphates are cheaper, but so much less effective that they cannot compete with bone-meal. *Precipitated* calcium phosphate behaves very like bone-meal, but is more expensive, tasteless, and more troublesome to administer; especially since the cattle do not "recognise it" and do not take it of their own accord. Bran is of course excellent but expensive. The phosphorus contained in bran and in bone-meal can be treated as about equally available in digestion, and the two sources therefore evaluated on the basis of their phosphorus content; 1 oz. of bone-meal being as useful in rectifying phosphorus deficiency as about 1 lb. of average South African wheaten bran. Owing to the high cost of bran "per unit of phosphorus," it only comes into consideration in practice when a definite value is placed upon it as an ordinary supplementary feed in a mixed ration, *e.g.*, for dairy cows.

For cattle reared under South African ranching conditions, and expected to earn their living exclusively on the veld, bone-meal is always recommended. The quantities to feed have already been dealt with, but in connection with Fig. 24 it may be added that the *time* taken to remove osteophagia is usually six to eight weeks when 3 oz. per head per day are used for oxen or growing stock, and 6 oz. for cows. This time can be further reduced to about three weeks by feeding large amounts such as 1 lb. per day. It is a good plan to start off on this liberal scale whenever it is desired to cut short an outbreak of lamsiekte. As soon as the osteophagia is reduced, it of course pays to drop down to the smallest amounts which hold the craving in check and give satisfactory returns in beef production.

From the two upper curves on the left of Fig. 24 it will be seen that the control cattle and the cattle receiving *chalk* maintained their high craving throughout the whole period during which the phosphorus-fed cattle rapidly lost osteophagia. Indeed, during the latter part of the period the chalk-fed animals actually showed increased osteophagia, thus contradicting the practice of some farmers of mixing lime with bone-meal. There is no deficiency of lime in the Armoedsvlakte vegetation, and added lime probably decreases the availability of food phosphorus during digestion. Moreover, all sorts of other compounds have been tried—Epsom salts, Glauber's salt, iron sulphate, sulphur, and a variety of others. So long as phosphorus is absent nothing is gained, and osteophagia does not disappear until a phosphorus compound in digestible form is supplied. "Abnormal craving," or "pica," or "osteophagia" in the cattle of these areas is definitely due to phosphorus deficiency and not to deficiency of anything else. The farmer should entertain no illusions about this and should leave "proprietary licks" alone, in favour of the much cheaper and more effective bone-meal.

Effect of Phosphatic Manuring.—The curves on the right of Fig. 24 show that the same results can be obtained by *manuring* the pasture with available phosphate. In the experiments here recorded, superphosphate was applied at the high rate of 500 lb. per acre just after the October rains in 1919. In May, 1920, the manured camp was tested against an unmanured control camp by introducing craving cattle. By this time the new grass of the former contained over three times as much phosphorus as similar grass from the latter, and as the chart (Fig. 24) shows, the cattle in the unmanured camp retained their high "craving for bones," while those

in the manured camp rapidly lost all sign of it. The moment the latter were transferred back to the unmanured camp at the end of February, 1921, the osteophagia began to return and in a few months was as bad as ever.

This experiment is theoretical rather than practical in so far as the majority of ranching farms is concerned. With land at 10s. to 30s. per morgen (about 2 acres), as it is around Armoedsvlakte, and with a shallow soil, and low rainfall strictly limited in its seasonal incidence, phosphatic manuring does not pay; costs more than the capital value of the land. The stock-carrying capacity of Armoedsvlakte is reckoned at about "9 morgen per beast," a ten thousand morgen farm being capable of supporting rather over a thousand cattle. Seven shillings per annum spent in getting bone-meal down the throat of an animal is a highly profitable proceeding, bringing in, as shown earlier, several hundred per cent. profit as increased live-weight. The same sum scattered over 9 morgen of land with, say, superphosphate at £4 per ton, would make practically no impression on the phosphorus content of the vegetation. On the other hand, at least 80 per cent. of the bone-meal fed to an animal ultimately passes out again in the excreta, after the animal has had the use of it; and remains on the farm, manuring the veld, slowly increasing its carrying capacity for vegetation and stock, and slowly increasing the phosphorus content of the pasture.

In arid areas of cheap land, therefore, the proper thing to do is obviously to base the *primary return*, for cash outlay upon the *saleable animal;* and treat the secondary manurial return as a consolation in store for posterity. In areas where rainfall is heavier and more evenly distributed throughout the year, the soil arable and deeper, the land nearer the big industrial centres or seaports and correspondingly more valuable, direct phosphatic manuring pays. Even then, it pays primarily as an arable proposition and it is still preferable to pass the phosphorus needed by the animal *through the animal first*, using the phosphorus-rich dung for fertilising the soil. As expressed in Fig. 1, the whole chain of disaster can be broken by manuring the soil, but it is cheaper to break it by feeding bone-meal, *incidentally* effecting phosphatic manuring.

VIII. SOIL DEFICIENCIES.

To return now to the starting point of all the trouble, the following soil analyses are of illustrative interest when considered in the light of the results of feeding phosphorus to animals reared upon it. Technical discussion of several soils of lamsiekte and styfsiekte areas will be found in the forthcoming "Reports of the Director of Veterinary Education and Research." At this juncture only a few points of major interest need be noted.

The soil of Armoedsvlakte is shallow, varying from dolomitic outcrop to a few feet of leached soil. According to the extent of leaching it varies from a heavy dolomitic loam to a sandy soil containing very little carbonate, although still *alkaline*. The following chemical and mechanical analyses, kindly undertaken by Dr. Marchand, of the Division of Chemistry, illustrate this:—

Lamsiekte Soil. Armoedsvlakte, Vryburg.

Modified Rothamsted Methods.

Chemical Analysis.	Dolomitic Areas. Per Cent.	Leached Areas. Per Cent.
Moisture	6·88	0·77
Loss on ignition	27·47	2·58
Insoluble matter (HCl)	31·07	90·18
Iron oxide and Alumina	1·56	6·10
Lime	12·07	0·16
Magnesia	21·34	0·12
Total potash	0·11	0·42
Total phosphoric oxide	0·12	0·03
Available potash	0·016	0·011
Available phosphoric oxide	0·001	0·0005
Nitrogen	0·24	0·08
CO_2 expressed as $CaCO_3$	45·0	0·12
Mechanical Analysis.		
Fine gravel	0·12	4·82
Sand	5·30	30·66
Fine sand	19·19	48·82
Silt	10·83	1·95
Fine silt	8·52	1·91
Very fine silt	6·00	1·61
Clay	7·47	7·15

The next two soils are from styfsiekte farms, *Lidgetton* near Maritzburg, Natal, and *Athole* on the High Veld, in the Ermelo District. Both are leached, *acid* soils (to litmus paper), from more hilly country of higher rainfall. They are deeper and contain practically no carbonate.

Styfsiekte Soils.

	Lidgetton, Natal. Heavy Loam. Per Cent.	Athole, Ermelo. Medium Grey Loam. Per Cent.
Moisture	5·46	2·79
Loss on ignition	15·46	6·87
Insoluble matter (HCl)	54·24	72·83
Iron oxide and Alumina	23·54	16·70
Lime	0·08	0·05
Magnesia	0·43	0·05
Total potash	0·73	0·03
Total phosphoric oxide	0·09	0·06
Available potash	0·02	0·004
Available phosphoric oxide	0·001	0·001
Nitrogen	0·31	0·11
CO_2 expressed as $CaCO_3$	Less than 0·01	Less than 0·01

The very low "available phosphoric oxide," ·001 per cent. or less, is the feature to which it is desired to draw special attention in all three soils. So far as present investigations go, all lamsiekte and styfsiekte soils have this feature in common; and as already shown, the low available phosphorus is reflected in the later stages of growth of all grasses (irrespective of botanical species) grown upon them.

A farm, "Verona East," for which, however, a complete analysis is not available at the moment, is of special interest as being in the Vryburg District not very far from Armoedsvlakte, but as showing two large areas differing widely in "available

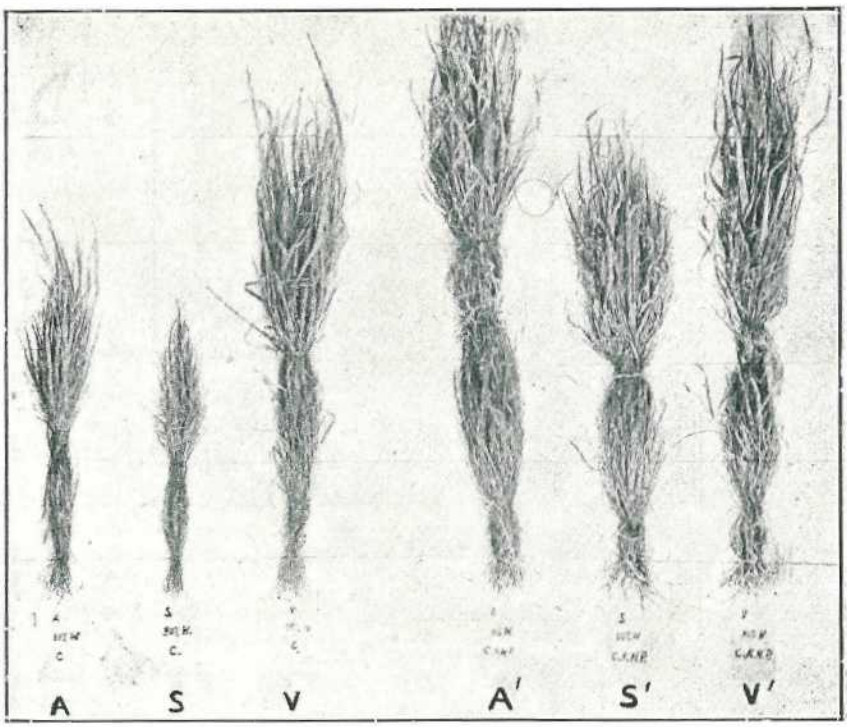


Fig. 25.—A Armoedsvlakte soil without manure; A' with full manure.
S Shepstone " " " S' " " "
V Verona East " " " V' " " "

phosphoric oxide.'' One of these areas is a grey granular stiff loam containing ·009 per cent. available P_2O_5, and the other a brown granular loam containing ·0027 per cent.; both exceedingly low in chalk. Osteophagia, occasionally leading to lamsiekte, occurs on the latter, but is not nearly so marked as at Armoedsvlakte. On the other area, so-called ''Ganna veld,'' of higher phosphoric oxide, lamsiekte never occurs. If an outbreak occurs on the phosphorus-low soil it promptly fades out on transferring the cattle to the soil richer in phosphorus. The vegetation growing on these two areas of the same farm reflect the proportion of phosphorus in the soil; the same botanical species of grass showing a relatively low phosphorus-content on one and a relatively high phosphorus-content on the other.

The soil analyses shown in the foregoing tables make dreary reading in an article designed to be attractive to the farmer, and may therefore be enlivened with a few photographs representing a preliminary study of selected soils in *pot experiments*. These experiments belong to a series conducted by Dr. Van Zyl (of this laboratory) and will appear in detail in forthcoming ''Reports of the Director of Veterinary Education and Research.'' Fig. 25, on the preceding page, offers a comparison of the lamsiekte soil of *Armoedsvlakte*, Vryburg (·001 per cent. available P_2O_5), the styfsiekte soil of *Shepstone*, Ermelo (·0015 per cent. available P_2O_5), and the Ganna veld soil of *Verona East* (·009 per cent. available P_2O_5), just referred to as free from both diseases. The comparison is between cuttings of barley grown in pots on the three soils, manured and unmanured, with liberal water supply (80 per cent. W.H.C.) in all cases.

It will be seen that sheaf V is almost as abundant as sheaf V', *i.e.*, that the Verona soil is fertile and benefits relatively little by manuring. Sheaves A' and S' are very much superior to A and S respectively, *i.e.*, Armoedsvlakte and Shepstone soils respond very readily to manuring, by increase of crop.

That the response to manuring is primarily a response to *phosphorus* is next shown for the Armoedsvlakte soil, in Fig. 26, illustrating the early stages of growth in the pots:—

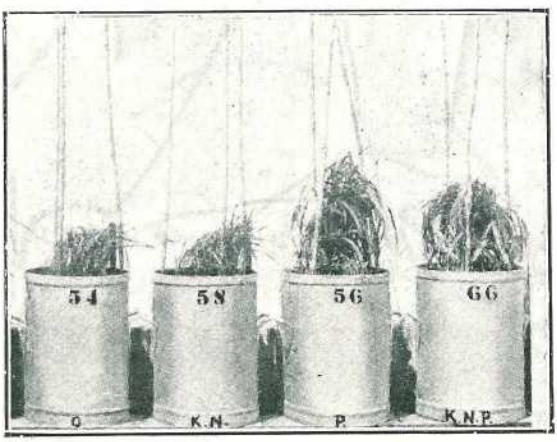


FIG. 26.

