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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment.

The Current Issue.

A notable feature of this issue is a valuable contribution, which has also been published in pamphlet form, on Stock Foods, by Mr. Brünnich. The Royal National Show at Brisbane is well covered, and departmental activities in relation thereto are excellently illustrated and comprehensively reviewed. Mr. Shelton discusses the exhibit and awards in the Pig Section. An award list in detail, which is of particular interest to farmers, has been held over on account of pressure on space for the October issue. Included among selected matter is an article on Meteorology in Agriculture, which is of particular interest at the present time. In addition, usual Journal features are well presented.

The Brisbane Exhibition.

The Royal National Association demonstrated fully its mission as an educative force at its Annual August Show, which was a pretty fair indication of our agricultural health and rural wealth. Ring entries were well up to the standard attained in former years, and were a good guide as to the progress we have made in the industries from which Queensland draws its life-blood. The animals paraded must surely leave their impress on Queensland's flocks and herds; they provided convincing evidence of the advance we have made in scientific stock-breeding. Few onlookers realise the years of patient effort by breeders that enables them to present such fine stock types for judgment. The prize-winning stock on parade—particularly the numbers and quality of those in the Dairy Division—made a most impressive sight. The Royal National Society is doing great work for the State, and in the variety, quality, and number of exhibits this year's show was one of its greatest successes.

Agriculture in Queensland—The Year's Review.

Agriculture in Queensland during the year ended 30th June last is exhaustively reviewed in the annual report of the Department of Agriculture and Stock. The report deals with several departments of production, and stresses the fact that the year generally was marked by abnormal dryness. The price paid for last season's wheat, just over 6s. a bushel, had induced the preparation this year of a larger acreage. It was expected that the area cropped would constitute a record. Since sowing, however, the rainfall in the wheat belt had not been heavy enough to promote a satisfactory general germination, and in some localities heavy frosts proved a retarding factor. Good general soaking rains were needed to establish the crop and ensure a satisfactory harvest.

The 1925 wheat crop returned in the aggregate, omitting grain retained for seed and farm feed, 1,799,263 bushels. Yields were irregular in some districts, notably in Maranoa and Inglewood. In some instances on the heavier soils, through ineffective germination, an odd failure was reported. On the Darling Downs, where most of the wheat was produced, the average yield was reduced by insufficient rain and late frosts.

Progress in the Sugar Industry.

The sugar industry in Queensland had made enormous progress in recent years, the report continued, and last year the highest yield of sugar was produced—viz., 485,585 tons of 94 net titre. The tonnage of cane grown was 3,668,252. This was largely due to the remarkable expansion which took place in the growing of sugar during the past five years, combined with a particularly good season in 1925. The area under cane last year was approximately 268,500 acres, which carried over 6,000 growers. Of this great area about 180,000 acres were crushed. The number of acres returned for 1925 as being under cane had increased by over 100,000 acres since 1921. The average and approximate yield of cane was high—viz., 20.38—while the yield of sugar was the best on record, being in the region of 2.70 tons per acre, the highest yield so far in the history of cane-growing in Queensland.

Favourable Market for Maize.

An extraordinary demand for grain for feeding stock in dry areas concurrently with a reduction in yield of the 1925-26 crop created a very favourable market for maize. Most of the big maize-producing provinces suffered from rain deficiency, and yields were much below normal. Light crops resulted from early plantings, but the main crop more or less failed. In contrast, the maize-growing tract on the Atherton Tableland enjoyed one of its best seasons, and more than 20,000 tons of good quality grain was the estimated yield.

Peanut Production.

Continuing, the report states that peanut production was becoming a staple and stabilised crop, particularly in the Kingaroy district. Last year, with the assistance of the Department, a shelling machine was installed by the Peanut Pool Board, whose base is at Kingaroy. Up till then the crop was marketed in the pod and, although the grower got some return, the profit went elsewhere. The fact that in 1924-25 only 691 acres were cropped for peanuts in the whole of the State, and that in the following year 3,000 acres were cropped in the Kingaroy district alone, showed how this minor industry had expanded. On present reports there is a probability this year of the area under peanuts in the South Burnett being extended to 10,000 acres.

The Dairying Industry—High Quality of Queensland Butter.

Favourable seasonal conditions governed the industry in the early part of the year, but the prevailing dry spell in the second half of the term was responsible for a diminution in production. Figures for the year show that 60,496,753 lb. of butter,

12,515,895 lb. of cheese, and 9,771,763 lb. of condensed milk were manufactured. First-grade butter attained a higher average quality and uniformity. The general high quality of Queensland butter was the subject of favourable comment and commendation of the experts appointed to judge the entries at the world's butter test in New Zealand. Second place in the test was gained by the Oakey District Co-operative Dairy Company, with only half a point lower than the winning competitor—a New Zealand company. An increase in the quantity of second-grade butter was attributable to unfavourable climatic conditions during the high-production period. The activities of the several commodity boards operating under the Primary Products Pools Acts had benefited the dairying industry very considerably. Marketing had been co-ordinated throughout the State, and a more orderly system evolved. The Paterson (Delroy) price stabilising scheme had had a beneficial influence on interstate markets. The adoption of an all-Australian brand for high-grade butter exports had also had an influence in enhancing oversea prices.

Progress in Pig-raising.

The year generally was not a good one for the pig-raiser. The growth of grain, green, and root crops was restricted by unfavourable meteorological conditions. Where the season was good, as at Atherton, marked progress was observed in the industry. Largely through the continuous efforts of the Department, a considerable improvement in the quality and condition of stock received at the curing and canning factories was noted, though there was still room for improvement.

Poultry Keeping.

The importance of poultry-raising was being more widely appreciated. Increasing annual export values indicated what was possible by a further development of oversea trade in poultry products. When eggs had been properly graded and packed, the experience of the trade had been encouraging. Practical interest in the industry was increasing, and many farmers were now including poultry-raising in the general range of their activities.

Cotton Yields and Cultural Methods.

The cotton industry had been affected by the abnormal dryness of the season. In consequence, the total yield for the whole State was below earlier seasonal estimates, and considerably below the 12,000-bale crop ginned last year. By 5th June only 5,147 bales, averaging 481 lb. each, had passed through the gins. Prospective later receivals indicated only a slight augmentation of this total. These figures, however, did not represent a lower yield per acre. Seed for a 40,000-acre planting was applied for, but it is doubtful if 25,000 acres reached maturity through inability to obtain a strike. Late-planted crops failed under the dry conditions. In several districts the yield per acre was from 800 lb. to 1,200 lb. of good-bodied, full 1⅛-in. cotton, and in a few cases as much as 1,500 lb. Returns like these demonstrate the drought-resistant capacity of the Upland type, and indicate that farmers in southern and central areas, where cotton can be grown profitably, should include planting of this crop in their farming plans. Cultural methods had shown a decided improvement. The remarkable results obtained last year by growers who applied methods of sound agricultural practice provided an excellent object-lesson in this connection. Standards generally had been improved, especially in the preparation of the seedbed. Gratifying results were reported from the Callide Cotton Research Station. A crop grown on new land, though planted late, yielded between 1,200 and 1,500 lb. of seed cotton of excellent quality per acre. Pure seed propagation work had continued along approved lines with satisfactory results. Satisfactory progress had been made also in progeny-breeding operations, and one strain has appeared of sufficient uniformity and of desirable characteristics as to warrant its increase. Further tests were in progress.

STOCK FOODS.

By J. C. BRÜNNICH.

The wealth of our State is based to a very large extent on the number of our live stock, and the welfare of the stock again depends entirely on the feeding, therefore the question **how, when, and what to feed** is of greatest importance to farmer and grazier.

All our wool, meat, hides, dairy produce, eggs, and the labour performed by horses and cattle are the result of feeding. All our live stock can be regarded as living factories producing from the feed consumed products useful to man.

As a large portion of our stock in Queensland is pasturing on natural herbage, the feeding, therefore, under normal conditions is more or less outside the province of agricultural science; but in times of scarcity, which periodically occur, hand feeding must be resorted to, and at such times it is of utmost importance to have some knowledge of the composition of various stock foods, which will have to be used in connection with poorer roughage to keep the stock in good condition.

It may be safely stated that at present, in the matter of feeding, local ideas are very elementary, or such mistakes would not be made as feeding starving sheep with chaffed sugar-cane, bought at an exorbitant price, considering that its food value is less than half that of poor bush hay, or a quarter of that of lucerne chaff. Professor Perkins drew attention to similar mistakes made in South Australia in 1914-15, when chaff was the most costly stock food on the market, and still it continued throughout to be most eagerly sought after, to the almost complete neglect of relatively cheaper concentrated foodstuffs.

Objects of Feeding.

The body of the young animal requires a sufficient amount of food to supply the materials necessary for its growth. But even during any part of the growing stage there is a continued breaking down and wearing out of all the tissues of the body, and this loss must be made up by the nutrients contained in the food to keep the animal in a normal healthy condition. Furthermore, food must be supplied to produce the energy for the carrying out of all voluntary and involuntary functions of the body. An animal working hard is using up a large amount of fat and muscle, but even an animal at rest requires food for the production of heat and other involuntary

functions of its body. Summarised the objects of feeding are as follows:—

(1) To maintain bodily heat;
(2) To repair waste tissues;
(3) To reproduce young;
(4) To form new tissues and organs;
(5) To perform muscular labour;
(6) To secrete various products;
(7) To lay up reserve stores.

Composition of Foods.

In order to get a clear insight in the art of feeding and carrying out of the objects above mentioned, we must understand the composition of the tissues that require building and renewing, and the composition of the foodstuffs available.

The composition of any stock food, analysed according to present conventional methods, is expressed as follows:—

Lucerne hay (in full flower) contains:

Moisture	10·0 per cent.
Crude protein	15·0 per cent.
Crude fat	2·8 per cent.
Carbohydrates or nitrogen free extract, by difference	33·2 per cent.
Crude fibre	31·0 per cent.
Ash	8·0 per cent.
	100·0 per cent.

Putting these results in another form, we find—

I. Moisture		10·0 per cent.
II. Dry matter		90·0 per cent.
(A.) Ash or mineral matter		8·0 per cent.
(B.) Organic matter 82·0 per cent.	Proteins	15·0 per cent.
	Fats	2·8 per cent.
	Carbohydrates	33·2 per cent.
	Fibre	31·0 per cent.

I. Moisture.—All foods contain a varying amount of water or moisture, even in apparently dry foods. In the animal body water constitutes about two-thirds of the body weight, and, as a rule, not sufficient water will be supplied by the food, and therefore an additional amount of water must be a separate part of the animal's food, and such water has to be of good quality.

The average amounts of moisture found in stock foods are as follows:—

Oil cakes, meat meals, &c.	6 to 10 per cent. moisture
Grains, seeds, and meals	10 to 15 per cent. moisture
Hay	8 to 12 per cent. moisture
Grasses, ensilage	65 to 83 per cent. moisture
Roots and tubers	70 to 90 per cent. moisture

Stock foods, which contain small amounts of moisture, always keep better than moist foods, and foods containing large amounts of water should be cheaper than dry foods.

II. Dry matter of a food is the solid matter left, after all the water has been driven off by artificial drying. The dry matter, on which the actual food value of a stock food depends, can be separated by burning or ashing into—

(*a*) Ash or mineral matter; and

(*b*) Organic matter.

(A.) **Ash or mineral matters** comprise about 5 per cent. of the bodyweight of an animal, and have most important functions to perform, as they enter into the formation of bones and teeth, of blood, and other fluids of the body, and direct and control various life processes. The importance of ash in stock foods influencing the welfare of stock has already been dealt with in previous papers ("Queensland Agricultural Journal," March and April, 1926). The ash of stock foods should contain sufficient amounts of lime, potash, and phosphoric acid, and smaller amounts of iron, magnesium, soda, sulphuric and hydrochloric acid, silica, and traces of hydrochloric acid and iodine.

As many of our stock foods are deficient in certain mineral matters, they may be supplemented by giving the animals licks.

Excess of mineral matters, as found for instance in immature mangels, and fodders grown on saline country, may cause trouble, just as an excess of salt in the drinking water may cause ill-health and even death of animals.

The amount of mineral in stock food varies with the stage of maturity, as some of the mineral matter is returned to the soil by the plants towards the end of the flowering and seeding stage of growth.

A liberal supply of mineral matter, more particularly lime and phosphoric acid, must be given to young growing animals, and at least double the amount of that actually required for the body should be supplied, as large amounts are wasted in the excreta. Mineral matters are also of the greatest importance to female animals during the periods of reproduction (gestation) and feeding their young (lactation).

A milch cow receiving a liberal ration of food which, however, was lacking in lime, continued during a test, lasting 110 days, to yield about 3 gallons of milk daily. The milk contained about $\frac{3}{4}$ oz. of lime, and a little over 1 oz. of lime was lost daily in the excreta and urine. During this trial the cow must have used up one quarter of the total amount of lime contained in her skeleton to make up for the lime deficiency in the food.

When making up rations the mineral matter of foods must be taken into consideration. All cereals and their by-products are low in lime. Legumes, like cloves, lucerne, cowpea, field peas, &c., contain high amounts of lime. The amount of phosphorus or phosphoric acid is low in straw, chaff, potatoes, and other root crops, whereas large amounts are found in cereals, bran, oil cakes, meat, and fish meals.

The amount of mineral matter found in stock foods will vary considerably according to the quality of soil on which they were grown.

During the years 1910 to 1914 a large number of ash analyses were made in connection with an investigation of the food value of various crops, and it is of interest to give a summary of the results of the analyses obtained, showing the variation of lime and phosphoric acid contents and the average amounts.

	100 LB. OF FODDER CONTAINS LB. OF—	
	Lime. CaO.	Phosphoric Acid P_2O_5.
Wheat straw	0·22 (0·16–0·25)	0·11 (0·06–0·20)
Wheat hay	0·25 (0·20–0·32)	0·39 (0·30–0·48)
Barley hay	0·45 (0·35–0·50)	0·56 (0·47–0·59)
Cowpea hay	2·30 (1·70–3·02)	0·50 (0·33–0·62)
Field pea hay	2·40	0·36
Lucerne hay	2·00 (1·65–2·47)	0·56 (0·48–0·78)
Mitchell grass hay	0·52 (0·35–0·84)	0·34 (0·18–0·50)
Rhodes grass hay	0·50 (0·27–0·70)	0·57 (0·27–0·96)
Paspalum hay	0·50 (0·16–1·01)	0·38 (0·17–0·72)
Prairie grass hay	0·55 (0·20–0·90)	0·51 (0·18–0·81)
Summer grass hay	0·21	0·76
Couch grass hay	0·80	0·63
Green sorghum	0·20 (0·09–0·31)	0·12 (0·07–0·16)
Pumpkins	0·03	0·15
Mangels	0·03	0·09
Carrots	0·11	0·18
Mixed pasture hay	0·45 (0·30–0·57)	0·41 (0·18–0·65)
Wheat, grain	0·06 (0·03–0·08)	0·86 (0·34–0·96)
Bran	0·09	3·00
Pollard	0·08	2·10
Maize	0·02 (0·01–0·07)	0·70 (0·60–0·86)
Cotton-seed meal	0·36	2·60
Linseed meal	0·50	1·70
Cocoanut oilcake	0·32	0·94
Sorghum ensilage	0·11	0·24

B. Organic matter is that portion of the food which burns when the material is strongly heated, and consists chiefly of compounds of carbon, hydrogen, and oxygen. These organic compounds were produced in the growing plants with the aid of sunlight from the carbonic acid in our atmosphere and water. The value of any stock food depends practically on the amounts and composition of this organic matter, which may be divided into **nitrogen-free compounds** and **nitrogenous compounds.** The latter in addition to the three elements mentioned contain nitrogen and small amounts of sulphur.

The actual composition of the organic matter is exceedingly complex, being formed of a very large number of organic compounds, but for practical purposes, food analysis divides them into the following classes:—(1) **Proteins,** (2) **Fats,** (3) **Carbohydrates** or as stated sometimes as **nitrogen-free extract,** and (4) **Fibre.**

(1) **Protein.**—The nitrogenous matters of the animal body, the major part being proteins, are found in the muscle, gelatinous parts of bones and tendons, brain, nerves, and other internal organs. Similarly in the stock foods the principal part of the nitrogenous material is protein. Various names have been in use, the compounds also being called proteids, albuminoids; but the name protein first proposed by Chittenden covers the whole class of these compounds. These compounds are some of the most complex organic compounds found in animals and plants, and contain carbon, 50·0-55·2 per cent.; oxygen, 19·0-24·0 per cent.; nitrogen, 15·0-17·6 per cent.; hydrogen, 6·5-7·3 per cent.; sulphur, 0·3-2·4 per cent.

In the conventional food analysis the total amount of nitrogen is determined, and the percentage of total nitrogen found is multiplied by 6.25, under the assumption that the proteins contain on an average 16 per cent. of nitrogen ($\frac{100}{16}$=6·25), and the result recorded as **crude protein.** This amount of crude protein will, naturally, include various other nitrogenous compounds, possessing all different feeding value, and in more complete analyses the **true protein,** the actual **flesh-forming nutrient** of foods is separately determined. Chief among the non-proteins are the **amides,** which are present to a greater or less extent in all foods, particularly in those of vegetable origin. The nutrient value of amides is similar to that of fat and carbohydrates. The value of protein is not restricted to the production of flesh, but in case of any surplus can be utilised for the production of heat and work, or building up of body fat. Fats and carbohydrates on the other hand cannot replace proteins.

In the past century, during the time Liebig did important investigations in agriculture, only one protein was supposed to exist, but subsequent investigation made by a large number of scientists proved the existence of a large number of proteins, which differ from each other with regard to the **amino-acids** they yield when digested. Feeding experiments have also proved that **several of the various amino-acids,** which make up the great number of proteins, **must be supplied** by the food for **complete nutrition.**

Of particular value for the maintenance and formation of growth are **lysine** and **tryptophane.** It was observed by many experimenters that the nitrogen equilibrium was disturbed, when all proteins yielding tryptophane were kept from the ration, which then was rendered incapable of sustaining life, because tryptophane appears necessary

for the normal functioning of the body, while a non-supply of lysine in the protein nutrients temporarily puts a stop to growth, and consequently to the proper utilisation of all the protein products. It was found that foods of animal origin like meat, milk, and eggs contain more of these important constituents than foods of vegetable origin, and for this reason a better rate of growth is obtained when part of the food ration is made up with meat or fish meat, and dairy products for pig feeding. It is of interest to give a short table published by F. E. Corrie, in the "Fertilisers, Feedstuff, and Farm Supplies Journal," October, 1924, showing the various proteins in a number of substances, and the percentage of lysine in each of the proteins present.

Source of Protein.	Name of Protein.	Lysine per cent. in Protein.	
Cow's milk ..	Lactalbumin	9·16	
	Casein	7·61	(tryptophane 1·5 per cent.)
Hen's egg ..	Albumin	3·76	
	Vitellin	4·81	
Bone, skin, &c. ..	Gelatin	6·00	
Beef	Protein	7·59	
Halibut (fish) ..	Protein	7·45	
Earthnut	Conarachin	6·00	
Peas	Vicilin	5·40	
	Legumin	4·98	
	Legumelin	3·03	
Kidney bean ..	Phaseolin	4·58	
Soya bean ..	Glycinin	3·39	
	Legumelin	4·91	
Maize	Glutelin	2·93	
	Zein	Nil	(tryptophane nil)
Wheat	Leucosin	2·75	
	Glutenin	1·92	
	Gliadin	Nil	(tryptophane Nil)
Linseed	Protein	1·20	
Barley	Hordein	Nil	

The actual amounts of lysine in some of the grains is very small; working the amount out for wheat, we find—

Proteins in Wheat.

Leucosin	0·4 per cent. with 0·011 percentage Lysine
Proteose	0·3 per cent. with ——
Edestin	0·7 per cent. with 0·015 percentage Lysine
Gluten—	
Gliadin	4·35 per cent. with ——
Glutenin	4·5 per cent. with 0·086 percentage Lysine
True proteins ..	10·2 per cent. with 0·112 percentage Lysine
Crude protein ..	12·1 per cent.

Maize contains only very small amounts of lysine as it is absent in its principal protein, the zein. Leguminous seeds like peas, beans, and earthnut contain relatively large amounts.

A few of the proteins are extremely poisonous, as for instance **Ricin,** the protein of the castor oil bean. The presence of a few castor oil beans in feed has caused the death of horses.

(2) **Fat.**—The non-nitrogenous part of the animal is chiefly fat, which is used in the production of heat and energy. The amount of fat in the animal varies more than any of the other substances, as it may be as low as 6 per cent., and rise to 30 per cent. and more. The fat is stored up in the animal body and is consumed as required, if an insufficient amount of fat is supplied with the ration.

The term "fat" includes the butter-fat in milk, fat of meat, oil in seeds, wax in plants, &c. In food analysis the amount of fat is determined by extracting it from the dry material with ether or benzine,

and because small amounts of other substances not true fats are also extracted, we call the ether extract **Crude Fat.**

The fats of various foods have not an equal value for the production of animal heat and formation of fatty tissue, the oils from oil seeds and cakes having the highest value, followed by the fat in cereals and leguminous seeds, and the fats in coarse fodders possess the smallest value, being 2·4, 2·1, and 1·9, respectively, as compared with starch, taken as the unit. From these figures it will be seen that fat has practically more than double the value of starch or sugar for the production of heat, and is really the most concentrated of food nutrients.

(3) **Carbohydrates** are a typical vegetable product, found only in small amounts in the animal body. They are composed of the elements carbon, hydrogen, and oxygen, and the two latter always in the same relative proportion as found in water. Usually from 50 to 70 per cent. of the dry matter in stock foods consists of carbohydrates, in soluble and insoluble forms, but all are readily digested by the animals. The carbohydrates can be divided into three classes—

(*a*) **Sugar,** like cane sugar, fruit sugar, &c.;

(*b*) **Amyloses,** like starch, dextrin, &c.;

(*c*) **Mucilaginous substances**, like gum, &c.

The carbohydrates are transformed into other organic compounds, and stored up in the animal body; they also are readily oxidised, and the energy produced by this process of slow combustion is used to perform work and maintain animal heat.

In the practise of conventional food analysis the amount of carbohydrates, also called **nitrogen-free extract,** is generally found by difference.

(4) **Fibre.**—The material forming the cell walls of plants is a carbohydrate **cellulose,** which exists in different forms. For food analysis the **crude fibre** is determined by boiling the fodder with weak acid and with weak alkali solutions, followed by washing, drying, and ashing.

Only portions of this crude fibre can be digested by animals. Towards the ripening period of plants the fibre becomes more woody and less digestible.

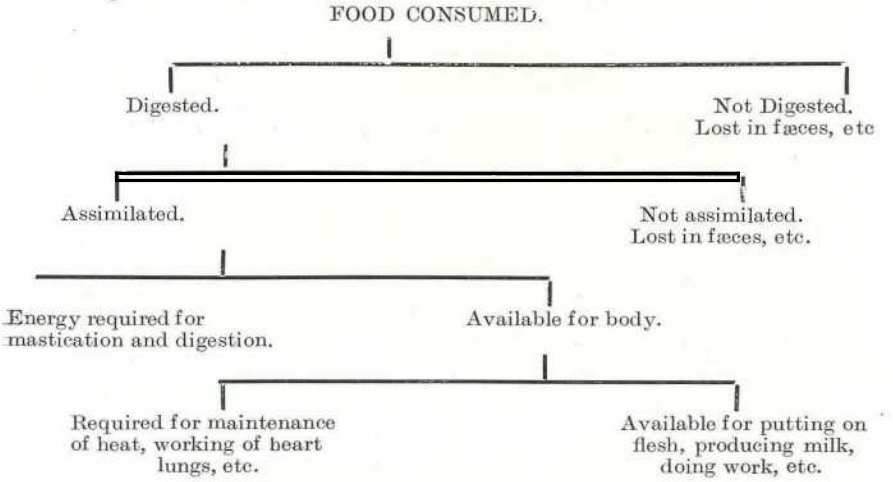
In Table I, the composition of various stock foods stating the percentage of these four principal food constituents, and also the average amounts of moisture and ash they contain, is given in columns 1 to 5. The amount of total dry matter is easily obtained by subtracting the amount of moisture from 100.

In many cases the variation in the percentage amounts of protein, obtained from analyses of stock foods from all parts of Queensland, are shown by giving the minimum and maximum amounts found below the average amount.

Digestibility of Foods.

The chemical composition of the food, as represented by the amounts of crude constituents given in the first five columns of Table I, are not of much value, unless the actual amounts of each of the constituents, which can be made use of by the animal by the process of digestion, are also known.

Let us consider first the actual **fate of the food,** after being consumed by the animal:—



This table shows that only a part of the food nutrients is really available for the main objects of feeding, and that a large portion is lost. The actual determination of the amount of food digested can only be found by a large number of carefully conducted experiments, in which the food material is analysed and weighed before consumption, and the weight and the composition of the animal excrement is determined, at the same time checking by weighing the body weight of the experimental animals. There exist, however, great practical difficulties in the carrying out of these experiments, and only a very small number have been made in Australia, so that we must take for the compilation of a table of **digestibility co-efficients,** in most cases, the results of European and American experiments.

During the year 1920 we carried out some feeding experiments with sheep at the Yeerongpilly Stock Experiment Station, and we found in most cases a good agreement with the usually accepted values; the digestibility of protein and fat was lower in some of our fodders, whereas the digestibility of the crude fibre was in some instances, in lucerne, bush hay, bran, and pollard distinctly higher, and this is probably due to the more quickly growing nature of our plants.

The digestibility of food is influenced by the age of the crop, the conditions of growth, the treatment of the crop at the time of harvesting, and lastly to a very large extent depends on the animal itself consuming the fodder.

From the moment the food is taken into the mouth up to the time it leaves the body continual changes take place. The food is first masticated, ground up into small pieces, and saturated with saliva. Ruminants, like oxen, cows, sheep, and goats, only roughly chew the food during the first mastication, as later on they regurge the food for more thorough mastication and salivation (chewing the cud). For this reason ruminants are able to digest a larger proportion of the nutrients contained in coarser and bulky foods than horses and pigs, which have only a simple stomach. In order to prevent horses eating concentrated foods like grain, oilcakes, &c., too quickly, a certain amount of chaff must be given at the same time to ensure proper

mastication. For pigs, which as a rule chew their food very lightly, any hard or coarse food must be softened by being soaked, steamed, or boiled, as, for instance, in the case of hard grains like maize.

During the process of digestion, which takes place first in the stomach and later in the intestines, the nutrients of the solid food are changed into soluble compounds which can be absorbed. During this process bacteria play an important part, more particularly in the digestion of fibre. The undigested residue of the food is from time to time excreted, and the time during which the food remains in the body depends on the amount of undigested matter and the size of the digestive organs. For ruminants, with an alimentary canal twenty to twenty-seven times the length of the body, it takes from three to four days. Pigs, with an alimentary canal fourteen times as long as the body, from thirty to forty hours, and with horses about twenty-four hours.

In Table II. the digestibility **or coefficients of digestibility** of the various nutrients of the stock foods, the percentage amounts of each of the crude nutrient digested is given, and the average values were used for the calculation of the percentage amounts of **digestible nutrients** contained in stock foods, given in columns 7 to 11 in Table I.

Nutritive Ratio.—We have already learned that the stock foods vary very much in their composition. All leguminous seeds, oilcakes, and meat meals contain a high percentage of protein and very little non-nitrogenous compounds, whereas grains and rootcrops contain large amounts of starchy matter with small amounts of protein. The proportion of these principal nutrients is called nutritive ratio or albuminoid ratio, or the ratio between the digestible pure protein and the sum of all the digestible non-nitrogenous nutrients. In the calculation the high amount of heat produced by fat is taken into consideration, and the formula is as follows:—

$$\text{Nutritive Ratio} = \frac{\text{Digestible pure protein}}{\text{Digest. fat} \times \begin{cases} 2{\cdot}4 \text{ for oil seeds and cake} \\ 2{\cdot}1 \text{ for cereals} \\ 1{\cdot}9 \text{ for coarse fodder} \end{cases} + \text{digest. carbohydrates} + \text{digest. fibre.}}$$

This nutritive ratio (column 12 in Table I.) must fall between certain limits in order that the food supplied to the animals does not lead to any waste and still keep the animal in good health and condition. The ratio will be different for young growing animals and adult stock, and as a rule for the younger animal a smaller or narrower ratio is required, as in this case the chief function of the food is to build up tissues for which purpose chiefly proteins are necessary.

Milk, which is the natural food of the young animal, has a nutritive ratio of $1 \div 4$. As a rule, it may be stated that the young animals require a ratio of $1 \div 4$ to $1 \div 5$. For adult animals the ratio should be about $1 \div 6$, and for the fattening of adult animals a much wider ratio of about $1 \div 8$ or even more is required. Milking cows need a ratio from $1 \div 5$ to $1 \div 5{\cdot}4$; a very heavy milker a ratio of $1 \div 4{\cdot}5$.

In the **chart** given in the appendix the position of all foods in regard to the average nutritive ratio of $1 \div 5$ is clearly shown. All the foods above the line are rich in protein, and the foods below the line contain less protein, and must be mixed with the protein-richer foods to make standard rations.

Starch Equivalent.—In order to compare roughly the total heat-producing and fat-forming powers of stock foods, the value of starch equivalent was introduced, which expresses the amount of pure starch, equivalent to the sum of all the digestible fat-forming nutrients in each food.

The relative fat-forming powers of the various nutrients, is, according to Kellner, as follows:—

1 lb. digestible fat	in oily seeds and oil cakes	= 2·4 lb. of starch
	in cereal and leguminous seeds	= 2·1 lb. of starch
	in coarse fodders (grass, hay, and straw) ..	= 1·9 lb. of starch
1 lb. of digestible carbohydrates and fibres		= 1·0 lb. of starch
1 lb. of digestible protein		= 0·94 lb. of starch

For exacting work a distinction should be made between maintenance starch equivalent and production starch equivalent, the former expressing the value of the food, equivalent to starch, necessary to maintain the animal at rest, without any gain or loss of weight.

The production starch equivalent, which is given in column 14 of Table I., takes into consideration the **value number** (V.) of foods (column 13 of Table I.), which expresses the percentage availability of the digestible nutrients in the stock food, with 100 being the maximum value.

Experiments have shown that most food stuffs have a food value below the expected value as calculated from the various digestible nutrients, due to the amount of energy wasted in the work of mastication and digestion. Wheat straw, for instance, is from 60 to 70 per cent. below the expected full value of 100, and, therefore, the value number is given as 30. As a rule the low value numbers of all coarse foods are associated with the amount and quality of the fibre present.

The formula for the calculation of the **production starch equivalent** is as follows:—

$$\left[\text{Digest. protein} \times \cdot 94 + \text{digest. fats} \times \begin{Bmatrix} 2\cdot4 \text{ oil seeds} \\ 2\cdot1 \text{ cereals} \\ 1\cdot9 \text{ coarse fodders} \end{Bmatrix} + \text{digestible carbohydrates} + \text{digestible fibre}\right] \times \text{V.}$$

This calculated value of the production starch equivalent is the best measure for comparing various foods for the production of fat, milk, growth, and work.

Food Units.—The market price of any stock food is by no means a measure of its relative feeding value. In normal seasons the market value of commonly used stock foods finds a level corresponding approximately to their feeding value, but in abnormal seasons many of the stock foods, on account of demand and scarcity, acquire quite exorbitant values. In order to approximately value stock foods and estimate the price of the food units per ton, the food units (column 15, Table I.) are calculated as follows:—

$$\text{Digest. crude protein} \times 2\cdot5 + \text{digest. fat} \times \begin{Bmatrix} 2\cdot4 \text{ for oilcakes} \\ 2\cdot1 \text{ for cereals} \\ 1\cdot9 \text{ for coarse fodder} \end{Bmatrix} + \text{digestible carbohydrates} + \text{digestible fibre.}$$

By dividing the market value per ton by the number of food units we obtain the cost per unit.

Bran costing £10 per ton is a very expensive food, as with seventy-eight food units would give a cost per unit of $\frac{200}{78}$ = 2s. 6$\frac{3}{4}$d. The cost per unit was 1s. 11d. in 1919, and only 1s. 2d. in 1914.

The stockowner should therefore carefully compare food units and market price in order to buy stock food economically.

Other important factors influencing the value of stock foods are palatability and succulence.

Palatability is such an illusive subject that it cannot be accurately defined, but is greatly influenced by familiarity and habit or custom. Palatability has an influence on the digestion, but not necessarily all palatable foods are easily digestible, and animals may show likings for food very indigestible and even poisonous. Again, some foods particularly nutritious may be at first refused, but may eventually be readily eaten as soon as the animals get accustomed to it; best results with feeding will only be obtained by using such feeds which are palatable and readily eaten by the animals. Sudden changes of food must be avoided, and any changes by adding new foodstuffs must be very gradual.

Succulence.—The beneficial effects of succulent foods, like green pasture grass, silage, and various roots has been amply demonstrated by scientific feeding trials and by practical common sense experience on farms. Succulent feeds promote digestion and have a highly beneficial slight laxative action. A dairy cow can only give a maximum yield when supplied with a certain amount of succulent food. Succulent food is of particular importance for young animals to promote a rapid sturdy growth, but is just as essential to all stock, horses, pigs, and sheep.

Vitamines.—Besides the nutrients so far mentioned, minute quantities of **accessory foodstuffs,** also called vitamines, are necessary for the maintenance of health and normal development of all animals. At least three classes of such foodstuffs are known to exist—

Fat soluble A, found in butterfat, yolk of eggs, milk, liver, &c., and in green leaves of plants;

Water soluble B, found in whole seeds and products made therefrom, in tubers and fleshy roots, leaves of plants, milk, and eggs; and

Water soluble C, found in abundance in fresh vegetables, fruits, and fresh milk from cows fed on pasture.

All cereal grains, seeds of legumes, tubers, and edible roots are deficient in fat soluble A, lime, and salt, and their proteins are frequently of poor quality.

The palatable green leaves, although low in total amount of nutrients, are complete foods for all animals which are able to consume large quantities.

Comments on Various Stock Foods.

Grass.—Natural grasses are without doubt the cheapest of stock foods, but as we can see from the analyses, ordinary pasture is of very varying composition, and therefore stock which depends on natural pasture alone are only for short periods of the year "on clover."

I cannot refrain from quoting here an extract from a lecture on stock foods, delivered at the Beenleigh and Rockhampton agricultural conferences by Professor E. M. Shelton. The remarks made over thirty years ago by this keen observer of wide practical experience apply

equally to the present day, and put the position of dairying and grazing on natural pasture in a nutshell:—

" Our Great Reliance on Grass.

"The natural grass in Queensland is so abundant and unfailing, and, as compared with artificial forage, so easily got that stockowners outside of towns complacently regard it as a sufficient food for all classes of stock at all times and seasons. It is only when protracted drought becomes calamitous that stockowners begin to realise the dangers of complete reliance upon natural supplies of stock food. Even during favourable seasons the annual loss, from the poverty of wild grasses during the winter months, must in the aggregate be enormous. During much of every winter our herds are losing the flesh accumulated during favourable summer months, thus literally converting flesh into nearly worthless manure, a process that can hardly prove profitable to the stockraiser. Let this be understood: good grass is the cheapest and best single stock food. No form of artificial food, whether grain, roots, or residual products, can compete in cheapness with natural herbage as a source of beef, mutton, and the other products of feeding; but to rely wholly and entirely upon the spontaneous herbage is to fail in obtaining the principal advantages derivable from such natural pastures. By piecing out the failing grass with hay, silage, or green fodders, we keep our animals in the highest working condition with that **small amount** of feed that every stockman knows is required to maintain vigorous, thick-fleshed animals up to their greatest efficiency. After the animal once becomes reduced in flesh, let the owner attempt to bring it up again to its condition of greatest usefulness as a milker or meat-making machine, and he will have it brought home to him, in a thoroughly practical way, how great his loss has been through sparing the feed. **Other things being equal, the animal that consumes the most feed gives the largest profitable return for feeding.** A hint of why the full-fed animal returns the largest available profit is furnished by our knowledge of the ultimate use to which food is put. It is plain that food is applied to two purposes: it goes to make up the loss of the animal machine itself through constant wear; and it is applied towards the production of the object of feeding—milk, beef, wool, &c. It is clear also that if the animal gets of food only sufficient to supply the constant wear and tear incident to existence, the feeder gets nothing in return for his feeding. But if he gives in quantity beyond the vital demands of the animal, that surplus will, more or less, go to the production of the valuable article which is the principal object of his feeding. Profit always comes out of the excess feed, and not from the small amount that is really required to maintain existence."

Quite excellent hay can be made from our natural pasture grasses, and an analysis of "bush hay" over fifteen years old showed it to possess a fairly high feeding value.

Unfortunately in good seasons enormous amounts of grass go to waste, as all the grasses, after being dried up, exposed to dews and scorching sun, rapidly deteriorate, losing colour, flavour, and quality, and have but little feeding value, so that they are only fit to be burnt off.

There is but little difference between the food values of the various most popular cultivated grasses—Paspalum, Canary grass, Rhodes grass, Sudan grass, and others—yet the variation in the composition

of the sample, according to season, locality, and age of crop in each species, is very much greater than the variation in composition from one species to another. It is quite obvious that it is impossible to judge the value of any grass by a few isolated analyses.

There are a few grasses like Couch grass (*Cynodon dactylon*) and Prairie grass (*Bromus unioloides*) which stand out on their own on account of high food value.

Roots and Other Succulent Stock Foods.

In Europe, Canada, and also in New Zealand, for the feeding of dairy stock, in addition to a rich pasture containing clovers, root crops play an important part. In our State we can supplement our natural pasture with the more valuable crops of lucerne and maize, and to some extent with pumpkins.

Mangels are the most watery of stock foods. Many of the Queensland-grown samples have a very low feeding value, much lower than the value obtained in root-crop-growing countries where the quality with regard to protein contents has been steadily improved by careful selection of seed. However, a special variety or cross of mangels, the "sugar mangel," several samples of which were analysed from the crop grown on our State farms, from seeds imported by Sir Matthew Nathan from the Cambridge School of Agriculture, gave as much as 1·7 per cent. of crude protein, making them a valuable food, as compared with our ordinary mangels containing only 0·6 per cent. of protein. Mangels and beets should not be fed to male sheep for long periods, as they are likely to cause urinary troubles.

Pumpkins are greatly relished by cattle, horses, and pigs, and are rather more nutritious than mangels. The seeds contain much protein and oil and should therefore not be wasted. Pumpkins are preferably fed raw to pigs. The seed act as a slight vermifuge; fed in excess, however, the seeds may cause digestive troubles. Cases have been reported that pumpkin seeds caused trouble when fed to poultry.

Potatoes and sweet potatoes contain about twice as much dry matter as mangels. They have a good food value, but as a rule have too high a commercial value as human food to make them profitable for feeding of stock.

Sweet potato vines are a very nutritious succulent food. They must be fed with caution to pigs, as in a few instances we found a hydrocyanic acid yielding glucoside in these vines. Any danger, however, is minimised by sprinkling a little molasses over the vines before being fed.

Silage.—One of the most economical means of preparing succulent foods for dry seasons and general use is by means of a silo. The most suitable crop for this purpose is maize. Crops of saccharine and non-saccharine sorghums may also be used; in fact, any succulent green crop may be utilised for the making of silage. Sunflowers, according to American and Japanese reports, make an excellent ensilage. A very fine sample of silage once submitted for analysis was made from wheat, thistles, and mustard. Another good sample was made with alternate layers of maize and prickly-pear. Leguminous crops, like lucerne, make a poor foul-smelling ensilage. The process of fermentation taking place in the silo has an influence on the nutrients in the food, some of the carbohydrates are lost, as well as small amounts

of proteins are decomposed; again the digestibility of the remaining protein is somewhat lowered. These losses, however, are fully compensated by the succulence and palatability of the ensilage. No better ration for milking cows could be found than a mixture of lucerne hay and maize ensilage, with small amounts of bran and pollard or oil cakes.

Hay.—The simplest and best way to preserve green fodders, which has been practised from time immemorial, is to make them into hay by drying in the air in the sun. The moisture can be reduced to 8 per cent., and all further fermentation is arrested. If the hay is not properly dried, detrimental changes can take place during storage. The quality of the hay depends: (1) on the quality of the raw material, (2) on losses and changes during the drying, and (3) on changes which may take place during storage.

Lucerne hay is an almost ideal food for dairy stock. When cut very young, before flowering, the nitrogen ratio is a little too high, but the ratio is lowered when cut in full flower.

Straw.—When plants mature a large proportion of the organic compounds, both nitrogenous and non-nitrogenous nutrients, are transferred from the green portion of the plants to the seeds. At the same time all stems and stalks become harder as the cellulose of the fibre becomes more and more lignified, and but small amounts of proteins, fat, and nitrogen-free extracts remain in the straw or chaff when the ripening of the seeds is completed. In samples of oat straw, cut at various periods of maturity, the amount of crude protein fell steadily from 10·1 per cent. to 4·3 per cent., and at the same time the crude fibre was increased from 29 per cent. to 50 per cent. The lignification of the cellulose or fibre in straw causes, when used as a feed, a great loss of energy for mastication, and consequently from 70 to 80 per cent. of the available digestible nutrients are used up to supply the energy required for mastication and digestion, and only from 20 to 30 per cent. of the nutrients are available for maintenance and production.

Cereal straws are very poor stock foods, and should only form a small portion of the ration. Ruminants can be given larger quantities than horses.

Leguminous straws are of considerably better food value, but not very palatable to stock—especially to horses.

Chaff.—Although the term chaff is elsewhere accepted as meaning the husks, or outer envelopes of cereal grain, with any light debris that may arise in threshing, in Queensland the term indicates hay or straw cut up into short lengths.

Unfortunately the chaffing of hay and straw tends to hide any foreign matter that such material may contain; further, the term **hay** should only be applied to any dried or cured cereal, grass or legume cut **before complete ripeness,** and in which the grain or seed has not been fully developed or removed. **Straw** implies any dried **ripe or mature** material from which the seed or grain has been removed by any process.

Chaff is liable to contain a good deal of rubbish like sand, earth, dust, weed seeds, moulds, and spores of fungi, &c., which can cause serious troubles, and therefore if poor qualities of chaff have to be used, in case of necessity, such chaff should be scalded or steamed before being fed. A good many samples of chaff have come on the market lately, which contained a large amount of stalks, leaves, and

seeds of the thorn apple (*datura stramonium*), a highly poisonous weed. Such chaff is very dangerous to stock, and cannot be used as a feed, and the sale of any chaff or hay containing this weed is an offence under the Stock Food Act. Farmers should take particular care to prevent the spreading of this noxious weed.

Grains and Seeds.—The composition of the grains and seeds depends largely on the state of ripeness when harvested. Immature seeds contain more protein and mineral matter, and lsss nitrogen free extract than ripe ones. The quality of all grains is also influenced by soil conditions, manuring, and season.

Oats may be considered the most valuable of cereal grains, and has no equal for the feeding of horses. They are a very good milk-producing food, if they can be obtained cheaply enough. Ground or crushed oats are excellent for calf rearing, as a supplement to skim milk.

Barley is particularly useful for fattening all stock, and a standard food for pigs. An excellent ration for breeding pigs is made up from 30 per cent. barley meal, 30 per cent. maize meal, 35 per cent. pollard, and 5 per cent. meat meal or blood meal. The latter promotes growth and can be left out during fattening period, and increasing at the same time the amount of barley and maize meal.

Wheat.—On account of its price wheat is only rarely used for feeding of stock; low grade and damaged wheat is a valuable food for poultry, and the shrivelled wheat generally contains more protein than first-grade plump wheat. Fresh wheat, whole grains, are dangerous to stock, and if used for fattening of cattle and pigs should be crushed or ground. The by-products of milling wheat, **bran** and **pollard,** are of particular value. Bran, the outer coating of the wheat kernel, is rich in digestible protein, digestible carbohydrates, and fat, and contains comparatively high amounts of mineral matters, phosphoric acid, magnesia, and potash, but is poor in lime. Bran has a beneficial laxative effect, which is increased by giving it in form of a bran mash.

Maize is suitable for all stock, but on account of its hardness not so easily digested as other grain, and therefore preferably fed in ground form as **maize meal.** Maize of all the cereal seeds contains the least amount of lime, and its proteins are very deficient in lysine. Maize is chiefly a heat and fat producing food.

It is of interest to note that the protein content of maize has been gradually decreasing year by year in Queensland. Twenty-three years ago a large number of different varieties of maize were analysed and found to contain high amounts of crude protein, averaging 13·5 per cent., and ranging from 12·1 to 13·8 per cent. An imported maize from the Argentine, containing 10·7 per cent. of crude protein, gave after being grown on our State farms 12·9 per cent. At that time I claimed our Queensland grown maizes to practically equal wheat as a food for poultry, &c. Since that time, however, a change has taken place, and the average of many samples analysed during the last three years was only 9·5 per cent. of crude protein, varying between 8 and 13 per cent. It is quite evident that our present maize is more valuable as a material for the production of cornflour and glucose, or production of power alcohol, than as a stock food. Maize grown for stock food purposes should be from specially selected seeds rich in protein. Of a very high food value are the by-products from maize, viz., maize

germ meal, polly meal, maize gluten meal, &c., which were on the market some years ago, but are at present not procurable, as they are eagerly bought up in the States where the factories utilising maize exist.

Leguminous Seeds.

Beans, peas, cowpeas, &c., are very nutritious food, containing large amounts of protein, and can be used for all stock. If fed in large amounts they may cause constipation and also thickening of the blood, and therefore should not form more than one-fifth to one-quarter of the grain ration. Leguminous seeds should be given either ground, crushed, or soaked. A few species of leguminous seeds, like Java bean are poisonous, containing a hydrocyanic yielding glucoside.

Oily Seeds.

Linseed, slightly crushed, is an excellent calf food, as it contains a large amount of fat. The by-product from the manufacture of linseed oil—the linseed cake—is one of our most soluble concentrated stock foods, but unfortunately the quality of linseed imported for the manufacture of oil is very much lower in its protein content than the linseed used in Europe, our linseed containing only 18 per cent. of crude protein, as compared with 24·2 per cent., the average in England. Again our cake contains only 25·5 per cent. of protein, as compared with European cake containing from 29·5 to 35 per cent.

Linseed cake used to contain from 9 to 10 per cent. of fat, and this made it valuable as a calf food to replace the fat lost in the milk on separating, but a new process of manufacture brings the oil contents down to 2 per cent. and less, and make the cake of much less value for calf feeding. All linseed contains more or less of a hydrocyanic acid yielding glucoside, and must be therefore used with caution, and never fed in excess. Several cases of death among calves have been reported, due to giving excessive amounts of linseed meal.

Sunflower Seeds and sunflower oil cake, if procurable, are excellent foods, suitable for all kinds of stock.

Peanuts or Earthnuts are a suitable feed for cattle, sheep, and pigs. If given in excess to pigs produces soft fat and inferior pork.

Peanut Cake is the richest of all our oil cakes. The vines of the peanuts may be collected and cured into a nutritious palatable hay. Peanut hulls ground are frequently used for the adulteration of stock foods; they have very little food value, on account of the high amount of fibre.

Cotton Seed is always used in Queensland in form of cotton seed meal, after extraction of the cotton seed oil, and up to the present cotton seed cake of local manufacture has not been put on the market. If the hulls are not removed before crushing **undecorticated meal** is obtained, which is of much less value than the **decorticated meal,** which contains no hulls. Undecorticated meal, on account of the indigestibility of the hulls, is a most constipating food, whereas decorticated meal is a valuable concentrate, suitable for cattle and sheep, but **not for pigs.** It is a good milk-producing food, and also good for fattening cattle and sheep.

Coconut Cake or **Copra Cake.**—The by-product of the manufacture of coconut oil is a very palatable and pleasant smelling concentrated food, suitable chiefly for dairy cows, but also for general use for cattle,

sheep, and pigs. The coconut cake should be soaked before being used, as it swells very considerably on absorption of water. When fed to dairy cows it helps to produce a good firm butter, whereas linseed meal tends to soften the butter, and cotton seed meal again produces a hard sallowy butter, of light colour and poor flavour.

Other By-products and Various Foods.

Meat Meal.—The by-products of meatworks sold under various trade names, as meat meal, dried liver, and lights, bovvaline, mutton protein, protein meal, ox-a-vita, &c., are valuable concentrated stock foods, and small amounts can form part of the rations for dairy cows, pigs, and poultry. Meat meal particularly promotes growth, as already explained before.

Blood Meal made from dried blood is another highly concentrated food, of similar use as meat meal. Ordinary dried blood, in coarse granular form, should never be used as stock food, as on account of the high nutritious qualities, inflammation of the stomach lining sets in where the hard grains come in contact. Serious injuries to pigs and poultry have been caused when feeding such coarse dried blood. Proper blood meal for stock food should be as fine as flour, and is highly digestible, and therefore used in small quantities only.

At the Yeerongpilly Stock Experiment Station, when carrying out feeding experiments with sheep, we found that of the crude protein in somewhat coarse blood only 61 per cent. was digested, whereas in the fine blood meal 89 per cent. was digested.

Molasses, the by-product of the manufacture of cane sugar, is palatable and much relished by stock. The feeding value consists entirely of soluble readily digested sugars, and molasses is therefore a heating and fat-producing food and supply no protein whatever. Amounts from 2 to 3 lb. daily can be given to horses and cows, sprinkled on roughage, which is made more palatable. Molasses act as an antidote against hydrocyanic acid poisoning, and therefore foods like young sorghum, Sudan grass, and cowpea vines, which may contain a hydrocyanic acid yielding glucoside in dangerous amounts, should be sprinkled with molasses before being fed to stock.

Compressed Concentrated Foods.—Hand feeding of sheep, more especially of large mobs of starved animals, has always been a big problem, as it is almost impossible to provide sufficient troughing to give all animals an equal chance, and the weak ones have generally to go without food. The use of troughs also leads to bolting of food and general waste. As sheep can pick up grain from the ground, as well as poultry, our sheep expert, Mr. W. Brown, recommends to dribble grain like maize and barley in a thin line on the circumference of large circles, which gives every sheep a chance to pick up a few grains. At present compressed concentrates are on the market which are particularly suited for hand feeding of sheep. Amongst the available foods we find linseed nuts, cotton seed, treacle cubes, and kubettes for sheep. These nuts should not be too large (cubes from $\frac{1}{2}$ to $\frac{3}{4}$ inch) and should if possible be made from a mixture of various grains, meals, and by-products in order to give the animals a variety of proteins, so beneficial to the general health. Amongst the available foods are linseed nuts (a form of linseed cake broken up into small pieces of suitable size for feeding of sheep), cotton seed, and treacle cubes. Each

of these products is made from a single by-product, and contains rather too high an amount of protein, whereas kubettes are made from a very large number of products containing an amount of protein equal to ordinary cereal grain, and are undoubtedly the most suitable food for hand feeding of sheep at present on the market. The manufacture of such compressed concentrates should be very much extended, and if offered at reasonable cost will lead to large consumption throughout the year because there are many localities where the addition of a little concentrate would be highly beneficial to grazing sheep.

Licks.—In many districts the supplying of licks containing **salt, lime,** and **phosphates** to stock is an absolute necessity, and nearly everywhere such licks can be given to benefit the health of the animals.

Fine Bone Meal can be mixed with coarse salt and forms a good lick, as long as care is taken that the bone meal is of good quality and specially sterilised by heating with super-heated steam. Ordinary bone meal as used as fertiliser should on no account be used. A good substitute for bone meal, supplying large amounts of lime and phosphoric acid, is **finely-crushed Nauru** or **Ocean Island phosphate.**

The licks should always be placed in sheltered troughs, preferably of the continuous supplying type recommended by our Department. A mixture of equal parts of coarse salt and phosphate makes a cheap effective lick. Small amounts of sulphur, adding, say, 2 lb. of flour of sulphur to every 100 lb. of salt and phosphate mixture, will be found beneficial. An addition of the same amount of carbonate of iron, or of sulphate of iron, will improve the health of stock in many districts.

"The Stock Foods Act of 1919."

Queensland possesses in the Stock Foods Act a piece of advanced legislation for the protection of all buyers of stock foods, which is far ahead of any similar Act in other Australian States, and quite up to the standard of such Acts existing abroad. This legislation, which at first met with some opposition on the part of the sellers, as it was considered to harass trade unnecessarily, is now welcomed by genuine manufacturers and dealers as a protection against unfair competition by unscrupulous traders, and puts the manufacture and sale of all stock foods on a sound basis.

Under the Act all wholesale sellers of any mixed concentrated or prepared stock food, which includes all kinds of meals and foods for stock, prepared in whole or in part, from one or more than one kind of grain or oils or juices of meats or other source, and any condimental patented or proprietary stock food claimed to possess nutritive as well as medicinal properties, must every year submit samples of such foods to the Under Secretary, and at the same time state the composition and food value of such samples. Certain stock foods must be labelled, stating on the labels the number of net pounds in the package, the distinguishing name or trade mark of the food, name and address of seller, and chemical analysis of the food, giving minimum amounts of crude protein and crude fat, and maximum amount of crude fibre. The seller must give at the time of sale an invoice certificate, giving among other things the gross weight, warranty about composition and amounts of foreign ingredients, &c. Upon the sale of hay, straw, and chaffs made therefrom, and mixed chaff, the invoice must specify each component, and in case of mixed chaff and straw chaff the package must be labelled M.C. and S.C.

respectively. Unfortunately the great majority of our stock food buyers pay but little attention to labels and invoice certificates, which are frequently torn up and thrown away, and therefore do not derive the full benefit of the Stock Food Act. The monetary value of any stock food can be enormously influenced by variation in the amount of protein and fat contained in the food, and therefore the stockowner, poultry farmer, &c., should carefully study the labels of various samples and compare them with the prices, in order to buy most economically.

Feeding Standards.

For the guidance of the stockowner in choosing and making up suitable rations, based on the composition of the various stock foods, it is necessary to draw up feeding standards, stating the amounts of each class of nutrient necessary to be provided in the rations for farm animals of all classes and ages, to keep them in best condition and obtain a maximum of production. During the last century many of such standards were drawn up by eminent men like Wolff, Atwater, Armsby, and Lehmann. Table III. gives the latest **standard rations** according to Dr. O. Kellner, the director of the Möckern Experiment Station (Germany), based on the amounts of dry matter, digestible protein, and starch values required for the rations.

How to Make up Rations.

As a basis for the making up of rations we must take into consideration the fact that a ruminant can eat daily an amount of fodder which contains dry matter equal to 2½ to 3 per cent. of the body weight of the animal. This amount is for full-grown animals, for maintenance and at rest, only from 1½ to 2 per cent., and for heavy milkers up to 3½ per cent. of the live weight.

A cow from 750 to 800 lb. live weight, yielding daily 2½ gallons of milk, would require, as calculated from Table III., per day a ration containing—

Dry Matter.	Digest. Protein.	Starch Equivalent.
23 lb.	1·65 lb.	9 lb.

For convenience and rapid comparison of all stock foods, the last two columns (16 and 17) of Table I. show the amounts of stock foods in pounds required to supply 1·65 lb. of digestible pure protein and 9 lb. starch equivalent.

We will start a ration with **good lucerne chaff**—

——	Dry Matter.	Digest. Protein.	Starch Equivalent.
25 lb. of lucerne chaff contains	22·6	2·58	7·45

which would supply an excess of nitrogen and not sufficient starch equivalent, which is quite apparent from columns 16 and 17, which show that only 16 lb. would be required to supply the necessary nitrogen and 30 lb. to supply the starch equivalent on account of the narrow nutritive ratio (column 12) of 1 ÷ 3·6, whereas we want a ratio of about 1 ÷ 5.

By reducing the amount of lucerne chaff and substituting the same amount of **wheat hay chaff** we get:

—	Dry Matter.	Digest. Protein.	Starch Equivalent.
13 lb. of lucerne chaff	11·7	1·34	3·9
13 lb. of wheat chaff	11·4	0·19	3·8
	23·1	1·53	7·7

The amount of protein is lowered a little too much and we have not sufficient starch equivalent. We must reduce the amount of chaff and add a more starchy food like **maize meal,** and make up the following ration, which brings the ration up to standard.

—	Dry Matter.	Digest. Protein.	Starch Equivalent.
13 lb. of lucerne chaff	11·7	1·34	3·9
10 lb. of wheat chaff	8·8	·15	2·9
3 lb. maize meal	2·6	·14	2·1
	23·1	1·63	8·9

If we start as basis of a ration with a **good bush hay** we find in:

—	Dry Matter.	Digest. Protein.	Starch Equivalent.
25 lb. good bush hay	23·0	·48	8·2

This ration is very deficient in digestible protein, and slightly deficient in starch equivalent.

If we replace 8 lb. of hay by 8 lb. of **maize meal** we obtain—

—	Dry Matter.	Digest. Protein.	Starch Equivalent.
17 lb. bush hay	15·6	·32	5·6
8 lb. maize meal	6·9	·37	5·6
	22·5	·69	11·2

The ration is still very deficient in protein, and too high in starch equivalent, maize being a one-sided starchy feed and we must therefore substitute much more nitrogenous concentrates like cotton-seed meal or linseed meal.

—	Dry Matter.	Digest. Protein.	Starch Equivalent.
17 lb. bush hay	15·6	·32	5·6
4 lb. maize meal	3·5	·19	2·8
2 lb. bran	1·8	·23	·9
2 lb. cotton-seed meal	1·8	·67	1·3
	22·9	1·41	10·6

The ration is still rather low in digestible protein for a milking cow and a little high in starch equivalent. The bush hay is evidently too poor to form a suitable basis for the ration, and the amount of concentrated food should not be raised over one-third of the total ration. The ration would have been still very much poorer if a poor quality bush hay had been used. The ration could be brought up to standard by increasing the cotton-seed meal to the maximum amount which can be safely given to a cow, making the ration as follows:—

—	Dry Matter.	Digest. Protein.	Starch Equivalent
17 lb. bush hay	15·6	·32	5·6
3 lb. maize meal	2·6	·14	2·1
2 lb. bran	1·8	·23	·9
3 lb. cotton-seed meal	2·7	1·01	2·1
	22·7	1·70	10·7

All the rations so far mentioned are deficient in not containing any succulent food, which is so essential to milking cows.

An excellent ration could be made up with **maize silage** as a basis, and using such concentrates in addition which are at present the cheapest foods on the market:

—	Dry Matter.	Digest. Protein.	Starch Equivalent.
40 lb. maize silage	12·0	·24	5·6
8 lb. lucerne chaff	7·3	·82	2·4
3 lb. barley meal	2·6	·25	2·2
1 lb. cotton-seed meal	0·9	·34	0·7
	22·8	1·65	10·9

This ration is just a little high in starch equivalent, but otherwise correct.

Similar rations can be made up from any material on the farm, by using the table of analysis of foods.

Feeding of Horses.

When making up food rations for horses we must remember that the digestive organs of a horse differs from those of ruminants. A horse cannot digest such large amounts of coarse bulky food rations as given to cows, and as a rule only one-third of the amount of roughage given to a cow should be supplied to a horse. Hand-fed milking cows should receive approximately one-third of the total dry of the ration in form of grain or concentrated foodstuffs, whereas to working horses one-half of the dry matter of the ration can be profitably given in form of grain or concentrates.

Valuable work with regard to horse feeding was done some years back by Professor A. J. Perkins in South Australia, paying particular attention to the "feeding value" prices of various foodstuffs in normal and abnormal seasons. Professor Perkins also collected data about the rations fed in old established livery stables and city carriers, and

it was interesting to note how closely the rations, found to be most suitable by long continued practical experiences of these firms, agree with Kellner's standards.

Light horses (averaging 1,000 lb. live weight) doing mail and other fast road work received a daily ration of 24 lb. wheat hay chaff, 2 lb. bran, and 2 lb. pollard, and twice weekly from 6 to 8 lb. of green lucerne.

Draught horses (1,400 lb. live weight) doing road and slow delivery work received 32 lb. wheat hay chaff, 8 lb. bran, and twice weekly 8 to 10 lb. of lucerne; an additional allowance of 4 to 6 lb. of crushed oats was given when doing long and heavy trips.

Another firm of carriers fed to medium draught horses (1,200 lb. live weight) a ration of 32 lb. wheat hay chaff and 5 lb. of bran, with an additional 5 lb. of oats in the winter months. When chaff became too expensive, they used with good results a ration consisting of 25 lb. of wheat hay chaff and 10 lb. crushed maize.

Feeding of Pigs.

The general rules laid down for feeding of stock apply to pigs, and there are no farm animals (the milking cow excepted), which put their food to better use than pigs. The aim of the pig farmer should be to produce as much growth as possible in the shortest time, and for this reason the ration for the young growing pig should be more nitrogenous, with a narrow nutritive ratio of about 1 ÷ 4. The amount of carbohydrates may be increased as the pigs grow older, and more so in the fattening period.

Lucerne is one of the best foods for pigs, and a field of lucerne is the only pasturage where pigs can be raised without any other food. As already pointed out, young growing pigs should, if possible, obtain some of the protein from an animal source, and for this reason skim milk is of particular value as part of a ration for pigs. Ground barley, where obtainable at reasonable cost, is another staple food for pigs.

A standard ration for ten young pigs of about 50 lb. average live weight would consist of 6 lb. pollard, 10 lb. ground barley, 4 lb. lucerne hay (chaffed) soaked in 4 gallons of skim milk. The 4 lb. of lucerne hay could be replaced by about 18 lb. of fresh cut green lucerne.

In cases where no lucerne is available more grain may be used, giving a ration consisting of 11 lb. pollard, 7 lb. crushed maize, 2 lb. linseed meal, with 4 gallons of skim milk.

As succulent foods sweet potatoes, swede, sugar mangels, pumpkins may be used. Separated or skim milk can be replaced by buttermilk.

With the ruling high prices which have to be paid for pollard and all concentrates, the standard rations above mentioned could not possibly be profitable and would have to be modified by utilising to a large extent succulent crops grown on the farm. From one-third to one-half of the ration must be made up from root crops, green crops like sorghums, rape, &c.

The importance of growing only such varieties of root crops which are particularly rich in nitrogenous matter is quite apparent, and the cultivation of sugar mangels already alluded to, containing three times the amount of nitrogen than the ordinary mangel, should be encouraged in all localities where it can be successfully grown.

The success of any pig farm will depend entirely on the quality and quantity of the food grown on the farm.

Feeding of Poultry.

Practical experience has taught the poultry farmer that laying hens require a ration fairly rich in nitrogenous nutrients, part of which should be of animal origin. A nutritive ratio from 1 ÷ 4½ to 1 ÷ 5 has proved successful.

Hens of a heavy type require comparatively less food than the more energetic lighter types.

According to Professor Wheeler, of the New York State Station, hens in full laying require:

	Digestible Nutrients per Day per 100 Lb. Live Weight—			
	Total Dry Matter.	Protein.	Fat.	Carbo-hydrate.
	Lb.	Lb.	Lb.	Lb.
Hens from 5 to 8 lb. weight	3·30	0·65	0·20	2·25
Hens from 3 to 5 lb. weight	5·50	1·00	0·35	3·75

In accordance with these amounts the daily ration for 100 laying hens, of light weight, should consist of 16 to 18 lb. dry matter, 2·50 to 3·0 lb. protein, 0·5 to 1·0 lb. of fat, and 10·0 to 11·5 lb. of carbohydrates.

Hens can only digest a very small amount of crude fibre, and this fact must not be lost sight of when choosing the most suitable grain for feeding, and for this reason oats are not so suitable as wheat or barley.

Of importance is a plentiful supply of mineral matters, containing lime and phosphoric acid, and grit and charcoal to aid in digestion.

A few standard rations to supply a liberal amount of food required by 100 hens of an average weight of 4 to 5 lb. per day can be made up as follows:—

I.	II.	III.
19 lb. wheat	11 lb. wheat	1 lb. wheat
5 lb. pollard	3 lb. bran	3 lb. bran
5 lb. bran	4 lb. pollard	5 lb. crushed barley
5 lb. (1½ gall.) skim milk	2 lb. lucerne meal	5½ lb. copra cake
	1 lb. meat meal	5½ lb. lucerne meal

An occasional change of the constituents of any ration is generally beneficial, but any change must be made very gradual, as with a sudden change of food fowls may refuse to eat it.

The amount of food required by growing chicks, per 100 lb. live weight, is much greater than the amount for fowls above mentioned. Pullets weighing about 1 lb. require just double the amount of food than given to hens of light weight.

At the present time dry mash feeding from suitable hoppers has become popular and is very successful, where a large number of fowls are kept. A good dry mash is made up as follows:—Four parts (by measure) of bran, one part each of pollard, ground oats, ground barley, corn meal, beef scraps, with ½ lb. of salt for one bag of the mixture.

Any other grain or seed, like Kaffir corn, sorghum seed, sunflower seed, panicum, canary seed, peas, beans, &c., may be substituted for other seeds, if obtainable at reasonable cost, always bearing in mind that the seeds, as feed for fowls, must be chiefly judged by their protein content, and not so much by number of food value.

In conclusion, I must point out that the figures given for the compounding of rations cannot be followed implicitly in all cases, but a certain latitude must frequently be allowed.

The objects of the pamphlet are chiefly the spreading of knowledge with regard to stock food in general, to eliminate errors in feeding, and more particularly to draw attention to some of the foods hitherto neglected, which can take the place of other more expensive foods. In nearly all cases practical experience is a valuable guide, but whenever possible combine "Practice with Science."

TABLE I.

Composition of Stock Foods.

—	Crude Nutrients Per Cent.						Digestible Nutrients Per Cent.					Nutritive Ratio 1 ÷	Per 100 lb.			lb. of Fodder to Supply.	
	Moisture.	Protein.	Fat.	Carbohydrates.	Fibre.	Ash.	Crude Protein.	True Protein.	Fat.	Carbohydrates.	Fibre.		Value.	Starch Equivalent.	Food Units.	1·25 lb. Protein.	9·0 lb. Starch Equivalent.
Green Fodders.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Grasses and Cereals—												1 ÷					
Barley, in flower ..	79·0	2·7	0·6	8·0	7·9	1·8	1·8	1·5	0·4	6·0	4·3	7·3	80	9·9	15·5	110	91
Buffalo grass	78·0	2·1	0·5	12·3	4·6	2·5	1·4	1·2	0·3	8·8	2·9	10·3	80	10·7	15·8	138	84
Canary grass	76·5	2·8 (2–3)	0·6	12·1	5·8	2·2	1·8	1·5	0·4	8·6	3·2	10·9	80	14·2	20·8	110	64
Couch grass	74·1	4·1	0·4	10·0	8·4	3·0	3·0	2·0	0·2	7·0	4·9	6·2	85	12·1	19·8	83	74
Flinders grass ..	68·0	1·8 (1·2–2·5)	0·4	11·3	14·0	4·5	1·2	1·0	0·2	7·8	8·0	16·2	76	13·0	19·2	165	69
Foxtail millet (*Setaria italica*)	87·0	1·3 (1·0–2·0)	0·2	6·2	4·1	1·2	0·7	0·4	0·1	3·8	2·2	15·5	82	5·4	8·0	412	167
†Guinea grass (*Panicum maximum*)	80·0	2·6 (0·7–3·5)	0·5	9·4	12·0	3·5	1·6	1·0	0·3	7·6	7·0	15·2	80	12·9	19·2	165	70
Indian cane	77·0	1·5	0·2	11·0	8·9	1·4	1·0	0·7	0·1	7·9	5·2	19·0	80	11·2	15·8	236	80
Maize	82·0	1·7	0·5	9·0	5·6	1·2	1·0	0·6	0·3	6·0	3·1	16·2	83	8·7	12·2	286	104
Mitchell grass ..	74·0	1·4 (1–2·1)	0·4	9·3	11·3	3·6	0·9	0·5	0·2	7·5	6·2	28·2	76	11·1	16·4	330	81
Mixed pasture, poor ..	80·0	0·7	0·2	7·5	9·0	2·6	0·5	0·3	0·1	5·4	5·2	35·4	86	9·4	11·9	550	95
Mixed pasture, average	80·0	1·3	0·3	7·8	8·2	2·4	0·9	0·5	0·2	5·8	5·0	22·4	90	10·5	13·5	330	86
Mixed pasture, best ..	80·0	2·5	0·8	8·5	6·0	2·2	1·6	1·3	0·4	6·3	3·6	8·2	92	10·8	14·6	127	83
Oats, in flower ..	76·8	1·9	0·6	10·4	8·5	1·8	1·4	1·2	0·4	6·5	4·9	10·1	75	9·9	15·6	138	91
Panicum frumentosum	76·0	1·5	0·5	12·0	6·0	4·0	1·0	0·6	0·3	8·5	3·6	21·2	80	10·7	15·2	286	84

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Paspalum	75·0	2·3 (1·2–4)	0·4	8·9	10·4	3·0	1·5	1·2	0·2	7·0	6·2	11·7	80	11·8	17·4	138	76
Prairie grass	76·8	4·6 (2·7–6·4)	0·8	8·5	6·7	2·6	3·0	2·2	0·4	6·6	4·3	5·3	86	11·7	19·1	75	77
Rhodes grass	75·0	1·8 (1·5–3)	0·4	10·0	10·3	2·5	1·3	1·0	0·2	6·8	6·0	13·2	80	11·3	16·5	165	80
†Sorghum (saccharine)	80·0	2·1 (1·7–2·7)	0·6	9·7	6·2	1·4	1·2	0·7	0·2	5·8	3·3	13·6	79	8·1	12·5	236	111
Summer grass ..	72·0	1·4	0·3	13·1	10·0	3·2	0·9	0·5	0·1	9·3	6·0	31·0	85	13·6	17·8	330	66
†Sudan grass ..	78·0	2·3	0·2	11·0	6·2	2·3	1·5	1·1	0·1	7·5	3·8	10·5	82	10·2	15·3	150	88
Sugar-cane tops ..	72·0	2·6	0·7	12·9	10·0	1·8	1·7	1·2	0·3	9·4	6·5	13·7	80	14·1	20·8	136	64
Water couch (*Paspalum distichum*)	77·0	1·8 (1·4–2·3)	0·3	10·7	7·5	2·7	1·4	1·1	0·1	7·1	5·0	11·2	82	10·9	15·8	150	83
Legumes—																	
Cowpea vines ..	78·0	2·3 (1·7–3·6)	0·6	10·7	5·5	2·9	1·6	1·2	0·3	7·3	2·8	8·9	77	9·1	14·7	136	99
Field pea, in flower ..	83·2	3·5	0·6	5·6	5·9	1·2	2·4	1·6	0·3	3·7	3·0	4·6	77	6·8	13·3	103	132
Lucerne, young ..	81·1	5·6	0·8	6·2	4·4	1·9	4·3	2·7	0·4	4·7	2·0	2·8	87	8·8	19·3	61	102
Lucerne, in flower ..	76·0	4·5	0·8	9·6	6·8	2·3	3·2	1·7	0·4	6·3	2·9	5·9	79	9·2	18·0	97	98
Trefoil (Medic burr)	78·6	4·3	0·5	10·8	3·0	2·8	3·0	1·5	0·2	7·4	1·6	6·3	80	8·8	16·9	110	102
Wild lucerne (*Stylosanthes mucronata*)	76·0	4·3	0·3	9·7	7·7	2·0	3·0	1·5	0·1	6·4	3·8	6·9	80	9·4	17·9	110	96
2. Roots, Tubers, &c.—																	
Canna edulis (Queensland arrowroot)	76·8	0·3	0·1	20·5	0·7	1·6	0·2	0·1	..	18·5	..	184	100	18·6	18·9	1,650	48
Carrot	83·0	1·0 (0·6–1·2)	0·2	11·9	1·6	2·3	0·7	0·3	0·1	11·0	0·9	41	87	10·6	14·0	550	85
Kohl rabi	84·6	1·2 (0·8–2·0)	0·1	9·7	3·0	1·4	0·5	0·2	..	8·8	1·5	51	90	9·4	11·6	825	96
Mangolds	85·0	1·2 (0·5–1·7)	0·1	10·0	2·3	1·4	0·7	0·1	..	9·0	1·1	101	70	7·1	11·9	1,650	127
Melon, pie	94·0	0·7	0·2	3·3	1·4	0·4	0·5	0·2	0·2	3·9	0·8	25	90	4·8	6·7	825	188
Potato, English ..	75·5	2·1	0·1	20·4	0·9	1·0	1·1	0·2	..	18·4	..	92	100	18·6	21·1	825	48
Potato, sweet ..	70·8	1·9 (0·5–2·8)	0·2	25·3	0·8	1·0	1·0	0·2	..	23·0	..	115	100	23·2	25·5	825	39
Pumpkins	83·0	2·2	0·9	9·0	3·1	1·6	1·5	1·0	0·6	8·0	1·6	11	85	9·7	17·7	165	93