Pot 54 is the control receiving no manure. Pot 58 received potash (K) and nitrogen (N), and shows no improvement. Pot 56 received phosphorus (P) alone and responded at once, as show by the much denser foliage. Pot 66 received nitrogen and potash as well as phosphorus, but as much the same as pot 56 receiving phosphorus alone, thus indicating that, apart from water supply, phosphorus is the main limiting factor in plant growth on the Armoedsvlakte soil.

In the case of *Shepstone* the soil is acid and responds to lime as well as to phosphate, as illustrated in Fig. 27.

Here it will be seen that sheaf 4 receiving lime (Ca) alone is better than sheaf 3 receiving no manure at all; and as good as sheaf 5 which receives potash and nitrogen in addition to lime. The fact that sheaf 6 receiving phosphorus and lime is as good as sheaf 7 receiving nitrogen and potash as well, indicates that the response to nitrogen (N) and potash (K) is not marked; while the great superiority of both over sheaves 3 and 4 shows quite clearly that phosphorus is again the main deficient constituent.

The influence of *water supply* is brought out by the next two photographs. Fig. 28 compares the early stage of growth of barley in pots containing the same three soils maintained under drier conditions (40 per cent. W.H.C.). Fig. 29 represents the crops cut from the same pots at an intermediate stage of growth.

It is at once apparent that when water is the "limiting factor," growth is best on the Armoedsvlakte soil and worst on the Shepstone soil, both when measured

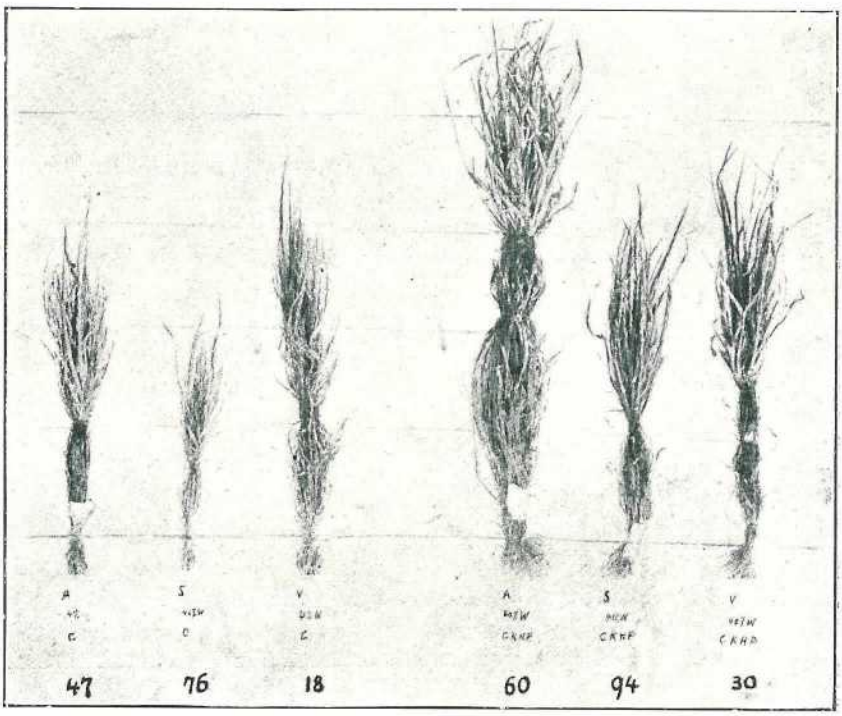


FIG. 27.

Fig. 27.—1 Lime alone
2 Lime, Potash, Nitrogen, Phosphorus } Low water supply.
3 Unmanured
4 Lime alone
5 Lime, Potash, Nitrogen } High water supply.
6 Lime, Phosphorus
7. Lime, Potash, Nitrogen, Phosphorus

(Nos. 60, 94, and 30) and when left unmanured (Nos. 47, 76, and 18). The Verona soil (No. 18) is more sensitive to drought and shows up no better than the Armoedsvlakte soil (No. 47) under restricted water supply, although, as Fig. 25 showed, it is much superior when water supply is abundant. Comparison of sheaf 60 with sheaf 30 in Fig 29 shows that manured Armoedsvlakte soil is superior to manured Verona soil, when the water supply is restricted; although, as Fig. 25 showed (A' and V'), much the same under abundant water supply and much inferior (A and V) when not manured.

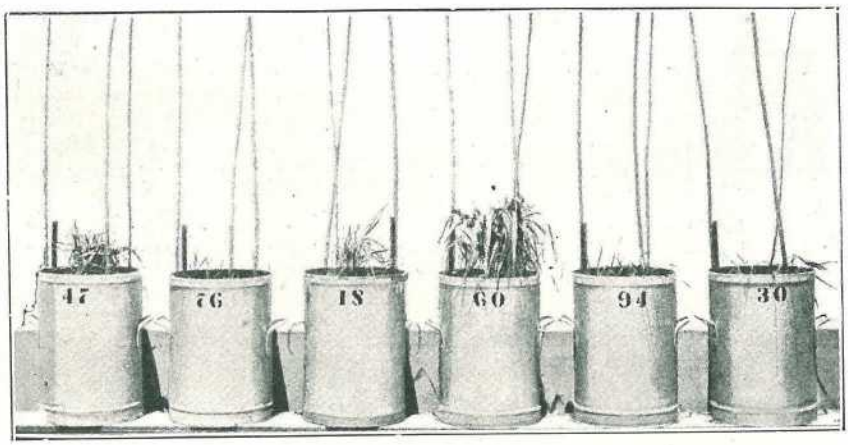


FIG. 28.—Pot 47, Armoedsvlakte, no manure; Pot 60, same, full manure.
Pot 76, Shepstone, ,, ,, Pot 94, ,, ,, ,,
Pot 18, Verona, ,, ,, Pot 30, ,, ,, ,,

All six pots *restricted* in regard to water supply. Early stage about six weeks old.

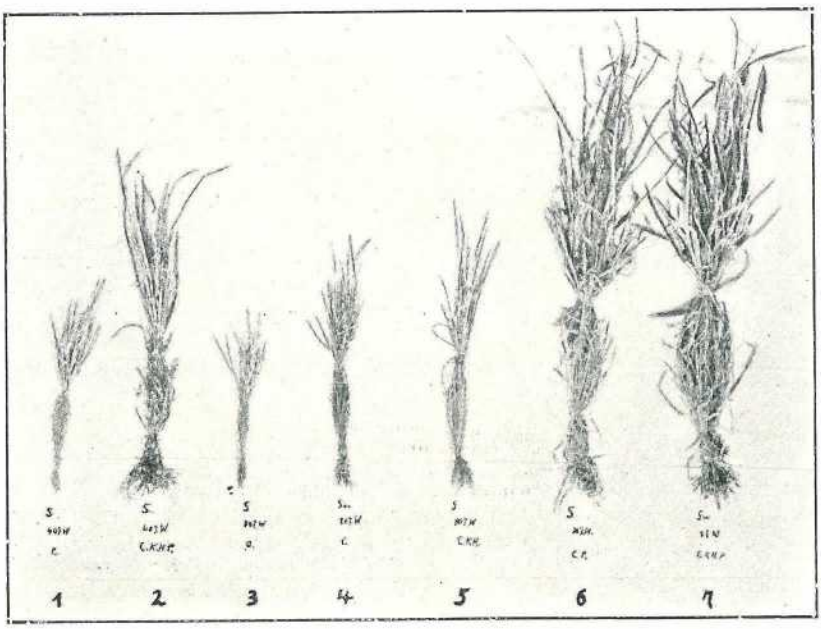


FIG. 29.—Same as Fig. 28. Barley three months old.
Crops cut from pots at intermediate green stage of growth and tied into sheaves for comparison.

Without entering into further details of the pot experiments which still have to be confirmed by *plot* (tenth acre) experiments *in situ*, it may merely be added that with the Verona soil rainfall is the main limiting factor in fertility, and that from the point of view of "plant food" it is not seriously deficient. The Armoedsvlakte soil is still subject to the limitations of rainfall, but withstands drought better wherever the depth is reasonable. With good rains, however, the second limiting factor of phosphorus deficiency enters, and although in a drought year Verona may be no better than Armoedsvlakte, the latter is far behind the former in a wet year. Unfortunately, the rainfall of the district is so unreliable and so seasonal in incidence that water supply tends to be the limiting factor in both cases, and the difference in "cattle grazed per morgen" is not so great as would be expected from the difference in fertility between the two soils. The most striking difference lies in the stunted growth of stock, and prevalence of lamsiekte, on farms of the Armoedsvlakte type, as compared with the freedom from disease and superior individual condition on farms of the Verona type.

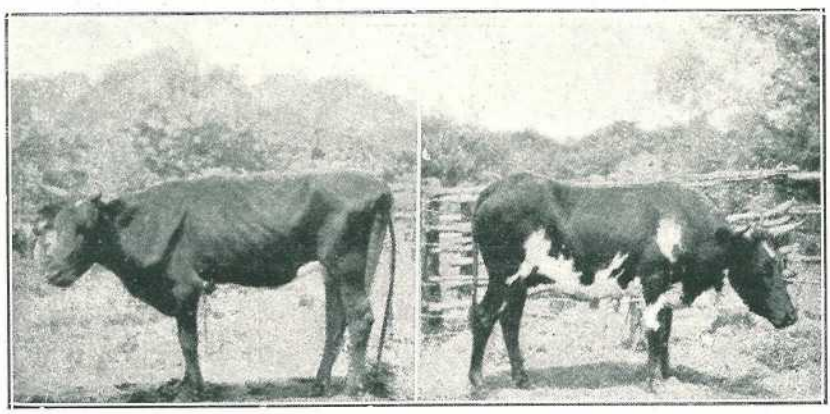


FIG. 30.

The Shepstone soil has triple limitations; sensitiveness to drought, deficiency of phosphorus, and deficiency of lime. Fortunately, it is in an area of much higher rainfall than Armoedsvlakte, and stock raising is still possible; better for sheep than for cattle. In fact the owner had practically abandoned cattle rearing altogether in favour of sheep, owing to the prevalence of styfsiekte, until the discovery was made that bone-meal feeding would prevent that disease and permit of normal growth. The photograph above, Fig. 30, brings our story back to its starting point by showing two Shepstone animals of the same age, one fed on bone-meal and the other not, for the year preceding the taking of the photograph.

A year earlier these two animals were very similar in appearance. The one on the left now shows incipient styfsiekte and is in miserable condition. The one on the right has grown out during the year of bone-meal feeding, is in excellent condition, and quite free from the disease. Otherwise the two animals were treated in exactly the same way, running together in the same paddocks. It may be added that the one on the right had suffered from styfsiekte the year before, and was *cured* by bone-meal feeding.

The reference above, to the distinction between rearing of cattle and sheep on deficient veld, will form the subject of a later paper; suffice it to mention, that although both species of animal are susceptible to phosphorus deficiency, the feeding habits of sheep, and the "winter trekking" customs of farmers in areas such as Shepstone, render wool-growing possible even where beef production is unprofitable on the natural unsupplemented veld. It is hoped to present data upon bone-meal feeding of sheep on another occasion, since although sheep do not react to a phosphorus deficient veld in quite the same way as cattle, they do undoubtedly benefit by bone-meal feeding. They show osteophagia only in feeble fashion, hardly recognisable unless carefully observed, and therefore do not develop lamsiekte; nor, so far as is known, do they develop styfsiekte. Particularly for growth, however, a small ration of bone-meal is recommended—about half an ounce three times a week, or about two ounces a week given with an equal weight of salt in the form of a lick to which the sheep have frequent access.

IX. REVIEW SUMMARY.

(1) This article "*Phosphorus in the Live Stock Industry*" is a companion paper to the article "*Cause and Prevention of Lamsiekte*" which appeared in the June, 1920, issue of this *Journal*. Its profusion of illustrated matter in the shape of charts and photographs is so arranged as to interest the practical agriculturist as well as the veterinarian.

(2) The first diagram offers a graphic summary of the various effects of phosphorus deficiency in cattle, and shows that the diseases lamsiekte and styfsiekte are *indirect* consequences of phosphorus deficiency in soil and pasture, although other etiological factors subsequently enter: a toxin produced from dead organic matter by a saprophytic anaerobic bacillus being the *direct* cause in the case of lamsiekte.

(3) The indirect consequences, however, are of less economic importance than the direct consequences, since the latter concern the *nutrition* of the animal itself. Low phosphorus-content is a noteworthy feature of South African soils, and over wide areas of the Union the level of phosphorus reached in the natural vegetation is below the physiological optimum requirements of cattle.