TABLE I.—*continued.*

Composition of Stock Foods—*continued.*

—	Crude Nutrients Per Cent.						Digestible Nutrients Per Cent.					Nutritive Ratio 1 :	Per 100 lb.			Lb. of Fodder to Supply.	
	Moisture.	Protein.	Fat.	Carbohydrates.	Fibre.	Ash.	Crude Protein.	True Protein.	Fat.	Carbohydrates.	Fibre.		Value.	Starch Equivalent.	Food Units.	1·65 lb. Protein.	9·0 lb. Starch Equivalent.
Green Fodders.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
2. Roots, Tubers, &c.—*continued.*																	
Sugar beet	77·0	1·3	0·1	17·8	1·8	2·0	1·0	0·3	..	17·5	0·7	61	75	13·9	20·7	550	75
Swede, purple top ..	86·0	1·0 (0·8–1·3)	0·1	10·1	1·6	1·2	0·6	0·2	..	9·7	0·8	52	85	8·9	12·0	825	101
Turnip, Scotch, yellow top	89·5	1·0 (0·6–1·2)	0·1	6·7	1·6	1·1	0·6	0·2	..	6·4	0·6	35	77	5·5	8·5	825	164
3. Various—																	
Cabbage	89·0	1·5	0·4	5·9	2·0	1·2	1·1	0·7	0·2	4·6	1·4	9·2	94	6·7	9·1	236	134
Mustard	85·1	3·9 (2·5–4·5)	0·5	5·1	3·0	2·4	2·5	1·8	0·3	3·5	1·6	3·2	90	6·7	11·9	92	134
Prickly-pear	86·5	0·4	0·1	8·8	1·8	2·4	0·2	0·2	..	4·0	0·5	23·0	85	3·6	5·0	825	250
Rape	86·0	3·5	0·7	4·2	3·5	2·1	2·6	1·9	0·4	2·9	1·9	2·9	87	6·4	12·1	87	140
Saltbush	67·8	5·0 (4–6)	0·7	14·8	6·6	5·1	2·6	1·5	0·3	9·8	2·6	8·7	60	8·6	19·5	110	105
Sheep's Burnett ..	76·3	4·4 (3·3–5)	0·7	9·0	6·2	3·4	2·4	1·3	0·3	6·0	2·5	7·0	70	7·2	15·1	127	125
†Sweet potato vines ..	85·6	2·0	0·7	6·3	2·8	2·6	1·0	0·6	0·2	5·2	1·8	12·3	80	6·4	9·9	286	141
Turnip, Swede } leaves ..	88·4	2·2	0·5	5·3	1·5	2·1	1·5	0·4	0·2	4·2	0·8	13·5	93	5·4	9·1	413	167

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
4. Silage—																	
Maize	70·0	1·9 (1·5–2·6)	0·7	15·5	9·2	2·7	1·0	0·6	0·3	10·7	5·2	27·5	82	14·0	19·0	286	64
Sorghum	74·3	1·8	0·4	10·4	8·9	2·2	·9	0·5	0·2	7·3	4·9	28·6	78	11·5	16·6	330	78
Sugar-cane tops ..	78·0	1·3	0·6	9·4	8·0	2·7	·6	0·3	0·2	6·6	4·0	55	80	15·1	18·0	550	60
Wheat, thistles, and mustard	65·0	4·6	1·2	13·5	11·9	3·8	2·2	1·2	0·6	9·5	6·5	9·8	80	10·4	17·3	136	87
Dry Fodders.																	
5. Hay and Chaff—																	
Barley	9·5	10·4	2·2	37·2	31·8	8·9	4·8	3·4	0·8	23·2	18·0	12·6	66	30·5	54·9	49	29
Bush hay, good ..	7·5	6·1	1·9	38·6	39·8	6·1	2·8	1·9	0·6	24·0	22·6	25·2	66	32·8	54·9	87	27
Bush hay, poor ..	6·5	2·8	1·1	36·6	45·3	7·3	1·4	0·7	0·5	18·5	20·2	56·8	50	20·3	43·3	236	54
Cowpea chaff ..	8·1	15·7	4·3	31·5	26·6	13·8	11·2	6·8	1·9	19·0	13·5	5·3	67	28·6	64·2	24	31
Lucerne, before flowering	8·2	21·0	2·8	31·4	25·9	10·7	15·7	10·5	1·3	21·2	11·8	3·4	63	28·7	75·0	16	31
Lucerne, in full flower	10·0	15·0	2·8	33·2	31·0	8·0	10·3	6·6	1·3	20·3	13·9	5·6	57	24·6	62·7	25	37
Lucerne chaff, poor ..	10·0	16·6	0·9	39·3	25·2	8·0	11·3	7·3	0·4	24·4	11·3	5·0	57	24·8	64·8	23	36
Lucerne chaff, good ..	8·0	20·7	1·4	40·9	20·0	9·0	15·5	10·3	0·7	27·7	8·4	3·6	63	29·8	76·4	16	30
Wheat	10·0	9·4 (6–10)	0·8	47·4	27·6	7·8	5·2	3·6	0·4	27·6	14·6	9·2	67	24·4	46·0	46	37
Wheat chaff	12·0	4·7 (4–6·5)	1·7	42·0	30·4	9·2	2·1	1·5	0·9	26·1	16·1	28·1	67	29·2	47·4	110	31
6. Straw—																	
Barley	8·5	3·5	2·0	38·4	41·0	6·6	1·0	0·7	0·8	20·2	22·0	62·5	46	20·5	46·2	236	44
Oats	9·2	4·0	2·3	42·4	37·0	5·1	1·5	1·2	0·7	19·4	21·0	34·8	43	18·4	45·5	136	49
Wheat	8·3	2·9	1·2	42·6	39·0	6·0	0·2	0·1	0·4	15·6	19·5	36·0	32	11·5	36·4	1,650	78
7. Grains, &c.—																	
Barley	14·0	8·6	1·5	71·0	2·7	2·2	6·5	5·9	1·2	65·0	1·6	11·7	98	73·2	85·4	28	12
Beans	14·3	25·4	1·5	48·5	7·1	3·2	20·1	19·3	1·2	44·1	4·1	2·6	97	66·7	101·1	9	14
Canary seed	11·5	15·2	5·4	57·7	5·1	5·1	11·5	10·6	4·3	48·7	2·9	5·6	97	69·6	88·4	16	13
Cowpeas	14·8	20·8	1·4	55·7	4·1	3·2	16·5	15·8	1·1	50·5	2·4	3·5	97	68·0	96·5	10	13
Kaffir corn	9·3	9·9	1·4	74·9	1·5	3·0	7·3	6·8	0·9	56·2	0·8	8·7	95	62·0	77·2	24	15
Linseed	7·9	18·2	38·6	20·0	12·1	3·2	14·6	13·6	32·8	16·0	1·0	7·0	98	107·5	132·3	12	8
Maize	13·0	9·5 (8–13)	4·0	69·3	2·8	1·4	6·7	6·2	3·5	65·8	1·8	12·1	100	80·8	91·8	28	11
Millet (foxtail) ..	12·8	10·9	2·9	55·2	14·3	3·9	8·3	7·7	2·1	41·5	1·3	6·1	95	51·6	68·0	22	17

TABLE I.—*continued.*

Composition of Stock Foods—*continued.*

—	Crude Nutrients Per Cent.						Digestible Nutrients Per Cent.					Nutritive Ratio 1 ÷	Per 100 lb.			lb. of Fodder to Supply.	
	Moisture.	Protein.	Fat.	Carbohydrates.	Fibre.	Ash.	Crude Protein.	True Protein.	Fat.	Carbohydrates.	Fibre.		Value.	Starch Equivalent.	Food Units.	1·65 lb. Protein.	9·0 lb. Starch Equivalent.
Dry Fodders.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
7. Grains,&c.—*continued.*																	
Millet, Japanese ..	11·5	12·6	4·8	60·8	8·6	3·7	10·2	9·1	3·7	45·7	1·2	6·0	95	60·1	80·2	18	15
Oats	13·3	10·3	4·8	58·2	10·3	3·1	8·0	7·2	4·0	44·8	2·6	7·8	95	59·5	75·8	23	15
Sorghum	12·8	8·9	3·6	70·8	2·0	1·9	4·6	4·1	2·8	60·6	1·2	16·5	98	70·0	79·2	40	13
Sunflower	8·6	16·3	21·2	21·4	29·9	2·6	14·7	12·8	20·2	15·4	11·0	5·9	92	80·0	111·7	13	11
Wheat, plump ..	13·4	12·8 (7·5–16·6)	2·0	67·7	2·4	1·7	10·8	9·5	1·3	62·2	1·1	6·9	95	71·1	93·0	17	13
Wheat, shrivelled ..	11·1	16·5	3·0	63·6	3·5	2·3	13·9	12·3	1·9	58·5	1·7	5·2	95	71·9	98·8	13	13
8. Oilcakes and Meals and By-products—																	
Barley branning ..	10·5	14·0 (11–15)	3·8	57·3	10·1	4·3	11·9	10·8	3·2	45·0	3·1	5·1	96	62·3	84·6	15	14
Barley meal	11·7	12·4 (10–13·5)	1·0	67·1	5·3	2·5	9·4	8·5	0·8	61·0	3·0	7·7	98	72·2	89·2	19	12
Bran	10·6	15·8 (13–18)	2·6	56·3	9·8	4·9	12·3	11·6	1·8	40·5	3·3	4·1	77	45·0	78·0	14	20
Brewers' grain, wet ..	73·0	7·5	2·0	10·1	6·0	1·4	5·5	5·2	1·6	6·2	2·4	2·3	86	14·6	25·8	32	62
Cocoanut cake ..	12·8	17·2	7·5	46·7	10·5	5·3	13·5	13·0	7·2	39·8	6·6	4·9	100	75·9	102·5	13	12
Corncobs, ground ..	8·4	2·5	0·7	54·7	32·0	1·7	0·5	0·3	0·6	26·3	18·3	15·3	50	23·1	47·1	550	39
Cotton-seed meal, decort.	9·0	41·0	7·0	29·0	8·0	6·0	35·3	33·7	6·6	19·5	2·2	1·1	97	67·2	125·9	5	13

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Cotton-seed meal, undecort.	9·0	24·0	5·0	35·0	22·0	5·0	17·1	16·2	4·5	18·0	4·0	2·0	84	40·3	75·6	10	22
†Linseed meal (crushed linseed)	7·9	18·2	38·6	20·0	12·1	3·2	14·6	13·6	36·6	16·0	4·0	7·9	99	119·5	144·5	12	7½
†Linseed oil meal ..	9·8	25·5 (25–27)	8·0	39·2	11·0	6·5	22·0	20·9	7·4	31·4	4·5	2·6	96	70·4	108·7	8	13
Linseed meal (new process)	11·2	27·2	0·8	40·7	13·9	6·2	23·4	22·8	0·7	32·6	7·0	1·8	96	60·3	99·8	7	15
Maizemeal	13·0	8·6 8-12	3·7	71·4	2·0	1·3	5·1	4·6	3·0	60·0	1·1	14·7	98	70·3	80·3	36	13
Malt sprouts (dried)	10·0	24·4	2·0	42·4	14·0	7·2	19·9	12·0	1·5	30·9	12·7	3·9	75	43·7	96·6	14	21
Millet meal	12·0	10·7	4·0	61·1	8·3	3·9	8·0	7·4	3·1	45·8	2·9	7·5	95	59·1	75·2	22	15
Peanut meal	10·7	47·6	8·0	23·7	5·1	4·9	42·8	41·4	7·2	20·2	0·4	0·9	98	75·2	144·9	4	12
Peanut cake (undecort.)	10·3	30·2	9·1	21·8	22·9	5·7	27·7	26·8	8·2	18·4	2·6	1·5	86	56·7	110·0	6	16
Pollard	10·4	15·7 (13·5–20)	3·6	61·4	5·8	3·1	13·8	11·9	3·1	54·0	2·1	5·3	86	63·6	97·1	14	14
Rice meal	10·1	11·5	11·3	55·0	4·6	7·5	6·7	5·9	9·5	50·1	2·3	12·2	96	74·8	89·2	28	12
9. VARIOUS FOODS—																	
Calf meal	10·6	16·2 (12–22)	7·2 5-11	55·9	4·5 3-9	4·6	13·1	10·0	4·5	45·0	4·0	5·9	86	58·3	91·3	17	15
Kubettes for sheep ..	10·0	13·8	3·1	59·5	8·3	5·3	11·0	7·5	2·8	42·0	4·5	7·0	86	51·1	79·9	22	18
Meatworks products—																	
Blood meal ..	10·0	75·1 (71–78)	1·5	7·7	..	5·7	67·0	58·5	1·3	5·0	..	0·01	100	63·1	175·6	3	14
Meat meals ..	8·0	54·4 (46–66)	8·0 2-14	6·1	..	23·5	48·3	42·0	7·0	4·5	..	0·5	100	60·8	143·3	4	15
Milk, cow's, whole ..	87·2	3·6	3·7	4·8	..	0·7	3·4	3·4	3·7	4·8	..	4·0	100	16·9	22·2	49	53
Milk, butter milk ..	90·8	3·6	0·8	4·1	..	0·7	3·4	3·4	0·8	4·1	..	1·8	100	9·2	14·5	49	98
Milk, butter, dried ..	7·0	34·5	1·1	49·1	..	8·3	32·5	32·5	1·1	49·1	..	1·6	100	82·3	132·9	5	11
Milk, separated ..	90·4	3·8	0·1	4·9	..	0·8	3·6	3·6	0·1	4·9	..	1·4	100	8·6	14·2	46	105
Milk, skim milk powder	6·0	32·7	1·6	52·0	..	7·7	31·0	31·0	1·6	52·0	..	1·8	100	85·0	133·3	5	10
Milk, whey	93·4	0·7	0·2	5·0	..	0·7	0·6	0·6	0·2	5·0	..	9·1	100	6·1	7·0	286	150
Molasses	24·0	2·2	..	63·8	..	10·0	1·0	..	..	57·3	..	..	88	50·3	59·8	8	18
Treacle cubes	9·9	27·1	4·0	38·7	15·3	5·0	23·0	21·8	3·6	25·4	4·0	1·7	85	49·8	95·6	8	18
Linseed nuts	10·2	27·7	6·2	37·9	11·5	6·5	23·8	22·6	5·7	30·1	5·5	2·2	95	66·8	108·8	7	13

REMARKS: Foods marked † contain Hydrocyanic acid,

TABLE II.

Percentage of Nutrients Digested in Stock Foods.

	Crude Protein.	Crude Fat.	Carbo-hydrates.	Crude Fibre.
BY RUMINANTS—				
Pasture grass	56	46	61	62
Bush hay	35-61	49	49-65	46-64
Lucerne, green	77-83	37-54	65-77	32-47
Lucerne chaff	66-73	30-51	61-71	34-65
Green maize	56-78	40-83	66-78	59-75
Green sorghum	62	85	78	60
Wheat straw	0-26	17-44	29-40	42-59
Bran	80	51-60	40-88	37
Maize	58-84	81-99	84-100	46-100
Potatoes	23-88	..	82-99	..
Mangolds	44-89	..	91-100	0-43
Linseed cake	80-90	86-97	60-96	0-92
Cotton-seed meal, decorticated	84-96	93-100	44-71	0-100
Cocoanut cake	75-84	96-100	80-86	54-73
BY HORSES—				
Bush hay	43-62	6-33	45-61	34-39
Lucerne hay	70-77	6-30	67-71	35-44
Wheat straw	12-44	..	4-56	3-14
Potatoes	88	..	99	9
Carrots	99	..	94	..
Oats	68-94	50-88	70-84	1-56
Maize	75-78	59-63	90-94	40-100
Linseed cake	57-88	53	94-98	..
BY PIGS—				
Potatoes	57-88	..	97-99	28-83
Maize meal	84	74	94	41
Wheat	80	70	83	60
Bran	75	70	65	30
Mangolds	55	..	98	79
Linseed cake meal	86	80	85	12
Cocoanut cake	73	83	89	60
Meat meal	97	86	..	..
Sour milk	96	95	98	..

CHART OF DIGESTIBLE NUTRIENTS IN STOCK FOODS

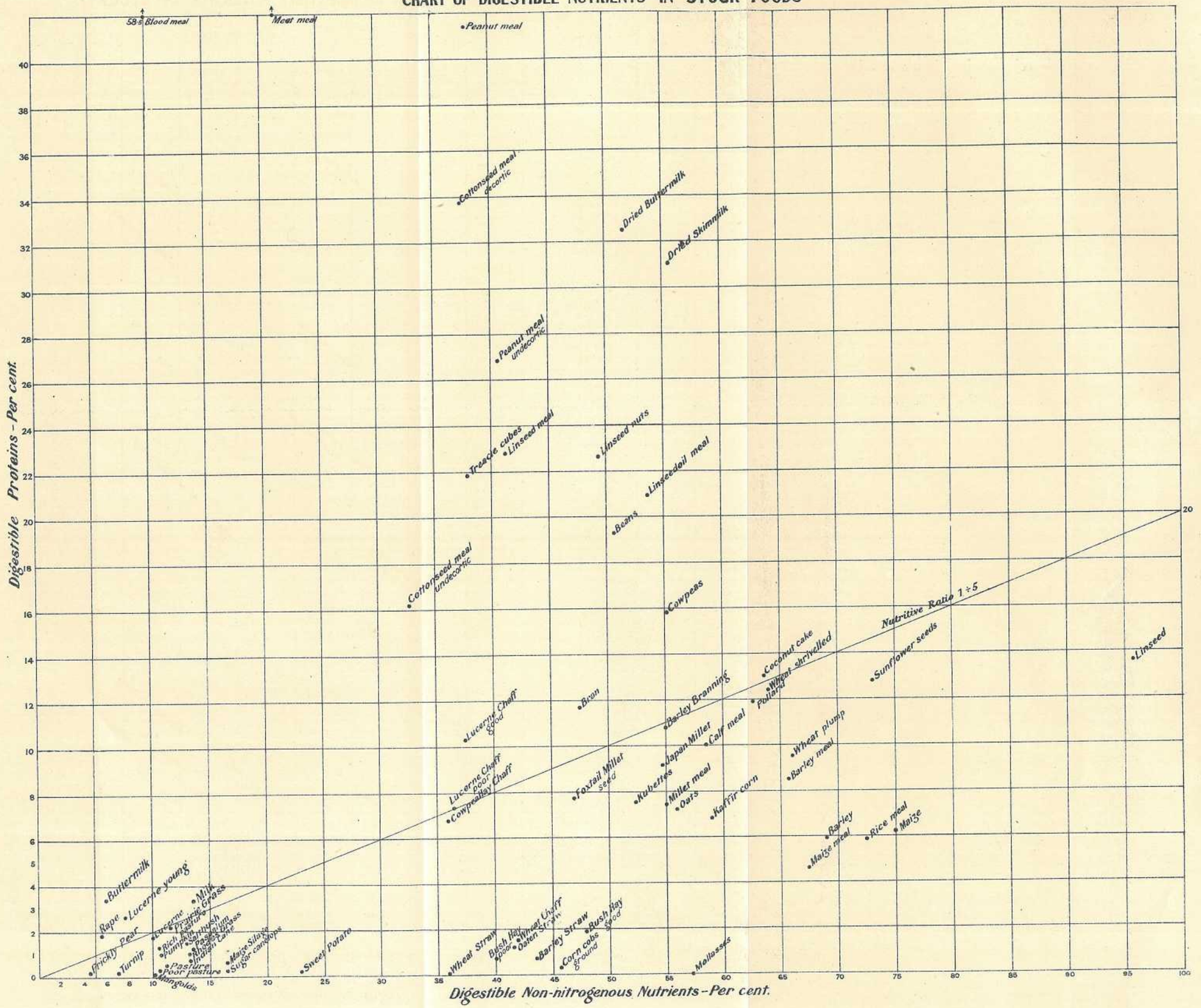


TABLE III.

Standard Rations.

Per Day and per 1,000 lb. Live Weight of each Animal.	Dry Material in Total Ration.	Digestible Nutrients.	
		Pure Protein.	Starch Equivalent.
	Lb.	Lb.	Lb.
Horses—			
At light work	18 to 23	1·0	9·2
Medium work	21 to 26	1·4	11·6
Heavy work	23 to 28	2·0	15·0
Milch Cattle—			
Yielding 10 lb. milk	22 to 27	1·0 to 1·3	7·8 to 8·3
Yielding 20 lb. milk	25 to 29	1·6 to 1·9	9·8 to 11·2
Yielding 30 lb. milk	27 to 33	2·2 to 2·5	11·8 to 13·9
Yielding 40 lb. milk	27 to 34	2·8 to 3·2	13·9 to 16·6
Fattening cattle	24 to 32	1·5 to 1·7	12·5 to 14·5
Growing Cattle—			
2-3 months, 150 lb. weight	23	3·4	18·5
3-6 months, 300 lb. weight	24	2·8	14·7
6-12 months, 500 lb. weight ..	26	2·3	12·5
12-18 months, 700 lb. weight ..	26	1·8	10·5
Sheep maintenance diet	18 to 23	1·2	8·7
Sheep fattening diet	24 to 32	1·9	14·5
Lambs, wool breeds—			
5-6 months, 60 lb	27	3·0	16·4
6-8 months, 75 lb.	25	2·5	13·0
8-11 months, 80 lb.	23	1·8	10·7
11-15 months, 90 lb.	22	1·5	10·2
15-20 months, 100 lb.	22	1·2	9·7
Growing pigs, fattening diet—			
2-3 months, 44 lb.	44	6·2	33·8
3-5 months, 110 lb.	36	4·5	32·0
5-6 months, 145 lb.	32	3 5	26·5
6-9 months, 200 lb.	28	3·0	24·5
9-12 months, 285 lb.	25	2·4	19·8

Bureau of Sugar Experiment Stations.

THE WORK OF THE BUREAU.

AN INTERESTING REVIEW.

The subjoined review of the last Annual Report of the Director of Sugar Experiment Stations (Mr. H. T. Easterby) (a branch of the Department of Agriculture) recently appeared in the "International Sugar Journal" published in London.

This lengthy report has as usual much of interest, and is so packed with information that it is perfectly impossible to do it justice in a short article; it extends to about eighty folio pages. The author has made it a custom periodically to supply various details as to the progress made in the industry for a number of years; and now that Queensland is becoming one of the chief cane-sugar producers of the world it may be of interest to review some of the lines of progress. One of the most striking among these is the rapidity of the increase in the acreage under cane and the amount of sugar produced per acre. A table is presented as regards this for the past twenty-six years, which practically coincides with the period of activity of the Bureau. Without repeating this long table, we can perhaps obtain the best idea by averaging the figures for the first and last five years periods, as follows:—

	Acres cultivated.	Acres crushed.	Tons of cane.	Tons of sugar.
1899-1903 ..	105,719 ..	69,945 ..	932,137 ..	101,031
1920-1924 ..	204,543 ..	113,867 ..	2,202,402 ..	283,139

It will at once occur to anyone reading these figures that, while the acreage crushed at the commencement of the period had not doubled at it conclusion, the sugar produced had during the same interval increased by nearly three times. This is a result of which the Bureau may well be proud. Great changes had, of course, taken place in the structure of the industry; there was the change from kanaka to white labour which was so confidently prophesied to bring about the ruin of the factories; the large estates were split up into a vast number of small plots, bringing into being a cane-farming population, independent of the mills; the latter were wholly remodelled and all small uneconomic ones were scrapped; the kinds of cane grown were completely altered. . . . A great deal of the most various scientific work was done by the Bureau, especially perhaps in the fighting of the pests in the fields, and a mass of advice was distributed to the farmers for their help and guidance. . .

One other point of great import is strongly commented on by the Director, and that is the lengthening of the crushing season. The natural season for crushing the sugar-cane the world over is when the active growth slows down in the dry, cold period: fortunately in most parts of the tropics the rains occur mainly in the summer, especially in regions of periodic rains. But the great masses of cane grown in the past two years have resulted in the milling season being extended after this cool, dry period into the hot, rainy season. Without more exact knowledge of the local possibilities one cannot suggest a remedy, but the Director appears to consider that it can be obtained, and it certainly needs attention. With the annual increase in the amount of sugar which has to find its level in the world's markets, it is obvious that, for the wave of prosperity which seems to be passing over the industry not to have a serious backwash, a great deal of fundamental work is opening up for the Sugar Bureau, and it is sincerely to be hoped that its warnings will be attended to in time.

SUGAR CROP ESTIMATE.

The Director of Sugar Experiment Stations, Mr. H. T. Easterby, places the present approximate estimate of this year's manufacture of raw sugar in Queensland at 380,000 tons. It may be pointed out that this is a considerable reduction in the estimates formed at the beginning of the year and is the result of the prolonged dry weather in nearly all the sugar areas of Queensland. This year there has been no regular wet season. If the dry weather persists it is quite possible that this estimate will be still further reduced.

Last season a good many of the Northern mills were obliged to crush into the early months of the present year, due to their large tonnages; this year, however, it is anticipated that all the mills should finish by the end of December.

CANE PESTS AND DISEASES.

The following report has been received (13th August, 1926) from the Assistant Entomologist, Mr. R. W. Mungomery, by the Director of Sugar Experiment Stations (Mr. H. T. Easterby):—

In the early part of July the Homebush and Sarina areas of the Mackay district were visited. The Homebush area was found to be comparatively free from pests of any serious nature, but Sarina, on the other hand, appears to have suffered one of the worst attacks in the history of canegrowing in that centre, and this year it stands out as one of the worst affected parts of the Mackay district.

This resulted from the incursions of the "greyback" cockchafer grubs (*L. albohirtum*), and it was augmented by the extremely dry weather conditions that set in from March onwards, when the grubs were reaching their third stage—the most destructive period in their life cycle.

Distribution and Effects of the Grubs *(L. albohirtum)*.

The worst damage occurred in the West Plane Creek and Middle Creek areas, and to a lesser extent near the Plane Creek Mill. When riding along the fertile valleys between the hills, fields of cane with brown and dead foliage gave indication of the haunts of these pests and of the terrible toll that they were exacting. On one farm a 30 to 35 ton crop was ruined and lying down, and a great deal of it was unfit for the mill; this damage occurred on new scrub land that had been planted with cane only the previous year, as well as on the older land, but this damage on the new land was not nearly so bad as that which resulted on the lands which had been cropped for a number of years previously.

The majority of the cane crops affected by grubs were standing, and this was no doubt due to the drier season which made the grubs feed lower down in the ground at a depth where they encountered sufficient moisture for their development. Hence, although the deeper roots were eaten off, the surface laterals were intact and still able to support the stool.

Nearly all varieties suffered, but some to a more marked degree than others, and those affected included D. 1135, Black Innis, Cheribon, M. 1900 Seedling, Pompey, H.Q. 458, E.K. 28, and Q. 813. Some farmers were inquiring concerning more resistant varieties, but the two former canes are some of the best and most resistant to grub attack of the canes yet introduced, and, provided, of course, that they are free from disease, I would recommend growers to continue planting these canes in their grub-infested lands. Should they attempt to grow some of the other popular canes, the effects of grub invasion would be even more disastrous.

Although beetles are collected rather extensively during the flighting season—and a spirit of co-operation exists in this direction which other localities might well emulate—one hears of no fumigation being attempted in this district, and it is surprising that growers should be apparently so apathetic towards this phase of control work until the pest delivers its blow. Let them therefore be guided by their past bitter experience and order ahead a small quantity of either carbon bisulphide or paradichlor. (or both if they wish to test their relative efficiencies in this district) in anticipation of a similar state of affairs in the ensuing year, and let them remember that fumigation directed against the small first-stage grubs in the early part of the year (i.e., January or February, as the case may be) has a greater chance of success than if left until the grubs, being in their second and third stages, are larger and more able to resist such control measures.

R. Limbatipennis.

Records were given by farmers where this beetle had been seen plentifully in the earlier months of the year feeding on Shea Oaks and of their larvæ being present in the soil nearby. These latter seem to have all been accounted for by the flocks of birds which followed the ploughs and planter prior to and during planting operations, with the result that I had no complaints brought forward of these insects doing damage here, and good "strikes" seem to have followed the early plantings. Adults of this species were not in evidence at the time of my visit.

The Mound-Building Ant *(Iridomyrmex* sp.).

This insect was found on the headlands of some cane paddocks amongst blady grass (*Imperata arundinacea*), but was not doing the damage such as has been credited to this insect elsewhere. Several of these ants were in a more or less comatose state, probably hibernating, whilst several of the mounds were totally deserted.

Rhabdocnemis obscurus.

I am indebted to Mr. N. L. Kelly for bringing under my notice the occurrence of the cane weevil borer in some Badila at Carmilla, and I would advise growers so troubled to read remarks and observe precautions as outlined in my last month's report on this insect in the Mackay district.

Mr. N. L. Kelly, Assistant to Pathologist, reports (21*st August*, 1926):—

Proserpine.

Proserpine is at present afflicted more by pests than by diseases, and by drought more than either of these.

The beetle borer (*Rhabdocnemis obscurus*) was found fairly widely distributed in the Cannon Valley and Saltwater districts. There are many farmers who cannot distinguish this pest from the less dangerous noctuid moth borer (*Phragmatiphila truncata*).

1. The moth borer may be in the tip or middle, or less frequently in the butt of the stem; while the beetle borer is always to be found in the butt.

2. The larval stages—the stages in which they bore actively—are easily distinguishable; the larvæ of the former being a caterpillar, grey to light-purplish in colour with a red head, and having prolegs, legs, and anal claspers. It is about 1-1½ inches in length. The larvæ of *R. obscurus* is a rather stout grub, white, with a red head, and having no legs. It is about ½-¾ inch in length. The following varieties—viz., N.G. 15, E.K. 28, 7R. 428, B. 208, and N.G. 24B, were found infested by beetle borers. Those portions of the stick which had been bored were often considerably contracted in diameter. It is obvious that the selection of seed cane has not been carried out as carefully as it should have been, and that the tachinid flies liberated some time ago have been diminished or destroyed by the burning of the cane in which they were breeding.

The control measures that readily suggest themselves are:—

1. Harvest the infested fields as soon as possible, so as to minimise the emergence of the weevil.

2. Never plant infested sets, but burn these before the beetle merges.

3. If and when the parasites are liberated, allow at least half an acre of infested cane to stand over, in which the parasites may breed.

The grub of the greyback cockchafer (*Lepidoderma albohirtum*) had caused very serious losses to at least six farmers, in one case the damage being estimated at £150. In most cases many feeding trees—*e.g.*, figs and ashes—could, with advantage, be destroyed; and a trial of paradichlorbenzene, a fumigant which can be obtained from several Brisbane firms, is strongly to be recommended.

The true wireworm (*Monocrepidius* sp.) was observed on a number of farms that were being prepared for the spring planting, and it will, doubtless, do considerable damage there. The fields in question had lately borne a heavy crop of grass and weeds, hence an obvious control measure—cultivate the fields better, thus removing the plants on which the *Monocrepidius* sp. (one of the click-beetles or skip-jacks) feeds. These—true wireworms—are Elaterids. The Chrysomelid "wireworm" (*Rhyparida limbatipennis*) was found on one field only. The season has not been favourable for a general emergence as early as July. The larvæ attacking each set were quite numerous—6-12. At the time of observation—a week after planting—they were still feeding on the ends, and had not attacked the eyes. The field was of a light sandy loam on a bloodwood ridge, and situated more than half a mile from the nearest shea-oak tree. This field had lately been under weeds, and many farmers are of the opinion, backed in one instance by observation, that *R. limbatipennis* can feed on other plants than the shea-oak; nevertheless, the demolition of these trees, coupled with the abnormal season, may considerably reduce the infestation on up-river farms this year. There is a certain amount of damage caused by wallabies, scrub turkeys, and particularly opossums in Up River and Kelsey Creek farms. One farmer estimates his loss, due to opossums alone, at 20 tons of cane, and thinks it desirable to have the season declared open for a longer period.

The Lower Burdekin District.

The Lower Burdekin district is infected to a very small extent with Mosaic, and far more considerably with Leaf Stripe. The cane-killing weed was found on about five farms at Home Hill. Top Rot, at present, is hardly to be found, though, in the summer, it will probably be as bad as ever. It may be that too much irrigation just before rain is a contributing factor.

Leaf Stripe.—It is rather disheartening to find that the majority of the farmers who are most seriously affected by this disease have not shown sufficient interest in their own affairs to read the reports, lately published, dealing with the five major

diseases, of which this, of course, is one. No farmer can judge the work of the Bureau who has not first tried active co-operation with us.

Leaf Stripe can be found in the Lower Burdekin practically wherever B. 208 is grown in quantity, and only in one badly-infected field had it spread to another variety—H.Q. 426. As no immune variety is known, this fact proves that secondary infection—by the fruiting bodies of the fungus being borne on the wind to, and germinating on, other canes is not very rapid. The wide distribution, and the frequent high percentage of infection, can thus be explained mainly by the lack of knowledge of the appearance and transmissibility of the disease, or by the carelessness of the farmers concerned.

1. The disease is widespread in the B. 208 grown at Airdale, Maidavale, and Klondyke. The losses caused by the disease vary with the variety of cane, and are sufficiently evident to all who grow B. 208 in those localities.

2. *Symptoms.*—The leaves of an infected stem are marked by curious stripes running from the base towards the tip. The stripes are few in number (say, 3-8), and are composed of many very narrow pale green or yellow discontinuous lines. The stripes alternate somewhat irregularly with stripes of the normal green tissue. Underneath the stipes is to be found a faint white fungus mycelium. On this are borne the "fruits"—conidia or spores—which in spring and summer bring about secondary infection, if most conditions prevail. When the stripes become older the tissues gradually die, and become compounded of red or brown longitudinal lines. In B. 208, in a badly-infected field, many stems may grow to abnormal lengths—coupled with a narrowness of the stem—and may be seen as freak stalks standing about 2 feet higher than those adjoining. Some farmers believe that these are the only diseased stems in the field, and again that the disease is a sign of general ill-health, or of the "running-out," of the variety. These beliefs are quite contrary to the facts, which are quite demonstrable.

3. *Control.*—(*a*) Eradicate infected fields after harvesting,—this often being advisable even with plant crops. If a crop is infected to a smaller extent than (say) 5 per cent., dig out infected stools when the cane is young (three or four months old). This prevents any secondary infection, and is very necessary if the field is to be used for seed. Avoid planting B. 208 in a field which has just carried a diseased crop, unless the preparation has been very thorough.

(*b*) If possible, choose as a source for seed, only a clean field. Several clean fields are to be found at Maedesme, Jarvisfield, Kalamia, &c.

Among the pests noted in this district were the Giant Termite (*Mastotermes darwiniensis*) on many farms, cane grubs on about six farms, and the bud moth (*Opogona glycyphaga*). The caterpillar of this moth was widespread around Ayr. It had destroyed 50 per cent. of the eyes in one field of H.Q. 426, and had bored into the stem in several cases. For description, see Bulletin No. 3, by Edmund Jarvis, of this Bureau (page 11).

NOTES ON A JAVANESE DIGGER-WASP.

By EDMUND JARVIS, Entomologist in Charge of the Meringa Laboratory.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, has received the following report (19*th August,* 1926) *from the Entomologist at Meringa, Mr. E. Jarvis*:—

The female specimen of *Triscolia rubiginosa*—mentioned in our last monthly report (May to June) as having been left at our Laboratory last month by Mr. H. Freeman—lived for twenty-seven days, dying on 11th July. Upon confining it in a suitable cage when first received, containing a grub of *Xylotrupes australicus* buried in damp soil, it deposited an egg (as was anticipated) on this new host. During the period 15th June to 10th July (26 days) it oviposited sixteen times on larvæ of this dynastid, known commonly by the name "Elephant Beetle." When caged with grubs of our cane-beetle, *Lepidoderma albohirtum* Waterh., however, it refused to lay eggs on them or to attack or paralyse them in any way.

Such indifference was not surprising, seeing that the latter destructive cane-beetle is not closely related to *Xylotrupes gideon* (the usual host of this wasp-parasite in Java), but belongs to quite a different sub-family, viz., the Melolonthidæ, the grubs of which feed on living vegetable tissue, whereas those of the Dynastidæ, which includes genus *Xylotrupes*, subsist for the most part on dead matter, such as humus, rotting wood, twigs, leaves, &c.

It is interesting to note, however, that nine of the eggs deposited by *rubiginosa* died between the dates 15th June to 11th July. The only wasp maggot, in fact, that attained full development (a female specimen) was that derived from an egg laid

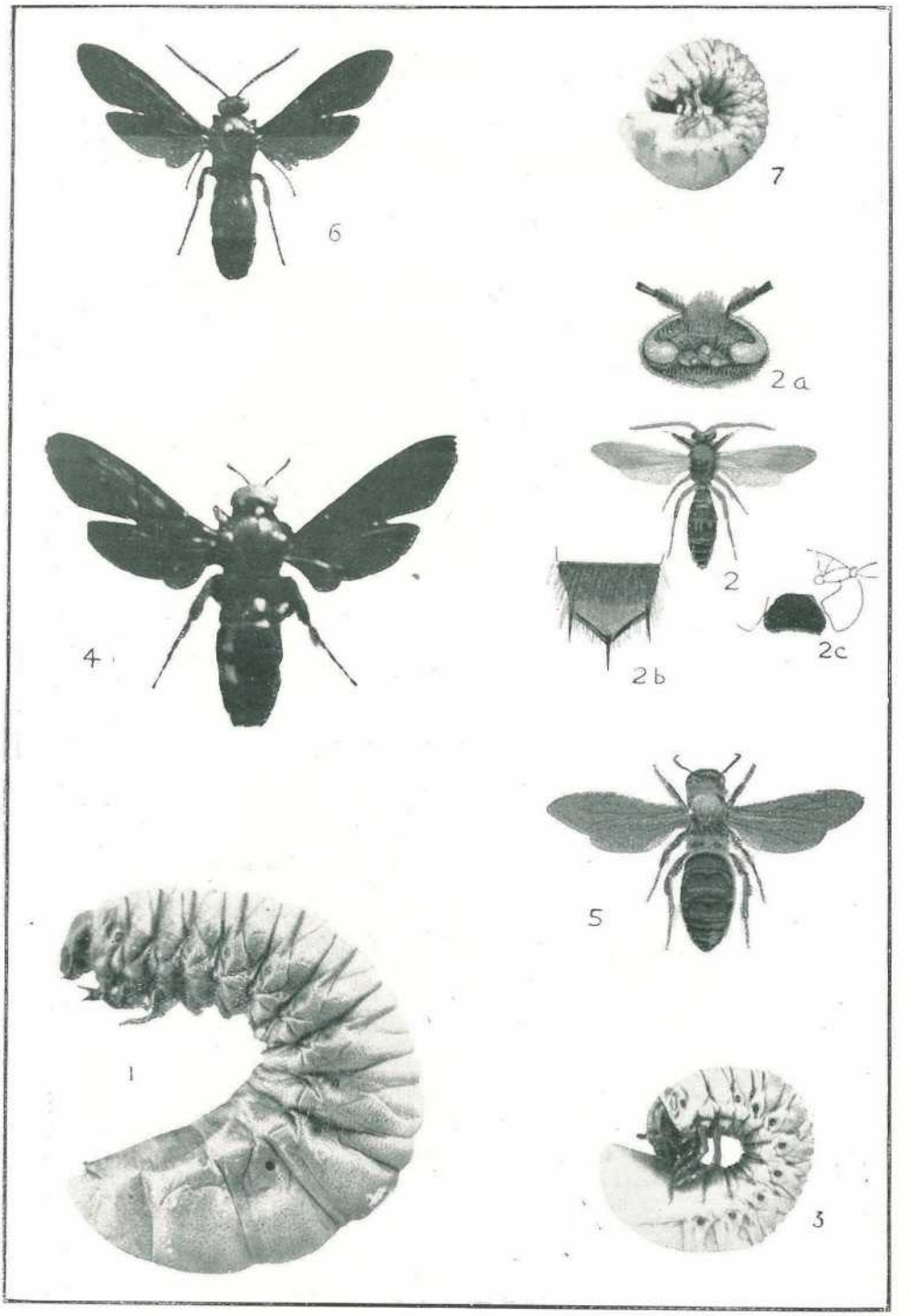


PLATE 38.

1. Grub of *Xylotrupes australicus* (full size).
2. *Campsomeris tasmaniensis*, male (slightly magnified).
   2*a*. head of same; 2*b*. anal segment of same; 2c. labrum of same.
3. Grub of *Lepidoderma albohirtum* (full size).
4. *Triscolia rubiginosa*, female (natural size).
5. *Campsomeris tasmaniensis*, female (slightly magnified).
6. *Triscolia rubiginosa*, male (natural size).
7. Grub of *Dasygnathus australis-dejeani* (full size).

upon a grub of its Javanese host (*X. gideon*) during the passage to Cairns. This egg hatched on 19th June, the larval stage being found to occupy eleven days, at the end of which period this maggot started to spin. The following day, however, this larva suddenly turned black and died before able to construct its cocoon.

On 15th June a grub of *albohirtum* (our greyback cane-beetle) was caged with this parasite, and when examined next morning the grub displayed normal activity, not having been attacked by the wasp. This test with our cane grub was repeated on the following day with similar results.

In addition to its belonging to a different sub-family, as above mentioned, the fully grown grubs of *australicus* and *albohirtum* differ considerably in size (see accompanying photos, Figs. 1 and 3), which probably affords another reason why the latter grub has proved an unsuitable host for this Javanese parasite.

Similarly, the female of *Triscolia rubiginosa* is much larger also than that of *Campsomeris tasmaniensis*, the Australian wasp parasite of our cane-grub (see Figs. 4 and 5).

The larva of *Dasygnathus australis-dejeani* Macl. which, although belonging to a different genus from *Xylotrupes*, is a species of Dynastidæ, happens to be still smaller than that of *albohirtum* (see Fig. 7), so that the possibility of its being able to serve as a host to *rubiginosa* seems quite out of the question.

Six of the paralysed grubs of *X. australicus* died before the larvæ of *rubiginosa* (hatched from eggs laid on them by this parasite) had become half grown, with the result that these wasp larvæ died also, through inability to obtain suitable nourishment. Another of these grubs was destroyed by the entomogenous fungus *Metarrhizium anisopliæ*, while three others perished prematurely, possibly from mechanical injuries received when digging them up from under rubbish heaps. Up to the present (13th July) only three paralysed grubs of *X. australicus* carrying eggs and very small larvæ of this wasp remain alive.

Although the introduction of this female digger-wasp will not, it appears, prove of any value as a controlling factor affecting the economy of our cane-grub, some useful data of a scientific nature have nevertheless been obtained regarding its life-cycle and ecological relationships associated with those of certain of our scarabæid beetles in North Queensland.

The parasitic phase of natural control of any insect pest constitutes a study presenting such difficulties as only a trained entomological expert can hope to fully appreciate.

Many exceedingly complex factors, affecting what is known as the balance of nature, call for serious consideration, a perception or knowledge of which often demands the employment of special apparatus and original methods of scientific experimentation.

Even when fully satisfied as to the advisability of introducing any insect into another country, "in no case will it suffice," says Dr. L. O. Howard, "to turn the imported material loose, even under the most apparently favourable conditions. The original supply must be multiplied by breeding, and experimental loosings must be made."

In the present instance we find from investigations carried out at Meringa Laboratory, that although the grub of *X. australicus* is about the same size as that of *X. gideon*, the former is apparently unable to endure the sting given by this Javanese digger-wasp, and consequently dies before its parasitic larva has had time to attain full development. In one instance a grub of our Elephant Beetle succumbed a few hours after being paralysed. The grub of *X. gideon*, however, having doubtless become accustomed to the sting, remains alive from nine to eleven days, allowing ample time for the maggot of *rubiginosa* to become fully grown. In conclusion, it might be mentioned that we have not up to the present discovered any indigenous wasp parasite associated with *X. australicus*. *Campsomeris ferruginea* Fabr. might be large enough to attack it, but is very rare in the Cairns district. Fortunately, however, our large Elephant Beetle is of little or no economic importance.

Results of Experiment Plots, 1925-26.

These plots were laid down on red volcanic soil at Meringa by Mr. A. N. Burns (Assistant Entomologist), who has supplied the following details relative to the results obtained against our cane-grub, *Lepidoderma albohirtum* Waterh., by the use of various soil fumigants.

SUMMARY, &C., OF EXPERIMENTS.

The results of field experiments recorded below cannot be taken by any means as indicative of the best results obtainable from the fumigant used, nor yet even of the ordinary amount of efficiency from each dose in each case. Weather and soil conditions, cultivation, and even the erratic distribution of grub infestation in all the plots have been adverse factors governing the results obtained.

The weather has been abnormally dry, the precipitation to 31st May (1926) being only 37.88 inches as against 57.36 inches for the corresponding period of last year, a difference of 19.48 inches. At the time of putting down each experiment the soil was fairly dry and very hard, and the cane rows very weedy and unworked. Shortly afterwards it was all scarified, but only a couple of inches deep, and long since the weeds have grown to such an extent as in many places to outgrow the cane, and the soil has become consolidated and the surface encrusted. Some "wilted" stools showed no grub attack, wilting being caused by the dry weather and hard ground. The plots that are affected most by dry weather are the paradichlor., calcium cyanide, benzine and naphthalene, and benzine experiments, being all either on top of or on the slope of a hill.

(1) *Calcium Cyanide* (½ drachm doses).—This plot shows a difference of 36.7 per cent. in grub infestation between the treated and control areas in favour of the former. In both plots the cane had suffered last season from grub damage, consequently it was rather uneven; in many places the stools were stunted.

(2) *Paradichlor.* (¼-oz. doses, finely sifted; machine injected).—This experiment gives a result of 48.4 per cent. in the difference of grub infestation between the treated and control plots, in favour of the treated cane. The cane in both blocks was fairly even, but, being situated on the top of a hill, were badly affected by the dry weather.

(3) *Paradichlor.* (¼-oz. doses; hand injected).—With normal weather conditions and proper cultivation this experiment would undoubtedly have given excellent results. With the adverse conditions that prevailed, it gives a percentage of 49.3 per cent. less grub infestation in the treated cane than in the control block. The treated block can readily be observed by the number of green stools when compared with the surrounding cane, also by its much higher and more regular growth.

(4) "*See Kay*" (1-drachm doses).—The cane in both the treated and untreated areas was fairly even, and situated on lower ground than the preceding experiments. Grub infestation was also more sporadic. The treated cane showed a percentage of 7.6 per cent. less in the number of grub-infested stools.

(5) *Benzine and Naphthalene* (4-drachm doses).—This experiment gave a difference of 15.5 per cent. less grub-infestation in the treated cane as compared with the control block. Originally, however, the cane in the control was slightly more vigorous and less patchy than the treated cane.

(6) *Shell Benzine* (4-drachm doses).—This plot gave even better results than the mixture of benzine and naphthalene in saturated solution, showing a percentage of 16.6 per cent. less grub-infestation in the treated cane than in the control plot.

The above percentages, and to some extent those secured from experiment plots described in our last report (June to July) cannot, as already mentioned, be taken as conclusive evidence of the maximum efficiency obtainable from any of the fumigants employed. In order to secure conclusive data, the cane on such experiment plots should, before treatment, be of uniform growth and grub-infestation, both on the control and fumigated areas.

In the present instance, as previously reported by Mr. A. N. Burns, "Weather and soil conditions, cultivation, and even the erratic distribution of grub-infestation in all the plots, have been adverse factors governing the results obtained."

Digger-Wasp Notes.

It is interesting to record that one of the three small larvæ of *Triscolia rubiginosa* L. (the Javanese scoliid parasite described in our last monthly report) has managed to obtain sufficient nourishment from a grub of *Xylotrupes australicus* Thomp. to enable it to spin a cocoon. Judging by its small size (1, ⅝ in. by ⅝ in.), in the event of a wasp emerging from it, this will probably be a male specimen. Of the two remaining larvæ of *T. rubiginosa*, one died while still small; and the other, although growing big enough before death of its host-grub to attempt spinning, succumbed before able to complete its cocoon.

Study of this scoliid wasp must perforce be discontinued for the present. As matters stand, we have only two cocoons from which specimens may emerge about next January. One of these was derived during the passage from Java to Queensland from a larva of *rubiginosa* nourished on its true host, *Xylotrupes gideon*. This

cocoon, which is a little larger than the one obtained by us from a larva reared on the grub of *Xylotrupes australicus*, may produce a female wasp. Both cocoons are being kept in moist soil, under conditions favourable for an ultimate emergence of these parasites.

Cane-Grub Infestation at Daradgee.

Early this month (6th August) the Assistant Entomologist (Mr. A. N. Burns) was instructed to visit Daradgee for the purpose of reporting on the more or less severe damage caused this season by grubs of *Lepidoderma albohirtum* Waterh. (greyback cane-beetle).

Infestation was practically confined to thirteen different selections, four of which were found to be very badly attacked; seven moderately to seriously infested; and four lightly affected.

The soil was red volcanic of a friable nature, and it was extremely interesting to note, from data supplied by Mr. Burns, that infestation in every area examined occurred either on hilltops or on slopes leading up to elevated ridges. The four most badly stricken areas (Nos. 1, 5, 8, 12 on accompanying map), which comprised about

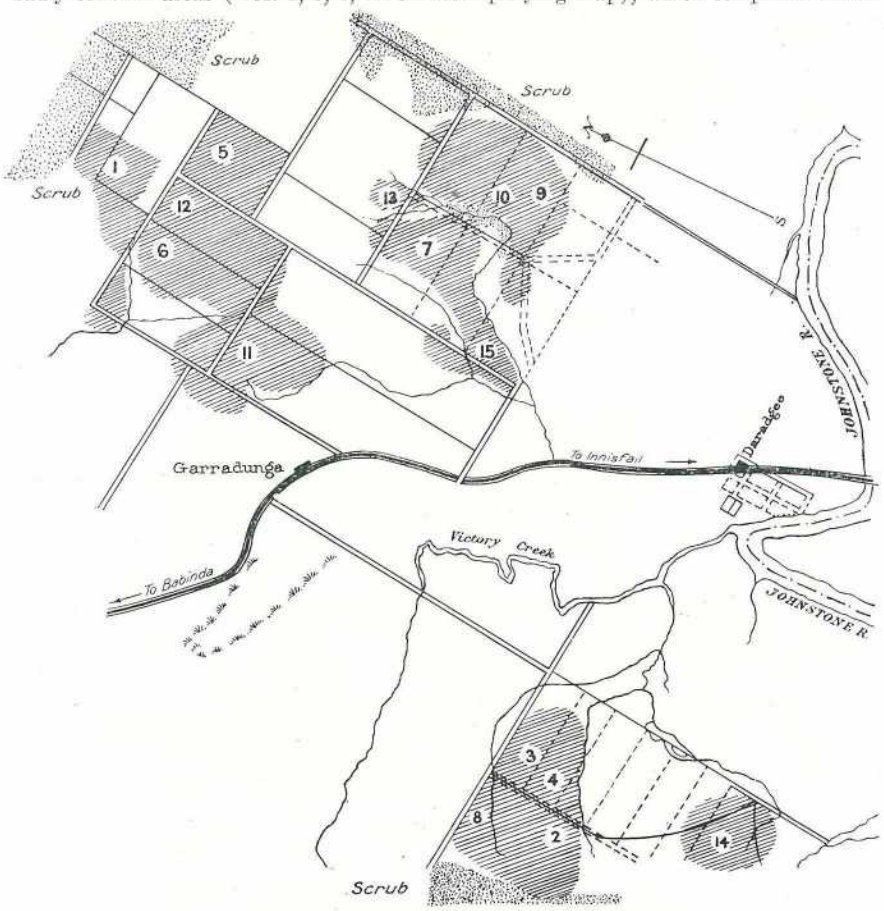


PLATE 39.

120 acres of hilly country, were situated in the immediate vicinity of scrub land. Nos. 7 and 13 included collectively about 80 acres seriously attacked; Nos. 3, 4, 6, 9, 11, about 160 acres moderately affected; and Nos. 2, 10, 14, 15 about 40 acres showing light grub-infestation.

Remedial Measures.—With regard to methods of combating this insect, I should advise collecting of the beetles wherever practicable from feeding-trees or food plants known from past experience to be habitually frequented; and secondly, fumigation of infested land with paradichlor. or carbon bisulphide. In the present instance the soil around Daradgee and position of the affected cane lands happens to be particularly suitable for such treatment, and either of the fumigants just mentioned should

prove effective if applied at the right time. Any grower at Daradgee wishing to combat cane-grubs with carbon bisulphide or with paradichlor. is invited to apply by letter to this Station for full directions regarding how, when, and where to apply these fumigants.

Notes on Lantana Fly (*Agromyza lantanae* Frogg.).

An application was received last month from the secretary of the Local Producers' Association at Saltwater, Mr. J. H. O'Callaghan, for specimens of *Agromyza lantanæ*, the little fly that exercises a controlling influence on the spread of the noxious weed *Lantana camara*. About 1,000 lantana berries, more or less, infested with larvæ of this useful fly were collected at Meringa and forwarded to Mossman, packed in a manner calculated to conserve moisture but prevent the development of mould during transit. It was gratifying to receive later on the following advice from the secretary of this association:—

> "The seeds arrived in good order, and a few of the flies were hatched out; others emerged since. There was very little sign of mould."

Although unable to prevent the spread of lantana in the Cairns district, this Agromyzid fly no doubt helps to keep it in check. When ovipositing in very young lantana berries, its larvæ are able to easily enter and destroy the soft immature seeds; while those produced from eggs laid in large green or ripening berries probably feed mostly in the pulp surrounding the seeds, finding the latter at such advanced stage of growth too hard to penetrate.

During 1924 two butterflies feeding on the flowers of lantana (*Theela agra* and *T. echion*) were introduced into Fiji from Honolulu in order to supplement the work of this Agromyzid fly. At present, it is generally realised that the check lantana is said to have received in Hawaii is not entirely due to the activities of *Agromyza lantanæ*, but to the combined action of many insects and other controlling factors.

ENTOMOLOGICAL HINTS TO CANEGROWERS.

By EDMUND JARVIS, Entomologist.

Termites Attacking Cane Sets.

White ants belonging to the genera *Termes* and *Eutermes* have been doing noticeable injury this season to freshly planted sets, possibly on account of prolonged drought conditions.

Unlike *Mastotermes darwiniensis*, these smaller termites seldom invade the growing shoots or sticks above ground level, usually confining their attacks to the internal woody tissue of the sets and to the sprouting eyes. Control measures consist in dropping baits at intervals in the planting drills. A simple form of such poison-bait is made from—white arsenic, 1 lb.; megass, 35 lb.; molasses, 10 to 15 lb. Mix the arsenic in about 2 quarts of water, and while stirring briskly to keep it from sinking to the bottom gradually add the molasses, stirring continually until it has thickened sufficiently to hold the poison in suspension. Then stir in the megass, mixing same uniformly with the poisoned molasses.

How Growers can Check the Weevil-Borer.

Now that cutting is in progress one has a chance of locating the whereabouts of beetle-borers on invaded areas. The position of infestations, occurring perhaps for the first time, should be carefully noted, and the Entomologist at Meringa advised without delay. Tachinid parasites of this pest will be liberated by the Sugar Bureau free of cost on areas affected by borer grubs.

Careful Seed Selection Advisable.

During planting operations reject all sets showing tunnelling of beetle or moth borers. Avoid procuring seed from localities known to be badly borer-infested. It is by means of such diseased seed that this weevil often obtains a footing in clean canefields, and when becoming firmly established is not easily got rid of. Similarly, growers on the Lower Burdekin must endeavour when planting to prevent introduction of the "Giant Termite" (*Mastotermes darwiniensis* Frogg.).

Occurrence of Green Muscardine Fungus.

Grubs killed by this vegetable parasite are usually noticed during the months of April to June. A very late occurrence, however, was brought under the notice of this Experiment Station towards the end of July by an Innisfail grower. When attacked by this fungus, the grub, instead of decomposing, retains its ordinary shape

and, gradually hardening, turns at first white and then olive-green. At this stage of development, being filled with fungus roots or mycelium, it becomes mummified and can be broken into pieces. Growers should collect all such green crusted-looking grubs, crush them into powder and thoroughly mix this with about one hundred times the quantity of moist finely sifted soil. Sprinkle such spore-laden earth very thinly in furrows, when ploughing land that is usually grub-infested each season.

BORER-INFESTED CANE FARMS.

The Director of Sugar Experiment Stations, Mr. H. T. Easterby, has received the following report (23rd August, 1926) on Survey of Borer-affected Cane Farms in South Johnstone Mill area, from the Assistant Entomologist, Mr. A. N. Burns:—

Leaving Meringa on Monday, 12th July last, for South Johnstone, headquarters being at the Sugar Experiment Station there, a complete survey of the badly and moderately-badly borer-infested farms in South Johnstone Mill area was carried out on the three ensuing days.

Through the co-operation of the chief and assistant cane inspectors, and their kindness in placing a rail motor at my disposal for two days, much ground was easily covered, and farms in the outlying portions of the area were visited.

The first day—13th July—was spent in visiting farms at Basilisk (No. 6 branch), the "Five Mile" (No. 1 branch), Kalbo Junction, and a small portion on the Nerada line. Taken as a whole, borer infestation in general is not very bad, though several farms visited were *individually* seriously affected. On one farm not only do the borers occur plentifully on the river flats—in which localities they were only found—but also on the red-soil hill adjoining. Nerada line may be said to be free from borers, but in many places on the red-soil highlands along it, grub damage may be seen. Evidence of grub injury was also observed on several other farms on No. 1 and No. 6 branch. Rat damage was not serious, and was most noticeable in cane on the river flats—especially on the fringes adjoining the long grass and undergrowth growing on the river banks.

14th July (Wednesday).—Visited farms on No. 2 branch, Myer's Siding, Main line, and Mill area. The Main line is practically free from borer attack and also grub attack. No. 2 branch and Myer's Siding had several farms badly affected by borer. At that place there is standover cane, unpermitted, which is very badly borer infested; several adjoining farms are consequently attacked on the edges of the cane adjoining. Taken as a whole No. 2 branch, from Myer's Siding on, may be said to be the wost borer attacked branch, though, with one exception, the centres of attack are confined to the cane in immediate vicinity of the edges of Mena Creek. Grub infestation is not bad on No. 2 branch; several farms showed small localised areas attacked near the tops of red-soil hills.

15th July (Thursday).—A very large area, including many outlying farms, was covered. Japoon, part of No. 3 branch, Sim's Siding, Austin's Siding, Anotti's Siding, Silkwood, the Eight-mile, Wylie's Siding, and No. 4 branch, and the Japoon end of the main line, was traversed. On No. 3 branch, one farm only, that of Messrs. Spitiri and Bonana, showed borer attack moderately badly on a rise from a creek bank. The main line and sidings above named were very free from borer though in places grub attack was noticeable on red-soil highlands. At Japoon, borer infestation was only moderately bad, one farm on the edges of Liverpool Creek showing the worst damage in a small patch of standover cane. No. 4 branch, at the extreme end, was fairly badly affected. Several acres of standover cane, unpermitted, are badly attacked. This area seemed free from grub attack, being flat country, and grey and brown soils. Silkwood area may also be mentioned as being fairly free from beetle borers. In this area grub attack is slight—the ground being level and the soil grey and brown.

ENTOMOLOGIST'S ADVICE FOR SEPTEMBER.

BY EDMUND JARVIS.

Army Worms again on the Warpath.

Caterpillars of the so-called "army worm" (*Cirphis unipuncta*) appeared in great force at Moolaba recently, 16 acres of young cane planted last May being more or less damaged.

Growers should be on the lookout for the occurrence of this pest on areas under ratoon and plant crops from 1 to 2 feet high. Low-lying flats bordering river banks are very liable to invasion, and when severely attacked complete destruction of the heart-leaves may follow.

These caterpillars usually feed at night time, hiding during the day amongst the unfolding leaves, their whereabouts, however, being invariably betrayed by numerous pellets of excreta or powdery fragments of same scattered among the central leaves or on the ground close to stems of affected plants.

Control measures are seldom necessary unless the caterpillars, when first noticed, happen to be still quite small or about half grown, and the cane very noticeably damaged.

In such cases no time should be lost, as such larvæ generally do the greatest injury during the fortnight preceding their maximum development. The following poison-bait is said to have given good results:—Bran 20 lb., Paris green 1 lb., syrup 2 quarts, orange or lemon, three fruits (finely ground), water 2½ gallons. These components should be well mixed together to form a fairly thick mash; fragments of which, about the size of a walnut, are scattered between cane rows close to the plants in the early evening. Another good method is to spray affected plants with lead arsenate in the proportion of 1 to 2 lb. arsenate to 50 gallons of water. This strength, if correctly made, will not burn the foliage.

Beetle Borer Displays Increased Activity.

As the season advances, accompanied by milder temperatures, damage due to weevil borers is gradually becoming more noticeable.

Inspection of cane growing in low-lying situations, or where this pest has previously occurred, should be carried out, and any infestations met with made known to the Entomologist at Meringa Laboratory.

Large Moth Borer in Evidence.

Caterpillars of the large moth borer (*Phragmatiphila truncata* Walk.) are responsible at present for the occurrence of "dead-hearts" among the first shoots of young ratoon and plant cane.

This insect is common at times in the Burdekin district; local infestations being recorded also from South Johnstone on certain low-lying areas. Such "dead hearts" should be cut out when noticed, care being taken to sever these diseased shoots at a point about a couple of inches below ground level, as the central tunnel of the caterpillar generally extends to within an inch or so of the set. Needless to say, these shoots must be crushed or otherwise destroyed. By following out this simple control method at the beginning of the season most of the moths which give rise to the second and much larger brood of caterpillars will be put out of action, and injury of this nature reduced to comparatively harmless proportions.

FIELD REPORTS.

The Central Field Assistant (Mr. E. H. Osborn) has forwarded the following report to the Director of Sugar Experiment Stations, Mr. H. T. Easterby (16th August, 1926):—

Rollingstone to Toobanna.

Right throughout the Herbert River area from, say, Rollingstone to Halifax, dry conditions prevailed.

Rainfall Figures.

	Rollingstone.	Ingham.	Halifax.
	In.	In.	In.
January	7.14	2.68	3.96
February	18.00	16.80	21.90
March	1.80	8.76	4.08
April	2.50	1.82	1.37
May	..	0.25	0.53
June	..	0.52	0.53
July	..	0.52	0.59
	29.44	31.35	32.96

Cane was very patchy, and a long way below last year's crop. Seventeen thousand tons were expected from eighty-eight growers, but it did not seem likely that these earlier figures would be realised under such unfavourable growing conditions.

About 400 acres had been planted for next year with, may be, another 100 in course of preparation. A large proportion of this planting is, however, yellowing rapidly, and unless rain comes soon will die out, making the prospects for 1927 very doubtful.

Among the centres inspected was Toobanna. This is now a particularly busy station with a fleet of motor lorries handling the cane.

Ingham.

Despite adverse weather conditions the town of Ingham is making steady progress, and most of the recently erected buildings are a credit to the district. Two fine new hotels have been opened and two more are nearing completion. The two local mills treated about 444,000 tons of cane between them last year.

New residences and wireless plants were new features noticed. The Government Radio Station 4 Q.G. is popular. Roadmaking is also being carried out systematically.

Crops.—Earlier mill estimates may not be realised. The harvest will be somewhere near 320,000 tons, against the large total of 444,000 tons of last year.

Besides having the dry weather to contend with, a few very severe frosts experienced at the end of July gave canegrowing on exposed places a severe setback.

Arrowing seemed to be more prevalent than usual in nearly all varieties, but exceptionally so in H.Q. 409. Some remarkably good strikes of young plant were seen, especially in ground that retained the moisture. N.G. 15 (Badila), Q. 813, Goru (N.G. 24), Korpi, Nanemo, H.Q. 409, and Oramboo all had made a good start. Sugar contents of the cane were also appreciably below last year's.

Cultivation.—A good deal of ploughing was being carried out, both by tractor and horse power. Of the former there are many types in use. The land has had more work put into it than at any other time, most of the soil being in a really good tilth.

Varieties.—N.G. 15, Q. 813, N.G. 24 and 24 B, H.Q. 409, Korpi, Nanemo, and Oramboo are the main canes grown upon the Herbert, and among these the proportion of Q. 813 for poor land has increased considerably of late years. Some splendid strikes of this cane were noticed in one case upon a very dry and poor block of ground. H.Q. 409 is also grown to a large extent upon land considered too poor for N.G. 15, and some good crops were noticed. Goru, where seen growing in sandy soil, looked extremely well for such a dry year. Good but patchy crops were also noticed of Korpi, Nanemo, and Oramboo, especially the latter.

B. 208.

A few acres of this cane were seen growing at Helen's Hill, and these seemed free from disease, but the owner was warned not to let any go away to other farms for seed unless thoroughly examined by a competent person.

Diseases and Pests.

Very little loss was noticed this year, an odd borer-infected stick only being seen. Grub damage was also very slight, while rats had only been troublesome in a few isolated areas. Near Yuruga a species of weed resembling the Cane Killing Weed of Proserpine, but in such a very withered state that it would be hard to identify it definitely, was seen in some plant H.Q. 409 on a poor forest soil. Numerous stools were in a very stunted and half-dead condition, while others had quite perished in the close vicinity of which this weed was growing.

Top Rot was rather prevalent in plant Badila on a couple of farms on the Lower Stone River. One farmer was getting plants from an area in which Top Rot has not so far occurred.

Gum.—This disease has not, so far, done much damage this season. In dry weather it is hard to identify gum in its earlier stages. In its later stage it was only seen in a couple of places—at Toobanna on the railway line and near Gairloch—in each case in H.Q. 426 ratoons. It looks as if the barring of this very susceptible variety by the company has given gum a decided check. One bad practice is still being carried out by Italian growers on the river, which is not calculated to make gum detection easier, and that is the habit of planting the whole stick of cane in the drills and afterwards cutting up with a cane knife, despite the many warnings that they have had against the practice. The company is propagating seedlings at its Macknade nursery to be grown afterwards near gum-infected cane with a view to obtaining a variety that may be immune to the disease. This interesting work is under the supervision of Mr. K. Gard.

The Northern Field Assistant, Mr. A. P. Gibson, reports (20*th August*, 1926):—

Innisfail.

Progress.—The progress of the industry may be judged by the growth of its dependent towns. Innisfail is rapidly covering more ground; streets and pavements have been improved, three reinforced concrete hotels under construction are nearing completion, two more concrete bridges are under way, one replacing the old structure at Bamboo Creek, the other spanning the upper waters of the North Johnstone River at a point adjacent to the company's tramway bridge.

Weather.—Moderately warm days, chilly nights, and scanty rainfall cover the month's climatic conditions. Only 61.64 points of rain had been recorded for the first seven months of the year; this fall is far below the mean. The grass temperature on the 26th July was 36 degrees, when slight frosts were experienced, a most unusual occurrence in these parts.

The Crop.—The outlook for the district is not so bright. Dry weather has had a bad effect on the general crop; this, accompanied by early arrowing, grub destruction in parts, and late harvesting obviously is responsible for its backwardness. Some of the mills will finish quite early, with the probability of still a further drop in mill estimates. The highland crops are much lighter than usual, but excellent crops of Badila were seen on some of the richer alluvial deposits. Most of the carry-over crop and grub-eaten cane had been harvested; the former contained much damaged or dead cane and its quality and weight proved disappointing. The semi-dry season has favoured the planter on the moister lands. Badila is the favoured variety; 98 per cent. of the crop milled at Mourilyan last year was of this kind. Pompey should only be grown on lands too poor to raise Badila.

Harvesting.—Ideal conditions continue for this work. Generally the crop is disappointingly short, many paddocks are cutting below early estimates; in consequence the cutting is proceeding rapidly. Grub affected and carry-over fields have been harvested first. The cane coming forward for treatment appeared fresh; it was decidedly cleaner than that of last crushing, and much is being loaded double on the trucks because of its shortness. In places a great quantity of cane is tumbling off the trucks in transit to the mills; such losses are mainly due to improper loading, the failing to tighten holding-down truck chains just prior to locos. taking delivery, and sometimes faulty rolling-stock. Parts of the volcanic red soils are rough, loggy, and have outcrops of basalt; on such lands the removal of the crop is difficult and more costly. High cutting was noted in some fields.

Crushing.—Mills are working well on the 1926 crop, big weekly tonnages are being treated, and at times the cane supply is inadequate. The bulk of the cane being milled is unburned and clean; such improved conditions should be welcomed, for this is of untold benefit to planter and manufacturer. The quality of the cane is exceptionally high. The South Johnstone factory is railing away its molasses in 200-gallon tanks and emptying same along its tramlines. Early mill estimates have been reduced some 45,000 tons, leaving at present an approximate district total of 590,000 tons to be crushed. Goondi and Mourilyan mills should have no difficulty in completing their crops before Christmas. Slender hopes exist of the South Johnstone mill finishing its present given estimate this year, unless the Tully mill renders greater assistance; at present it is relieving it of some 900 tons weekly. Boats and railways are removing the large quantity of sugar at the several mills almost as quickly as it is manufactured.

Ratooning.—The new crop is ratooning all the way from poor to good. Conspicuous yellow leaf patches were again noted, more particularly on the volcanic red soils, due to apparent deficiency of some plant food, probably potash, possibly exhausted from such soils by some scrub tree or trees. The harvested areas generally receive one of the following early treatments:—

(1) Off-barring: After burning trash, the nearby soil is turned away from the stool by use of the plough and the interspaces subsequently levelled and cultivated by horse or power implements.
(2) Volunteering: Trash is permitted to remain as when cut.
(3) Relieving: The trash is drawn off the stubble only.
(4) Rolling: Trash is rolled to interspaces from one to three drills apart, according to the density of same; this operation costs about 30s. per acre.

Satisfactory results are obtained from the latter two mentioned operations; subsequent husbandry is minimised, humus is added to the soil, but the danger of fire is great, and some growers declare that the cane borer destruction is more pronounced where this practice is followed.

Cultivation.—Some growers have reached the advanced stage of success, not because of working land of quality, but because they follow a judicious system of cultivation, coupled with the selection of vigorously growing and disease-free cane

when planting, but other farmers are not so careful. Our sugar lands appear lacking in organic matter, therefore it seems imperative to conserve more of our trash and keep on growing leguminous crops; this is becoming more necessary as our lands become older and poorer. It is very poor agriculture to roughly plough a field just harvested twice and immediately replant. A disc harrow drawn across highly cut stubbles often gives beneficial results. Various causes are responsible for cane stools working to the surface; subsequent improved crops are made possible by throwing soil on to them.

Planting.—A large area had been and is being planted; that completed early has made slow progress, but has greatly improved since some rain of recent date. Placing full length cane in drills and cutting them into sets as they lie is often done. This should not be encouraged, for reasons given in previous reports. We can only urge the growers to do something that will help arrest some of the possible causes of the ever-rising tide of pests and diseases. Sets being used for planting in some instances were far from perfect.

Manuring.—Mill compo. and megass ash had been distributed over resting areas. Various mixtures were being added to plant and the new ratoons.

Pests.—Grubs, weevil borers, and rats, to a lesser degree, have caused much destruction of this year's crop. The first-named has accounted for estimated district loss of 18,000 tons. Most of the grubs have gone down to pupate. The weevil borer is working its hardest, being severe on individual farms. This pest is to be more dreaded than the cane grub, therefore it is highly desirable that it be controlled prior to its becoming fully entrenched. A breeding tachinid fly cage is under way at the South Johnstone Sugar Experiment Station, and the farmers are proposing to erect others throughout the area; this should be good news to the grower and may have the desired effect of arresting or wiping out what is a very serious pest.

Diseases.—Leaf scald was observed to a lesser degree in this area than most northern sugar areas. Spindle Top (or Top Rot), so named because of its very thin top, is widespread, being particularly noticeable on all classes of soil throughout Mourilyan and Tully areas, and, like arrowing, marks the end of growth of affected canes. The lengthy stretches of dry weather have probably been responsible for this. Its presence may be manifested in one or more canes of affected stools, but not necessary in all. It may easily be detected by purple topped leaves, dead hearts, dwarfed tops, fine top, the shooting of topmost eyes, and the forming of aerial roots. Such affected canes apparently are not healthy, therefore it is advisable to discard them when planting. The prosperous Upper Daradgee area was inspected; the make up of this soil is alluvial, mainly adjacent to the river and fringed by the usual volcanic red ridges which extend back to the nearby ranges. Here soil, rainfall, and climate combine to raise the finest of corps. Badila is wholly grown.

Farmers should avoid leaving standing cane intended for plants on the fringes of scrubs and creeks, for here it is more subjected to destruction by pests.

The Southern Field Assistant, Mr. J. C. Murray, reports (17th August, 1926):—

Bundaberg.

In the Bundaberg district, practically all the cane in the belt stretching from Lover's Walk through to Spring Hill was affected by frost. D. 1135 probably suffered the worst. M. 1900 Seedling showed a certain degree of resistance; also Q. 813, H. 227, E.K. 28, Q. 970. Taking the severity of the frost into consideration, it is surprising that more damage was not done, especially as the cane was backward and lacked vitality. On the river there was no noticeable damage. A fungus, perhaps induced by the severity of the winter, was heavily attacking the cane in places. It resembled the well-known "cane soot" of sugar-cane. In taking plants from areas where this occurs, select good, sound cane, as free from cracks as possible. It would be a wise precaution to soak them for a few hours in a weak formalin solution, say, half a gallon of formalin to fifty or eighty of water. This would be hardly practicable for a big bulk of plants, but would be of use where a farmer wishes to increase his supplies by planting from a variety plot.

Mount Bauple.

A very fair crop will come from Bauple this year. The district generally has a prosperous appearance, the extension of fruitgrowing and road construction helping to deepen this impression. There should be a big future ahead of this district in relation to citrus fruits and bananas, the fine easterly aspect of the jungle-clad hill-slopes being particularly favourable.

Three varieties showing well in the Bauple areas are E.K. 28, Q. 813, and H.Q. 285. Growers are recommended not to plant areas that are unwieldy, but to farm efficiently on lands within their financial resources. Sugar farming is now a highly specialised industry with good rewards for those who treat it as such, but with small results for those who do not. A farm of moderate size, adequately drained, tilled, and fertilised will produce more than a much larger area indifferently farmed. Also to make a success of a farm it must be treated as a life work, not as a "get-rich-quick" project.