(4) Charts and photographs conclusively demonstrate that in such areas phosphorus is a *limiting factor* in the *growth* of young stock, in the *condition* of older cattle, and in the *milk yield of cows*. Any digestible phosphorus compound, given as supplement to the natural grazing, rectifies the deficiency and permits of normal development. Phosphatic manuring of the soil has the same effect, but is impracticable in ranching areas worth only 5s. to 15s. an acre. Bone-meal feeding is the practical solution for ranching conditions. Bran is useful for dairy stock or high-grade animals receiving supplementary rations in the ordinary course of events. Rock phosphate is of little value and presents difficulties in administration.

(5) The demands for phosphorus are least for mere maintenance, intermediate for growth, and highest for milk production. The bone-meal ration therefore recommended for the districts investigated varies from ½ lb. per head per week for adult oxen and young calves, ¾ lb. for growing stock over 300 lb. in weight, up to 2 lb. or even more for lactating cows. This should be given in the form of daily portions (excluding Sundays), or at least tri-weekly. Bi-weekly or weekly feeding is wasteful and ineffective.

(6) On such a ration of bone-meal the rate of increase in weight during spring and summer is approximately twice that of unrationed controls. Expressed as percentage increase on initial live-weight, the gains are naturally most striking with young animals. One chart shows calves of 300 lb. live-weight that have increased in weight to about 470 lb. during the season on the natural grazing, and to about 640 lb. when supplied with bone-meal. The immediate effect upon growth is clearly brought out by photographs. Accompanying the superiority in weight, comes earlier maturity and superior quality of beef.

During the rainless winter the grazing is naturally poor and no headway is made by the stock. The phosphorus-fed cattle, however, maintain the advantage gained during spring and summer; and in some cases improve upon it in spite of the adverse conditions to which all stock are then subjected. Phosphorus feeding is shown to pay several hundred per cent. upon the outlay for bone-meal.

(7) The interesting phenomenon of "Osteophagia," a specific form of "Pica," is well illustrated, and its value as a symptom of phosphorus deficiency discussed.

(8) The methods adopted for routine feeding of bone-meal under practical ranching conditions are illustrated by photographs.

(9) An interesting experiment establishing the relationship between "phosphorus and food consumption" is discussed, and it is quite clearly shown that although animals receiving a bone-meal ration do eat more food in putting on additional weight, they also give a much better return "per unit of food consumed." When the phosphorus deficient controls were coaxed to eat more food than required for mere maintenance, they simply "combusted" the excess for no useful purpose. A *functional* as well as a *structural* role is predicated for phosphorus in cellular metabolism, and an analogy drawn with the "vitamins." Cattle artificially "stunted" in growth for about a year by dietary deficiency of phosphorus showed a growth rate almost above the normal on supplying the missing factor.

(10) Seasonal variation of phosphorus-content in the natural grazing is then discussed, data on chemical composition of the grasses being correlated with data derived by determining the amount of phosphorus required to prevent osteophagia in the cattle. As would be expected, the deficiency is least acute in the young grass and increases as the grass matures, the actual percentage phosphoric oxide of the dry winter vegetation being about .08 per cent. Broadly speaking, however, the

grazing is below normal requirements of mixed stock all the year round. The ratio "phosphorus content" to "energy value" serves as a rough guide in assessing deficiency by analytical methods. A few interesting veld photographs of the area studied are shown.

(11) A few analyses are presented, comparing soils from lamsiekte and styfsiekte farms with similar soils free from these diseases. Shortage of phosphorus, generally down to .001 of "available phosphoric oxide," is the characteristic feature of the "deficient soils." Photographs of "pot experiments" enliven the analytical data, the crops obtained indicating phosphorus deficiency and low rainfall as the two main factors limiting the stock-carrying capacity of the Bechuanaland dolomitic district concerned; phosphorus alone, or phosphorus and lime, being the limiting factors in the well-watered but extensively leached soils of the Natal District and Ermelo High Veld.

CONCLUSION.

In concluding this article a broad recapitulation for the practical farmer is worthy of italics:—

In all areas where the soil and pasture are known to be deficient in phosphorus, it is profitable to feed bone-meal to practically all stock for the sake of improving condition and facilitating rapid growth. For cattle it is particularly advisable since two important diseases, lamsiekte and styfsiekte, can be prevented by liberal bone-meal feeding. When insurance against disease, increased beef production, increased milk yield, and more rapid growth of young cattle are all taken into consideration, it will be found that any expenditure on bone-meal is repaid many times over.

Acknowledgments.—It is a pleasure to render acknowledgment to Mr. D. T. Mitchell for supervision of the programme at Armoedsvlakte during 1920-21; to Dr. F. Veglia for like service in 1921-22; to Mr. Fourie in 1923; to Mr. Rodgers and Mr. Du Plessis for execution of detail at Armoedsvlakte, and to Mr. Marais for like work at Shepstone; to Mr. Richards, owner of Shepstone; and to Mr. T. Meyer for assistance with earlier experimental work and with charts and photographs.

USE OF DISINFECTANTS ON THE DAIRY FARM.

Deterioration in the quality of milk and cream has in several instances been traced to the use of disinfectants on the dairy farm through its addition to water used in the cleansing of milking machines, separator parts, buckets, cans, cows' teats and udders, and to the water used by milkers for cleansing their hands. The application of ointment to the sore teats of milch cows caused the trouble in a few instances.

For the purpose of cleansing milking machines, separator parts, and all dairy utensils, a small quantity of washing soda added to warm cleansing water will remove all grease and particles of dirt. After this is done all parts of plant and utensils that come in contact with the milk and cream must be sterilised by the use of boiling water or live steam.

The teats and udders of the cows should be washed in warm water and dried with a clean cloth. When a healing ointment has been applied to the teats, all trace should be removed with warm water before milking and the teats smeared with vaseline and dried with a clean cloth On completion of the milking, wash and dry the teats and apply the healing ointment when necessary.

The milkers' hands should be cleansed thoroughly with warm water and soap and then dried. The wash water should be changed as required, so as to prevent its being contaminated.—C. MCGRATH, Supervisor of Dairying.

THE JOURNAL APPRECIATED.

Thus a Goombungee farmer (28/11/27): *"Just a line to let you know how we appreciate the 'Queensland Agricultural Journal.' We enjoy reading it very much. I am enclosing a subscription for Mr. ——— as a Christmas present for him. I am sure he will like the Journal."*

RAINFALL IN THE AGRICULTURAL DISTRICTS.

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

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	July.	No. of Years' Records.	July, 1928.	July, 1927.		July.	No. of Years' Records.	July, 1928.	July, 1927.
North Coast.	In.		In.	In.	*South Coast*—continued:	In.		In.	In.
Atherton	0·90	26	2·23	2·16	Nambour	2·92	31	1·02	0·30
Cairns	1·57	45	1·50	2·02	Nanango	1·74	45	0·84	0·55
Cardwell	1·39	55	0·64	2·04	Rockhampton ...	1·46	40	0·30	2·27
Cooktown	1·00	51	0·25	1·20	Woodford ...	2·48	40	1·38	0·49
Herberton	0·72	40	2·58	1·85					
Ingham	1·52	35	0·73	3·10	*Darling Downs.*				
Innisfail	4·67	46	5·15	6·76					
Mossman	1·42	14	0·86	1·48	Dalby	1·77	57	1·18	0·41
Townsville	0·56	56	0 02	5·41	Emu Vale ...	1·58	31	2·07	0·84
					Jimbour	1·62	39	1·32	0·27
Central Coast.					Miles	1·69	42	2·15	0·07
					Stanthorpe ...	2·07	54	2·54	0·10
Ayr	0·65	40	...	4·13	Toowoomba ...	2·08	55	1·61	0·52
Bowen	0·93	56	0·08	2·49	Warwick	1·84	62	1·84	0·46
Charters Towers ...	0·62	45	0·09	2·63					
Mackay	1·67	56	0·05	3·29					
Proserpine	1·30	24	0·55	3·61					
St. Lawrence ...	1·28	56	0·09	3·38	*Maranoa.*				
					Roma	1·49	53	0 82	0 16
South Coast.									
Biggenden	1·42	28	0·64	0·70					
Bundaberg	1·89	44	0·96	1·06	*State Farms, &c.*				
Brisbane	2·26	77	0·72	0·52					
Caboolture	2·27	40	1·04	0·52	Bungeworgorai ...	1·73	12	0·50	0·10
Childers	1·77	32	0·67	1·43	Gatton College ...	1·45	27	0·79	0·14
Crohamhurst ...	2·97	35	1·46	0·47	Gindie	1·04	27	0·23	0·11
Esk	2·02	40	1·50	0·80	Hermitage ...	1·81	20	1·65	0·76
Gayndah	1·49	56	0·67	0·99	Kairi	1·25	12	1·21	1·54
Gympie	2·21	57	1·39	0·46	Sugar Experiment Station, Mackay	1·50	29	...	3·07
Kilkivan	1·79	48	0·86	0·63					
Maryborough ...	1·94	55	1·20	0·81	Warren	1·27	12	...	1·50

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for July this year, and for the same period of 1927, having been compiled from telegraphic reports, are subject to revision.

GEORGE G. BOND,
Divisional Meteorologist.

QUEENSLAND RAIN-FOREST TREES.

By W. D. FRANCIS, Assistant Government Botanist.

The Weeping Myrtle, which is illustrated by the accompanying photographs, is commonly seen overhanging freshwater streams in the lighter class of "scrub" or rain forest. The species is known botanically as *Eugenia Ventenatii*. The trees attain a height of about 80 ft. and a stem diameter of about 2 ft. 6 in. On large trees the bark is gray or dark-gray and prominently furrowed or fissured. The species is recorded from as far south as the Hastings River in New South Wales (C. Moore) and from Rockingham in the north of Queensland (Bentham).

Photo.: W. D. Francis.

Plate 79.—Weeping Myrtle (*Eugenia Ventenatii*), a Large Double-stemmed Specimen on the Banks of Ithaca Creek, near Brisbane.

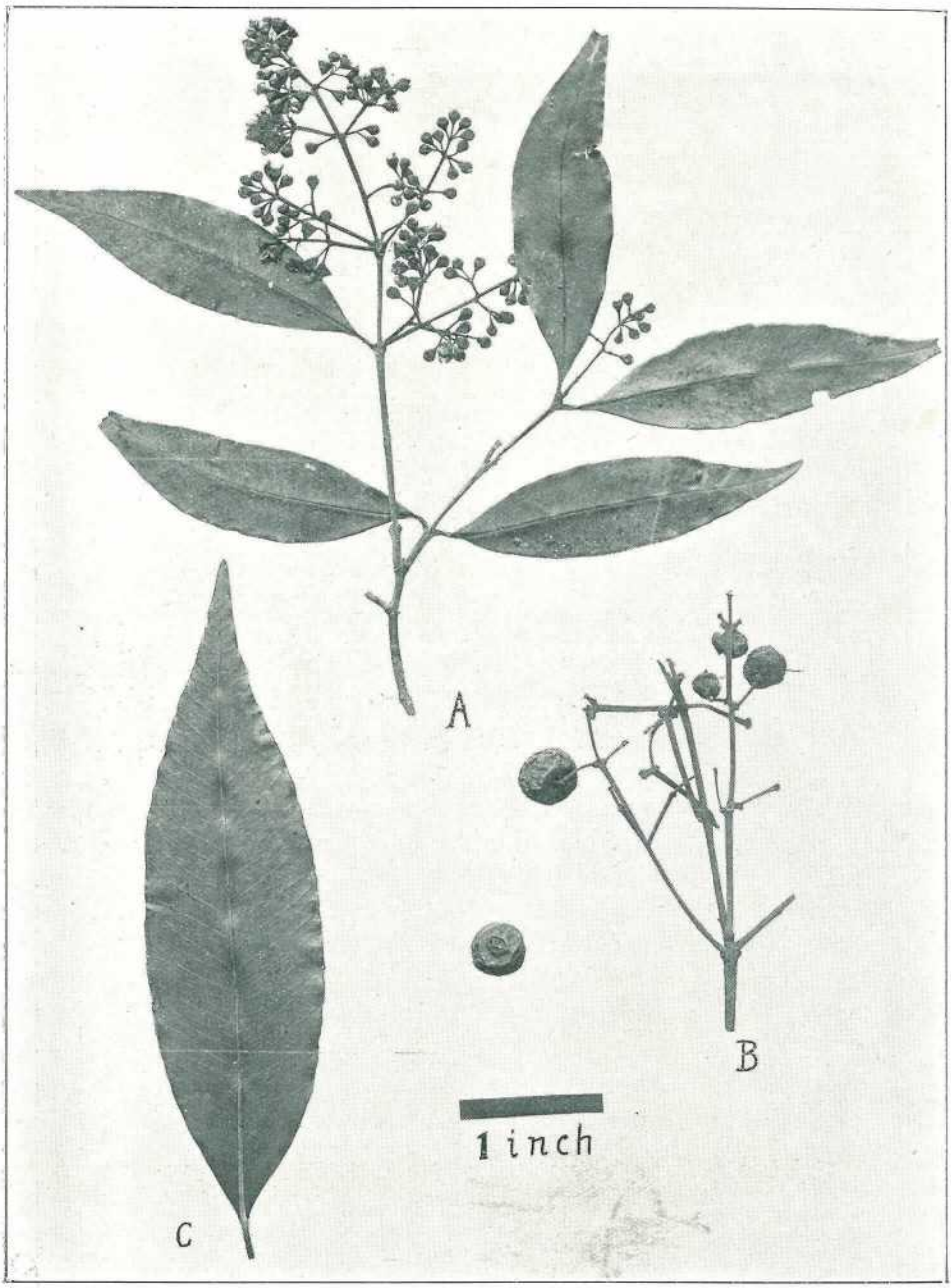


Photo.: Dept. Agriculture and Stock.]

PLATE 80.—WEEPING MYRTLE, *Eugenia Ventenatii.*

A—Flowering twig;
B—Twig bearing dried fruits;
C—Leaf showing underside.

THE VICTORIAN MEAT EMBARGO.

RESTRICTIONS CONTRARY TO THE SPIRIT OF FEDERATION.

The Premier (Mr. W. McCormack) has given the following information to the Press:—

The Victorian Public Health Department, under the Meat Supervision Regulations recently issued, requires that any carcass or meat introduced from any place outside Victoria must be conveyed to the Government Cool Stores, Victoria Dock, or some other suitable place, for examination and branding. It is also provided under these regulations that every person who sells any meat which has been chilled or frozen shall attach a label to the meat or package stating if such meat is chilled or frozen, as the case may be, and where it is imported the word "imported" must be inserted on the label. This means, in effect, that to every small cut of meat, weighing possibly not more than 1 lb., there shall be attached a label setting out the foregoing particulars.

It is obvious that the regulations have been very carefully framed and are designed to exclude the entry of meat into Victoria for sale from other States, especially in regard to the impracticability of fulfilling the requirements of the Victorian Regulations applying special brands to retail sales of chilled meats.

A Constitutional Point.

Exception is also taken by the Premier to the term "imported," as applying to goods produced within Australia, and he referred to the special definition given under the Victorian Regulations which means that the word applies to any place outside Victoria and not outside Australia. This procedure is significant of the desire of the Victorian authorities to take action which is tantamount to the restriction of trade between the States, and is quite a modern conception of the use of the word "imported" as applying to goods or produce produced in one State of the Commonwealth and tendered for sale in another State.

An Untenable Argument.

Statements made in the Victorian press that stale meat has been foisted upon the public to the detriment of the health of the community are difficult to understand. The chilled meat supplied by Queensland is despatched from meatworks which are conversant with the preparation of meat for export, and where slaughtering operations and the examination of the carcass and viscera are under the control and supervision of skilled veterinary surgeons.

Chilled Meat a Wholesome Food.

It is generally agreed that chilled meat is essentially a wholesome food, and it is estimated that practically all the beef supplied to consumers from the metropolitan abattoirs in Sydney is chilled before reaching those consumers, and that in the case of beef supplied to consumers in Melbourne about 60 per cent. of such meat is chilled at some stage before delivery. Consequently it appears anomalous that exception should be taken to the supply to the Victorian public of chilled meat of Queensland origin.

A Restriction of Interstate Trade.

For the benefit of consumers who may be unaware of the fact, the Premier pointed out that practically one-half of the cattle within the Commonwealth are in this State, and the markets of Victoria and other States must provide a natural outlet for some of the beef and meat products raised in Queensland. Conversely, the people of this State consume and utilise a large proportion of raw and manufactured products from Victoria, and there has been no suggestion that harassing restrictions on the importation of these products should be insisted upon by the authorities in this State.

In practice, it is impossible to conform with the Victorian requirements in respect of the introduction of meat into that State, and while it is recognised that it is a matter for the State Government concerned to take such action as would fully safeguard the public health of the community, it is considered that in this particular case the interests of consumers in the Southern State would be fully safeguarded by the adoption of more practical methods than are at present in force.

METHYLENE BLUE REDUCTION TEST.

ITS VALUE IN MILK GRADING.

C. McGRATH, Supervisor of Dairying.

These notes are reprinted from the Journal for April, 1927, in response to repeated requests for information on the subject.

The methylene blue reduction test, as a quick method for determining approximately the number of bacteria present in a sample of milk, is recommended to graders at cheese factories and milk-receiving stations.

The process is not as accurate as the plate culture or the most recent direct microscopic count methods.

The latter tests, however, are more complicated and expensive, and call for special training and more skill than in carrying out the methylene blue reduction test.

A comparison of the results of grading milk by the direct microscopic count and the methylene blue reduction determination has proved that the latter test can be used with advantage where milk is received for human consumption or manufacturing purposes.

The methylene blue reduction test is of special value for the grading of milk received at cheese factories, as a fermentation test can be made on the same sample of milk, after the colour reduction time has been recorded.

It is not suggested that this test would take the place of the usual inspection and grading of the milk which must always be carried out by a qualified milk-grader.

No technical description of milk and no test at present known can replace the practical knowledge obtained by experience in the grading of milk and its products.

Descriptions of odours and flavours of milk and its products, in terms definite enough to guide an inexperienced grader, have been found to be impossible.

The methylene blue reduction test can be made when the grader decides that it will aid him in determining the quality of milk.

The test, however, should be applied to each milk supply a few times each month, and by averaging the reduction time results the work of the grader becomes of greater value.

When the test has been in operation for some time, the average quality of each patron's milk can be more definitely determined.

Attention can be given to improve the quality of the milk below first grade.

In classing the milk delivered at a cheese factory, the grader will readily discern the night's milk from the morning supply.

A pleasant, clean, partially-ripened flavour of the milk held overnight indicates that the milk has been produced under sanitary conditions, and the desirable lactic acid micro-organisms predominate.

The clean, pleasant, fresh smell and flavour of the morning's milk is indicative of the conditions under which the milk is produced, handled, and delivered at the factory.

To produce a first-grade milk having a low acidity and bacterial count and free from excess sediment requires care and attention on the part of the producer and is a more expensive operation than the production of milk of a lower grade. High-grade milk and its products increase consumption and raise the price of such products with benefit to all engaged in the industry.

Producers of first-quality dairy products should be paid a substantial premium. Low-grade dairy products decrease consumption and lower the price for high-grade products.

The Test.

It has been determined that when a definite amount of methylene blue has been added to a sample of milk and a temperature of 98 deg. Fah. is maintained, that decoloration occurs at a rate determinable by the number of bacteria present.

Milk which contains several million bacteria per cubic centimetre will be decoloured in a few minutes, while milk which contains a few thousand bacteria per cubic centimetre will retain the blue colour for several hours.

The decoloration is dependent upon the amount and rapidity of acid produced by the activity of the bacteria in the milk samples.

To carry out the methylene blue reduction test only a small amount of apparatus is required, and consists of—

Glass test tubes, 6 x ¾ in.;

Rack for holding same;

Water bath to maintain temperature of samples;

20 c.c. milk pipette.

Stock solution of methylene blue is made by dissolving 1.1 grams dry methylene blue dye in 500 c.c. of distilled water.

The dilute solution for use is made, as required, by adding 39 c.c. of distilled water to 1 c.c. of methylene blue stock solution. This dilution will keep three days, and gives one part of dry crystalline blue in 200,000 parts of the milk sample tested.

Procedure.—Mix the milk thoroughly before drawing off the sample.

Pipette 20 c.c. of the milk and deliver into a sterile test tube; add 2 c.c. of dilute methylene blue. Mix thoroughly, and close with a cotton plug. Place the test tubes in a bath and keep at a temperature of 98 to 100 deg. Fah. Observe the change in the colour of the milk at intervals.

By comparing the test milk samples with a quantity of normal milk the time of disappearance of the blue colouration can be fixed.

The grade of the milk is determined by the rapidity with which the blue colour disappears.

The following times record the standards according to Hunziker:—

Time decoloration.	Quality milk.
2 hours	Poor
2 to 5½ hours	Fair
Over 5½ hours	Good

The methylene blue test and its relation to bacterial content of tested milk is shown in the following table:—

Time decoloration.	Classification.	App. number of bacteria per c.c.
Less than 20 minutes	Poor	20 millions
20 minutes to 2 hours	Medium	4 to 20 millions
2 hours to 6 hours	Fair	½ to 4 millions
6 hours or over	Good	Less than ½ million

Sterilise test tube and pipette by boiling for 20 minutes before use.

Close test tubes with plug of cotton when in rack awaiting use, and insert cotton plug as soon as sample of milk is delivered into same. Keep closed during the period of the test.

Rinse the pipette with boiled water after sampling each supply.

The stock solution will keep for six months.

The dilute solution to be added to the samples of milk will keep three days.

The methylene blue reduction test will assist the grader to divide the milk supply into several grades. A low bacterial count is indicative of sanitary production and handling of the milk.

The age and local climatic conditions, together with the milk grader's practical experience, enable him to assess the value of the test which can be used in cheese factories and milk-receiving stations with advantage.

PLEASED WITH THE JOURNAL.

A Mulgeldie farmer writes (27/12/27): *"Kind'y renew my subscription to the 'Queensland Agricultural Journal.' May I say that I think your Journal is one of the best published for the man on the land. . . . Wishing your Department and Journal continued success."*

A TON LITTER OF DUROC-JERSEY PIGS.

It will interest readers generally to learn that the "Ton" litter of Duroc-Jersey pigs which Mr. Percy Campbell, of Lamington, had on exhibition at Brisbane Show completed the test for a "short" ton (2,000 lb.) one week before they were six months old. Ten pigs were saved of twelve farrowed, and it was these ten pigs that averaged 200 lb. each when one week short of six months old. They were fed on farm foods in plenty, and were given good care and attention, though weather conditions for the first four months of the test were somewhat unfavourable.

This record does not exceed the ton litter of Gloucester Old Spot pigs which were bred and fed at Orbost, Victoria, by Messrs. Russell and Johnstone, but indicates that considerable progress has been and is being made in the development of early-maturing marketable pigs.

It is, of course, understood that the markets of to-day do not call for these heavyweight pigs, but it is of considerable interest to know that it is possible under Australian conditions to develop pigs to the weight of 200 lb. alive at six months old, for after all it represents a good deal more than an average daily increase in weight of 1 lb. per day on farm-grown foods, and under conditions which are possible on any farm where the business is carried on along reasonable lines and where good animal husbandry is practised.

The pigs made a fine picture when they were out for exercise. They were exceptionally well developed, and represented the most up-to-date type of Duroc-Jersey pig we have yet seen at an Australian show. "Of course, it means a lot of work," said Mr. Campbell, "but it is surely worth while to demonstrate what can be done if one has the type of pig one fancies and a type that can be developed to maturity as bacon pigs at less than six months of age." It is noteworthy that the Duroc-Jersey and Gloucester Old Spot breeds are the first in Australia to put up such excellent weight records.—E. J. SHELTON, Instructor in Pig Raising.

PIG PRODUCTS AT THE SHOW.

Good progress has been made in recent years as a result of an active and progressive campaign by the Department of Agriculture and Stock, and considerable attention has been focused upon the business of pig farming, as an adjunct both to dairying and to other branches of agriculture. Production is increasing, quality is certainly improving, and the returns to the producer are much more lucrative now than in days gone by. During recent months, however, pig prices have been lower than usual, and farmers have had something of a set-back which, though temporary, is nevertheless disappointing. In July and August, pig prices improved considerably, and prospects appear bright for further increases, particularly in view of the higher values ruling in the Southern States.

Lower prices to the farmer have, however, not been without some compensation, if it can be so regarded, for the lower range of cost to the consumer for hams, bacon, and other pig products has resulted in an appreciable increase in consumption.

Featuring this particular aspect of the business, the array of pork products at this year's Show superseded any previous attempt at their display, and both in the Meat Industry Hall and in the court of the Department of Agriculture and Stock attractive and educational exhibits were staged.

A prominent feature of the Departmental display was the comparison between several grades of bacon, the objective being to focus the attention of farmers upon the importance of producing nothing but the very best quality commodity it is possible to market. Public taste is changing, the popular heavyweight fat bacon of years ago has gone for ever, and in its place the meaty pork chop has come to stay. The demand nowadays is for prime quality fleshy bacon only. Pithy slogans announced that a meal without meat is not complete—that meat is a tissue builder—that meat makes muscle—that children need meat for protein, energy, minerals, and vitamins—that meat sundries are sources of vitamins—that lean meat is rich in iron—that meat fat is palatable and digestible; while everyone was urged to make meat the centre of the balanced diet.