The writer has frequently been asked what was the effect of the white patch or "butterfly" on the leaves. This is quite a harmless condition. Leaves should not show this "butterfly" too much at cutting time, because from the writer's field observation a too-frequent exhibition of these white patches synchronised with a low or medium sugar content.

There is still a little Mosaic in the Bauple district.

Mary Valley.

There is very little cane growing in this district, farmers not generally considering it a paying proposition. Splendid crops can be grown here, but distance from mill and other factors are proving too much for the farmers.

Beenleigh.

Regarding varieties, methods of cultivation, &c., there is nothing fresh to comment upon since last visiting this district. Farmers are recommended to take drastic steps with regard to the Fiji disease in the D. 1135; it is in every block the writer has so far visited. When cutting, the D. 1135 must come out. Q. 813 can take its place. Fiji disease, where it occurs, absolutely kills the cane, and as it is only just starting in Queensland, drastic measures must be used for stamping it out. Farmers will be expected to act on these recommendations.

METEOROLOGY AND AGRICULTURE.

W. R. BLACK, B.Sc., Ministry of Agriculture and Fisheries (Great Britain).*

Climate, definable as the average of meteorological conditions over a long term of years, has a predominant influence upon agricultural production. As crops differ in their individual demands for warmth, rainfall, and sunshine, so an excess or deficiency in the requisite quantities of these essentials causes injury and possibly complete failure. Not less important than the requisite seasonal quantities of these meteorological elements is their incidence in the life of crops, since as a general rule there are critical periods or stages in growth at which certain quantities of rain, sunshine, or warmth are particularly necessary. Climatic conditions are often found in "zones," the effect upon vegetation being most clearly exemplified in continental regions, such as North America, with its cotton, maize, and wheat belts. In England, as a result of the climatic differences, corn crops are found mainly in the eastern and grassland in the western counties.

In addition to their direct action upon crops, meteorological elements have an indirect influence, bearing chiefly upon cultural operations and upon the pests and diseases to which crops are subject. Obviously, if ploughing, seeding, and harvesting operations have to be undertaken when weather conditions are adverse, the chances of a successful crop are lessened. Temperature and humidity at various periods in the life-history of insect and fungus pests are all-important to the development of these pests, the effect being accentuated if at the same time the weather conditions adversely affect the growth of the host crops or bring them to a susceptible state at the right moment from the point of view of attack. The weather also indirectly influences crop growth through its effect on the soil, rainfall above a certain amount leading to the washing away of plant nutrients.

To a limited extent it is possible to modify climatic influences locally, *e.g.*, by draining marsh land; by cutting down forests; by irrigation to counteract deficiency in rainfall; and by the use of smoke screens, artificial heat, or flooding to guard against frost. Certain crops also, such as glasshouse crops, can be grown profitably under artificial conditions that make them almost independent of climate. In general, however, it is true to say that there is no possibility of so changing climate as to render it more suitable to particular crops. Such crops and their varieties must be chosen, and farming operations so ordered, therefore, as best to support the existing climatic conditions.

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* In "The Journal of the Ministry of Agriculture" (Great Britain) for July, 1926.

Use of Meteorological Observations in Practical Agriculture.

The crops and operations customary in any given district have been adopted, presumably, after long experience based on past successes and failures. It is impossible, however, to be certain that such crops and operations are indisputably the best, because one cannot be sure that all alternatives have been tried, a consideration which gains in importance when it is remembered that modern agricultural science is ever placing fresh discoveries before the farming public. The practical man should know within a reasonably short time what farming practice can be adopted, what new crops can be grown, and which of the discoveries made by research institutes can be put into operation in his own particular case with chances of success. As a recent example may be cited the introduction of the sugar beet crop, in the case of which the weather conditions which favour good yield and quality must be known and compared with those obtaining in a district in which its introduction is contemplated.

Careful and detailed data relating to meteorological conditions experienced throughout the life of crops, and their effect on growth, are thus required if new agricultural practices and the results of agricultural research are to be given their full value.

Use of Meteorological Observations in Agricultural Research.

A study of meteorological conditions is necessary for the carrying out of research. The *plant breeder*, for example, desires to know the critical stages in a plant's growth so that he may breed varieties with characteristics that will render them more resistant at those critical periods (whether to direct adverse weather conditions or insect and pest attacks), or characteristics that will predispose those critical periods to occur at times when weather conditions are likely to be favourable. An outstanding example of fitting a crop to climatic conditions is afforded by the breeding of "Marquis" wheat in Canada; this wheat matures a few days earlier than standard varieties grown up to the time of its introduction; these days were critical days, however, and the wheat could be grown in districts with a risk of earlier winters, so that a great expansion of the area under the crop in that country resulted. For the same reason "Marquis" escapes much of the rust which used to ravage "Red Fife" and its other predecessors.

The *worker on soils and manures* desires to know how, with any given soil, the effect of manures both on yield and quality of crop varies with meteorological conditions, so that he may give advice to the practical farmer in accordance with the weather experienced and that to be expected from a study of foregoing seasons. Thus from a study of soil and weather the soil worker may be able to advise that a dressing of nitrogenous manure applied for wheat in winter will need to be repeated in spring; that with the prospect of a large spring rainfall muriate of potash can be equally well applied to potatoes as sulphate of potash; that, as the summer is wet, basic slag may be applied with every prospect of increased keep from pastures in the autumn.

The *soil physicist* desires to know the effect of meteorological factors on those soil conditions (*e.g.*, soil moisture, plasticity, cohesion, &c.) on which soil tilth depends, so that he may assess the relative efficiency of different cultural operations, both from the practical and economic aspects. He also needs this information to supplement and check his laboratory investigations on the physical properties of soils.

Apart from its intrinsic value to soil science, this knowledge is of the greatest importance to the *agricultural engineer*, as it enables him to base his implement designs on definite information in place of empirical observations. Detailed local data regarding rainfall, humidity, temperature, sunshine, and wind are directly of value to the agricultural engineer in investigations of the use in agriculture of water and wind power and of drying apparatus.

The *plant pathologist* is concerned with the effect of climatic conditions on insect and fungus pests in order that control measures may be devised, and, as a result, and with observations of meteorological conditions at any place and time, practical growers may be advised as to the necessity, or otherwise, of adopting these measures. The value of observations on the effect of weather on outbreaks of epidemic diseases of plants is shown by work in Europe and America. In France and Italy it has been found possible, by careful meteorological, crop, and pest observations, successfully to forecast outbreaks, and an organisation has been set up both at Montpellier and at Turin for the purpose of warning growers when to spray.

Considerations such as the foregoing show how necessary it is for the advancement, both of the practice and science of agriculture, that careful and detailed meteorological observations should be carried out concurrently with observations on the growth, yield, and quality of crops, their response to manures, their resistance to attacks of insect and fungus pests, &c.

Use of Meteorological Observations in Forecasting Yields.

Observations of meteorological data on the one hand, and of crop data on the other, may prove to be of value, among other purposes, for that of forecasting yields of crops. Statistical methods have been evolved whereby, given sufficient data of both kinds, the two can be correlated and the effect of meteorological elements, singly or in combination, on the crop yields ascertained. It may therefore be possible in future, by using the meteorological data collected in any season and applying "correlation efficients," worked out by statisticians, to estimate the probability that the crop yield will be above or below a certain amount. This aspect of agricultural meteorological work is the one above all others that has made a special appeal abroad. The value of forecasts is likely to be increased proportionately to the length of time that they can be made in advance; the date at which they can be made depends, of course, largely on the times of critical periods in the crop's life. One aspect of crop weather forecasting, which has received some attention in the past, is that of weather cycles or periodical repetition of weather conditions; such cycles are stated to have been discovered, and the search for fresh ones is being pursued. Other things being equal, repetition of meteorological conditions may be expected to lead to reproduction of agricultural phenomena.

Agricultural Meteorological Work Abroad.

This country has hitherto been very much behind others, notably Russia, the United States, and France, in the study of agricultural meteorology. A Bureau of Agricultural Meteorology was established in Russia as far back as 1894 for the organisation of agricultural and horticultural meteorological stations to determine the relation of weather to crop production, and by 1912 observations were kept at eighty-one experiment stations. An Agricultural Meteorology Division of the United States Weather Bureau was formed in 1916 for the purpose of organising agricultural meteorological stations at the chief agricultural experiment stations of the country. A similar scheme was begun in Canada in 1915. Stations on the Russian plan have been established quite recently in Italy. In France an "Agricultural Physics and Meteorology" service was established in 1912, and when, in 1921, the new French agricultural research organisation was set up, agricultural physics and meteorology stations were made an integral part of this organisation; much practical use has been made in France of work in which meteorological data have been related to outbreaks of plant diseases. In Hungary and Japan agricultural meteorological organisations have been set up with the express task of furnishing forecasts of crop yields. In Brazil an agricultural meteorological service was formed in 1921; agricultural meteorological stations have been established in that country both at agricultural experiment stations and at climatological stations.

Agricultural Meteorological Work in Great Britain.

Except for isolated pieces of research on, for instance, the correlation between the weather and the yield of wheat, by such investigators as Mr. R. H. Hooker and Sir Napier Shaw, and work by Dr. R. A. Fisher on the effect of weather on the yields of the experimental plots at Rothamsted, no serious attention was given in this country to agricultural meteorology until 1922; in that year a committee, appointed by the Agricultural Research Council, under the chairmanship of Sir Thomas Middleton, suggested that studies of three types should be encouraged in this country, viz.:—

(1) General studies of the correlation between weather and crops in a particular area, by examination of the data relating to crop yields and meteorological conditions in that area over a number of years, with the object of increasing the accuracy of crop estimates.

(2) The organisation by the Ministry of Agriculture on a uniform plan of the collection of observations on the state of crops (autumn and spring sown cereals, root crops, potatoes, grass, and horticultural crops), and the incidence of insects and fungi, accompanied by meteorological observations at agricultural experiment stations in all parts of the country.

(3) The carrying out of special intensive studies of the reaction of crops to weather.

The committee's recommendations were adopted by the Agricultural Research Council, and a conference of representatives of education and research, under the chairmanship of Sir A. D. Hall, drew up a scheme to carry out the committee's second recommendation.

The British Agricultural Meteorological Scheme.

The following are particulars of this scheme, in which the Ministry of Agriculture, the Board of Agriculture for Scotland, and the Meteorological Office are jointly concerned. Twenty-three agricultural meteorological stations have been set up at the following places:—Craibstone, Boghall (Scotland, E.); Cockle Park, Houghall, Osgodby (England, N.E.); Sprowston, Cambridge, Rothamsted, Chelmsford (England, E.); Sutton Bonington, Wellington, Worcester, Oxford (Midland Counties); Wisley, East Malling, Wye, Long Sutton (England, S.E.); Newton Rigg, Aber (England, N.W.); Aberystwyth, Long Ashton, Newton Abbot, Gulval (England, S.W.). These stations are shown in the map on page 327. The stations are situated at agricultural research institutes, agricultural colleges, crop testing stations, or county council farm institutes. The observations taken are of four kinds: (1) meteorological, (2) agricultural, (3) horticultural, (4) phenological.

Meteorological Observations.

All the stations take the meteorological observations; these are maximum and minimum air temperature, from which mean and "accumulated" temperature is computed; rainfall; sunshine; soil temperature (2 ft., 8 in., 4 in.); humidity (dew point and relative humidity); wind; and general weather observations. These observations are taken once daily, at 9 a.m. G.M.T., with the exception of humidity and soil temperature, the data regarding which are taken three times daily, at 9 a.m., 3 p.m., and 9 p.m.

In addition, certain stations (*e.g.*, Rothamsted and Cambridge), which have been equipped with self-recording instruments, take the meteorological observations in greater detail. These centres are engaged in researches directed towards improving the reliability and usefulness of the routine observations.

Agricultural Observations.

Most of the stations take observations on agricultural crops for correlation with the meteorological data. These observations are taken on selected fields in the neighbourhood of the meteorological station, and relate to the same varieties of crops each year. Those specified so far are as follows:—

Corn Crops (Wheat, Oats, Barley).—Variety, soil characteristics, previous cropping, manuring, cultural operations, date of sowing, date of appearance above ground, date of breaking into ear, date of flowering, date of harvest, the yield per acre of corn and straw and the bushel weight; attacks of diseases and pests. (A phenomenon between the date of appearance above ground and the date of breaking into ear is to be specified later. In the case of oats this intermediate stage is when the majority of plants in the field show four leaves.)

Root Crops (Turnips, Swedes).—Variety, soil characteristics, previous cropping, manuring, cultural operations, date of sowing, date of appearance above ground, date of breaking into rough leaf, yield per acre (tops and roots separately), attacks of diseases and pests.

Grass (Meadow Hay).—Soil, manuring, cultural operations, date of flowering of (*a*) sweet vernal, (*b*) perennial rye grass, date of cutting, yield per acre of hay; attacks of diseases and pests.

Crop Testing Stations.

In the case of agricultural crop observations, the agricultural meteorological scheme has been combined with a scheme for the testing of varieties of farm crops. Under the latter scheme, six stations have been established in different climatic districts of the country for the purpose of testing the yields of new varieties of cereals, roots, &c., in comparison with standard varieties for those districts; at such stations it is obviously necessary to take full and accurate measurements of the meteorological conditions under which the crops grow, in order, if the new varieties fail, to ascertain whether, and which, meteorological conditions are unfavourable to their growth, or, if they succeed, to be enabled to recommend them to growers under certain meteorological conditions.

Horticultural Observations.

Twelve stations take observations on horticultural crops for correlation with meteorological data. These stations are classed as either principal or secondary, according to whether special plots are set aside for the purpose of observations or

not. Special plots of peas are kept by both principal and secondary stations. Special plots of fruit are kept by principal stations; at secondary stations existing trees and bushes are used for the purpose of observations. The special plots consist of:—

(1) *Apples* (Worcester and Bramley's Seedling).—Four bush trees of each variety. On Doucin (Type 2) stock with 2-feet legs.

(2) *Plums* (Victoria).—Four half-standard trees.

(3) *Blackcurrant* (Boskoop Giant).—Ten bushes interplanted.

True stocks of these varieties are supplied from the East Malling Research Station. The observations on these and on peas are as follows:—

Apple (Worcester and Bramley's Seedling) and *Plum* (Victoria).—Date of flowering, duration of blooming season, date of June drop, date on which the bulk of the fruit is ripe, crop from each tree, attacks of diseases and pests, duration of defoliation period, shoot growth.

Blackcurrant (Boskoop Giant).—Date of blossoming, date when all currants are fully ripe, crop from each bush and total weight of fully ripe currants, duration of defoliation period, number of "big buds" during first week in January, attacks of diseases and pests.

Peas (Gradus).—Date of appearance above ground, height of peas at intervals of seven days, date of first open flower, date when first picking would be possible, average height of plants at completion of growth, volume of dry peas harvested, attacks of diseases and pests.

Fruit Testing Stations.

In the case of horticultural crop observations, this scheme has been combined with a scheme for the testing of new varieties of fruit trees, under which stations are being established in different climatic districts of the country; this scheme is a counterpart of the crop testing scheme which has been explained above.

Phenological Observations.*

In addition to the observations on plant growth and plant pest appearance, required under the agricultural and horticultural parts of the scheme, various stations have responded to an invitation to collect additional phenological observations: these observations are the date of flowering (or other growth stage) of any or all of twenty-one wild plants, shrubs, and trees. The observations are made year after year on the same bush, plant, or association of plants, growing under average conditions (*i.e.*, not very sheltered or very exposed), well established. In selecting the plants to be observed, preference is given to species growing in the neighbourhood of stations where observations under the Agricultural Meteorological Scheme are being recorded, and which are familiar to farmers and, possibly, to other individuals.

It may be explained that the effect of all the meteorological elements making up the character of the season can be expected to be summed up in such plants as have been selected: these plants may be termed indicator plants, and they show whether the season is early, normal, or late. Observations of this kind have been summed up in the United States in a "bio-climatic law" of latitude, longitude, and altitude, to the effect that the climatic variation in plant development is some four days to each degree of latitude and to each five degrees of longitude, and to each 400 feet of altitude, the phenological dates being later northward, eastward, and upward in the spring and early summer, and the reverse in the late summer and autumn. Good use has been made of these phenological observations in regulating farming operations and in combating pests (*e.g.*, Hessian fly).

In addition to the data specified above, diaries are kept at the stations for the purpose of recording day by day the observer's own impressions of the effect of weather on crops. When the material (meteorological and biological), collected under the Agricultural Meteorological Scheme, is available in satisfactory form for a sufficient length of time, arrangements will be made for it to be subjected to rigorous statistical examination with the object of determining the effect of meteorological conditions on the growth of crops. It is hoped, also, to place freely at the disposal of investigators interested in one or more of the various aspects of the work, all the material available. During the time that the scheme has been in operation,

* Phenology is that branch of meteorology which treats of climatic influences on certain recurrent phenomena of animal and vegetable life.

monthly reports have been issued summarising the data collected at the various stations, and copies of these reports may be obtained free on request from the Ministry of Agriculture and Fisheries. It is further hoped that the observers at the different stations will keep in mind the objects for which the observations are made, and utilise them whenever opportunity occurs in their own districts. Exceptional occurrences, like long droughts, heavy floods, unusual lack of sunshine, &c., must express themselves on crops and stock, and may produce effects after long intervals that an ordinary monthly comparison will not disclose. There is also the question of the recovery of crops from adverse conditions, which cannot very well be scheduled, but may be of real importance and interest to those who are in daily touch with the facts.

The agricultural meteorological scheme of the Ministry is in the charge of a committee, of which representative meteorologists and agricultural, biological, and statistical workers are members.*

Effect of Weather on Animals.

The writer has failed to discover that much attention has yet been paid, in foreign agricultural meteorological schemes, to correlating the meteorological data available with data relating to animal husbandry. Climate has obviously been as important in determining the fauna of various districts as it has the flora. Obviously, crops have an important influence on the animals feeding on them, so that climate will affect animals indirectly through crops. It must also have a direct influence. Temperature and humidity, necessarily, have considerable effect on the *health* of animals and on the pests to which they are subject. Temperature must affect the *rationing* of animals for the production of meat and milk, and weather conceivably affects the composition of milk; the effect of sunlight, even, has to be considered in connection with the feeding of animals. And, as regards *breeding* questions, it seems that meteorological conditions influence fertility (at least of sheep); and artificial lighting (quite apart from effects on health and rationing) may also influence fecundity. The effect of meteorological conditions on the animal husbandry of the country appears therefore to offer a wide field for study.

NOTE.—No attempt has been made in this article to deal with the supply of weather forecasts to farmers; a special leaflet on this subject (''The Weather and the Farmer'') may be obtained free on application to the Ministry of Agriculture and Fisheries.

The writer desires to express his indebtedness to members of the committee for their kindness in perusing and making suggestions regarding this article.

* The committee is composed of:—Sir Napier Shaw, F.R.S. (Chairman), Sir Thomas Middleton, K.B.E., C.B., &c., Prof. V. H. Blackman, F.R.S., Mr. R. Corless, M.A., Dr. R. A. Fisher, M.A., Mr. J. C. F. Fryer, M.A., Mr. R. H. Hooker, M.A., Mr. R. G. K. Lempfert, C.B.E., Mr. H. G. Richardson, M.A., B.Sc., Mr. H. V. Taylor, A.R.C.S., Mr. W. R. Black, B.Sc. (Secretary).

QUEENSLAND SHOW DATES, 1926.

Wynnum: 3rd and 4th September.
Imbil: 8th and 9th September.
Zillmere: 11th September.
Gympie: 15th and 16th September.
Beenleigh: 16th and 17th September.
Stephens: 18th September.
Pomona: 22nd and 23rd September.
Malanda: 22nd and 23rd September.
Esk (Camp Drafting): 24th and 25th September.
Melbourne Royal: 16th to 25th September.
Rocklea: 25th September.
Nundah: 1st and 2nd October.
Kenilworth: 7th October.
Southport: 9th October.
Enoggera: 9th October.
Balmoral: 16th October.
Brookfield: 23rd October.
Mount Gravatt: 30th October.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JULY, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING JULY, 1926 AND 1925, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	July.	No. of Years' Records.	July, 1926.	July, 1925.
	In.		In.	In.
North Coast.				
Atherton	0·94	25	0	0·17
Cairns	1·60	44	0·27	0·55
Cardwell	1·45	52	0·49	0
Cooktown	1·01	50	0·50	0·46
Herberton	0·73	39	0·26	0·26
Ingham	1·54	34	0·67	0·33
Innisfail	4·71	45	2·69	0·98
Mossman	1·52	13	0·10	0·35
Townsville	0·57	55	0·19	0·11
Central Coast.				
Ayr	0·67	39	0	0·15
Bowen	0·94	55	0	0·43
Charters Towers ...	0·63	44	0·17	0·23
Mackay	1·70	55	0·13	0·39
Proserpine	1·35	23	0·24	0·42
St. Lawrence ...	1·31	55	0·06	0
South Coast.				
Biggenden	1·46	27	0·55	0·87
Bundaberg	1·93	43	0·18	0·45
Brisbane	2·31	75	0·85	0·72
Childers	1·80	31	0·92	0·43
Crohamhurst ...	2·94	20	1·00	0·50
Esk	2·05	39	0·60	1·07
Gayndah	1·52	55	0·34	0·41
Gympie	2·23	56	1·05	0·58
Caboolture	2·31	39	0·57	0·43
Kilkivan	1·71	47	0·20	0·81
Maryborough ...	1·96	54	0·99	0·34
South Coast—continued:				
Nambour	2·97	30	1·34	0·23
Nanango	1·76	44	1·02	0·57
Rockhampton ...	1·49	39	0·26	0·18
Woodford ...	2·53	39	0·43	0·25
Darling Downs.				
Dalby	1·78	56	0·64	1·13
Emu Vale ...	1·59	30	1·23	0·93
Jimbour	1·65	38	0·38	1·30
Miles	1·73	41	0·30	0·63
Stanthorpe ...	2·08	53	1·65	1·92
Toowoomba ...	2·10	54	0·89	0·84
Warwick	1·85	61	0·92	1·09
Maranoa.				
Roma	1·51	52	0·18	0·56
State Farms, &c.				
Bungewergorai ...	1·73	12	0·12	0·55
Gatton College ...	1·45	27	0·36	0·59
Gindie	1·04	27	0	0·52
Hermitage ...	1·81	20	0·98	0·86
Kairi	1·25	12	0·36	0·42
Sugar Experiment Station, Mackay	1·50	29	0·07	0·42
Warren	1·27	12	0·13	0·18

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 1925, having been compiled from telegraphic reports, are subject to revision.

GEORGE G. BOND,
Divisional Meteorologist.

RECENTLY DESCRIBED QUEENSLAND PLANTS.

In continuance of the series of illustrations of recently described Queensland plants, two species are represented on Plate 40. Botanical descriptions of these new species were published in the Proceedings of the Royal Society of Queensland for 1925 by Messrs. C. T. White (Government Botanist) and W. D. Francis (Assistant Government Botanist). The figures were drawn by Mr. I. W. Helmsing, Illustrator of the Department of Agriculture and Stock. The two plants shown belong to the Labiate family, which also includes such well-known plants as mint and sage.

In Figure 1, *Prostanthera megacalyx* is represented. It is a shrub or undershrub first collected at Quilpie, Western Queensland, by Mr. A. E. Deane, who writes: "This shrub grows on the side of a very rocky ridge and has been flowering since August, when I first noticed it." The other species, *Prostanthera suborbicularis*, shown in Figure 2, was found at Adavale, in Western Queensland, by Dr. W. MacGillivray, the well-known naturalist, on 29th August, 1923.

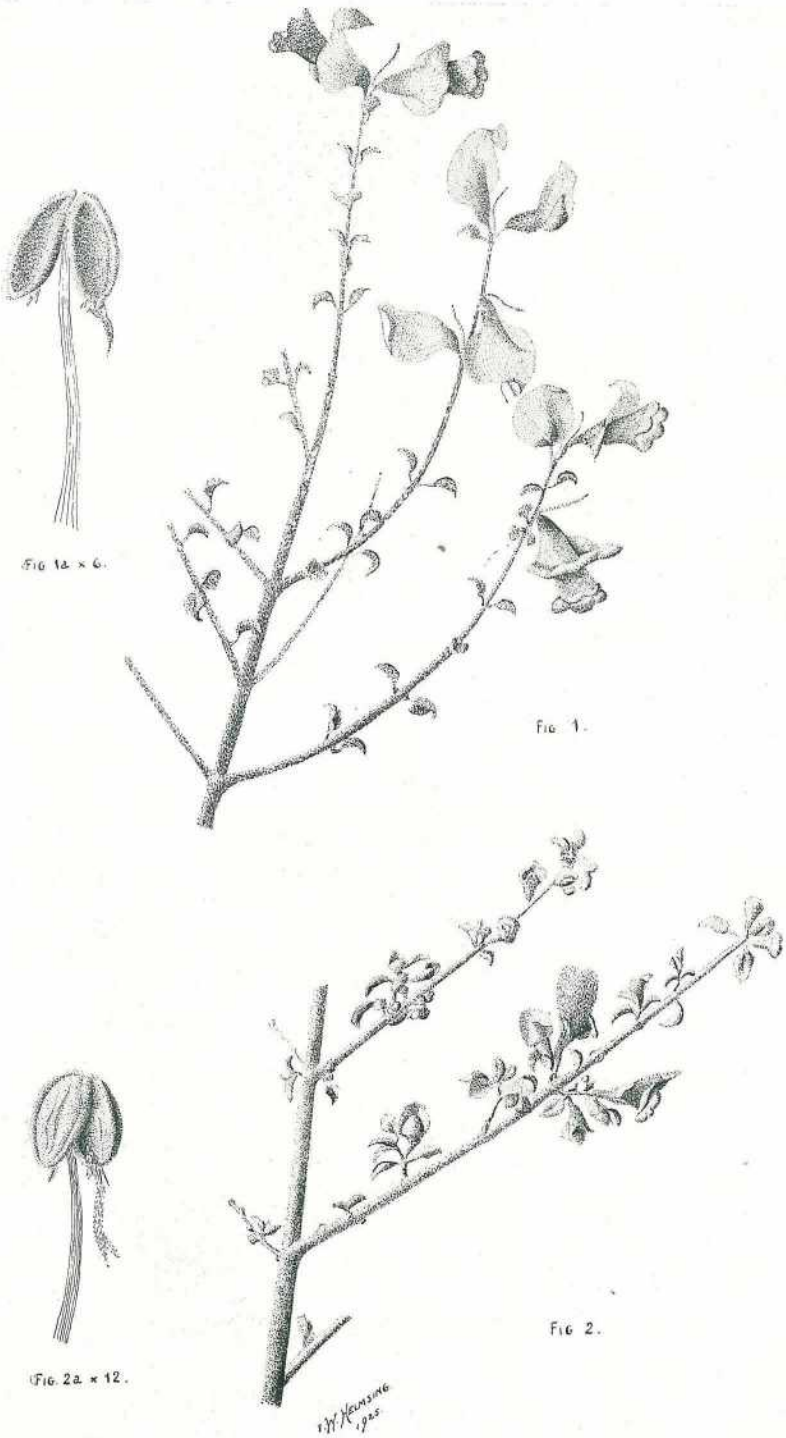

PLATE 40.

Fig. 1, *Prostanthera megacalyx*, about natural size ; 1*a*, anther × 6.
Fig. 2, *Prostanthera suborbicularis*, about natural size ; 2*a*, anther × 12.

PLATE 41.—THE OFFICIAL OPENING BY HIS EXCELLENCY THE GOVERNOR-GENERAL, LORD STONEHAVEN.
Supporting him are His Excellency the Lieutenant-Governor, Hon. William Lennon; the Premier, Hon. W. McCormack, and the Minister for Agriculture and Stock, Hon. W. Forgan Smith; the Under Secretary, Mr. E. Graham; and Mr. Ernest Baynes, President of the Show.

ROYAL NATIONAL EXHIBITION.

THE GREAT AGRICULTURAL EVENT OF QUEENSLAND'S YEAR—HIGH STANDARDS MAINTAINED—THE MOST SUCCESSFUL SHOW OF A LONG SERIES.

The great Annual Show in the State Capital provides a fitting stage for the presentation in infinite variety of Queensland's products and the pick of her flocks and herds.

Standard Stock breeds; principles and practice of modern farming; improvements in agricultural machinery, implements, communication and transport; the richness of Queensland's rural resources; the inter-dependence of country and urban industry; and the intricacies of business procedure as applied to primary production were all demonstrated, typified, or represented.

The general happy social conditions of Queensland were reflected in huge daily attendances of prosperous-looking and orderly crowds.

In weather and everything else the National Association was well favoured and many new records were established.

In the brilliant sunshine of a typical Queensland spring day the 51st Annual Show of the Royal National Association of Queensland was opened by His Excellency Lord Stonehaven, Governor-General of Australia, on 9th August. The exhibition was a revelation of the immense natural wealth of Queensland and her wonderful capacity for production, even in a year of unusual dryness. On the opening day all previous attendance records were broken, when, it is estimated, 80,000 people congregated on the ground.

The Court of the Department of Agriculture and Stock, district exhibits, and the fine educational and originally arranged exhibits of the Forestry Service were outstanding features of the pavilion displays. The stock paraded in the arena and presented for judgment would command attention and win commendation in any show ring in the Commonwealth. Visitors from other States, including some of Australia's most successful breeders, were favourably impressed with the quality of the cattle shown. The horses, too, particularly the blood and draught classes, were worthy representatives of their respective breeds. A group of Clydesdale sires, which have been placed at the disposal of farmers for breed improvement by the Government, commanded attention and shared in popularity with the remarkably fine troop of police riders from the Government Remount Station.

Another notable feature was a great display of motor vehicles, which improve in range and variety each year, in the John Reid Hall and associated annexes.

A collection of temperate and tropical fruits in almost infinite variety and excellence of quality could not, probably, be excelled in any county.

Among those present at the official opening besides the Governor-General and Lady Stonehaven were His Excellency the Lieutenant-Governor, Hon. W. Lennon; the Premier, Hon. W. McCormack; the Minister for Agriculture and Stock, Hon. W. Forgan Smith; the Under Secretary, Mr. E. 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 Director of Fruit Culture, Mr. A. H. Benson; the President of the R.N.A., Mr. E. Baynes; and the Secretary of the R.N.A., Mr. J. Bain.

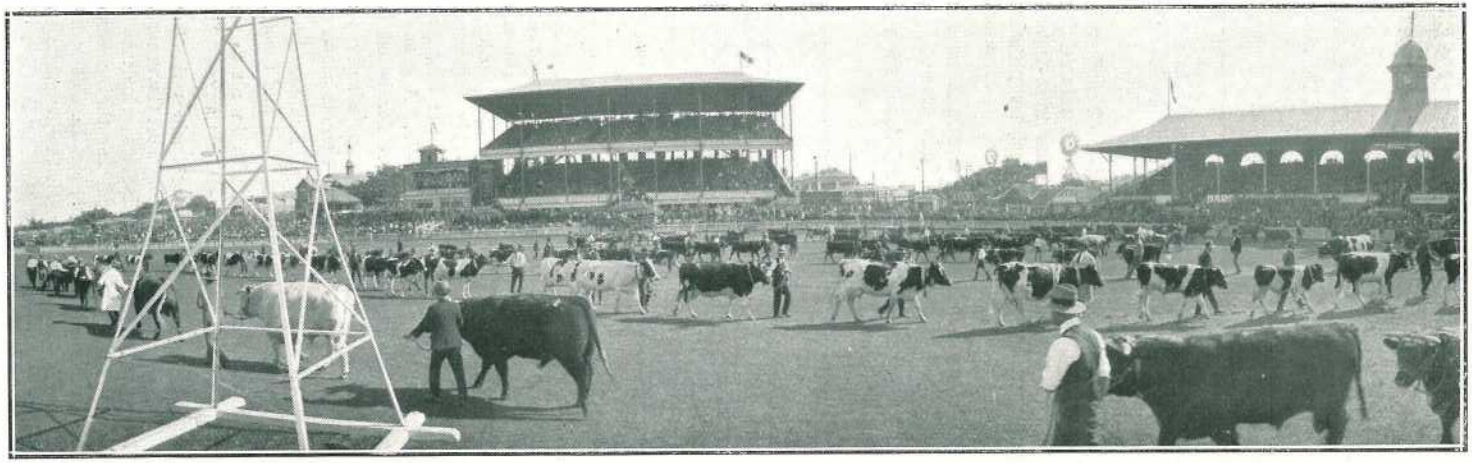

PLATE 42.—GENERAL VIEW OF THE ARENA ON THE OPENING DAY. GRAND PARADE IN PROGRESS.

PLATE 43.—AN INFORMAL CHAT ON QUEENSLAND'S RESOURCES. THE GOVERNOR-GENERAL OF AUSTRALIA (LORD STONEHAVEN) AND THE PREMIER OF QUEENSLAND (HON. W. MCCORMACK).

THE AGRICULTURAL COURT.

REPRESENTATION AND REVIEW OF DEPARTMENTAL ACTIVITIES.

This year the Court embraced a number of new features. The several sections were prepared for educative purposes and to illustrate the work of technical and field officers of the Department.

Individual trophies presented a completeness both in artistic detail and in the manner in which information was presented for the benefit of the interested observer. The general arrangement of the Court within a neat colonnade treated in white and gold relieved with buffs and set off with festoons of greenery and ferns was combined in an harmonious setting.

The several sectional displays, of which detailed descriptions follow, comprised exhibits of Sugar, Wool, Maize, Wheat, Cotton, Power Alcohol, Broom Millet, Rice, Sorghums, Tobacco, Fruit and Horticulture, Herd Testing, Pig and Poultry Raising. A panel of edible shrubs, contributed by the Botanical Section, was of particular interest, while the Entomological and Plant Pathological Division of the Department and the Stock Experiment Station at Yeerongpilly also added highly educational evidence of the alliance of Agriculture with Science.

QUEENSLAND'S WEALTH IN WOOL.

Many excellent exhibits of Queensland's great staple industry were included in district exhibits. The Department of Agriculture and Stock had a magnificent display in its Court, in which a highly educative trophy based on fleeces and pieces, arranged by the Instructor in Sheep and Wool, Mr. W. G. Brown, was a conspicuous feature. Experts, both of the run and the wool room, were immensely pleased with its appearance and comprehensiveness. It was most elaborate, and wool information and samples were so tabulated and arranged as to convey to even the casual observer an idea as to the stages in sequence of converting wool from its greasy state to the finished fabric. A sample of a clip from each district was distinctly arranged and its commercial value indicated. Queensland being probably the finest Merino country in the world, samples of this wool predominated naturally. Coastal and crossbred wools were also displayed to advantage. All were bright, clean, fine up to super fine, and high-yielding—most attractive wools of the highest quality. "The best fleeces the Department has ever handled" was the verdict of Mr. Brown.

In the several district exhibits wool was a prominent feature. Woodford and Kilcoy showed specimens of Romney Marsh, crossbred, comeback, and Leicester-cross, all tastefully arranged. The Northern Downs were well represented with topping fleeces. South Burnett showed a good mixed range, not large, but of right quality. Wool in five varieties from the Brisbane Valley was up to a high standard.

The Wide Bay and Burnett display ranged from the fleece in the grease to finely-woven material, which enhanced greatly the whole presentation from this rich region. The South Coast had reason to be proud of its share in the wool display, while North Queensland was well represented in this section and earned very favourable comment. An outstanding exhibit was that from the North Coast and Tablelands (New South Wales), which comprised wools from Glen Innes and Inverell, embracing all specimens from Merino to coarse crossbreds. Scoured wool was also included.

The numerous entries and fine exhibits indicated strongly the increasing bias of farmers and small holders generally towards sheep-raising as an adjunct to their other undertakings. Wool in the Departmental Exhibit prepared by Mr. W. G. Brown comprised a good range of high-class Merino fleeces, similar in quality to those shown at Wembley and Dunedin Exhibitions. Quality ranged from 60's warp up to 80's spinners' wool. These were all typical Queensland wools, shown according to district of origin.

In a section was shown farmers' wool in the rough, as received at the Departmental Woolroom, to be treated under the Farmers' Wool Scheme. Several of the numerous sorts were shown. It was, of course, impossible to show every class or sort which is made in the course of the wool season. The British-Australian Wool Realisation Association found 847 types in Australian wool, and these are now stabilised for relative values and quality, a truly monumental work which is never likely to be altered.

The operations of the Departmental Wool Scheme are extending rapidly. It is of great advantage to the smaller holders to have their wool handled well, and put in an attractive form before the buyers.

Some graphic charts illustrating one of the activities of B.A.W.R.A. were shown. Two hundred and seven millions of pounds sterling were received for wool handled and sold by the Association in four years, with little actual loss or friction.

Graphic evidence of the activities of the Department in the Wool and Sheep Branch was presented. Lectures, practical advice, and inspection of land are all part of the week's work.