The array of pork products in the Departmental court, as well as in the trade displays, were worth going a long way to see.—E. J. SHELTON, Instructor in Pig Raising.

PLATE 81.—QUEENSLAND PIG INDUSTRY COMMITTEE.

Front Row (reading from left to right):—Messrs. A. B. Anderson (J. C. Hutton's Pty., Ltd.), E. J. Shelton (Instructor in Pig Raising, Department of Agriculture and Stock and Chairman), T. L. Jones (Foggitt Jones Pty., Ltd.), J. A. Heading (Queensland Co-operative Bacon Association).

Back Row (left to right):—J. Winders (Stenographer), H. O'Boyle (Commonwealth Department's Representative), A. J. Mackenzie (Instructor in Animal Husbandry, Gatton College), John Hardcastle (Dugandan), R. G. Watson (Brisbane).

Absent from Group:—E. E. Forth of J. C. Hutton's Pty., Ltd. and Mr. H. M. Hart, Darling Downs Co-Operative Bacon Co., Ltd.

JUDGING UTILITY POULTRY.

By P. RUMBALL, Poultry Expert.

In the judging of utility poultry, the judge must be acquainted with two standards—one known as the Poultry Club standard and the other the Utility standard. The former indicates the type, colour, and general appearance of the breed, while the latter embodies features indicative of high production.

During the present year many juvenile poultry clubs have been formed. The Department of Agriculture and Stock is co-operating with the Department of Public Instruction in this work, and in order to obviate the necessity for club members to make a study of both standards and arrive at a well-balanced decision as to what is required, have drawn up a utility score card for the White Leghorn, as this breed is being most extensively used by club members.

UTILITY SCORE CARD FOR JUVENILE POULTRY CLUBS.

Breed: White Leghorns.

Head.—Skull, fine, full, and rounded at back; beak, medium, length, stout and slightly curved, point well clear of front of comb; colour yellow (with continued production colour fades)	7
Eyes.—Bright reddish gray in colour, full, prominent and expressive ..	10
Comb and Wattles.—Bright red in colour, medium size, fine in texture. Comb: Male, perfectly erect, rising from a firm base, moderately thin, extending well beyond the back of the head, following, without touching, the line of the neck, deeply and evenly serrated, the spikes broad at base, free from thumb marks and side sprigs; Female, same as male, except that the comb falls gracefully to either side	5
Face.—Bright red, lean, smooth (not sunken), free from feathering and whiteness	3
Lobes.—Ear lobes well developed, equally matched, smooth and open; colour, white or cream, white preferred	3
Type.—*Male:* Wedge-shaped, wide at shoulders, narrowing as little as possible to the tail; breast full and rounded; back long, broad and sloping to the tail; neck medium length, well furnished with hackle feathers; tail full with flowing sickle feathers and carried at an angle of 45 degrees from the back; saddle hackle profuse; fluff moderate; carriage alert, well balanced and upright; wings tightly carried and well clipped up.	
Female.—The type of the female is similar to that of the male, with the exception that the tail is not carried at such a high angle. In addition to natural sexual features, such as comb, tail, &c., the general body carriage is not as upright	20
Skin and Abdomen.—Texture of skin to be of the thinnest and finest quality, and pliable; abdomen to be elastic, avoiding sagging in, or fullness indicating excess of fat	5
Legs and Feet.—Strong, medium length, wide apart, yellow in colour (bleaching with production), free from feathering or fluff; toes, strong and well spread	3
Plumage and Condition.—Feathers soft and silky, pure white in colour, close but not hard, as in Game; cleanliness of feathers and legs and general health essential	14
Size.—Male (6 months old), 5 lb., female, 3½ lb. Birds weighing ½ to 1 lb. above these weights to score maximum points, those in excess or under weight to be out	5
Conformation (indicating capacity).—	
(*a*) Length, as taken from the base of the neck to the base of the tail.	
(*b*) Depth to be determined by the vertical space between the back and the breast bone and between the end of the breast bone and the pelvic bones.	
(*c*) Width as measured across the saddle and immediately behind the wings, and as indicated by the distance apart of the legs ..	20
Freedom from Coarseness.—	
(*a*) Shanks strong, not too coarse or too fine in bone.	
(*b*) Pelvic bones strong at base, fine and straight.	
(*c*) Tissue—pelvic bones to be free as possible from gristly covering	5
TOTAL	100

SUGAR LEVIES.

Regulations under "*The Primary Producers' Organisation and Marketing Act of* 1926" have been approved, providing for levies on suppliers of cane to sugar-mills at the following rates for the season 1928 (the figures for 1927 are given for comparison purposes) :—

Name of Mill.	General Levy by Queensland Cane Growers' Council.	Defence Fund Levy by Queensland Cane Growers' Council.	Levy by District Executive.	Special Levy by District Executive.	Levy by Sugar Mill Suppliers' Committee.	Total Levies for 1928.	Total Levies for 1927 given for comparison.
	d.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
Mossman Central	¾	1	⅛	4	..	5⅞	6¼
Hambledon	¾	1	⅛	¼	..	2⅛	2⅛
Babinda Central	¾	1	⅛	..	..	1⅞	2⅛
Mulgrave Central	¾	1	⅛	..	..	1⅞	2¼
South Johnstone Central	¾	1	1½	..	1	4¼	5½
Goondi	¾	1	1½	..	..	3¼	5¼
Mourilyan	¾	1	1½	..	½	3¾	5½
Tully River Central	¾	1	2½	..	..	4¼	5½
Macnade	¾	1	½	..	..	2¼	3
Victoria	¾	1	½	..	..	2¼	3
Kalamia	¾	1	1	..	..	2¾	3½
Pioneer	¾	1	1	..	..	2¾	3½
Inkerman	¾	1	½	..	..	2¼	2½
Invicta	¾	1	1	..	..	2¾	4
Proserpine Central	¾	1	2	..	..	3¾	4½
Cattle Creek Central	¾	1	1	..	..	2¾	3
Plane Creek Central	¾	1	1	..	..	2¾	3
Marian Central	¾	1	1	..	..	2¾	3
North Eton Central	¾	1	1	..	..	2¾	3
Pleystowe	¾	1	1	..	1	3¾	4
Racecourse	¾	1	1	..	..	2¾	3
Farleigh	¾	1	1	..	..	2¾	3
Qunaba	¾	1	¼	..	..	2	2¾
Bingera	¾	1	1¼	¾	..	2¾	3
Fairymead	¾	1	2¾	..	..	2½	3¼
Gin Gin Central	¾	1	1¼	¾	..	2¾	2½
Millaquin	¾	1	¼	..	½	2½	2¾
Isis Central	¾	1	¼	¼	..	2¼	*3½ †¼
Childers	¾	1	¼	..	..	2	2¼
Maryborough	¾	1	2¾	..	..	2½	2¾
Mount Bauple Central	¾	1	¾	..	..	2½	2¾
Moreton Central	¾	1	1½	..	⅝	3⅞	4⅜
Rocky Point	¾	1	1	..	..	2¾	3

* Booyal. † Pialba.

No poll will be taken in respect of the General Levy of ¾d. per ton (1st column) for the Queensland Cane Growers' Council; but before the other levies are made, growers are given the opportunity of petitioning, before 1st October, 1928, for a poll to decide whether or not any particular levy shall be made. In the case of the levy of 1d. for a Defence Fund, the petition must be signed by at least 100 canegrowers.

In the case of any of the other three levies, the petition must be signed by at least 100 or 50 per cent. (which ever shall be the less) of the cane suppliers to any particular mill.

The Defence Fund Levy (2nd column) will be utilised for the purpose of creating a Defence Fund for the Queensland Cane Growers' Council. The levies by District Executives (3rd column) will be utilised for administration purposes of the respective District Cane Growers' Executives and of the Mill Suppliers' Committees in the respective districts.

The levies mentioned in the 4th column for Hambledon, Mossman, Bingera, and Isis will be used for administration purposes of the respective Mill Suppliers' Committees. The Gin Gin levy will be utilised for administration purposes of the Cane Suppliers' Association and the Sugar Mill Suppliers' Committee.

In the 5th column the Mourilyan, South Johnstone, and Millaquin levies will be used for administration purposes of the respective Mill Suppliers' Committees. At Pleystowe the levy will be used in defraying the expenses of a check weighman at the Mill. At Moreton the levy will be utilised in defraying the expenses of a Farmers' Representative at the Mill.

Full particulars of these Regulations appear in the *Government Gazette* of the 30th August, 1928, or may be obtained on application to the Managers of the various sugar-mills in Queensland or to the undersigned—

E. GRAHAM, Under Secretary,
Department of Agriculture and Stock,
Brisbane.

30th August, 1928.

CO-OPERATIVE CARTAGE OF CREAM.

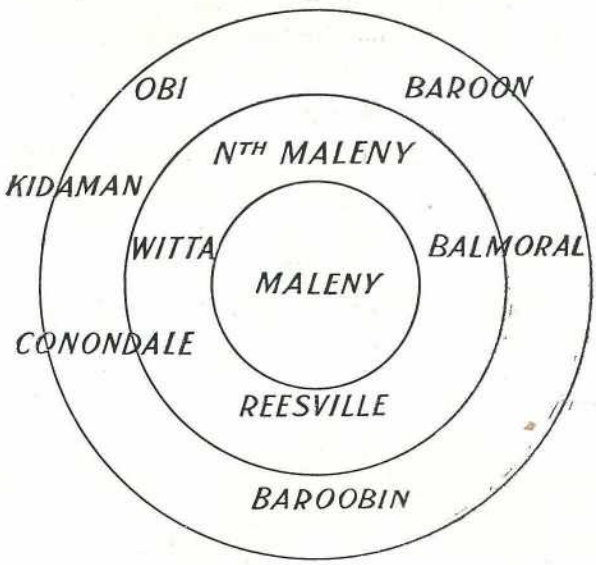
BY S. A. CLAYTON, Inspector of Dairies.

The co-operative cartage of cream is a link in the chain of farmer co-operation, and gives effect to a slogan for the dairying industry—"Co-operation from the cow to the consumer."

The co-operative butter factory is the manufacturing unit of the dairying industry, and should be the pivotal point of farmer activity in the district it serves. One further step to that end would be co-operative cartage of cream.

Take, for instance, a factory which is financed by its suppliers taking up an equal number of shares, the man living alongside the factory taking up no more than the most distant supplier (say, 15 miles). The dairy farmer living close to the factory gets more for his "supplier-shares" by having some value added to his farm by the mere fact of its being in proximity to the manufacturing unit; this in addition to his other advantages in having school, stores, hospital, and other community services and conveniences right at his front gate.

On the other hand, the dairyman living 15 miles away gets only his cream manufactured for his "supplier-shares." He pays 5d. per gallon to bring his cream to the factory, lives under harder conditions, and yet he is actually the greatest potential factor in the factory's economical progress by reason of the fact that increased cream production must come from farther out, for, as a rule, the near areas to the factory are producing up to their capacity. This can best be explained by the accompanying diagram showing concentric circles with the factory as the centre. As an example let us take the Maleny district.



It may be argued that the area within the middle radius should produce more than the inner one, and the country within the outer circle might be induced or developed to produce more than the two inner ones. One way of doing this is to take away some of the disabilities of the outer ring of farmers and make those within the inner circles contribute something to him out of the unearned value obtained by their having the factory so much closer to them.

By cutting the transportation costs of farmers in the outer ring it will encourage them to bring more country into cream production, and closer settlement, so I think it can be proved that the factory must look to its outer ring of dairymen for any increase in its output and economic business expansion.

The Present System and a Suggestion for Improvement.

Ninety per cent. of the cream comes to the factory by lorry or wagon which is paid for by the supplier using such transport. The factory cheque is paid to the carrier and the account of each supplier is debited according to the amount of cream supplied by him. About 160 cartage accounts have to be kept by the factory,

and bookkeeping could be cut out under the co-operative cartage scheme. The remaining 10 per cent. is brought in by individual dairymen.

The scheme that I suggest is one whereby the factory takes control of the whole of the cream, splits the supply up into convenient units, making the supply to each unit as nearly equal as possible, and sets out conditions of cartage, time of starting, route, &c. Cream carters would be invited to tender for each unit.

The more distant farmers in the outer circle would have their transportation charges reduced by 50 per cent., and I estimate that the factory could get the whole of its supply on the platform for 2½d. per gallon during the term of, say, three or four years' contract, with the possibility of a reduction for the following term. The supplier would not be at the mercy of the carrier, and any complaints he might have would go direct to the factory management.

The factory would control the whole supply from farm to churn with, I think, advantage to the condition of the cream on arrival on the testing floor.

Finally, it would encourage production in areas remote from the factory, and it is to these more distant localities that the factory must look for its increased output. As set out in the beginning, such a system would provide another link in the chain of co-operation from the cow to the consumer.

FARM BUILDINGS—SITE AND ASPECT.

A very considerable proportion of disease and mortality can be more or less directly traced to errors in constructing the buildings in which animals live all or part of their time. Although for each kind of animal different considerations carry weight, yet there are certain principles common to the proper construction of all buildings intended to house stock.

In selecting the site for stables, cowsheds, and pig and calf pens some freedom of choice is generally offered to the farmer. These structures should not be placed on low-lying, swampy ground, or on ground liable to be flooded, or they will always be damp and probably associated with chills and rheumatism; while the animals, having to expend so much of their food in maintaining bodily warmth, will not thrive so well as those in drier and better situated buildings.

Buildings are better on higher land, which can more readily be drained. It is also desirable to take into consideration the dryness of the soil. A shallow soil with a clay subsoil, for example, is not the most suitable, and alluvial flats and "made soils" are unsuitable places on which to place buildings for stock.

This is often important—partly in relation to its effect on the health of stock and partly because it affects the comfort, not only of the animals, but of those working among them. Whenever possible, in most parts of this State, a southerly or westerly aspect should be avoided, and shelter from the south and west secured. Despite the great heat of summer in many parts of the State, more loss is certainly occasioned by the cold of winter, and anything in the housing of stock that tends to protect them from southerly or westerly winds is of advantage. Continued exposure to cold westerlies when the animals are confined in small pens which prevent them exercising themselves will rapidly lower their vitality and disease-resisting power, especially in the case of young stock, and will retard their development by forcing them to devote so much of their food toward the maintenance of body temperature.

In like manner the sudden changes of temperature which occur with southerly winds and winter storms are liable to produce catarrh and pneumonia in all classes of stock exposed to them, particularly when such exposure follows recent shearing or clipping, de-trucking after a long railway journey, sudden release from close confinement in a hot atmosphere, or over-heating from some other cause. After sudden falls in temperature or cold rain, semi-starvation often leads to heavy losses. Penned animals have no chance of taking advantage of shelter afforded by the ground and suffer accordingly.

The selection of an east, north-easterly, or northerly aspect has the further advantage of catching the morning sun in the winter and allowing sunlight to enter freely into buildings all the year round. The top of a ridge is never a good place for housing stock or placing cow-bails; on such a site the buildings are exposed to all the winds that blow.

Answers to Correspondents.

Stock Inoculation.

E.R. (Woroon)—Your questions are answered by the Chief Inspector of Stock, Major A. H. Cory, M.R.C.V.S., as follows:—

1. Will young cattle eighteen months and under get pleuro if they are allowed to run with cattle which have had it and are inoculated, or at what age?

   Yes, animals can contract pleuro pneumonia contagiosa at any age if placed in contact with diseased animals.

2. Why must cattle be inoculated in the tail?

   If the inoculation takes place in any other part of the body than the tail the disease progresses to such an extent that it usually kills the animal. Inoculation is carried out in the tip of the tail because the circulation of blood at that place is very weak compared with other parts of the body.

3. If tails are inoculated to-day and they fester and rot three days hence, will the beasts be immune or will they get pleuro?

   If inoculated tails fester it goes to show that the inoculation has either been carried out in an unhygienic manner or that the virus was contaminated with pus organisms, when, in most cases, it is necessary to amputate the tail some two or three joints or inches above the seat of the pus formation.

4. Why not use other than needle and setons and inoculate the same as for redwater, and not touch the tail?

   An ordinary hypodermic syringe used for inoculation of stock against redwater can be used in place of the setons in the tip of the tail, but only a few drops of virus are required.

BOTANY.

Trees for Bowenville.

R.H.F. (Bowenville)—The Government Botanist, Mr. Cyril White, F.L.S., advises:—

Perhaps the all-round best timber for you to grow in your district is the ordinary rough Ironbark (*Eucalyptus crebra*). Another timber that is extraordinarily lasting in the ground is the common Bloodwood (*Eucalyptus corymbosa*). Seeds of both these species are obtainable from Mr. A. Murphy, Woy Woy, N.S.W.

Melaleuca lateritia is a native of Western Australia. It is not listed in any of the State catalogues. Sometimes the Department of Agriculture at Perth has seeds of native plants available for distribution, and if you write to Mr. W. M. Carne, Botanist, Department of Agriculture, Perth, it is possible he may be able to send you some.

PIG RAISING.

Replies selected from the outgoing mail of the Instructor in Pig Raising, Mr. E. J. Shelton.

Treatment for Ailing Sow.

C.K. (Maleny)—

With regard to the sow which has been off colour for some time, we would suggest reducing the amount of maizemeal given to this animal and increasing the amount of green food, at the same time allowing her as much liberty as possible, so that she can spend her time grazing over succulent pasture and, in this way, picking up portion of her living. We would suggest doses of Epsom salts—two ounce packets given in the morning fed for a day or two. This would freshen her up a good deal and be productive of some good. She should also have plenty of clean drinking water, some charcoal, and some bonemeal. (See reply to K.H.)

A Suffering Sow.

V.E.K. (Tallegalla)—

From your details the sow is suffering from paralysis of the hindquarters, due probably to impaction of the bowels. This form of paralysis is rather common, especially in dry times when there is a scarcity of laxative foods, such as greenstuff or skim milk. Continual feeding on dry food will cause constipation in pigs, and the constipation may be the indirect cause of boils; it also may affect the nervous system of the hindquarters, causing partial paralysis. Treatment.—Keep the sow in a dry, warm shed, with plenty of dry bedding. Feed her a sloppy diet containing skim milk, pollard, and a little maize, and as much succulent greenstuff as she will eat, preferably lucerne. A dose of castor oil, one-third cupfull mixed with a small feed when she is hungry, would be very helpful. It may also be helpful to massage the hind parts from the loin down to the tail with turpentine and oil and plenty of rubbing. With careful treatment the sow should recover, but it would not be advisable to keep her as a breeder.

Lice-infested Pigs.

K.H. (Monto)—

Make up a mixture of half a pint of benzine, half a pint of kerosene, and seven pints of fish oil, crude oil, or old motor oil, and apply this to the pigs by means of a soft cloth attached to an ordinary household broom. If the oil was placed in a kerosene tin and the cloth dipped therein, you could use this mixture easily, although it would pay to give the animals individual attention, for there are places like the inside of the ears and round about the neck to which it is not easy to apply the oil in any other way than by hand. We do not think that it is payable to dip pigs in the same way as cattle, for they are hard to handle, and there is much risk associated with forcing them through a dip. It is much more convenient to treat them by hand, and takes considerably less time. Rubbing posts are also well worth trial. Good stout posts should be erected in the paddocks where the pigs are kept, and around these posts should be wrapped strong cornsacks, kept in position by a cord. The sacks should be saturated with oil occasionally. You will find that the pigs very soon learn to rub against this, and in this way they oil themselves.

Arrowroot, "Sweet Bucks," and Artichokes for Pigs.

INQUIRER (Toowoomba)—

The bulbs of the arrowroot plant have value as pig food. We prefer that these bulbs should be washed, cleaned, and thoroughly cooked, before being used as a food for pigs, particularly for very young stock, and in each instance it is preferable to use them in conjunction with skim milk and grain, like barley or maize, and green food.

From Mr. Brünnich's Bulletin on Stock Foods, and which has been posted to you, you will note the advice given on the use of various foods. The Agricultural Chemist stresses the importance of balancing the rations, more especially for young and fattening pigs, which do not usually have the advantage of green food in addition to their grain and other foods.

It is difficult to make a comparison between the actual feeding value of raw arrowroot bulbs and raw sweet potatoes, for the latter are more palatable to pigs (young stock particularly) than the former.

Both of these root crops have actually a better feeding value when boiled or steamed than when fed raw, this for the reason that the cooking renders them more appetising and the pigs consume more than they would if fed in the raw or uncooked state.

Argument as to whether it pays better to cook food for pigs than to feed it raw is a very old one. Even experimental tests have not demonstrated that it pays generally to cook all the food fed to swine.

The jelly-like substance resulting when boiled arrowroot bulbs and sweet potatoes are cooked is not harmful to pigs, provided they are given other foods in addition to the cooked roots.

Of course, from a paddock standpoint, the arrowroot lends itself well to hurdling off, particularly where a deep furrow is run out or the soil opened up close to the bulbs, so as to allow the pigs to work into the stool of roots from one side, but this system of feeding is not advocated for very young pigs, for the bulbs are somewhat tough, and the young pig would not eat

sufficient to maintain the required growth. Breeding sows and boars, in particular, would benefit by a system of feeding in this way.

Jerusalem artichokes are recommended for pig-feeding on the paddock system. Yields of from 6 to 8 tons an acre may be expected in normal seasons, though on soils specially suited to this crop, much heavier yields may be obtained. The artichoke plant grows from 6 to 8 feet high, is of a sunflower type, with a profuse crop of miniature sunflower-like blooms. The special advantage of this crop is that one well established in good ground, careful cultivation and feeding off will result in a continuance of growth over several years. The roots are ready for use when the plant dies as winter approaches. The tubers left in the ground shoot again when spring returns, and all that is necessary is to plough and harrow the ground and put it into good condition for the future growth of the crop. In this way a crop of artichokes may be maintained for eight or nine years.

It may, of course, be necessary to replant areas that are eaten out and in this way provide for a sufficient number of plants on the area fenced off. It is preferable to let the pigs do their own harvesting when feeding off artichokes and, for this purpose, the crop should be hurdled or fenced off in suitable areas. A portable shelter shed and a water trough are also necessary, while it is equally necessary to balance the ration with nitrogenous crops, such as lucerne and other green foods, and with skim milk.

Ordinary swede turnips are not of the same value for pig-feeding purposes as they are for sheep, although they can be used. It would appear that it would pay handsomely for farmers to have small areas of arrowroot, artichokes and sweet potatoes, for all these crops are available during the winter months, when other foods are in short supply. They are all readily cultivated, and in normal seasons provide heavy yields of very succulent food.

TO PROTECT STORED GRAIN FROM RATS AND MICE.

The Minister for Agriculture and Stock, Mr. W. Forgan Smith, announced recently that mice and rodents have from time to time caused considerable damage to the cereal crops harvested in Queensland, and this department had occasionally been called upon for advice as to an efficacious means to check the damage to grain occasioned by these pests. In many cases the damage has been fairly considerable, and, in addition to the loss of grain actually consumed, a considerable quantity of grain is gnawed and the quality generally is depreciated. In the case of wheat which is stored in bags, the mice make holes in the bags and considerable quantities of wheat run from the bags and become deposited on the floor of the shed or on the ground beneath the stack. The wheat which is taken from the bags causes the stacks to collapse and renders it difficult to protect the stacks against the weather.

There are two ways in which stored grain may be protected against the depredations of vermin. One is to occasionally fumigate with charcoal fumes, and the other is the use of cyanogas (calcium cyanide). The use of cyanogas is comparatively simple and safe, and the residue left after the poisonous gas has been evolved is quite harmless, being nothing more or less than pure lime. The fumigation with calcium cyanide, which gives off slowly hydrocyanic acid gas, is a practical method of destroying both rats and mice in the grain shed or the wheat stack. The poisonous gas, although deadly to animal and insect life, is not absorbed to any extent by the wheat grain. **Naturally, every precaution must be taken that human beings do not come within the range of the calcium cyanide while poisonous gas fumes are being emitted from it.**

For a number of years past the control of mice and rats has attracted the attention of scientists, and in 1906 a preparation known as Dr. Danysz bacillus was tested in this State, but, unfortunately, the results did not prove satisfactory in the extermination of the vermin. About the same time a proprietary preparation, which was sold under the trade name of "Ozoa," was experimented with, and the results in this case were also unsatisfactory.

There is, of course, necessity that in the introduction of organism causing disease to mice and rats, every precaution must be taken that the disease cannot possibly be contracted by humans or domestic animals.

From time to time reference has been made in the "Queensland Agricultural Journal"* to the means by which rodents and mice might be kept in subjection.

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* "Q.A.J.," vols. for 1915, 1917, and 1925.

General Notes.

Staff Changes and Appointments.

Constable H. A. Daly, of Tolga, has been appointed Inspector of Slaughter-houses.

Mr. H. F. Sibley, Inspector of Slaughter-houses, Charters Towers, has been appointed also Officer under and for the purposes of the Animals and Birds Acts.

Mr. E. P. Colyer, of Kooroocenah, Lowmead, has been appointed Officer under and for the purposes of "*The Animals and Birds Acts*, 1921 *to* 1924."

Messrs. F. Dobson, A. J. Marks, and A. C. Randley, of Cedar Creek, Dayboro, have been appointed Honorary Inspectors under the Diseases in Plants Acts, and Mr. W. B. Christie, of Cooran, has been appointed Temporary Inspector under those Acts.