FODDER TREES AND EDIBLE SHRUBS.

Among the more remarkable and valuable features of the Australian vegetation is the number of trees and shrubs, natives of both the inland "scrubs" and open country, that are edible for stock. A representative collection of about thirty species was staged in the Departmental Court. Among them were specimens of Mulga, Kurrajong, Bottle-tree, Whitewood, Bumbil-tree, Cotton Bush, and several species of Saltbush. All these and many others have helped to keep stock not only alive, but in good condition during long spells of dry weather. The conservation, propagation, and utilisation of these valuable plants is obviously a matter of national importance.

The planting of combined shade trees and fodder trees is a move in the right direction towards successfully reducing pastoral risks in dry seasons. Many of the native trees, though excellent, are of slow growth; this cannot be said of all, however, particularly the Kurrajong and Red Ash. Some exotic trees also are useful fodders, and serve the combined purposes of shade and fodder. One of the most valuable of these is the Phytolacca, or Bella Sombra Tree, a tree of very rapid growth and standing heavy pruning. Another tree, the leaves of which are greedily eaten by stock, is the so-called "Portuguese Elm" (*Celtis sinensis*); this is an ornamental tree of fine spreading habit. This exhibit was altogether a fascinating feature of the Departmental Court.

Pastoralists and others interested in these matters are invited to send specimens for determination and report to the Department, or if contemplating planting to request information. Inquiries addressed to the Under Secretary or direct to the Government Botanist will always receive prompt attention.

SUGAR INDUSTRY—DISPLAY BY THE BUREAU OF SUGAR EXPERIMENT STATIONS.

The varieties of cane exhibited by the Bureau of Sugar Experiment Stations included a number from Hawaii, West Indies, Java, and Mauritius. Other varieties were from 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 5,000 of these seedlings have been raised, but many of them are, of course, weeded out in the process of selection. Commercial trials of the best of them are now being undertaken. One of the objects of the Sugar Experiment Stations has been the introduction and testing of new 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 as to whether 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. 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 growers.

Full descriptions of the varieties exhibited appeared on cards, which also give commercial cane sugar content, attached to the canes. Many of these canes are at present 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 proportion of the number of new and tested canes distributed from the Experiment Stations in the course of the past twenty years.

Sugar-Cane Propagation.

The Sugar Experiment Station at South Johnstone, near Innisfail, has, during the past three 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

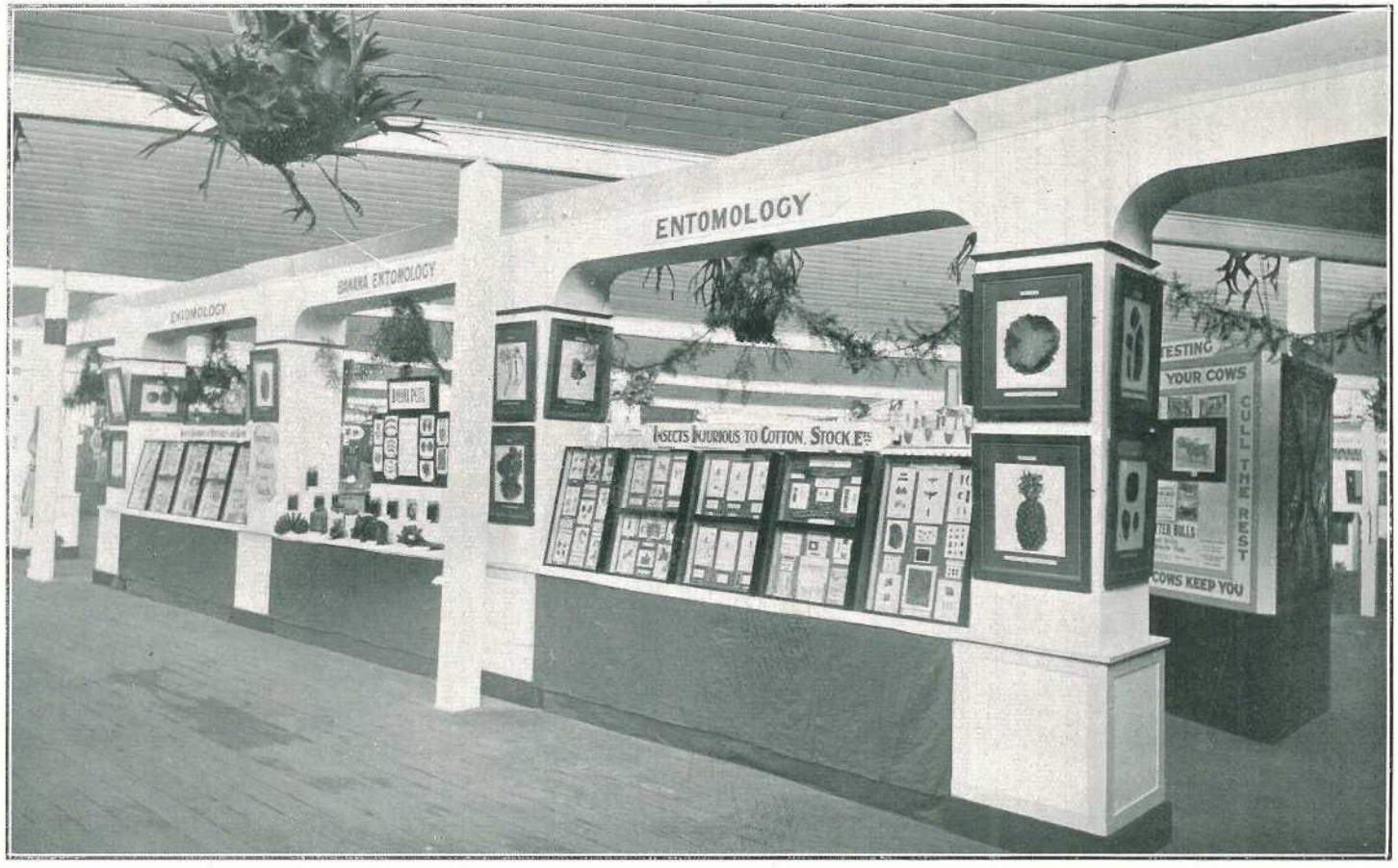

PLATE 44.—HOW QUEENSLAND FARMERS ARE SERVED BY SCIENCE—ECONOMIC ENTOMOLOGY ILLUSTRATED IN THE DEPARTMENTAL COURT.

PLATE 45.—"OIL" FROM THE SOIL—THE FUEL OF THE FUTURE—QUEENSLAND MEETING A NEW DEMAND—THE MANY TROPICAL PRODUCTS FROM WHICH POWER ALCOHOL MAY BE OBTAINED—A SECTION OF THE DEPARTMENTAL COURT.

has to be handled most carefully. Specially prepared boxes of soil which have previously been sterilised are used. 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 Badila characteristics, and it is trusted that a cane equal to the Badila will be discovered.

Study of Soils, Cultivation, and Fertilising.

Work at the Experiment Stations also comprise 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, and growers are taught the principles of cultivation and business methods by visits to the Experiment Stations, and by lectures and addresses delivered in the several sugar districts, and by the issue of bulletins. It is 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, particularly in respect to the application of lime where necessary, green manuring and fertilisers, and the treatment of the land by proper soil handling. Upwards of 1,400 cane soils have so far been analysed. Cane samples are also tested free of charge, so that growers may know the best time at which to cut their cane. Field officers move around among farmers, giving advice on cultural operations and other matters affecting their industry.

Investigation and Research Work.

Investigation and research work in connection with the sugar-cane's most serious pest—viz., the grub—is now being carried out by the Bureau of Sugar Experiment Stations in a systematic manner, and numerous bulletins have been issued upon the subject. The entomological laboratories are situated at Meringa, near Cairns, which is the centre of the worst grub-infested region in North Queensland. Chemical fumigants are being successfully used in the destruction of cane grubs. A pathological staff is being established to deal with diseases in cane.

Economic Value of Cane Cultivation—Its National Significance.

The work of the Sugar Experiment Stations, in relation to the promotion of the agricultural welfare of Queensland in connection with the sugar industry, cannot be over-estimated. When it is considered that this industry is the greatest agricultural one in Queensland, and will produce about 380,000 tons of sugar this year, estimated to be of the value of over £9,000,000, 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 poorness of soil, are not suitable for cane. This belt is included between latitudes 16 deg. and 28 deg. south, and the bulk of the staple is grown within the tropics.

Rainfall.

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 last year was about 484,000 tons.

The Greatest Agricultural Industry in the State—White Labour Production.

Australia is the only place in the world where cane sugar is produced by white labour. We are in competition with countries which produce sugar by black labour and under black-labour conditions. In Java, wages are only about 10d. per day, the worker keeping himself.

About £16,000,000 are invested in the Queensland sugar industry. It is the greatest agricultural industry in the State. No other branch of agriculture in Australia employs so much manual labour.

The yield of cane and sugar per acre is improving; this is due to better methods of cultivation and growth of superior canes. The mills have also largely increased their efficiency, and over £1,000,000 have been spent during the past five years in improving existing mills.

In addition, the Queensland Government has erected the most modern sugar plant in Australia in the Tully River district.

In the Court of the Department of Agriculture the activities of the Bureau were fittingly and impressively illustrated. It was a display in which the steady progress of a great industry was readily discernible, and that suggested illuminatingly what Science and Agriculture can do when working in double harness.

THE FUEL OF THE FUTURE.

No more important question affecting the commercial and industrial development of Australia exists to-day than that of the supply, within its own territory, of a relatively cheap and effective fuel for internal combustion engines. Apart from the diligent search for petroliferous oil in Queensland, the establishment in the Northern part of the State of distilleries for the manufacture of power alcohol at an early date promises to be one of the most important developments in the history of this progressive State. An unlimited field for its manufacture is at hand.

Fully 80,000 gallons of petrol are required to-day to meet requirements within the Commonwealth. As the world's supply of this latter product is decreasing, other sources of fuel supply are being exploited. Undoubtedly, Queensland offers a most suitable field for development of the production of power alcohol. Fifteen million gallons of molasses are produced annually as a by-product from sugar manufacture, estimated to furnish from sixty-five to seventy-two gallons of power alcohol to the ton.

Several crops which thrive well here can also be used for the same purpose. These include grain sorghum, maize, sweet potatoes, cassava tubers, arrowroot, and sugar-cane.

In the Power Alcohol Exhibit in the Departmental Court a special feature was made of cassava, as the Department of Agriculture and Stock, after importing 1,500,000 cassava cuttings from Java last year, has given attention to the distribution and planting of these in the Mackay district, in order to give the crop a thorough trial. Photographs of several experiment plots and of individual varieties, together with a number of relevant details, assisted in giving a completeness to this interesting and instructive exhibit.

AGRICULTURE.

Maize as King—The Central Trophy.

Maize was king this year and was enthroned in the centre of the Departmental Court. The trophy was a work of art and a distinctive feature of the whole display. In its general arrangement and the final court array, the work of Mr. H. W. Mobsby, F.R.A.S., Departmental Artist and Photographer, was plainly discernible. Though on a very much smaller scale, it was suggestive of his excellent work at Wembley, and more recently at Dunedin, where he arranged Queensland's representation of her contribution to Industry and Commerce with such effect that it was regarded as one of the strongest features of the Exhibition. The trophy illustrated the work of the Maize Specialist of the Department (Mr. C. J. McKeon) clearly and illuminatively. Methods of plant and seed selections were demonstrated, and relevant information was set out clearly on printed cards in proximity to each individual exhibit. The whole was an object lesson of what may be accomplished by head and hands working in unison.

The uniformity of type according to variety and the quality and productivity of the special strains of seed displayed afforded striking proof of the fact that nothing but good can result from scientifically-controlled seed improvement work of this character. The Department makes a practice each year of raising fairly large quantities of stud seed maize for distribution and sale to growers. Obviously, the grower has a direct means of improvement at hand, and if full advantage is taken of the Department's work, it must exercise a potent influence on the production of increased quantities of Queensland's principal cereal.

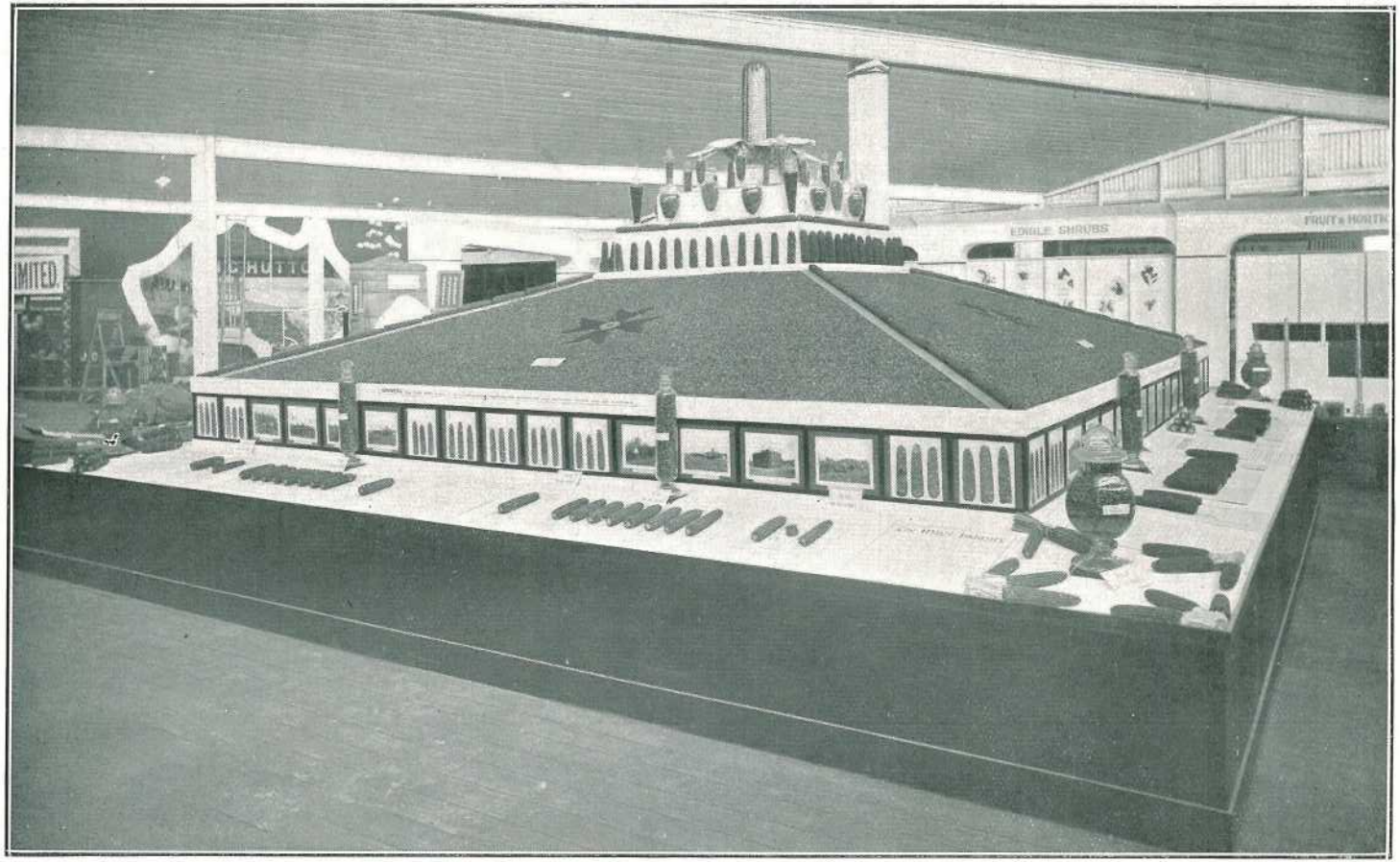

PLATE 46.—MAIZE TROPHY—CENTRAL FEATURE IN THE COURT OF THE DEPARTMENT OF AGRICULTURE.

PLATE 47.—THE WINNING DISPLAY IN "A" GRADE. EXHIBIT FROM THE NORTH COAST AND TABLELANDS OF NEW SOUTH WALES.

PLATE 48.—THE WINNING DISTRICT EXHIBIT, "B" GRADE, FROM THE BRISBANE VALLEY.

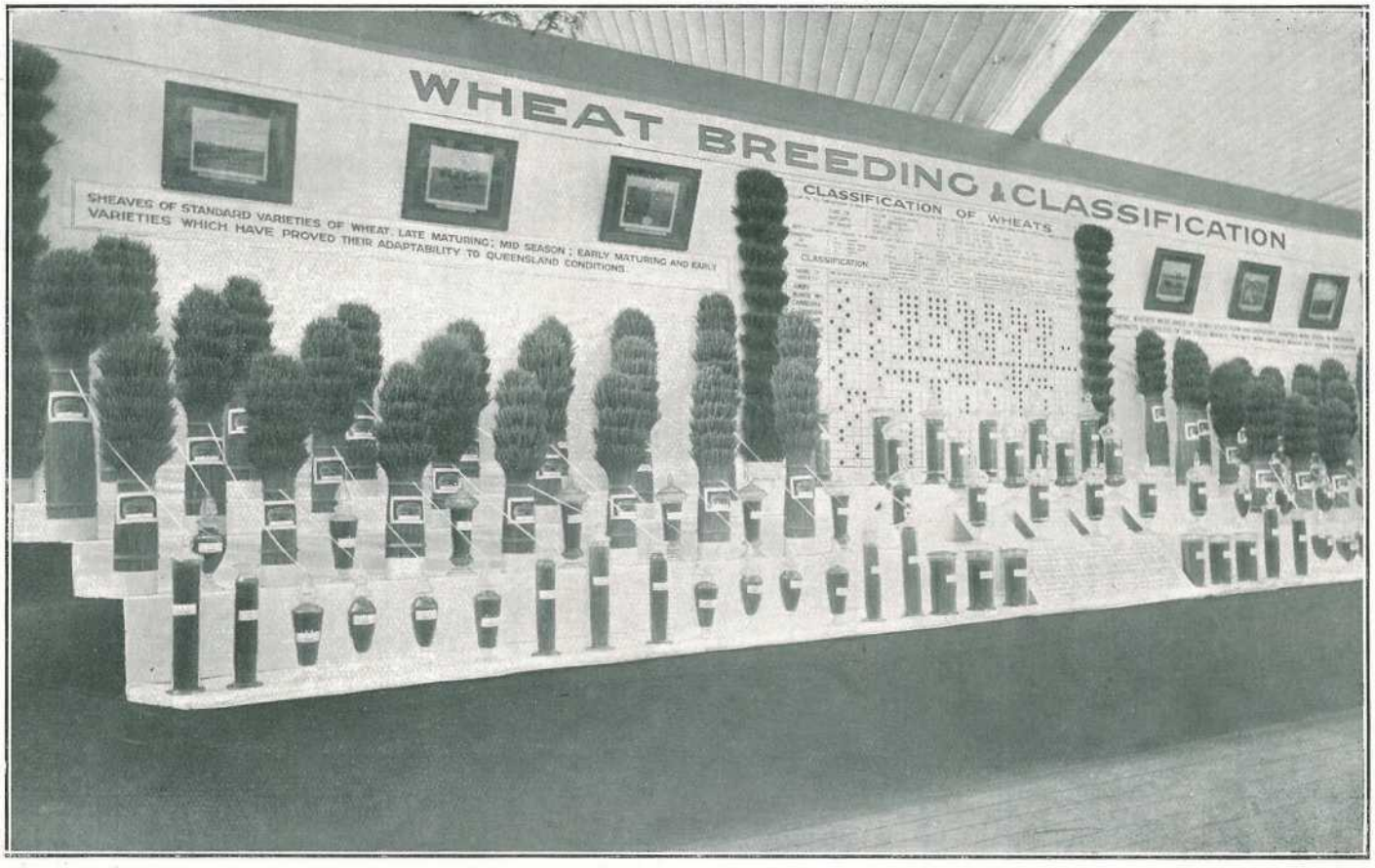

PLATE 49.—QUADRUPLING QUEENSLAND'S GRAIN YIELD. SYSTEMATIC PROGRESS IN WHEAT BREEDING, THE WORK OF THE DEPARTMENT OF AGRICULTURE, ILLUSTRATED.

"Of the world's great work he has done his share
Who has garnered a crop of wheat."

Wheat.

Special significance was given to this year's display, and it illustrated graphically the scheme the Department initiated for the standardisation of Queensland-grown wheats, which, at the commencement of the season, was agreed upon in conference between representatives of the Department and the Wheat Board, and immediately afterwards put into practice. Centrally situated in the exhibit were depicted the classification of varieties, their periods of maturity, the soils and districts most suitable for their development, and the character of each kind of grain.

Details of the scheme and of arrangements for giving effect to it were set out explanatorily. This served to stress the fact that the co-ordination of effort between officers of the Department and the representatives of the growers is a definite step towards placing wheatgrowing on a bedrock foundation.

The raising of supplies each year of pure seed of dependable varieties supplied in the first place by the Department of Agriculture, and their propagation under a premium system by arrangement with individual growers and the board, and the cleaning, grading, and substitution of the resultant seed for a large percentage of the commonly grown class of seed wheat, often of mixed origin and full of impurities, must exercise in the main a most beneficial effect on the stabilisation of the industry. Further, the scheme is designed to directly link up the work of field officers of the Department and its wheat breeder at Roma with that of the wheatgrowers and the board, and if given full effect to will indubitably have a direct influence on the expansion of a primary industry which promises to be a very valuable asset to the State. Already about forty growers are engaged in raising special strains of seed which should produce several thousand bushels this year, all things being favourable.

It was of interest to note in reference to the artistically prepared sheaves on the exhibit, the product of Departmental experiment plots, that they were similar in design to those sent to the Wembley and Dunedin Exhibitions, which, in the case of the former, were adopted as a standard type for the Commonwealth display at the Empire Exhibition.

It has often been remarked that Queensland cannot grow wheat. No more striking example in refutation of such statements could be seen than the excellent samples of straw and grain on the Wheat Trophy. It suggested the natural engendering of a feeling of confidence in an unbiassed observer that wheat must become an important Queensland crop. The major portion of the wheat exhibits owed their origin to the Roma wheatbreeding farm, and to the subsequent work of field officers in testing and proving adaptability of the varieties to differences in environment and soil common to an extensive range of wheatgrowing country.

Rice.

Sheaves of several varieties of Upland rice, samples of padi (unhusked rice), and Hulled rice, the commercial product, which was prepared in Brisbane from padi grown on Departmental experiment plots in the Northern part of the State, show unmistakably that the Upland variety thrives well under conditions where dependence is placed on the natural rainfall. Rice is generally regarded as a crop which has to be grown solely under irrigation conditions by cheap labour. This is not so. The Upland variety has been brought to a high state of perfection; it is a prolific cropper, and produces a heavy, plump, nutritious berry, equal to the best swamp rice. Of much significance also is the fact that Upland rice can be sown with a drill in a similar manner to wheat, harvested with a reaper and binder, and threshed with the same kind of machine as is used for threshing wheat.

Australia imports practically the whole of its rice requirements and its rice starch; ample scope exists, therefore, for the production of this valuable crop within her own borders. Tariff protection against the competition of cheap, foreign labour would be required. Excellent returns were obtained on the small experiment plots where the samples shown in the exhibit were grown; these ranged from a calculated yield of from forty-eight to fifty-five bushels per acre of rice padi.

Sorghum.

Dairymen who raise the ordinary classes of saccharine sorghum for fodder purposes are interested in a new strain of seed introduced in 1924 by the Department from the United States of America, where it is known as "Honey Sorgho." Tested on Departmental experiment plots in the North, where it thrives well, splendid yields were obtained, ranging from 25 to 34½ tons of green fodder per acre. Owing to its high sugar content, animals are very fond of "Honey Sorgho," which promises to be an acquisition to stockowners. Specimens in the Departmental Court attracted much attention.

Tobacco.

In this section two interesting models were shown of a flue-curing pipe leaf tobacco house and a barn for curing cigar leaf, also samples of the respective classes of tobacco. Modern manufacturers now demand that leaf must be carefully cured to conform to certain standards of quality to meet the requirements of customers who have been educated up to the use of higher grades of smoking tobacco, and the educational work of the Department in this respect was well represented.

Cotton.

The exhibit of the Cotton Branch this year was prepared to feature some of the factors which contribute to the production and the preparation of a bale of cotton. A bale of cotton was the central object in the display, and around this was grouped the exhibits and descriptions thereof, which illustrated many of the operations essential to the production of a bale of lint cotton.

On one side of the stand supporting the bale were displays explanatory of some of the important points of the plant-breeding operations which apply to the problem of breeding uniform strains of cotton to suit the different districts in the State in which the fibre is cultivated. Illustrations of the meaning of such terms as the "drag" of a cotton, the "uniformity of length of staple," the "lint index," "uniform seed types," "typical bolls," were of highly educative interest.

On the other side of the stand grades and staple lengths which are used in the classing or grading of the Queensland cotton crop were set out. The set of standards used in determining the grade of the seed cotton as it arrives at the ginneries and the set of standards of lint cotton which illustrate what the corresponding grades of seed cotton will produce when ginned were shown. In addition to these were panels of combed seed cotton and pulls of lint cotton illustrating the various staple lengths which are used in determining the average length of the fibres in each consignment of cotton received at the ginneries.

On the ends of the stand the by-products of seed cotton, such as the seed and its various products, were shown. These included displays of linters which are obtained from the seed prior to crushing for oil extraction; the kernels as they appear before being cooked; the slabs of 'cake" after the kernels are cooked and pressed to extract the oil; the meal obtained by grinding the cake; and the refined oil which is obtained from the cotton seed. Besides these, a display of cubes of pressed meal and molasses for stock feed was arranged. Both these and the ground meal are being used extensively on the sheep stations at the present time. In addition were shown panels of combed seed cotton illustrating the improvement which is being made in the Durango cotton through the plant-breeding operations of the Cotton Section of the Department of Agriculture and Stock. A comparison of the Durango variety in its different stages of improvement with the old Queensland cotton was presented. This afforded an opportunity of observing progress in improving the uniformity of Queensland cotton.

It is anticipated that with the organisation which has been developed in the Cotton Section of the Department of Agriculture even more marked progress will be made as the full effects of the various breeding operations are obtained. It is believed that under such a system as has been developed the cotton-growers of Queensland will eventually be receiving strains of seed which for uniformity will compare favourably with any other cotton-growing countries.

THE FRUIT INDUSTRY.

A variety of young stock from the Bribie State Nursery showing results of propagation by various methods, also specimen plants of new varieties of strawberries raised from seeds and giving every indication of all-round improvement on previously existing varieties, found place in the Departmental display.

Fruit of several varieties of Avocado pears (from Acclimatisation Gardens) showing the different types of this esteemed fruit were presented.

Specimens of citrus fruits were shown as an aid to definite and correct naming of varieties.

The pruning of deciduous and other fruit trees was interestingly illustrated.

DAIRYING.

The dairying industry is expanding throughout the State, and the dairy farmer is the pioneer in many of the new areas being opened for close settlement. The first half of this season was favoured with serviceable rains, and the output of dairy products was heavy. Dry conditions of the latter half of the season curtailed operations considerably. Enlargement of dairy factory premises and the remodelling of manufacturing plants has received attention, and most large factories are furnished

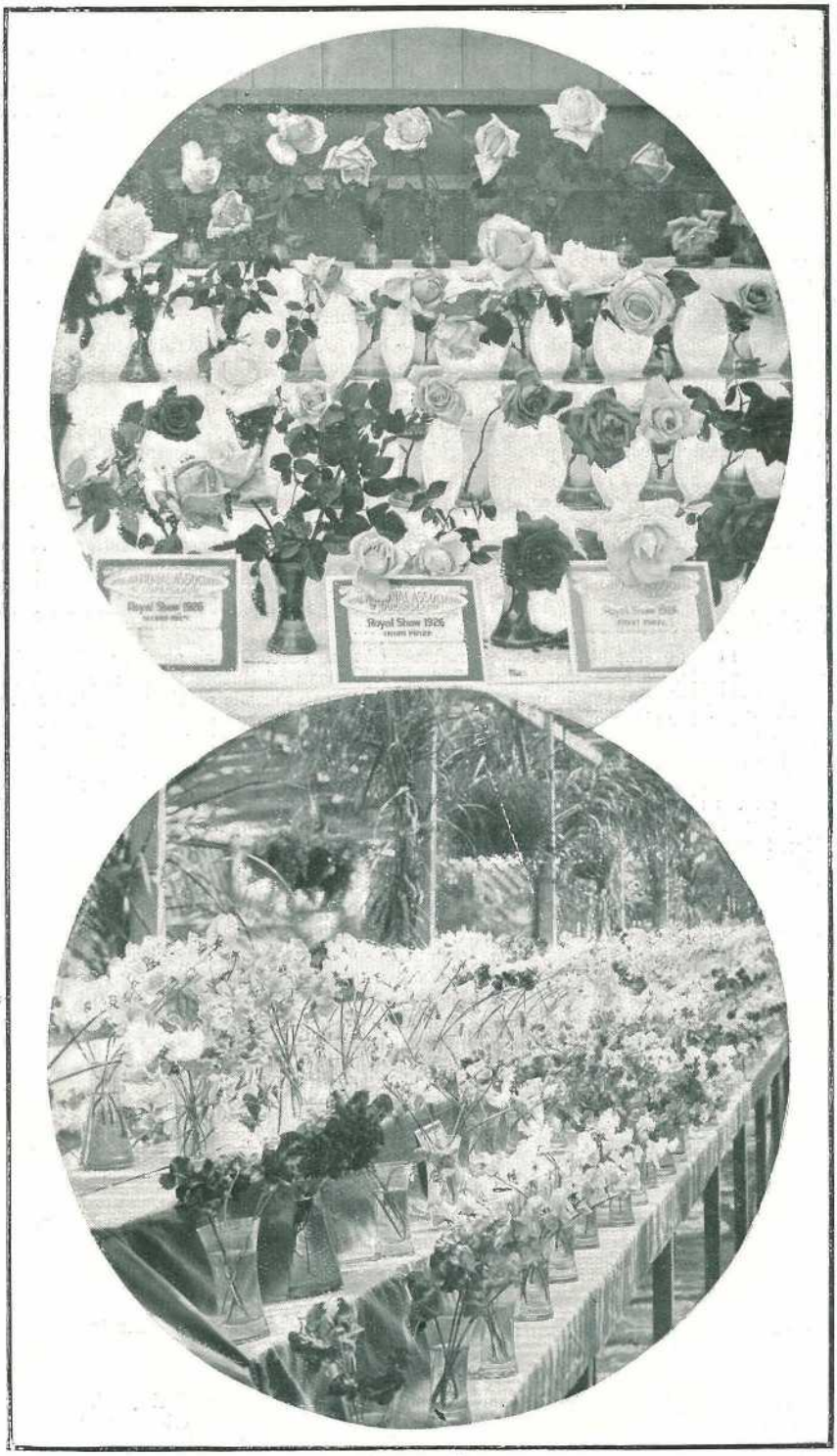

PLATE 50.

1. A PEEP AT THE ROSE SECTION, HORTICULTURAL DISPLAY.
2. SWEET PEAS IN THE HORTICULTURAL BOWER.

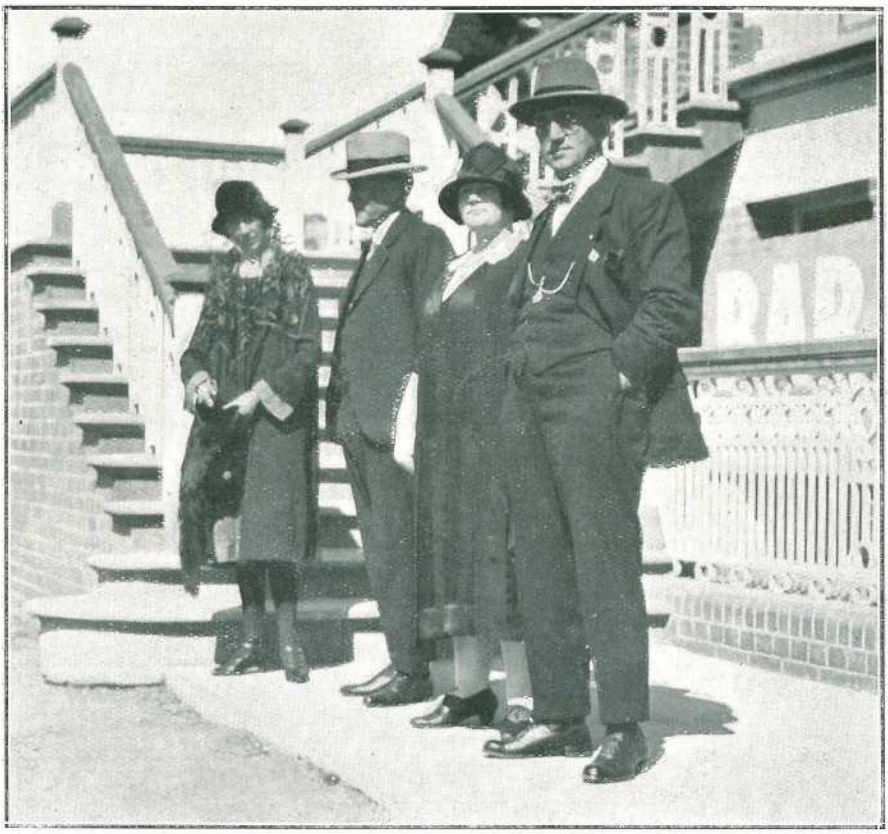

Plate 51.—Interested Visitors.

(*Right to Left*).—Hon. W. Forgan Smith, Minister for Agriculture and Stock, and Mrs. Smith; Mr. E. Graham, Under Secretary, Department of Agriculture and Stock, and Mrs. Graham.

Plate 52.—Departmental Activities Illustrated.

Court of the Department of Agriculture.

PLATE 53.—POPULAR PANELS IN THE COURT OF THE DEPARTMENT OF AGRICULTURE.

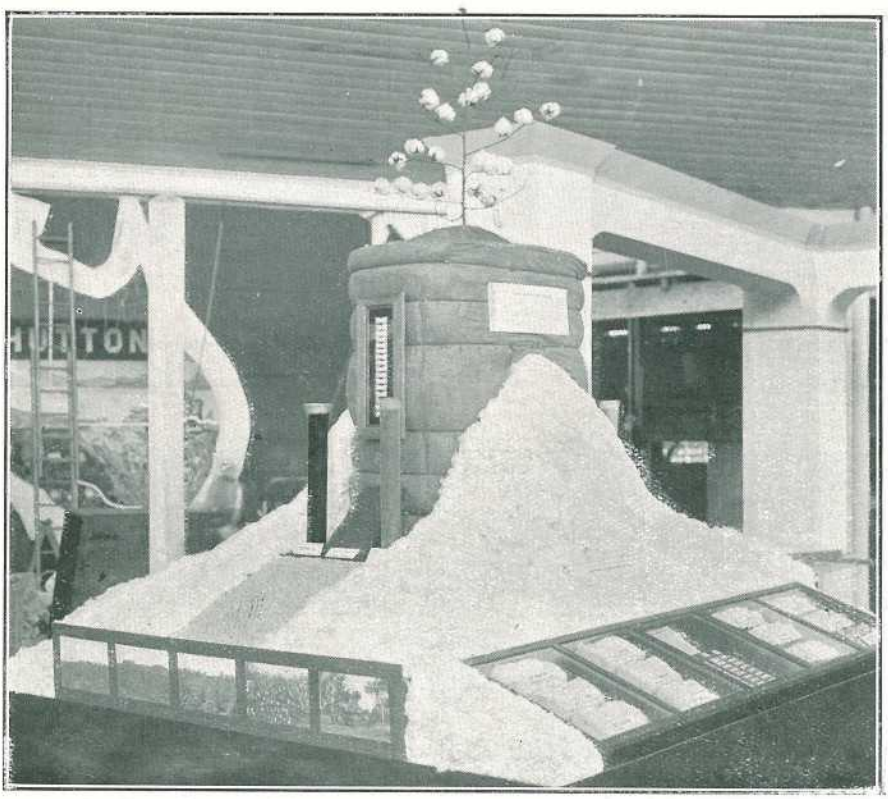

PLATE 54.—A "WHITE HOPE" OF WHITE AUSTRALIA.
A Representation of Queensland's Progress in Cotton Culture, Court of the Department of Agriculture.

Plate 55.—A Study in "Counts"—Wool Trophy in the Court of the Department of Agriculture.