Mr. H. J. D. McBean, Stock Inspector, Pittsworth, has been appointed also Inspector of Brands.

Additional Sanctuaries.

Talgi Holding, near Capella, and the property of Mr. E. P. Colyer, Kooroocenah, Lowmead, have been declared sanctuaries for animals and birds.

Quality of Queensland Cheese.

A consignment of sixty-four crates of Queensland cheese, specially made for exhibition at the Nottingham Show, aroused great interest in Tooley street. As space had not been reserved in advance, the cheese could not be shown in Nottingham, and as an alternative it was opened in Tooley street. The trade declared that the cheese was the best ever received from Australia, and it has almost all been sold at prices averaging more than the current rates for New Zealand cheese.

Dairy Quality of Friesians.

Figures are coming to hand regarding the production of the herds under the past year's Government test in Victoria. One Friesian herd in which there are six mature cows and eleven heifers shows the excellent average of over 1,200 gallons of milk and 431 lb. of butter-fat a head for their 273 days' test. This herd is in a district where there is no irrigation, and which experienced the dry weather conditions which so seriously affected the grazing over most of Victoria during the past year. Their fine average is thus another proof of the all-round dairy quality of Friesians, and their reliability for dairying under any seasonal conditions. Among this herd of seventeen head there were three mature cows which gave 630 lb., 634 lb., and 636 lb. of butter-fat respectively in their 273 days' test. Another mature cow gave 584 lb. of butter-fat in her term, while a junior three-year-old heifer gave 521 lb. of butter-fat, and a junior two-year-old gave 545 lb. of butter-fat respectively in their nine months' test. The ten best cows and heifers in the herd actually show a return of 1,470 gallons of milk and 527 lb. of butter-fat a head for their 273 days' test.

A Plant Cane Precaution.

In connection with the clean seed nurseries for sugar-cane which have been established in the Atherton district, it is desired that no plants should leave that area except by a special permit of an inspector under the Diseases in Plants Acts. In order to give effect to this desire, a Proclamation has been issued, declaring that the removal of any plant or part of any plant of sugar-cane to be used for the purpose of planting will be permitted only under the authority, terms, and conditions contained in a permit issued by an inspector under the Acts.

Pastoral Supplies.

The comprehensive display of fencing wire, groceries, wireless, and station supplies exhibited by the Queensland Pastoral Supplies, Limited, was awarded first order of merit at the Brisbane Show. Their exhibit gave the visitors a very good idea of the many lines that this firm carry, and how adequately they cater for the man on the land. They sell direct to the producer at wholesale rates, a policy which is becoming more appreciated every year. One of their latest lines is the "Pifco" Incandescent Kerosene Lamps. They also had on view the "Astor" Five-valve Neutrodyne set. The "Trafalgar" cold safe, another line in great demand in the country, was also on view. The length of wire sold annually by this firm would encircle Australia many times.

Animal Nutrition—Departmental Investigation.

The Minister for Agriculture and Stock (Mr. W. Forgan Smith) has arranged for the Agricultural Chemist, Mr. J. C. Brünnich, and the Instructor in Sheep and Wool, Mr. J. Carew, to visit some of the pastoral districts for the purpose of making special inquiries into nutrition matters.

Messrs. Brünnich and Carew will be at Charters Towers from the 7th to the 12th September, at Hughenden from the 12th to the 17th, at Winton from the 17th to the 22nd, at Longreach from the 22nd to the 27th, at Emerald from the 27th September to the 2nd October, at Springsure from the 2nd to the 6th October. While in these districts, both officers will visit as many stations as possible, and at the conclusion of their inquiries will deliver addresses to interested pastoralists.

Fruit Trees and White Ant Attack.

When cleaning land for orchards or vineyards great care should be exercised to remove all stumps and roots from the ground. Any white ants' nests in the vicinity should be destroyed. When trees become infested, cut out the damaged wood if possible. Avoid scarring the trees near the base as these scars are likely to induce white ant attack. Dead or dying infested trees should be removed and burnt. Where the roots are attacked the use of paradichloro-benzine or some other fumigant is suggested. This will destroy the white ants attacking the roots and in the adjacent soil, and will act for a time as a preventive.

To apply the paradichlor, dig a circular trench 3 to 4 inches deep at a distance of 6 inches from the trunk of the tree, and scatter 2 oz. of the fumigant on the bottom of this, afterwards filling in with soil. The fumigant is more active when the soil is warm than when it is cold, and is not effective when the soil is saturated with water. For young trees a dose of 1 oz. is sufficient. If necessary the treatment should be repeated.

The Way of Scientific Achievements.

"Rontgen, examining his vacuum glow, did not foresee that he was to revolutionise surgical operations. But it is just the clear vision of one step which means progress—whither we know not, but nevertheless progress. Whilst many are flinging themselves blindly against the wall of mystery, here and there a leader can discern places where the wall is yielding, where attack can force an aperture. The light does not penetrate the aperture; it is sufficient if it illuminates the stone that has next to be loosened. We cannot ask more of a scientific leader than that his vision shall suffice for the next step. In the country of the blind the one-eyed man is king."—Professor A. Stanley Eddington, D.Sc., LL.D., F.R.S.

The Dairy Farmers' Decalogue.

1. Thou shalt use a registered bred-for-production sire of thy breed.

2. Thou shalt join a milk-recording association and keep records on the individual cows in thy herd.

3. Thou salt cull thy herd, for it is written that she that produceth not shall be cast out.

4. Thou shalt replenish thy herd with the heifers raised from thy best cows and thy purebred sire.

5. Thou shalt feed the individual members of thy herd according to their producing ability, for, to her that giveth shall be given, and from her that giveth not shall be taken away.

6. Thou shalt provide them with an abundance of such grains as are necessary to balance thy home-grown foods.

7. Thou shalt at all times provide thy cows with pure water that they may quench their thirst.

8. Thou shalt not condemn thy bull to die unless thou hast proven his daughters, for cursed is he who slays the sire of high producers.

9. Thou shalt not waste feed by exposing thy cows to the storms of winter, but shall keep them in clean, comfortable quarters.

10. Thou shalt not caress thy cow with the milking stool lest she smite thee with her hind foot and fail to give thee her full flow.

All these commandments shalt thou keep; for he that keepeth them not shall not enter into the promised land nor attain the goal of prosperity.—"The Cow Bell," Edmonton, Alberta (Canada).

Humus—How it Increases Fertility.

The presence of humus in the soil increases fertility in a number of ways. In the first place, it absorbs and retains moisture in the soil, and prevents surface evaporation. A surface soil fairly rich in humus exercises much the same influence on the underlying soil as does a mulch of dead leaves or other vegetable matter. During dry spells, and under the influence of hot winds usually prevalent under such conditions, the loss of moisture from the soil under surface evaporation is enormous, and in soils destitute of humus this loss is so rapid as to result in the drying up of the soil and the wilting of the crops. The final result of such conditions is the formation of scalded spots and the complete removal of the fine surface soil in the form of dust.

The humus in the soil is the ingredient which is most subject to alteration and destruction, and under dry conditions it is more or less rapidly destroyed. As soon as it has lost its moisture and become dry, it is rapidly burnt out by the combined action of sun and air. So that it is exactly in those circumstances where its presence is most essential that it is most liable to destruction, and the necessity for renewing it is most urgent.

The presence of humus in the soil also tends to improve the texture of the soil, lightening it and loosening it, and preventing compaction of the surface. It is thus of special value in the amelioration of stiff soils.

It is the principal source of nitrogen in the soil, and by its decay under the influence of soil organisms, ammonium salts and nitrates are produced, which are the forms in which this important element is assimilated by the plant. It is of interest to remember that the humus of arid or semi-arid regions is richer in nitrogen than that of the moister districts. This is a point of great importance with reference to the potential fertility of these soils. In point of fact, from a variety of causes acting together, the soils of the dry climates are richer in plant-food of all kinds than are the soils in regions of greater rainfall, consequently nothing but the absence of water prevents these from being extremely reproductive. There is, therefore, no problem which exceeds in importance that of retaining in the soil the little moisture that it receives, and any operation that succeeds in arresting, even partially, the loss of that moisture deserves the most careful consideration.

"World's Most Efficient Cow."

It was recently stated that a Canadian Ayrshire cow was the "World's Most Efficient Cow" by reason of her production of 87,843 lb. milk in five years. This record, a very fine one, has time and again been beaten by Friesian cows. An Otago (New Zealand) Friesian, Burkeyje Sylvia Posch, produced 200,000 lb. milk in eleven and a-quarter years continuous milking. Rosevale Burkeyje Sylvia, a daughter of Burkeyje Sylvia Posch, has completed seven first-class Certificates of Record, with an average production of 632.56 lb. fat, and she is now eighty-three days on with her eighth test. Her total production to the end of January, 1928, is 122,528 lb. milk and 4,623.99 lb. butter-fat. The cow will be eleven years old next July.

Monavale Queen Bess, a Taranaki Friesian cow, now eight years old, has four first-class Certificates of Record, with a total production of 94,170.2 lb. milk and 3,493.78 lb. fat.

Grahamholm Colantha Segis Maid, Minnesota, U.S.A., holds a record for production of 100,458.9 lb. milk and 3,070.13 lb. fat in three years.

Adirondac Wietske Dairy Maid has Records of Production for four years, totalling 129,409.6 lb. milk and 4,192.55 lb. fat, or an average yearly production of 32,349.9 lb. milk and 1,048.13 lb. fat.

Clara Findley Second, a British Friesian, produced 98,240 lb. milk in four and a-half years (four lactation periods) and 3,261 lb. fat.

Oamaston Jenny, another British Friesian, is the first cow in Britain to complete five consecutive 20,000 lb. of milk annually. She is just ten years old, and her total yield to date is 136,780 lb. of milk.

No. 2A.—Dam under test yielded 301 lb. fat in 213 days, whilst her daughter, by a Friesian sire (not Topsy Prince), yielded 223 lb. fat in 259 days.

Systematic testing and the correct interpretation of figures alone enable a farmer to breed progressively. It is only too evident that one particular sire has produced daughters that are definitely superior to their dams, whilst the daughters of two other sires were just as definitely inferior to their dams.

The above evidence only goes to show that dairying without testing is utterly unsatisfactory, and that it is probably responsible for the poor circumstances in which many dairymen find themselves.

The Home and the Garden.

KITCHEN GARDEN.

Our notes for this month will not vary much from those for September. Sowings may be made of most vegetables. We would not, however, advise the sowing of cauliflowers, as the hot season fast approaching will have a bad effect on their flowering. French beans, including butter beans, may be sown in all parts of the State. Lima and Madagascar beans should also be sown. Sow the dwarf Lima beans in rows 3 feet apart with 18 inches between the plants. The kitchen garden should be deeply dug, and the soil reduced to a fine tilth. Give the plants plenty of room, both in sowing and transplanting, otherwise the plants will be drawn and worthless. Thin out melon and cucumber plants. Spraying for fungoid diseases should be attended to, particularly all members of the *Cucurbitaceæ* and *Solanum* families, of which melons and tomatoes are representative examples. Give plenty of water and mulch tomatoes planted out last month. Asparagus beds will require plentiful watering and a good top-dressing of short manure. See our instructions in "Market Gardening," obtainable on application to the Under Secretary, Department of Agriculture and Stock. Rosella seeds may be sown this month. No farm should be without rosellas. They are easily grown, they bear heavily, they make an excellent preserve, and are infinitely preferable to the mulberry for puddings. The bark supplies a splendid tough fibre for trying up plants. The fruit also makes a delicious wine.

FLOWER GARDEN.

The flower garden will now be showing the result of the care bestowed upon it during the past two months. The principal work to be done this month is the raking and stirring of the beds, staking, shading, and watering. Annuals may be sown as directed for last month. Plant tuberose, crinum, ismene, amaryllis, pancratium, hermocallis, hippeastrum, dahlias, &c. Water seedlings well after planting, and shade for a few days. Roses should now be in full bloom. Keep free from aphis, and cut off all spent flowers. Get the lawn-mower out and keep the grass down. Hoe the borders well, and trim the grass edges.

Orchard Notes for October.

THE COASTAL DISTRICTS.

October is frequently a dry month over the greater part of Queensland, consequently the advice that has been given in the notes for August and September regarding the necessity of thorough cultivation to retain moisture is again emphasised, as, unless there is an adequate supply of moisture in the soil to meet the trees' requirements, the coming season's crop will be jeopardised, as the young fruit will fail to set.