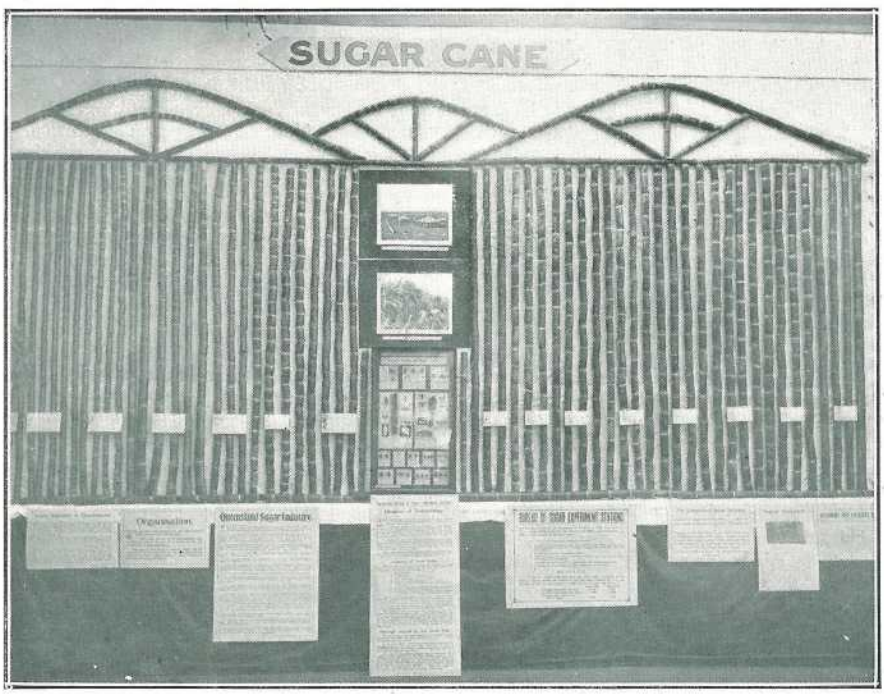

Plate 56.—The Great Work of the Bureau of Sugar Experiment Stations Illustrated in the Departmental Court.

with the most modern dairy plants. Pasteurisation of cream for butter-making is carried out throughout the State. The process aids in the production of a more uniform butter of excellent storing character. The work of the various bodies operating under the provisions of the Primary Products Pools Act has benefited the industry. The adoption of the "Kangaroo" brand for choicest butters exported from the Commonwealth has had the effect of improving the value of Australian choicest butters on the London market. The success of Queensland exhibits in the International Butter Test held in New Zealand has assisted materially to draw the attention of overseas buyers to the excellent quality of our first-grade butters. Quality combined with systematic marketing provides against undue fluctuation of prices, and gives to the primary producer an increased return for his products. Pasteurisation of milk for cheesemaking has given satisfactory results, and the principle is being gradually adopted. The Hamilton Cold Stores opened for the season and have been accorded appreciative patronage. The refrigerated space provided is ample to meet an extension of the industry and the increasing patronage of dairy interests. Storage and loading facilities obviate fluctuations of temperature—an important factor in safeguarding the quality of dairy products. The butter passes direct from the cool rooms into the refrigerated chambers on the ships.

The better bull scheme was introduced by the Minister for Agriculture and Stock, Hon. W. Forgan Smith, with a view of encouraging the breeding of better dairy cows. Provision is made for a subsidy of £ for £ to purchasers of approved dairy sires. By systematic herd-testing and the use of pure-bred sires the production of the dairy herds will be increased and the industry made more remunerative. The conservation of fodder has been advocated by departmental officers, and advice is given regarding the suitability of crops and their preservation in the form of ensilage. The feeding of a balanced ration to dairy cows on a production basis has been stressed, and the economic importance of systematic feeding should receive careful consideration by all dairy herdsmen.

Departmental inspectors report that dairy farm equipment is being gradually improved; milking plants are being installed on many dairy farms. The proper erection, care in working, and cleansing are essentials in obtaining satisfactory results from the use of milking plants. There is evidence of a desire for a better class of dairy sires. The dairy instructors on the Departmental staff find that modernisation of dairy factory plants has had a beneficial effect on the product, and anticipate an increased quantity of first-grade dairy produce in the approaching season. The Departmental graders' work was very heavy in the earlier portion of this season. The gradual flow of dairy products to the Hamilton Cold Stores will tend to increase the efficiency of the work of the grading officers. All this work, in the form of representation, demonstration, and suggestion, was a strong exhibition feature.

The Herd Testing Branch of the Department was represented by a demonstration of the importance of the scales and Babcock tester. Herd-testing has expanded considerably during the last few years, and six officers were employed solely on this work last season. Applications were received from about 110 Local Producers' Associations for the services of herd testers, representing 525 dairymen. Approximately 15,000 cows were submitted for testing. It should be noted that the Department is carrying out this work free of cost. Herd testing has been in progress in other parts of the world for at least thirty years, and dairy farmers of Queensland should realise the importance of this work. The dairy section of the Departmental Court contained convincing evidence of the value of this work.

POULTRY.

Although small, this exhibit conveyed much useful information to both poultry keepers and prospective poultry keepers. The illustrations on the feeding of poultry for production were practical and valuable. The work of the Department and its general educational efforts were strikingly set out.

The combination of fruitgrowing and poultry-raising was well illustrated. Many handy home-made utensils, such as trap nests, feed hoppers, and a drinking fountain suitable for the use of chickens, completed an exhibit from which a good deal of information could be gathered and which was strong in every point.

ANIMAL PATHOLOGY AND BACTERIOLOGY.

Tuberculosis.—The various manifestations of tuberculosis in animals, especially among the bovine species, were displayed. In this connection a photograph of an apparently healthy cow, in reality a tubercular animal capable of transmitting tuberculosis, was shown. It was also clearly shown that tuberculosis is not an hereditary disease, and, provided certain precautions are taken, it is possible to rear healthy offspring even if both the male and the female parents are affected with the disease.

Tables setting out the number of pigs slaughtered in the course of a period of ten years and the percentage found to be affected with tuberculosis were exhibited, the inference being that, provided all milk products fed to pigs were previously heated to 180 degrees F., the percentage of affected pigs would show a substantial decrease.

Ticks.—Cattle ticks in various stages of development and informative cards and charts dealing with tick eradication work were featured.

Pure cultures of pathogenic micro-organisms growing on artificial media were displayed, and include a tubercle bacilli, blackleg bacilli, streptococcus mammitis, and bacillus abortus. The abovementioned organisms are responsible, as is well known, for some of the more common diseases in our cattle.

Plate cultivation showing the necessity for cleanliness on the dairy farm and in the factory was shown, and it was made apparent how and why cleanliness affects the quality and the keeping properties of dairy products. The solution of this problem is simple; the cans, after washing and cleansing, should be sterilised by live steam for a period of not less than three minutes. The usual practice of momentarily steaming or scalding the cans is quite ineffective.

Numerous cultures of contaminating bacteria which may, as a result of carelessness, gain access to milk and cream and impart unpleasant flavours and odours were exhibited.

Serums and vaccines prepared in the Laboratory for the prevention of blackleg, pleuro-pneumonia, tick fever, and for the prevention and cure of contagious mammitis and other diseases were tabled.

There were also cultivations of strains of lactic acid bacteria for the ripening of cream and for cheesemaking. This section was one of the strongest educative features of the show.

ENTOMOLOGICAL AND PATHOLOGICAL EXHIBIT.

The entomological section of the Division of Entomology and Plant Pathology was represented by a large series of exhibition cases illustrating the life histories of the more important insect pests of Queensland; the value of the exhibit was further enhanced by the display of fresh plant material featuring the work of several of the more destructive pests of bananas.

Much interest in the case illustrating the life history of the Queensland Fruit-fly, the several stages of which were illustrated adequately by a series of paintings and specimens of each stage of the insect's life cycle, was evident. Another case of outstanding interest was one illustrating in a similar manner the commoner scale insects of citrus orchards, while the codling moth case also received special attention.

Among the other entomological exhibition cases were those dealing with the pumpkin beetle, potato tuber moth, the large wax moth, the army worm, and the bean fly. Insects injurious to stock or associated with sickness in stock were represented by the blowflies and the ironbark saw fly.

The insect pests of bananas were illustrated partly by exhibition cases and partly by fresh and preserved plant material showing the nature of the injuries inflicted by the various insects. One large case illustrated the life history of the banana weevil borer, and a second one dealt with the banana fruit-spotting bug, while three smaller cases showed a fine series of insects associated with the banana plant. Fresh plant specimens also illustrated very adequately the damage done by the banana weevil borer and other banana pests.

The pathological section of the division was represented by a series of framed photographs and paintings showing the characteristic features of some of the more important plant diseases of this State; special mention may be made of those depicting bean anthracnose, Irish blight of tomato, brown rot of peach, black spot of citrus, pineapple fruit rot, and blackleg of potato. Irish blight was also fittingly figured. A banana plant affected with bunchy top was staged. This was a popular feature in view of wide-spread interest and of the comprehensive steps being taken to deal with it.

The large exhibition cases containing insect specimens and coloured drawings were the work of Messrs. E. Jarvis, H. Jarvis, and I. W. Helmsing; three small cases showing the various insects associated with the banana plant were the work of Mr. J. A. Weddell. The preparation of the exhibit was in the hands of the Chief Entomologist, Mr. Veitch, with whom were associated Messrs. J. L. Froggatt, J. H. Simmonds, I. W. Helmsing, and J. A. Weddell.

PLATE 57.—AN INTERESTING CORNER OF THE COURT OF THE DEPARTMENT OF AGRICULTURE.

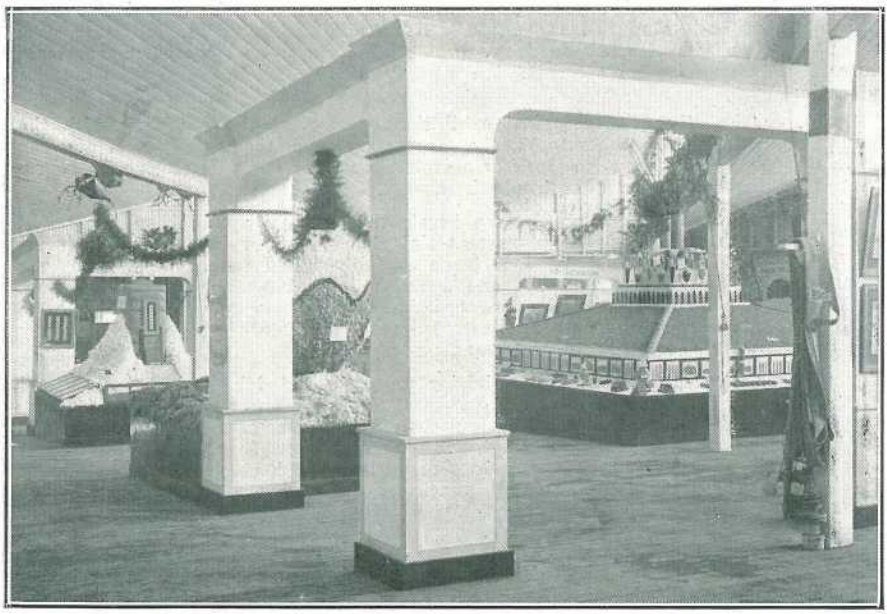

PLATE 58.—A GLIMPSE OF THE COURT OF THE DEPARTMENT OF AGRICULTURE FROM THE MAIN AVENUE.

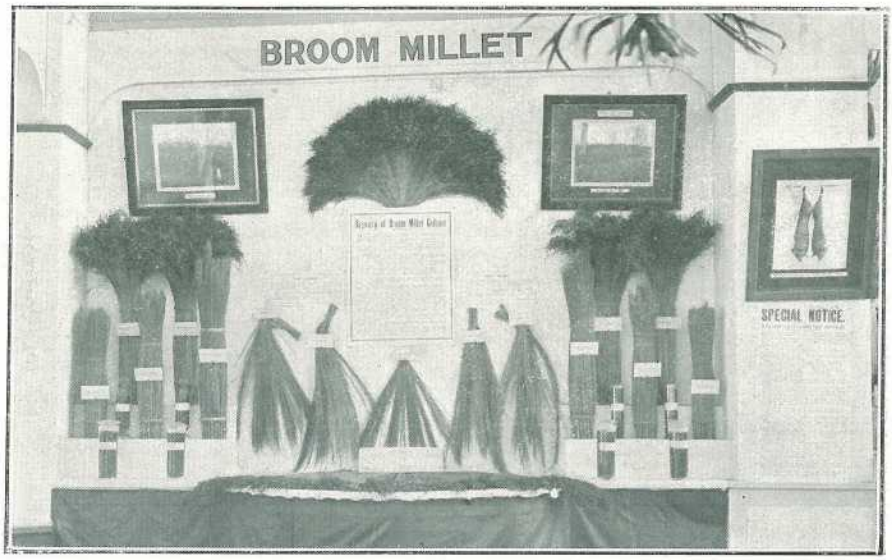

Plate 59.—Queensland Farmers Provide Raw Material for Home Industries—A Panel in the Departmental Court.

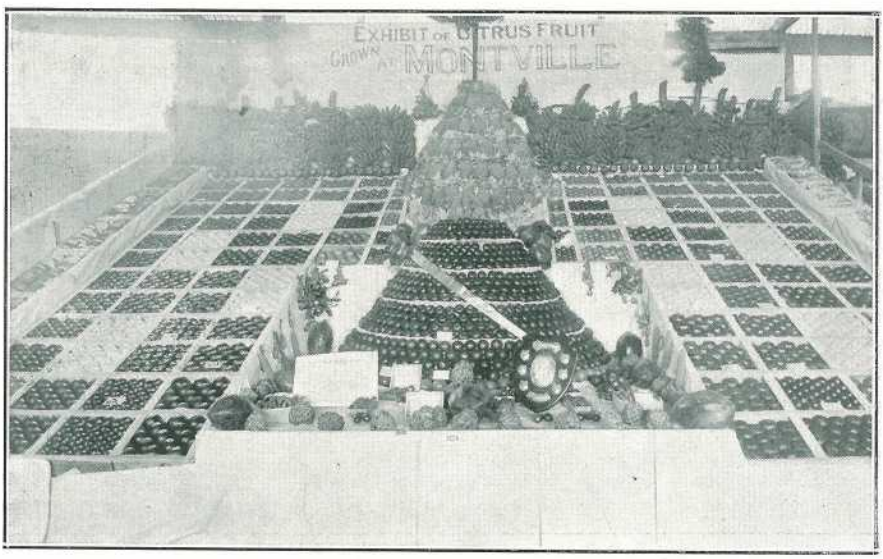

Plate 60.—The Sun Gold of Sunland. Citrus Fruits from the Famous Blackall Range.

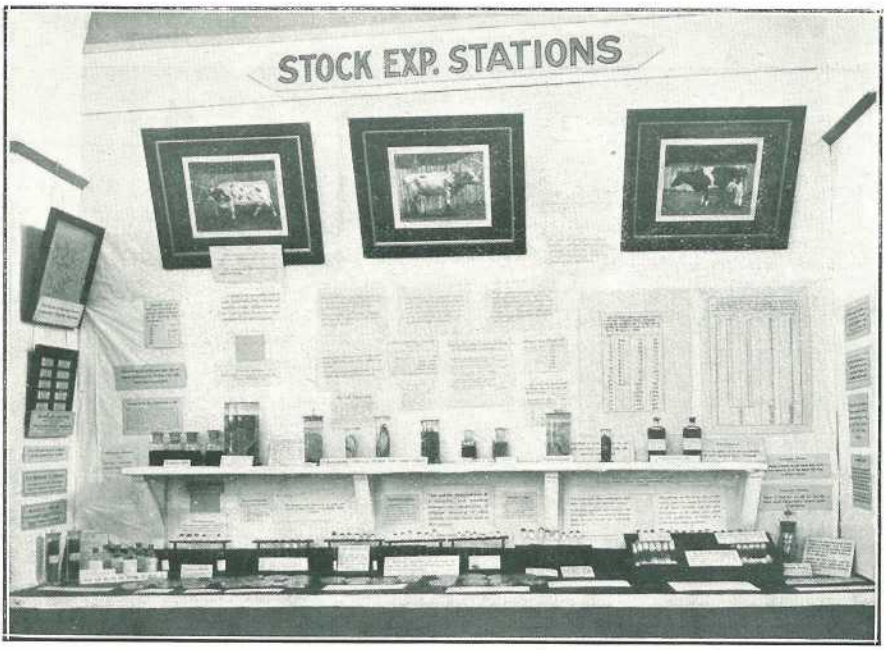

PLATE 61.—THE BACTERIOLOGIST'S CORNER.
A Great National Service Illustrated in the Departmental Court.

PLATE 62.—A DISPLAY OF NORTH QUEENSLAND PRODUCTS. A FIRST ENTRY OF EXHIBITS FROM OUR FERTILE TROPIC LANDS.

STUD PIGS AT THE ROYAL NATIONAL SHOW.

E. J. SHELTON, Instructor in Pig Raising.

"Pigs is Pigs" might well have been written over the pig pavilion at the Royal National show recently concluded, for this year well over 300 head of pure-bred pigs, and a score or more pens of porkers and baconers were on view; they comprised the finest entry of stud pigs—in the stud sections—penned at any show in Queensland to date, and in so far as quality goes were far and away ahead of any previous exhibition. The exhibitors too were more numerous, and were drawn from a much wider field of activity, while their entries were in almost every instance more liberal and of very even quality. This speaks volumes for the progress of the industry, for exhibiting pigs at shows is by no means an easy task even with the comparatively good conditions under which the pigs are accommodated on the Royal National Showground, conditions by the way which will have to be considerably improved upon if the entry grows, as there is every evidence that it will as the years go by.

It is evidence, too, of the improved value being placed on the better class animal, for though the stud sales were in a general sense dull and unattractive, the average price realised is far higher than could have been obtained even five years ago. Twenty guineas was an almost unheard of price for a stud pig in the days that have past, but even with a dull market at this year's show this figure was exceeded in several instances, and this for comparatively young animals. The increased entry in the Pig Section, and the greater distance travelled by exhibitors in coming forward to the show, is evidence also that Queensland is being recognised more and more as an agricultural and pastoral State, a country in which pig raising is destined to play an important part as an agricultural vocation. It is evidence that stud breeders are looking to the North for a market outlet for the stud animals they have available for sale, and which, if prospects are sufficiently attractive, they are prepared to exhibit in the competitive class, and then with or without prize records submit to public auction or private contract for disposal to the best advantage possible to breeders anxious to improve and build up their herds here. The stud sales are important events too, for farmers from every portion of the State, and many visitors from other States, gather together, and opportunity offers for the purchase of selected animals—a range of animals which it would be very difficult to inspect at any other season of the year. The stud sales play an important part in that breeders look forward to them as providing this special opportunity for purchase, one farmer in particular remarking that he not only usually buys a pig or two himself but his neighbours commission him to secure "something special" for them, for with the hall mark of having been exhibited at Brisbane Show a greater value is placed upon the animals than if they were purchased locally even at a lower price.

The Pig Section is a growing one too; it is one that is causing the Royal National officials a good deal of concern, for, as one of the committee remarked, "Its no good, we will just simply have to find the money to build your fellows a better and a more commodious pig pavilion, and when that is done we hope it will be placed in the vicinity of the cattle section and not as at present in what has been known as 'Petty's Paddock," quite a long way from where the cattlemen—who are the ones usually specially interested in the pigs—gather."

It is a particularly important section from a departmental point of view, for with thousands of interested folks viewing the exhibits all day long every day of the show the slogan of "Better Pigs on Every Farm" must be impressed on a much wider field of both city and country folks than if there were no show at all.

One feels convinced that the thousands of people, both young and old, who "see" good pigs at the show and who view them in clean, comfortable, well-bedded, and nicely white-washed pens, must go away with a more up-to-date idea of the possibilities of keeping pigs clean and of the advantages to be gained by providing a superior class of accommodation for their animals; at any rate, the idea that the pig is a filthy, degraded animal, and that pig raising is a "low down" occupation, must surely be dispelled as one passes up and down the clean orderly pig pens on the showground. This is the more important when considered from the standpoint of

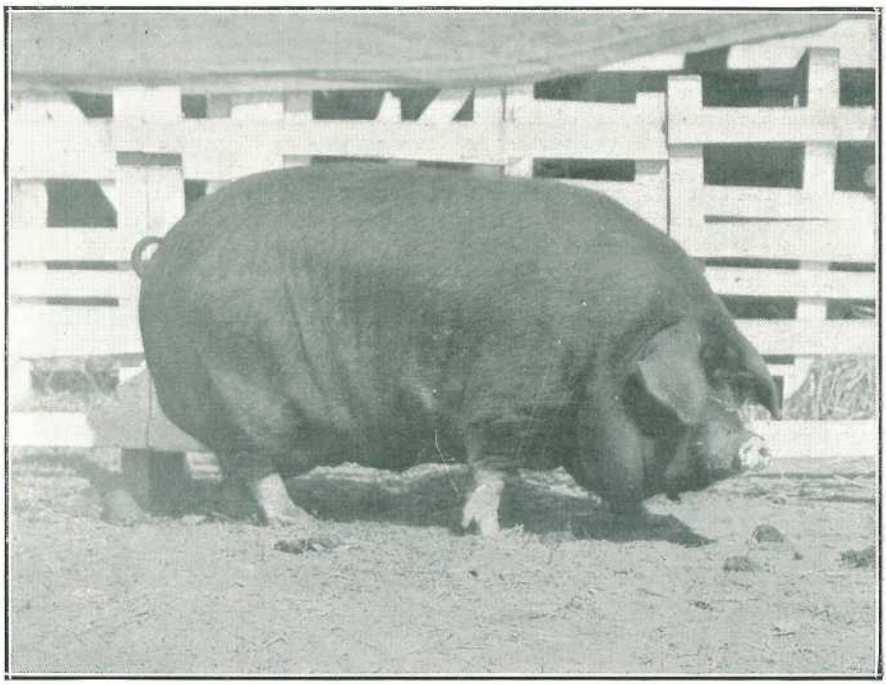

PLATE 63.—CHAMPION POLAND-CHINA SOW "DANESBRO WINIFRED," BRISBANE SHOW, 1926. Owner, Mr. A. N. White.

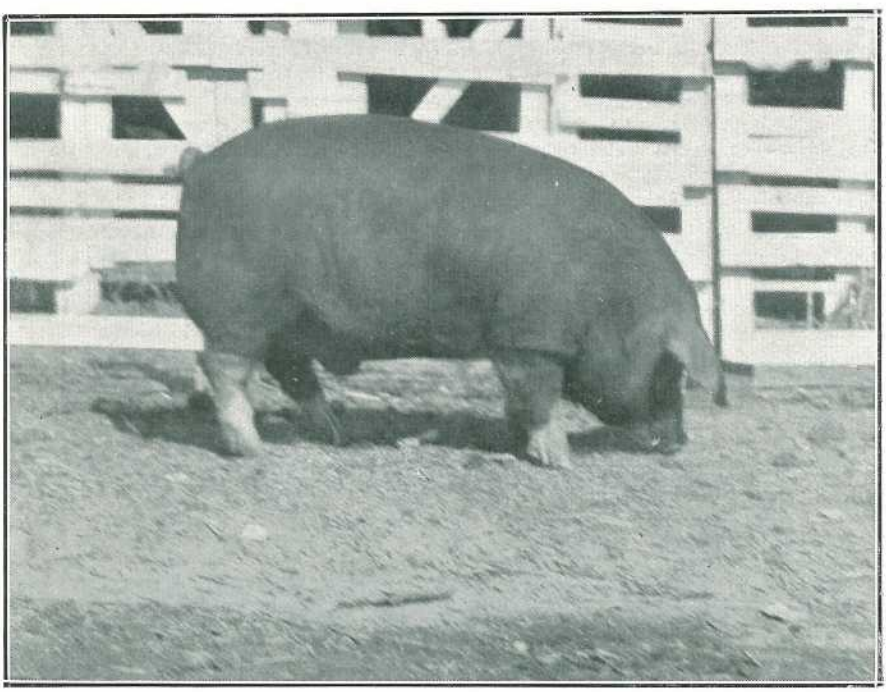

PLATE 64.—RESERVE CHAMPION POLAND-CHINA BOAR, "ORORA ADONIS," BRISBANE SHOW, 1926. Exhibited by Mr. A. T. Beezley.

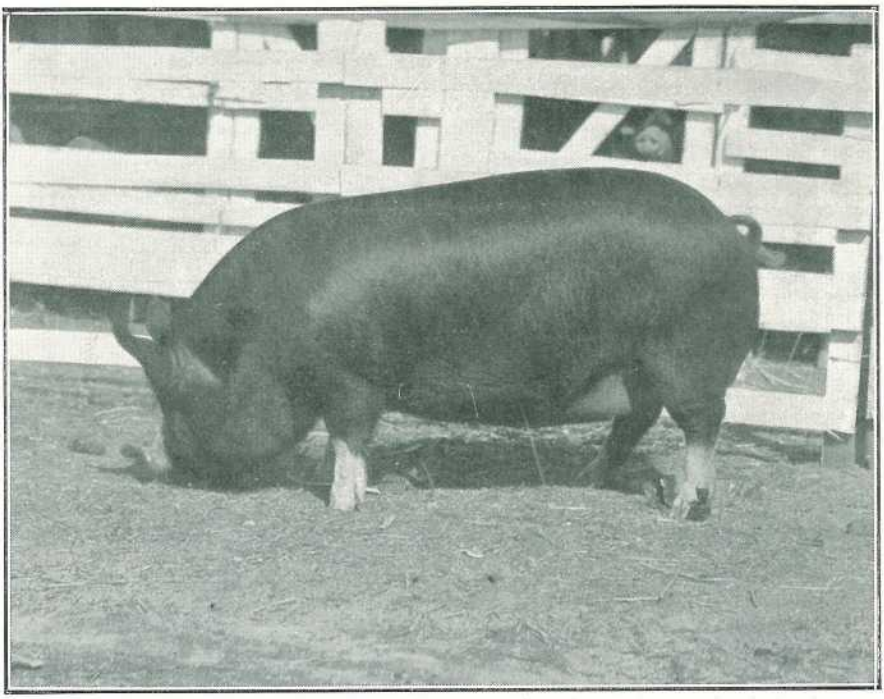

Plate 65.—Reserve Champion Berkshire Sow, Brisbane Show, 1926.
Bred and exhibited by Dunwich Benevolent Asylum, Stradbroke Island, Queensland.

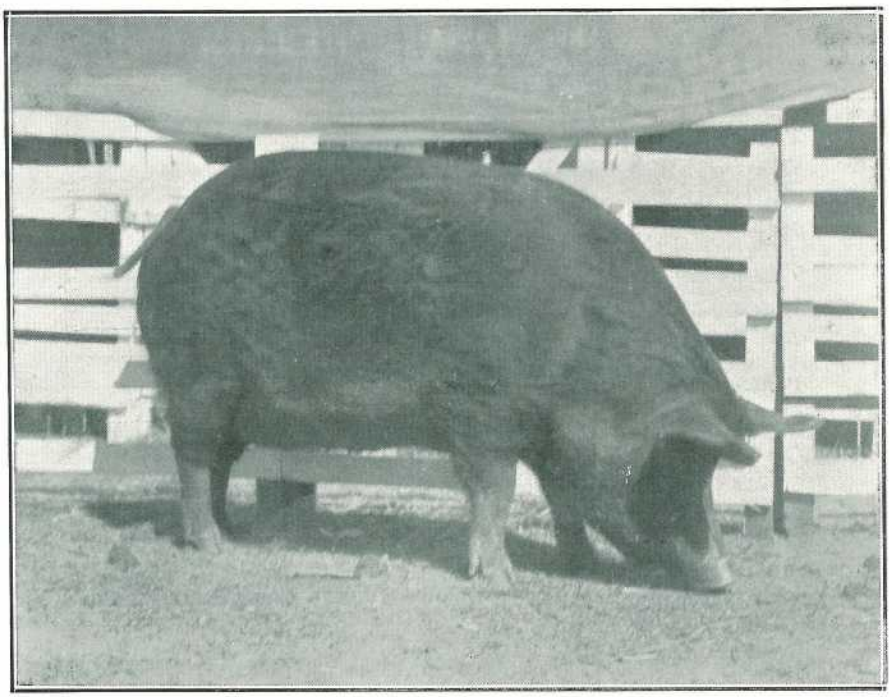

Plate 66.—Champion Tamworth Sow, "Blakeney Ribbons," Brisbane Show, 1926.
Owned and exhibited by Mr. A. N. White.

the child and of the junior farmer; one little chap interested in Pig Clubs remarked to the writer, "I wish my dad would only come and see the pigs, for the pigs on our farm are simply awful and the pigsties wouldn't keep a bandicoot in."

Viewed, therefore, from these several angles, the exhibition of stud pigs at such a function as the annual shows of the Royal National Agricultural Association, and at similar shows throughout the State, has a far-reaching effect on the industry, one it is difficult to figure out in terms of pounds, shillings, and pence.

Viewed from the effect the stud sales and the consequent distribution of stud animals has upon the quality of the pigs coming forward to our bacon factories, it will be noted that, as far as the pig world is concerned, there are no more important occasions throughout the year than the annual live stock exhibitions and sales, for per medium of the stud sales more breeding stock go out to farms in widely scattered areas throughout the State than at any other period during the whole of the twelve months.

To the Queensland Branch of the Australian Stud Pig Breeders' Society the occasion of the Royal National Show and the stud stock sales are of much value, for gathered together on these occasions are farmers from every part of this and the sister States; this means that the annual general meeting of members of the Society, which for convenience sake is usually arranged during show week, is much more largely attended than would be possible otherwise. In addition, that portion of the meeting taken up in a general discussion of matters of import to the pig-raiser, and in which pig-raisers and others interested are invited to take part, whether members of the society or not, is of greater value and interests more folks than if it were a mere formal meeting for the despatch of official business.

Finally, looking at it, as it were, through the eyes of the Royal National Agricultural Association, the Pig Section is one of far-reaching importance, for it not only attracts a large proportion of exhibitors but as a live stock section it draws a crowd of spectators. It is one of the sections which together go to make up the show. To the pig-raiser the Royal National Show would be of minor importance were it not for the attractive schedule of prizes and the added opportunities offering for the disposal, per the stud sales, of the stock he has available for sale.

As showing the wide distribution of stock from these sales, it might be mentioned that the following represent the principal centres to which stock purchased at this year's stud sales were despatched, viz.:—(*Note.*—The figures in brackets represent the number of pigs.)

In the North—Ana Branch, via Ayr (1), Gladstone (4), Miriam Vale (2), Murray's Creek (1).

Callide Valley, via Rockhampton.—Thangool (1), Biloela (6).

South Burnett District.—Kingaroy (3).

North Coast.—Gympie (1), Eumundi (5), Yandina (1), Kureelpa, via Nambour (1), Maleny (2), Peachester (2), Kilcoy (2).

Brisbane and Metropolitan.—Suburban (2), Sandgate (1), Dunwich (2).

South Coast.—Canungra (1), Beaudesert (7), Oxenford (1), Wangalpong (1), Kingston (19), Ormeau (1).

Brisbane Valley.—Esk (2), Toogoolwah (1).

Lockyer Valley.—Gatton and College (5).

Fassifern Valley.—Boonah (1), Maroon (3).

South-west and West.—Morven (1), Dirranbandi (3), Kaimkillenbun (3).

Interstate.—Botany (1), Burra Burra (2), Dryaaba (2), Murwillumbah (2).

It is safe to say that had seasonal conditions been more favourable and the price of maize and other feeding stuffs more within the reach of the pig-raiser this distribution of stock would have been much greater. Had sales been more brisk, local and interstate exhibitors would not only have sold more animals but they would have made many more purchases themselves. At last year's sales and at the sales of a year or two since, animals were despatched to New Zealand, South Australia, and several consignments to the Atherton Tableland in the North, while interstate purchases absorbed a goodly number of the best animals available.

As showing the wide field from which exhibits are drawn to the pig section at the Brisbane Show it is interesting to note that Tasmania was represented by two exhibitors, one from Moonah, via Hobart, and one from Wilmot in the north-west of

that island. Victoria sent one of her best judges to adjudicate in the Berkshire section. New South Wales was represented by one of its most popular pig judges, and also sent along nine exhibitors, while from this State there were twenty-three exhibitors in the Pig Section, the writer as a judge in several sections, and twenty or more contestants in the Young Judges' Competition (Pigs).

The Championship Winners.

Reference is made on another page to the prize winners generally, hence we shall refer here only to the championship winners in the several breeds exhibited.

In the Berkshire section, which usually heads the list in so far as number of entries are concerned and general average quality, the Mental Hospital at Goodna were awarded the male championship, their boar "Brentwood Star" (4374) having also won similar honours at the 1925 exhibitions under the late Mr. W. J. Warburton's ownership. With the partial dispersal of the Northgate stud the Goodna Hospital became the possessors of this championship winner, a boar sired by a well-known Southern champion, "Bylands Nugget" (3800). The reserve championship in the male classes was annexed by the Westwood Farm Home for Boys with "Waterview Beau" (7566), a wonderfully developed fifteen months' old sire, by "Claremont Tomnant" (6070), a well-known Tasmanian prize winner. This particular boar has an interesting record. He was in the first instance a free gift to the Farm Home, given in replacement for an animal purchased at the 1925 exhibition and which, unfortunately, died a few weeks after. It is to the credit of the donor, Mr. L. S. Ducat, that he forwarded such an excellent specimen of the breed, a boar that will do both studs credit. He won championship honours also at Toowoomba some months ago.

In the Berkshire sow classes, the championship went to a Tasmanian-bred sow, "Wilmot Cecile" (6754), shown by Mr. H. J. Keevers, of the Richmond River, N.S.W. This sow was purchased by Mr. Keevers as a youngster at the Sydney Show, and has since developed into a very fine quality animal. The reserve championship found its way to the exhibit in the under 12 months' old class penned by the Dunwich Benevolent Asylum, an institution which has recently come to the fore again with its stud stock. They were noted prize winners many years ago and have turned out many useful animals. This sow was sired by "Conargo Skipper" (5737) and had as her dam "Parramatta Joyce" (5864), both animals purchased for Dunwich by the writer a couple of years ago.

The Yorkshires.

The Middle Yorkshire breed, one of the most popular and successful in the State of Victoria and a breed with a wonderful reputation overseas, does not "take on" in Queensland to the same extent as the black with white points and the red breeds, nor have they ever attracted more than one or two exhibitors; on this occasion the breed was represented by four animals only, all shown by the Trustees in the Estate of the late Mr. W. J. Warburton, the male championship winner "Newington Adventurer" (2090) having scored similar success at previous Brisbane and Sydney shows, as also was the case with the female champion "Newington Snowflake" (2693), both animals being bred at the State Hospital, Newington, N.S.W.

The Tamworth.

The Tamworth section was well represented and the quality well up to the average, though several inferior males were penned, pigs which should have not been entered at all; it is these inferior types, and pigs which appear weak and undeveloped, which do this breed more harm than anything else, for the Tamworth never was and never will be a "sty pig"; he finds his most suitable environment in the field grazing and hunting up his living under comparatively harsh conditions—conditions under which some of "the sty bred" pigs would fail to develop or to prove profitable. The Tamworth has attained phenomenal success during recent years, a period during which the demand for fleshy meat has been steadily increasing.

The championship winner at last Sydney Show, Mr. F. Ebberns's "Blakeney Sidney" (389), was again successful. He hails from Kelso, near Bathurst, N.S.W., and was bred at the Hawkesbury Agricultural College, Richmond, N.S.W., a stud carrying some very fine quality Tamworth and Berkshire pigs. The reserve champion winner, Mr. A. N. White's "Blakeney Special" (549), bred by exhibitor topped the list when it came to the stud sales, changing hands and becoming the property of Mr. H. J. Keevers at 25 guineas. He was a remarkably well developed, typical sire, and should be heard of again at future shows.

A well-known champion, Mr. A. N. White's "Blakeney Ribbons," was adjudged the champion sow. She also was bred at the Hawkesbury College, and was under offer for some time last year to the writer on behalf of a New Zealand friend, who will

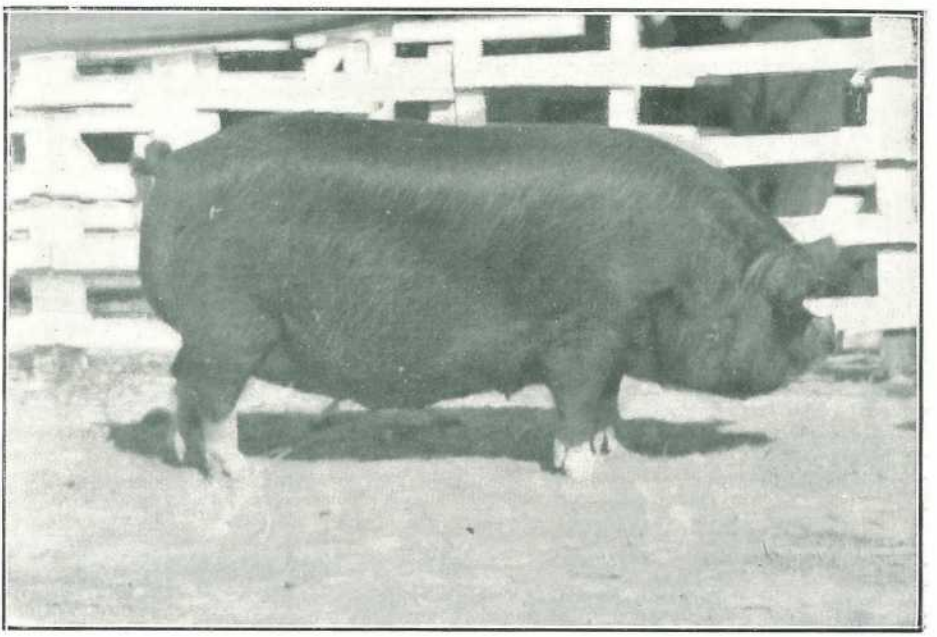

PLATE 67.—CHAMPION BERKSHIRE SOW, "WILMOT CECILE," BRISBANE SHOW, 1926.
Owned and exhibited by Mr. H. J. Keevers.

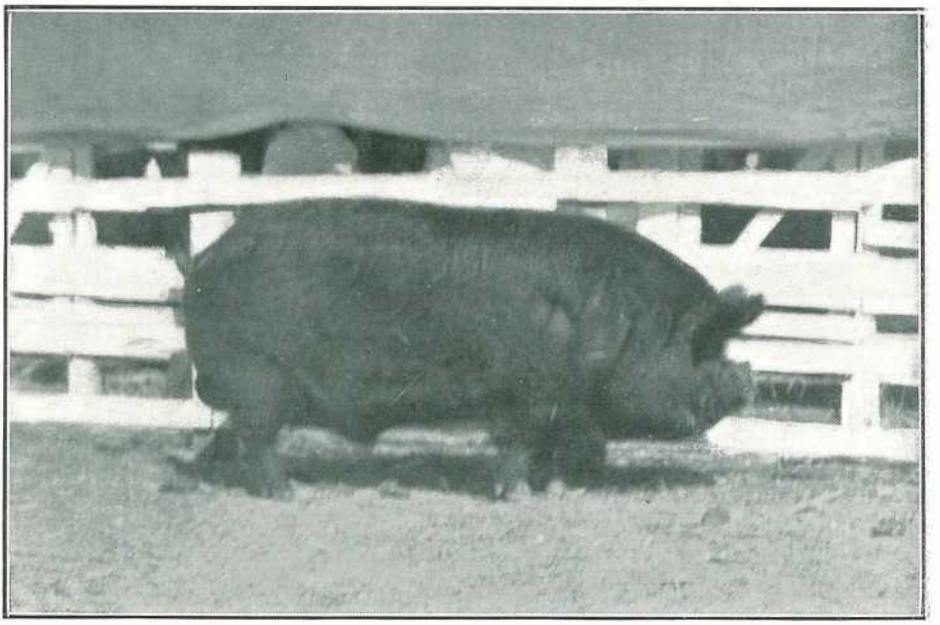

PLATE 68.—CHAMPION BERKSHIRE BOAR, "BRENTWOOD STAR," BRISBANE SHOW, 1926.
Owned and exhibited by the Mental Hospital, Goodna.

now regret not having completed the deal. "Ribbons" is a very well developed sow of a deep-bodied, roomy type. The reserve champion sow was also the property of Mr. White, "Blakeney Singer" (491) by name, and a sow of good quality.

The Poland-Chinas.

The black with white points breed of America, the Poland-China, has forged its way to the front rank in recent years, and has attained a widespread popularity. It is a breed one needs to understand in order to secure the best results, for both male and female have a tendency to "run to fat" unless given abundant green food and compelled to take regular exercise. They are a breed out of which more advantage will be gained by crossbreeding with the Tamworth than if used in the pure state, this particularly so where the objective is "bacon pig" production. Mr. A. N. White again secured the championship, this time with "Blakeney Royal" (158), another product of the Hawkesbury College stud. The reserve champion, Mr. A. T. Beezley's "Orara Adonis" (273), was also a reserve champion winner at last Sydney Show, at which Mr. Beezley purchased him from his breeder, Mr. C. J. Frank. He is a neat attractive boar of up-to-date type.

In the female classes, Mr. A. N. White's "Danesboro Winifred" annexed the red, white, and blue; she is a well-known prize winner and a daughter of a former champion at Sydney. The reserve champion sow was selected from the younger sows, and in this case the winner was Messrs. Yalden Bros., with "Boynes Wood Stella" (321), an excellent quality sow.

The Duroc-Jerseys.

The latest introduction from America and from Canadian studs, the Duroc-Jersey, was well represented at this year's show though, in point of number of exhibitors, they were limited. However, the four exhibitors—Messrs. Brown Bros., of Mooroombin, Percy Campbell, of Lamington, Mr. H. Bruxner, of Beaudesert, and Mr. Leo. Delroy, of Murgon—are all enthusiasts in the breeding of these red pigs, and they all report much success, both with the pure-breds and with the crosses with the Berkshire and similar types. The championship in the male classes went to Percy V. Campbell's "Taldra Imperial" (63), a recent purchase from the South Australian Duroc Stud of Mr. W. H. Bruce, and a boar, the direct progeny of recently imported strains in this now popular breed. The original importers of this type, Messrs. Brown Brothers, of "Mooroombin," Toogoolawah, were successful in winning the female championship on this occasion with "Mooroombin Sunset" (1), one of the original importations. There were many other useful quality pigs in these several classes.

The Gloucester Old Spots.

This is a new breed that so far has not been given much publicity. It is an old-time English breed with a wonderful reputation overseas; a breed possibly destined to occupy an important place in our pig industry, but a breed which is somewhat unattractive in appearance to the inexperienced breeder, a breed which will have a rather tough row to hoe before it reaches the front rank in the estimation of breeders more accustomed to the neater bodied, more compact—and in that sense more attractive—types like the Berkshire, the Yorkshire, and even like the Tamworth and the American breeds. There were but two exhibitors, and no championship awards.

Pork and Bacon Pigs.

In one sense the pork and bacon pigs were a disappointment, though there were a dozen entries all told. This is a section which needs revision before it is placed on a satisfactory basis, and it will probably be found eventually that carcass contests will be very much more profitable and instructive than the penning of whatever animals exhibitors can hunt up for this section of the show.

Non-Competitive Model Bacon Pigs.

An effort was made this year to pen six non-competitive model bacon pigs; six pigs were penned, three of the Tamworth-Berkshire type and three of the Berkshire type. They filled a useful purpose as indicating something of the type of bacon pig required by the factories, but they were variable in weight, a fact streessed at each of the lecturettes given by the writer at this pen during the currency of the show. It is hoped to have this feature again at next year's show and to enlarge on the present system if possible.

Altogether the Pig Section proved an attractive and interesting one, one justifying the expenditure, and one well worth enlarging and making better provision for at future shows.

Answers to Correspondents.

BOTANY.

In the course of the month the Government Botanist, Mr. C. T. White, F.L.S., addressed the following replies to correspondents, and which are of general interest.

Vernacular Names of Plants.

A.B.C. (Clifton)—

As a general rule, shrubs and many plants in common garden use have no set vernacular names, the botanical ones being usually employed by gardeners and in the horticultural trade generally. Sometimes vernaculars are given that are mere translations of the botanical names. Of the list you send, the best I can do is—

Buddleia Veitchiana (Veitch's Buddleia).—Messrs. Veitch and Sons are famous English nurserymen, who have had collectors in various parts of the world collecting plants.

Habrothamnus elegans (Purple Haborthamnus).

Photinia serrulata (Chinese Hawthorn).

Pittosporum undulatum.—This species can be labelled simply "Pittosporum," for it is this species that is generally known by this generic name to cultivators.

Ochna mauritiana (Bois Bouquet of Bois Jasmin of the French people of Mauritius).

Choisya ternata (Mexican Orange Flower).

Escallonia macrantha (large Red-flowered Escallonia).

Polygala grandis (large-flowered Polygala).

Sandalwood—Wilga.

A.T. (St. George)—

1. There are two species of "Sandalwood" cut and exported from Australia —a Western Australian species (*Fusanus spicatus* or *Santalum cygnorum*) and a Northern species (*Santalum lanceolatum*); the Northern tree extends throughout North Queensland, the Northern Territory, and the North-west of Western Australia. It is generally regarded as the more valuable of the two; the chief port of export is Thursday Island. A strange feature about this tree is the fact that it extends through Southern Queensland right into New South Wales; but as the tree comes south it loses its valuable properties, the wood of the southern trees being quite scentless.

   The Buddha tree, known in Western Queensland almost universally as "Sandalwood," does not belong to the "Sandalwood" family, but the Myoporum family (*Myoporaceæ*); the wood of several trees of this family is similar to Sandalwood, but the Chinese will not accept them; the wood contains no "santalol," the active constituent of Sandalwood oil. The Buddha Tree (*Eremophila Mitchellii*) has a much smaller, narrower leaf than the true Sandalwood; it is also a smaller tree.

2. The Wilga (*Geijera parviflora*) is a valuable fodder tree, though opinions regarding it differ very considerably. An analysis made by Mr. F. B. Guthrie, one time Government Agricultural Chemist of New South Wales, was as follows:—Water, 47.73 per cent; ash, 5.21; fibre, 7.61; albuminoids, 14.25; carbohydrates, 23.02. Nutrient value, 42; albuminoid ratio, 1—2.

"Bean Tree" (*Castanospermum australe*).

E.G.S. (Cairns)—

The bean forwarded belongs to the "Bean Tree" or "Moreton Bay Chestnut" (*Castanospermum australe*). The large seeds are poisonous, causing severe gastro-enteritis, and often death in cattle and horses. This is due to a poisonous saponin. The beans, however, were eaten in former days by the natives; they, however, scraped them very finely, placed them in a dilly-bag in running water for about forty-eight hours, and then cooked them.

Zieria Smithii*—*Baccharis halimifolio.

The specimens are the small bush with a rather strong smell—*Zieria Smithii*, a very common shrub on scrub farms in coastal Queensland. The leaves contain a prussic-acid yielding glucoside (like sorghum), and if eaten in quantity may cause death. So far as I have observed, however, stock eat the shrub to a very limited extent.

The coarser shrub is *Baccharis halimifolia*, the tree Groundsel, a native of South America, common as a naturalised weed in Queensland. As the plant had been suspected on several occasions of causing death among stock, feeding experiments were made with the plant, but these yielded negative results. Stock as a general rule do not take to this plant unless forced to do so by hunger. A leaflet on the plant has been posted for your information. Personally, I rather doubt either plant being the cause of your trouble, and would be inclined to look elsewhere; if further losses are occurring or one feared, perhaps an inspection could be made of your paddocks.

"Royal Blue Grass" *(Andropogon intermedius).*

A.H.H. (Wollongbar, N.S.W.)—

Your specimen is *Andropogon intermedius*, a native of Queensland and New South Wales and extending from the coast some distance inland. The grass produces a fair amount of palatable, though, perhaps, rather coarse, forage. I have not heard a local name applied to it. Mr. Breakwell in his "Grasses and Fodder Plants of New South Wales" gives the vernacular "Royal Blue Grass."

"Native Lucerne" (*Psoralea leucantha*)—"Native Plumbago."

R.P. (Richmond)—

The plant forwarded is *Psoralea leucantha*, a native of the North Queensland Gulf country and the Northern Territory. I have had no previous experience with this plant as a fodder, but I know that others of the same genus (*Psoralea*) are common in Queensland and other Australian States, and are generally regarded as useful and nutritious fodders. Several go under the name of "Native Lucerne"; they are legumes and are not known to possess any poisonous properties. Some years ago I was up in the Julia Creek district, where a great many losses among sheep had occurred, and I came to the conclusion that they were caused by sheep eating the "Native Plumbago," a small shrub with typical "Plumbago" flowers and small sticky pods, that was common in the scrubby patches on ridges above the river. Eradication of this plant was advised, and the owner wrote me later that his losses had ceased. This particular plant may be worth looking for on the holding mentioned.

Plants Identified.

K.O'S. (Taroom)—The specimens sent proved to be—

2. *Acacia salicina* var. *varians*.—Sometimes known in Western Queensland as "Black Wattle," a name, however, given in Queensland to a number of different species of Acacia.
3. *Acacia fasciculifera*.—Sometimes known as "Ironwood Brigalow." A very hard timber, durable in the ground.
4. *Abutilon oxycarpum*.—A small shrub of the Mallow family (*Malvaceæ*). I have not heard a common name for it.
5. *Olearia stellualta*.—Daisy Bush.
6. *Solanum ellipticum*.—Potato Bush. The green berries are reputed poisonous.
7. *Bursaria incana*.—A small tree said to be good forage.
8. *Vernonia cinerea*.—A common weed of the Composite family (*Compositæ*). I do not know a vernacular name for it.
9. *Abutilon auritum*.—A small shrub of the Mallow family (*Malvaceæ*). I have not heard a common name.
10. *Turræa pubescens*.—A shrub, commonly leafless, or nearly so when in flower.

"Honey Bean" (*Gleditschia triacanthus*).

A.B.C. (Clifton)—

The tree commonly known on the Downs as "Honey Bean" is *Gleditschia triacanthus*, the "Honey Locust," a native of Central North America, widely cultivated as an ornamental tree throughout the temperate parts of the world. Agapanthus, is, of course, a very different plant—one of the Lily family (*Liliaceæ*).

Lobelia purperascens.

G.M.W. (Waterford)—

The small plant of which you send a specimen is *Lobelia purperascens*. It is very common in Southern Queensland, but I have never heard a common name applied to it. The small stems exude a milky juice (sometimes not very copious) which has been used as an external application to cuts and sores. I have never heard of the plant before as an antidote for snakebite; taken internally it might prove dangerous, as the plant belongs to a genus (*Lobelia*) which contains several poisonous species.

Red Ash—"Coffee Bush"—"Quinine Berry."

C.O'S. (Taroom)—Your specimens proved to be—

1. The tree with the leaves silver underneath—*Alphitonia excelsa*, the Red Ash. This tree grows both inland and on the coast. The very young twigs when peeled of bark often emit a very strong smell of sarsaparilla. The leaves are liked by all classes of stock and are a valuable standby in times of drought. Sometimes the tree is called "Silver Wattle," but, of course, it is not a wattle.

2. The tree with small red berries—*Breynia oblongifolia*, sometimes called coffee-bush on account of the red fruits, but is in no way related to the true coffee.

3. The tree without silver leaves and berries—*Petalostigma quadriloculare*. At times the tree is covered with rather large yellow "berries"; these are extremely bitter, hence the tree is often called "Quinine Berry." The bark also is bitter.

It is always best to number specimens, retain a duplicate similarly numbered, and names will be returned to numbers each time; for instance, start the next sending with No. 4. Notes such as you send about the wood of the "Quinine Berry" are always acceptable.

VETERINARY.

Subjoined are selected replies to correspondents by officers of the Veterinary Staff in the course of the month, and which are of general interest:—

Greasy Heels.

The successful treatment of a draught mare with greasy heels depends on the length of time the animal has been in this condition, her age, and the nature of the food and surroundings.

Give the mare a physic ball made up as follows:—Barbadoes aloes, 6 drachms; extract of belladonna, ½ drachm; powdered ginger, ½ drachm.

Prepare the mare with two bran mashes, six hours apart, and fast her for sixteen hours, keeping ample water beside her. Then ball her and do not give her any green food until the physic has set. Clip all the hair off the affected parts and wash well with soap and water. Next, dry thoroughly by painting the part with methylated spirit, and do not touch it with water after the cleansing process is complete.

Then dust it thoroughly with acetate of lead, 1 part; sulphate of zinc, 1 part.

Successful treatment depends on keeping the mare out of the wet and muddy water-holes.

Give her the following powder in her food once every day for fourteen days:—Epsom sales, 1 oz.; powdered gentian, 1 drachm; powdered sulphate of iron, 1 drachm; powdered aniseed, 1 drachm.

Foul in the Foot.

Case: A calf is suffering with a disease of the foot. The disease is a series of cracks just above the hoof and on the back of each of her four feet, and appears to be extending to the front. The legs are swollen and cause the animal great pain. Her appetite is exceedingly good, but she moves about with the greatest difficulty, and is beginning to get poor, irrespective of the fact that she is being hand-fed. She has had the complaint for about three or four months.

Reply: From the symptoms described, it appears as if the animal is suffering from what is known as "foul in the foot." In such a case, the affected foot should be thoroughly washed with clean tepid water. A pad of cotton wool soaked in a saturated solution of blue stone should be placed on the affected parts, and kept in position by means of a bandage. This treatment should be repeated daily until the wounds have healed.

Peculiar Smell in Milk.

Case: A cow's milk, after standing about eight hours, has a peculiar smell and becomes a dirty grey in colour. The cow appears to be in good health, and is being milked twice daily. She calved on the 13th May, and it is only within the last few days that anything wrong has been noticed with her milk. Why should a cow vary in her milking to the extent of a gallon in twenty-four hours? The weather is warm and she is on her usual feed.

Reply: Give the cow the following drench:—1 lb. Epsom salts, 1 oz. hyposulphite of soda, 2 oz. powdered gentian, 1 oz. powdered ginger, 1 lb. molasses, 1 gallon water. Drench her after a twelve hours' fast. Flood out the uterus with 30 grains of permanganate of potash and 1 gallon of water once every day for fourteen days. The variation in the milk supply is probably due to the period of oestrum, which continues for about twenty-four hours and varies sometimes one way or the other, depending on the animal's condition and general health.

Blood Scours.

Case: Out of twelve heifers saved, six were reared. When from three weeks to two months old, they got the usual scours, and then after several days, instead of the scours it was pure blood. Some of them died after a couple of days, and others lingered on for weeks. Every effort was made to save them. The inquirer gave them his fingers to suck in the milk, and even went so far as to give one a bottle. It lingered on for about five weeks, but did not improve.

Reply: These animals suffered from what is commonly known as blood scours, which in the majority of cases proves fatal. In treating such cases, the animal should be given two tablespoonsful of castor oil, and after this has operated, a mixture of one ounce of sulphuric acid and one pint of cold water. One teaspoonful of this mixture added to half a pint of water should be given in the form of a drench daily until the disease disappears.

Milk Fever.

Case: Snakebite was suspected as the cause of death of a cow. Without a knowledge of symptoms, either before or after death, the cause was indefinite. The cow was in great condition, and left the yard after morning milking quite all right. In the evening she was found off her legs—at least she was unable to come home; she struggled to rise, but was not able. The following morning she was much worse, and when seen was thoroughly out to it. Her eyes were inflamed, breathing was heavy, and there was an occasional spasm of pain, which it was thought indicated inflammation of the bowels. She was drenched a couple of times, but soon after she died. A post-mortem showed no inflammation of the bowels; there was no sign of inflammation, either in bowels or paunch, and liver and kidneys were perfectly sound; lungs were slightly touched, but not of any consequence; the heart was quite empty; not a drop of blood appeared to be near it. It looked as if the blood had failed to circulate, and the heart had pumped dry. That was the only unnatural appearance discerned.

Reply: In cases of snakebite, putrefaction of carcass sets in early, and the hair is easily pulled off the skin. Particulars as to date of calving and whether she was in calf again are not available, but strongly suspect milk fever as the probable cause of death. Probably the drench entered her lungs and brought on a slight mechanical pneumonia, which assisted to kill her.

Worms in Horse.

Case: A horse was fairly fat, and suddenly he started to fall away, and his coat got fairly rough; thought he had worms, and gave him a drench of a pint of raw linseed oil and 2 oz. of turpentine. He passed a lot of worms; so gave him another dose a fortnight later, but he is still the same, and is inclined to be hide-bound.

Reply: The horse referred to is apparently suffering from worms, and it is recommended that he be given one of the following powders, night and morning, for six days, mixed in the food or in a little water, and given as a drench:—1 drachm tartrate of antimony, 1 drachm Barbadoes aloes, 1 drachm sulphate of iron, ½ oz. aniseed. A pint or so of linseed jelly mixed with the food daily would also be of considerable advantage.

PIG RAISING.

Following are selected replies to correspondents by the Instructor in Pig Raising (Mr. E. J. Shelton, H.D.A.) in the course of the month, and which are of general interest:—

Pig Raising as a Sugar-grower's Side Line.

With special reference to pig raising as a "side line" to sugar-cane growing in the Proserpine and surrounding districts on the North Coast of Queensland: It is true that from a general survey of these districts it appears that sugar-cane growers depend entirely on "cane" as the one and only industry in which they engage and are interested, but this does not signify that other industries are not possible or profitable. To us it signifies that sugar-cane has in the past been such a profitable crop that those farmers engaged in the cultivation of this crop have devoted the whole of their energies to the one crop, and have not bothered about pigs, or cows, or other branches of agriculture. Of course, the Proserpine district is somewhat isolated as far as pig raising is concerned, for there are but limited local markets, and there is no export of pork from Bowen, or even from Townsville, 170 miles further north, or other ports within easy reach on the southern side of this township. This makes it somewhat difficult for the man with a few pigs to sell, but conditions are changing, and many farmers in the sugar-growing districts are now looking round for fresh avenues of income, and a good deal of attention is being directed to pig raising as a possible way out of the difficulty in so far as finding a market outlet for farm crops are concerned. There is a bacon factory (Messrs. Conaghan Brothers, Limited) at East street, Rockhampton, 277 miles south of Proserpine, while the fresh pork market at Townsville, 159 miles further north, is a fairly good one. Pig raising is essentially a crop-growing proposition when considered from the mixed farming point of view, hence the success or otherwise of the venture will depend largely on the fertility of the land and methods of cultivation. Climatic conditions at Proserpine are, of course, essentially tropical, but that does not indicate that stock raising is not possible. Stock require to be handled on correct lines to ensure success. We shall be pleased to supply any detailed information required in connection with this industry on request.

Condition of Boar.

It would appear from your letter that your boar is overfat and lazy, and that he lacks a sufficiency of exercise and green food. We recommend reducing his condition, compelling him to take active and regular exercise, giving him a liberal supply of green food, but very little grain or meal and ample drinking water. It would pay, also, to give him two teaspoonsful of Epsom salts in his drinking water or milk every morning for one week, then again in two or three weeks' time. It would be as well to allow him to run with the sows part of the time and to keep him in a well grassed pig paddock in preference to a pig sty. Pea meal given as a mash mixed up with milk is advised for a trial. This is often effective in freshening up a boar. You could obtain stimulants (drugs) from Surgical Supplies, Limited, Brisbane, but these should only be used as a last resort. Of course, the trouble may be due to some abnormal growth at the point of the sheath or to inflammation. In this case it would require veterinary attention.

General Notes.

Bathurst Burr, Galvanised Burr, &c.

By an Order in Council, Bathurst Burr (*Xanthium spinosum*), Galvanised Burr (*Bassia Birchii*), and Noogoora Burr (*Xanthium Strumarium*) have been declared to be noxious plants for the purposes of the Land Acts (1910 to 1925). These are, in addition to Prickly-pear, Zamia, and Desert Poison Bush, already defined as noxious plants by the 1910 Land Act.

Staff Changes and Appointments.

The following appointments have been made at the Agricultural Bank, Brisbane:—Mr. T. R. Quinn, Sub-Accountant; Mr. F. A. McMahon, Applications Officer; Mr. O. W. Whittaker, Clerk (Arrears); Mr. W. B. Smith, Sales and Possessions Officer; Mr. J. T. McGuckin, Clerk (Securities); and Mr. C. W. Andrews, Clerk (Securities).

Messrs. J. Carew and N. E. Goodchild, Senior Field Assistants, Cotton Section, Department of Agriculture and Stock, have been transferred to Ipswich and Maryborough, respectively.

The Royal Society of Queensland.

At the last ordinary monthly meeting of the Society in the Geology Lecture Theatre of the University, Prof. E. J. Goddard, B.A., D.Sc., presided.

Dr. W. H. Tilling and Mr. S. Stephenson, M.A., were nominated for ordinary membership.

The Chairman extended the best wishes of the Society to Mr. Owen Jones, B.Sc., who is also well known in yachting circles as skipper of "Caress," Queensland's representative in the Australian championship and Forster Cup series, and who was about to leave for a post-graduate science course at Cambridge University.

Mr. H. A. Longman, F.L.S., exhibited the symphyseal portion of mandible with remains of two incisors of *Diprotodon minor* Huxley. The specimen was obtained near Murgon, South Burnett, and handed to Rev. C. H. Massey, by whom it was donated to the Queensland Museum.

Prof. H. C. Richards, D.Sc., communicated a paper by Capt. J. A. Edgell, R.N., entitled "Report on Solar Phenomenon Observed by H.M.A.S. 'Moresby' on Wednesday, 4th November, off the East Coast of Queensland." The paper describes and illustrates a halo around the sun observed near Keppel Island.

Dr. W. H. Bryan, M.C., read a paper entitled "The Earlier Palæogeography of Queensland." The author discussed the several views as to the shape and extent of the primeval Australasian continent, and with the aid of lantern slides traced the history of its growth period by period through the Palæozoic Era. Throughout the whole of this time the western half of Australia remained a land mass, while on the other hand much of Eastern Australia was covered by a succession of seas. To the east of these again in the positions now occupied by the Coral and Tasman seas, and possibly extending as far as New Caledonia and Fiji, there probably existed a great land mass which has been lost to Australia by a series of foundering movements which may have begun in Permian times. Thus the Palæozoic seas of Eastern Australia would appear to have been elongate and limited by land masses on each side just as the Mediterranean Sea is at the present day.

Dr. F. W. Whitehouse, M.Sc., read a paper by Dr. W. H. Bryan, M.C., and himself entitled "The Later Palæogeography of Queensland." The authors show on their map a greater extent for the Triassic lakes (in which the Ipswich coal measures were deposited) than has been recognised previously. Evidence is given indicating that, during the period of deposition of the Walloon coal measures, several transient incursions of the sea took place in the area. During the succeeding (Cretaceous) period the sea occupied the central portion of the continent extending, apparently, from the Gulf to the Bight. Continuous deposition was arrested by a temporary return to land conditions before the final stage of flooding by the sea. The close of the Cretaceous marked a return to lake conditions. The deposits of the Tertiary period are known only from isolated areas, all more or less near the east

coast, the precise extent of the lakes in which they were formed being unknown. It is suggested, however, that during the Tertiary period the shore line was not far from its present position.

Dr. E. O. Marks, Prof. H. C. Richards, and Messrs. A. K. Denmead, C. Ogilvie, H. A. Longman, C. H. Massey, and Prof. E. J. Goddard commented upon the papers.

Pomelos, Shaddocks, and Grape Fruit—Citrus Nomenclature.

There is a great deal of uncertainty in this State respecting the nomenclature of the different types of citrus fruit belonging to the genus Citrus, species *decumana*, but it may be stated that all pomelos, shaddocks, forbidden fruit, and grape fruit are all types of one species of citrus fruit, viz., *Citrus decumana*. They are all pomelos in the same way that all varieties of mandarins are called mandarins and all varieties of oranges are called oranges; but they are distinguished from all other species of the genus Citrus by the size of the flowers and the manner in which the flowers are produced, by the shape and size of the leaves, the petioles of which are winged, the wings varying in size in different varieties but resembling each other in shape in that they are usually roundish or oblate and not elongated. The flesh of the fruit is also quite distinct from that of other citrus fruits in that the pulp contained in each section of the fruit consists of a number of particles which vary considerably in size, but which have one character in common, in that each of these particles is quite distinct and is easily separated from the adjacent particles. The skin surrounding each division of the fruit is also very tough and usually bitter.

The skin proper is usually smooth and of a pale yellow colour, and the inner skin is a white pithy substance that varies greatly in thickness and bitterness, some fruit having a heavy pith which is so bitter that it is used for making "Pomelo Bitters," whereas in others it is much thinner and of a bitter-sweet taste.

The fruit varies in size from about 3 inches to 10 inches or even more in diameter, as well as in shape, as it may be oblate, round, oval, or pear-shaped. The colour of the flesh also varies from green to red with many shades between the two extremes. The flavour of the flesh also varies very much, as some fruit are distinctly acid, whereas others have a pleasant sub-acid, slightly bitter taste, and some are decidedly bitter.

The pomelos are quite distinct from the so-called Poor Man's Orange, of which there are many types in this State, as the latter are types of the smooth-leafed Seville orange *Citrus Bigaradia*, which is frequently sold as a grape fruit, very much to the detriment of the latter, which it does not resemble in the slightest, either in flavour, texture, or quality.

Sugar-cane Levy Regulations.

Regulations have been issued under the Primary Producers' Organisation Acts empowering the Council of Agriculture to make the following levies on canegrowers:—

One penny per ton on all sugar-cane delivered to the North Eton Mill; and

One halfpenny per ton on all sugar-cane delivered to the Moreton Mill—

during the 1926-27 season.

These levies will be utilised for the purpose of the employment of growers' representatives at the North Eton and Moreton mills during the coming season.

Provision is made for the Council to make levies on the canegrowers in the following districts for the 1926-27 season at the following rates:—

Cairns mills, ½d. per ton; Innisfail mills, 2d.; Herbert River mills, 1d.; Kalamia and Pioneer mills, 1d.; Inkerman mill, 1d.; Invicta mill, 2d.; Proserpine mill, 3¼d.; Mackay mills, 1¼d.; Bundaberg mills, ½d.; Maryborough mills, 2d.; Southern District mills, 1¾d.

These levies are to be paid to the Queensland Cane Growers' Council, which shall utilise them for the purpose of financing the District Cane Growers' Executives, Mill Suppliers' Committees, and Mill Suppliers' Associations in the various canegrowing districts.

Provision is also made that all the organisations handling these levies must furnish the Minister not later than the 31st March, 1927, with an audited statement setting out in detail the receipts from the various levies and the disbursements therefrom.

Farm and Garden 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, panicums, pumpkins, melons, cucumbers, marrows. Plant sweet potatoes, yams, peanuts, arrowroot, tumeric, 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.

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 ft. apart with 18 in. 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 tying up plants. The fruit also make 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 diseases 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.

THE COW'S WATER SUPPLY—SLIMINESS IN MILK.

The significance of the cow's water supply in relation to the quality of its product is emphasised by recent field investigations on "slimy" milk. The investigations were made by a senior dairy instructor of the New South Wales Department of Agriculture in connection with the inferior cream delivered to a South Coast butter factory during a dry spell last summer, and the facts are worth noting by every dairy farmer.

The cream was comparatively fresh and presented no off flavour or smell at the time of arrival at the butter factory; its consistency, however, was distinctly abnormal. The particles of fresh casein appeared to be particularly adhesive, and thus produced the slimy character in the cream, which on being touched with a stirring rod could be drawn out into very long threads. This cream was set aside together with other low-grade creams to be subsequently manufactured into low-grade butter. It was noticeable with a check sample which had been under observation for about forty-eight hours that the sliminess had diminished and a putrid odour had developed.

From inquiries made it was learned that at least two dairymen in the locality were troubled with this slimy condition in their cream at the same time. These farms were visited and an endeavour was made to trace the source of trouble. The dairy buildings were well preserved and clean, while reasonable cleanliness was displayed in the treatment of all dairy utensils, &c. Milk buckets and separator parts were thoroughly washed and scalded each day before use. It was thus evident that the trouble was not directly due to the use of dirty utensils.

A sample of each cow's milk was then carefully collected into sterile vessels and kept under observation for a day. Several such milks showed the defect, and the responsible cows were sorted out and their milk kept away from the rest, but the cream from the herd still showed the defect.

It was observed, however, that on account of the prolonged dry weather the once running freshwater creek which flows through these dairy farms had become a chain of potholes. Bacteriological examinations of water taken from the creek revealed the presence of large numbers of organisms which were capable of causing "ropiness" or "sliminess" when inoculated into sterile milk. It was observed that many of the milking herd on their way to the bails would wade into this stagnant water to drink, and in doing so gathered on their udders and other parts of their bodies millions of objectionable bacteria which later found their way into the milk pails, where they would multiply rapidly and cause undesirable fermentation. One of the dairymen was fortunate in being able to remove his cattle to a better watered paddock, and was no longer troubled with "slimy" cream.

These results show the effect on the quality of both milk and cream of a stagnant water supply, especially one which is accessible to cows. Better results are obtained by troughing such water to minimise pollution and resultant infection.

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.

1926.	SEPTEMBER.		OCTOBER.		SEPT.	OCT.
					MOONRISE.	
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	6·8	5·36	5 34	5·50	1·39	2·9
2	6 7	5 36	5 33	5·51	2 35	2·53
3	6 6	5 37	5·32	5·52	3·24	3 31
4	6·5	5 37	5 31	5 52	4 9	4·7
5	6 4	5·38	5 29	5 53	4 53	4·40
6	6 2	5 38	5·28	5·53	5·31	5·9
7	6·1	5·39	5 27	5·54	6 6	5·44
8	6·0	5 40	5 25	5 54	6 39	6 16
9	5·59	5 40	5 24	5 55	7·9	6 44
10	5·58	5 41	5 23	5 55	7 43	7 24
11	5 57	5·41	5·22	5·55	8·14	8·4
12	5 56	5·42	5 22	5·56	8 47	8·46
13	5 54	5 43	5·21	5 56	9·23	9 36
14	5 53	5·43	5 20	5·57	10·4	10·30
15	5 52	5·54	5 19	5 57	10 50	11·28 p.m.
16	5·51	5·44	5 18	5 58	11 41 p.m.	12·26
17	5 50	5 45	5·17	5·59	12·39	1·39
18	5·48	5·45	5 16	5·59	1 43	2·45
19	5 47	5·46	5 14	6 0	2·49	3 52
20	5·46	5·46	5·13	6 1	3·58	4·57
21	5·45	5 46	5·12	6·1	5·7	6·13
22	5 44	5·47	5 11	6 2	6·15	7·9
23	5·43	5·47	5·10	6 2	7 20	8·13
24	5·42	5·47	5·9	6·3	8·26	9·13
25	5·41	5 47	5 8	6 4	9·30	10·16
26	5·40	5·48	5·8	6 4	10·32	11·9
27	5·38	5 48	5 7	6·5	11·32	nil a.m.
28	5·37	5·48	5 6	6·6	nil	12·5
29	5·36	5·49	5·5	6 6	12 28	12·50
30	5·35	5·49	5·4	6·7	1 21	1·30
31	...	...	5·4	6 8	...	2·8

Phases of the Moon, Occultations, &c.

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

7 September	●	New Moon	3 44 p.m.
15 ,,	☾	First Quarter	2 26 p.m.
22 ,,	○	Full Moon	6 19 a.m.
29 ,,	☽	Last Quarter	3 47 p.m.

Apogee, 7th September, 6 24 a.m.
Perigee, 21st September, 4 18 p.m.

On the 19th of September a conjunction of the Moon and Jupiter will take place about a quarter of an hour before the Moon rises at Warwick. It will, however, afford an interesting daylight spectacle soon after 3 o'clock in the afternoon when the planet should be seen to the left of the Moon, apparently at a distance of less than four times the diameter of the latter from the planet, although many millions of miles will actually separate the two objects.

Delta Capricorni will be occulted by the Moon on the 19th in Southern Queensland. About 9.30 p.m. the star will appear a little to the right of the Moon, which will obtrude itself between the star and the earth, a few minutes later. About 10.10 the star will again be seen on the opposite side of the Moon, low down to the left. The Moon being nearly full, binoculars or a telescope will be necessary to observe this occultation.

The beautiful planet Venus will no longer be such a brilliant object in the morning sky, as it will not rise until a few minutes after 5 each morning during the month, and the Sun will be rising only half an hour later at the end of the month, and it will be practically lost in the approaching daylight.

7 October	●	New Moon	8 13 a.m.
15 ,,	☾	First Quarter	12 27 a.m.
21 ,,	○	Full Moon	3 15 a.m.
28 ,,	☽	Last Quarter	8 57 p.m.

Apogee, 4th October, 11 12 a.m.
Perigee, 20th October, 1 0 a.m.

October.—Mercury will rise 28 minutes before the Sun on 1st October, on the 15th at 1.18 before the Sun, and on the 31st at 1.49 before the Sun.

Venus will rise at 5.9 minutes before the Sun on 1st October, on the 15th at 7.55 p.m., and on the 31st at 6.26 p.m.

Jupiter sets at 3.12 a.m. on 1st October, on the 15th at 2.15 a.m., and on the 31st at 1.21 a.m.

Saturn sets at 9.13 p.m. on 1st October, on the 15th at 8.27 p.m., and on the 31st at 7.32 p.m.

An interesting spectacle may be seen on the evening of the 22nd when the Moon, rising soon after 7 o'clock, will appear to be attended by the planet Mars, which will seem to be about five or six times the diameter of the Moon to the north of it. Both objects will be in parts of their orbits, which bring them nearer than usual to the earth. The Moon will be at a distance of something like 230,000 miles, and the planet at the much greater distance of about 235 millions of miles.

No occultation of any popular importance will occur during this month, and most of the other phenomena either occur in the daytime, when unobservable, or are of little popular interest.

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.