Thorough cultivation of all orchards, vineyards, and plantations is therefore imperative if the weather is dry, as the soil must be kept in a state of perfect tilth, and no weeds of any kind must be allowed to grow, as they only act as pumps to draw out the moisture from the soil that is required by the trees or fruit-yielding plants. Should the trees show the slightest sign of the want of moisture, they should be given a thorough irrigation if there is any available means of doing so, as it is unwise to allow any fruit trees to suffer for want of water if there is a possibility of their being supplied with same. Intermittent growth, resulting from the tree or plant being well supplied with moisture at one time and starved at another, results in serious damage, as the vitality is lessened and the tree or plant is not so well able to ward off disease. A strong, healthy, vigorous tree is frequently able to resist disease, whereas when it has become debilitated through neglect, lack of moisture or plant food, it becomes an easy prey to many pests. If an irrigation is given, see that it is a good one and that the ground is soaked; a mere surface watering is often more or less injurious, as it is apt to encourage a false growth which will not last, and also to bring the feeding roots to the surface, where they are not required, as they only die out with a dry spell and are in the way of cultivation.

Irrigation should always be followed by cultivation, so as to prevent surface evaporation and thus retain the moisture in the soil.

All newly planted trees should be carefully attended to, and if they show the slightest sign of scale insects or other pests they should receive attention at once. All growth not necessary to form the future tree should be removed, such as any growths on the main stem or main branches that are not required, as if this is done now it will not only save work later on, but will tend to throw the whole strength of the tree into the production of those limbs that will form the permanent framework of the tree. In older trees all water sprouts or other similar unnecessary growths should be removed.

Keep a good lookout for scales hatching out, and treat them before they have become firmly established and are coated with their protective covering, as they are very easily killed in their early stages, and consequently much weaker sprays can be used. The best remedies to use for young scales hatching out are those that kill the insects by coming in contact with them, such as miscible oils, which can be applied at a strength of 1 part of oil in 40 parts of spraying material and will do more good than a winter spray of double the strength. In the use of miscible oils or kerosene emulsion, always follow the directions given for the use of these spraying materials, and never apply them to evergreen trees when they are showing signs of distress resulting from a lack of moisture in the soil, as they are then likely to injure the tree, whereas if the tree is in vigorous growth they will do no harm whatever.

All leaf-eating insects should be kept in check by the use of an arsenate of lead spray, taking care to apply it as soon as the damage appears, and not to wait till the crop is ruined. Crops, such as all kinds of cucurbitious plants, tomatoes, and potatoes are often seriously injured by these insects, and the loss occasioned thereby can be prevented by spraying in time. In the case of tomatoes and potatoes, a combined spray of Bordeaux or Burgundy mixture and arsenate of lead should be used, as it will serve the dual purpose of destroying leaf-eating insects and of protecting the plants from the attack of Irish blight.

Grape vines require careful attention, and, if not already sprayed with Bordeaux mixture, no time should be lost in applying this material, as the only reliable method of checking such disease as anthracnose or black spot and downy mildew is to protect the wood and foliage from the attack of these diseases by providing a spray covering that will destroy any spores that may come in contact with them. The planting of bananas and pineapples can be continued during this month. See that the land is properly prepared and that good healthy suckers only are used. Keep the plantations well worked, and allow no weed growth. Keep a very careful lookout for fruit flies; destroy every mature insect you can, and gather and destroy every fallen fruit. If this is done systematically by all growers early in the season the subsequent crop of flies will be very materially decreased. See that all fruit sent to market during the month is carefully handled, properly graded, and well packed—not topped, but that the sample right through the case or lot is the same as that of the exposed surface.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

Much of the matter contained under the heading of "The Coast Districts" applies equally to these parts of the State, as on the spring treatment that the orchard and vineyard receives the succeeding crop of fruit is very largely dependent. All orchards and vineyards must be kept in a state of perfect tilth, and no weed growth of any kind should be allowed. In the Western districts, irrigation should be given whenever necessary, but growers should not depend on irrigation alone, but should combine it with the thorough cultivation of the land so as to form and keep a fine soil mulch that will prevent surface evaporation.

All newly planted trees should be carefully looked after and only permitted to grow the branches required to form the future tree. All others should be removed as soon as they make their appearance. If there is any sign of woolly aphis, peach aphis, or scale insects, or of any fungus diseases on the young trees, these diseases should be dealt with at once by the use of such remedies as black leaf forty, Bordeaux mixture, or a weak oil emulsion. In older trees, similar pests should be systematically fought, as if kept in check at the beginning of the season the crop of fruit will not suffer to any appreciable extent. Where brown rot has been present in previous years, two or more sprayings with Bordeaux mixture can be tried, as they will tend to check other fungus growths, but at the same time the sodium or potassium sulphide sprays are more effectual for this particular disease and should be

used in preference when the fruit is nearly full grown. All pear, apple, and quince trees should be sprayed with arsenate of lead—first when the blossom is falling, and at intervals of about three weeks. Spraying for codlin moth is compulsory in the fruit district of Stanthorpe, and wherever pomaceous fruit are grown it must be attended to if this insect is to be kept in check.

In the warmer parts a careful check should be kept for any appearance of the fruit fly, and, should it be found, every effort should be made to trap the mature insect and to gather and destroy any affected fruit. If this is done, there is a good chance of saving the earlier ripening summer fruits, if not the bulk of the crop. Tomato and potato crops will require spraying with Bordeaux mixture, as also will grape vines. Keep a very strict watch on all grape vines, and, if they have not already been treated, don't delay a day in spraying if any sign of an oil spot, the first indication of downy mildew, appears on the top surface of the leaf. Spraying with Bordeaux mixture at once, and following the first spraying up with subsequent sprayings, if necessary, will save the crop, but if this is not done and the season is favourable for the development of the particular fungus causing this disease, growers can rest assured that their grape crop won't take long to harvest.

Where new vineyards have been planted, spraying is also very necessary, as if this is not done the young leaves and growth are apt to be so badly affected that the plant dies.

Farm Notes for October.

FIELD.—With the advent of warmer weather and the consequent increase in the soil temperature, weeds will make great headway if not checked; therefore our advice for last month holds good with even greater force for the coming month. Earth up any crops which may require it, and keep the soil loose among them. Sow maize, cowpeas, sorghums, millet, paniculms, pumpkins, melons, cucumbers, marrows. Plant sweet potatoes, yams, peanuts, arrowroot, turmeric, chicory, and ginger. Coffee plants may be planted out. There are voluminous articles in previous journals giving full instructions how to manage coffee plants, from preparing the ground to harvesting the crop, to which our readers are referred.

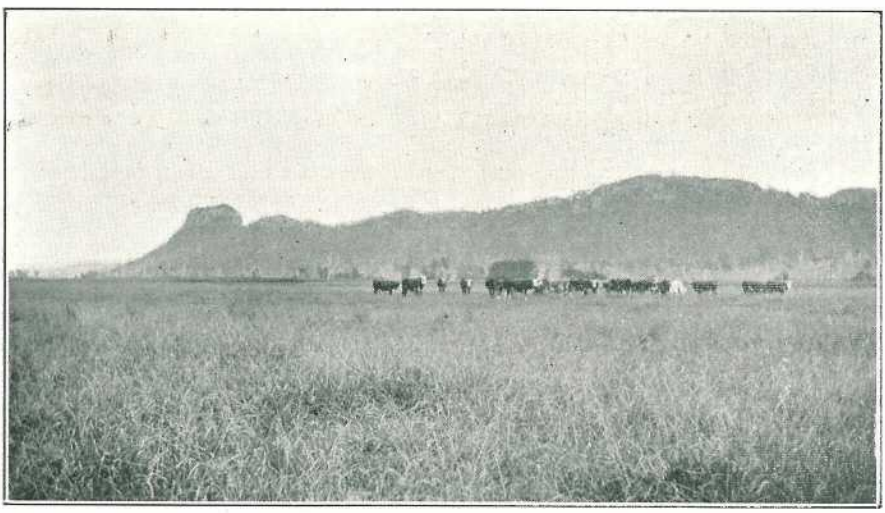

Photo.: Miss J. Easton.]

PLATE 82.—RICH PASTURES SHADOWED BY MINTO CRAIG ON COOCHIN COOCHIN.

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.

	September, 1928.		October, 1928.		MOONRISE. Sept., 1928.	Oct., 1928.
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6.7	5.36	5.34	5.50	6.45	7.42
2	6.6	5.37	5.33	5.51	7.46	7.42
3	6.5	5.37	5.32	5.52	8.49	8.49
4	6.4	5.38	5.31	5.52	9 54	9.58
5	6.2	5.38	5.29	5 53	10.59	11.5
					a.m.	a.m.
6	6.1	5 39	5.28	5 53	...	12.10
7	6.0	5.40	5.27	5.54	12.8	1.11
8	5.59	5.40	5 25	5.54	1.24	2.6
9	5.58	5.41	5 24	5.55	2 26	2 50
10	5.57	5.41	5.23	5 55	3,24	3.30
11	5.56	5.42	5 22	5.55	4·6	4.4
12	5 54	5.43	5 22	5 56	4 47	4.36
13	5.53	5.43	5.21	5 56	5 29	5.6
14	5.52	5.44	5 20	5.57	6.3	5.36
15	5 51	5.44	5.19	5.57	6.35	6.7
16	5.50	5.45	5.18	5.58	7.5	6.37
17	5.48	5.45	5 17	5.59	7.35	7.11
18	5.47	5.46	5.16	5.59	8.5	7.50
19	5.46	5.46	5 14	6.0	8.39	8 35
20	5.45	5.46	5.13	6 1	9.14	9.23
21	5.44	5.47	5.12	6.1	9.54	10.14
22	5.43	5.47	5.11	6.2	10.40	11.5
						p.m.
23	5.42	5.47	5.10	6.2	11.30	12.5
24	5.41	5.47	5.9	6.3	12.23	1.6
					p.m.	
25	5.40	5.48	5.8	6.4	1.20	2.8
26	5.38	5.48	5.7	6.4	2.23	3.11
27	5.37	5.48	5.7	6.5	3.25	4.13
28	5.36	5.49	5.6	6.6	4.28	5.19
29	5.35	5.49	5.5	6.6	5.30	6.28
30	5.34	5.50	5.4	6.7	6.35	7 39
31	...	...	5·4	6.8	...	8.51

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.

Phases of the Moon, Occultations, &c.

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

7 Sept.	☽	Last Quarter	8 35 a.m.
14 ,,	●	New Moon	11 21 p.m.
22 ,,	☾	First Quarter	12 58 p.m.
30 ,,	○	Full Moon	10 42 p m.

Perigee, 5th September, at 3.18 a.m.

Apogee, 12th September, at midday.

The occultation of Tan Tauri, magnitude 4·3, will occur at Brisbane, Toowoomba, and Warwick about 3·30 a.m. on the 7th, but about half-an-hour earlier in North Queensland. The reappearance of the star near the southern edge of the Moon will occur in Southern Queensland within about ten minutes of its disappearance, but in the north the time will be extended by as much as an hour.

The planets Mercury and Venus will be in apparent juxtaposition on the 10th, also on the 9th and the 11th, but to a somewhat less extent. They will be seen in the western sky about half-an-hour or more after sunset: but both planets, being on the far side of their orbits, will not be seen to the best advantage, neither planet being near its maximum brightness.

Phi Orphinci will be occulted at Rockhampton and throughout Northern Queensland on the 21st—at Rockhampton at about 7·45 p.m., and the star will reappear between four and five minutes later. At Cairns the occultation will take place about eighteen minutes earlier, and reappear proportionately later.

Psi Sagitarii, magnitude 4·8, will be occulted on the 23rd, about 10·25 p.m., at places in Southern Queensland, and about a quarter of an hour later at Rockhampton, while at Cairns the occultation will be very slight, if visible at all, a few minutes before 11 o'clock.

The Sun will set at the nearest point to due west on the 23rd, and rise at the nearest point to due east on the 24th. If these points are carefully noted they will be of value.

Mercury will be at its greatest elongation, 23 degrees east of the Sun on the 29th, when it will not set until one hour fifty-eight minutes after the Sun.

6 Oct.	☽	Last Quarter	3 6 p.m.
14 ,,	●	New Moon	1 56 a.m.
22 ,,	☾	First Quarter	7 6 a.m.
29 ,,	○	Full Moon	8 4 a.m.

Perigee, 2nd October, at 8 0 a.m.
Apogee, 18th October, at 6 6 a.m.
Perigee, 30th October, at 11 54 a.m.

The occultation of the giant planet Jupiter by the Moon will take place about 3.20 a.m. on October 2nd at Warwick and Toowoomba, near the western horizon, and will be best seen with binoculars or telescope on account of the brightness of the full Moon. It will also be occulted soon after 8 a.m. on the 29th when both are below the western horizon.

A small star in Taurus will be occulted by the Moon on the night of the 3rd, about 43 minutes after midnight at Maryborough, but at Gympie the star will probably be only just grazing the southern edge of the Moon.