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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment

Queensland's Pastoral Year.

THERE are now approximately 22,200,000 sheep depastured within the State. This is an increase of over two millions compared with the previous year. The figure for the current year is the highest recorded since 1932, when the total was 22,324,278. Cattle have increased approximately by 50,000, the estimated number being 6,000,000. Many graziers have introduced new blood from overseas or the Southern States, in conformity with a general plan to raise livestock standards.

The frozen beef export trade remains about the same as in previous years, but chilled beef exports continue to indicate a steady increase. Statistics issued by the Australian Meat Board show that for the last two years, the percentage of beef exported from this State, as compared with the total export from the Commonwealth is over 90 per cent.

Except in some of the central and far western pastoral districts where seasonal rainfall has been sub-normal, stock has wintered well. Recent beneficial rains in the more favoured parts of the State have assured sufficient spring pasturage.

Prices for fat sheep, and especially lambs, have been profitable to the grazier throughout the year, and compare favourably with quotations in other States for similar classes of stock.

The demand for grazing properties in Queensland shows a firming tendency, and denotes confidence of investors in the pastoral industry and in the State. The end-of-the-season wool sales were held in June, and clearances were satisfactory. It is regretted, however, that prices were not maintained, and that an aggregate decrease of nearly £3,000,000 in the value of the season's clip has to be recorded. An aggregate offering of 483,561 bales of wool was sold in Brisbane during the season and realised £7,626,056. The average price for greasy wool throughout the year was 11·98 pence.

The Year in Agriculture.

FOR the farmer, it was generally a favourable year. Pasture and water supplies were ample for all requirements, but, as can be expected in a country with such a wide diversity of climatic conditions, there was a considerable variation in seasonal circumstances. The heavy summer rains received throughout the main agricultural regions from late October to February assured an abundance of grass and fodder crops, and permitted the conservation of larger reserves for livestock than had been possible for some years.

The wheat industry is expanding in the Western Downs, Maranoa, and Central Districts. Considerable areas of new land have been brought into production, particularly in districts now freed from prickly pear. Crops were adversely affected by late sowings, insufficient soil moisture, rust, and storms, but in spite of all vicissitudes, an over-average yield was obtained from a record acreage. It is confidently anticipated that State requirements of wheat will be fully met within a few years. Maize growers in the North have had another favourable season, but in the chief southern maize districts yields were under average. Because of the difficulty in obtaining satisfactory returns from maize in the drier farming regions, some attention is being given to the cultivation of grain sorghums, which besides showing greater drought resistance, may be harvested by mechanical means. This season's cotton crop returns, while affected adversely by unfavourable climatic conditions, have undoubtedly demonstrated that cotton should have an important place in the cropping rotations on farms in the south-eastern part of the State. Ample evidence of the value of growing cotton in rotation with grassland was again obtained by farmers individually, and also by experiment. It is confidently anticipated that this practice will be applied on an increasing scale in the future, to the benefit of both cotton yields and the productivity of the pastures. Substantial additions have been made to the storage silos at Kingaroy, the centre of a fertile peanut and general farming district. The peanut industry is also expanding in the Central and Northern districts. The area cropped with tobacco and the quantity of cured leaf marketed, were comparable with the returns of the previous season. Although weather conditions were less favourable, prices received for good leaf have shown a substantial increase. The cultivation of a wide range of subsidiary crops—such as potatoes, pumpkins, panicum, canary seed, broom millet, and arrowroot—has been carried on successfully throughout the year.

The Sugar Industry.

FOLLOWING the harvesting of a record sugar cane crop in Queensland in 1936, production advanced still further to create another record in the 1937 season. The tonnage of cane crushed—5,140,000 tons—was less by 32,000 tons than that of 1936, but the sugar content of the cane was unusually high and permitted the manufacture of 762,794 tons of sugar, an increase of about 18,000 tons over the output of 1936. Another Queensland record was achieved by the production of 3·05 tons sugar per acre of cane harvested; and a world's record was established by the seasonal average manufacture of one ton of sugar from only 6¾ tons of cane. Because of an advance in overseas prices, somewhat improved values ruled for "excess" sugar; while the average price paid for No. 1 pool sugar was £17 11s., as compared with £17 1s. 4d. for 1936. A total of 422,000 tons of sugar was exported but, fortunately, arrangements were made to market a substantial proportion of this sugar before the International Sugar Agreement came into operation; otherwise, the Australian quota would have been exceeded and a carry-over of stocks would have been inevitable.

In spite of the comparative failure of late summer monsoonal rains, preliminary estimates indicate that the 1938 cane crop will at least equal the previous record. Because of late growth, however, it is anticipated that the average sugar content of cane will be considerably below the record figure registered last season.

The continuous improvement in aggregate and unitary yields, recorded in recent years, irrespective of seasonal circumstances, is evidence of concentration on improved methods of production by the Queensland sugar industry and its technical advisers.

Dairying.

DECREASED domestic supplies early in the year improved dairy produce values, which were maintained as a result of higher prices abroad. Production has been increasing rapidly since the widespread autumnal rains and the year ended with nearly all butter factories working at full capacity. The steady expansion and development in this industry is clearly illustrated in the monthly returns of many factories at which new records have been established.

The standard of butter quality maintained has been most satisfactory, over seventy-five per cent. of the butter submitted for grading having been of choice quality. Bacteriological and chemical surveys of factories by officers of the Dairy Research Laboratory, resulting in improved water supplies and methods of manufacture and handling, have contributed largely towards this achievement. A butter standardisation service, which aims at the manufacture of a butter of uniform and economical composition is conducted by the laboratory, and the general employment by factories of this service would be of immense value to the industry.

Pure bred cows qualifying for entry to the advanced registers of the several herd book societies returned some excellent yields, which compared favourably with those obtained in other States.

Brown Spot of the Emperor of Canton Mandarin and its Control.

L. F. MANDELSON, B.Sc.Agr., Research Officer, and F. W. BLACKFORD, B.Sc.Agr., Assistant to Research Officer.

BROWN spot of the Emperor of Canton mandarin is a serious disease, the distribution of which is apparently restricted to New South Wales and Queensland. Observation indicates that it occurs only in the variety mentioned which, however, is of considerable importance to these two States. The disease was first observed in Queensland at Howard in 1928, and it was apparently confined to that locality until early in 1934, when it was found to be present in the Elimbah district. Brown spot has been known to occur in New South Wales for many years past, where its control is considered to be a major citrus problem.

Symptoms.

The most conspicuous symptom of the disease is the spotting which occurs on the rind of the fruit. Shortly after the fruit sets, the first sign of infection may be observed as a black dot on the surface. As the fruit develops, these lesions become larger, until eventually they become sunken, chocolate coloured, circular spots varying in size from $\frac{1}{8}$ in. to $\frac{3}{8}$ in. in diameter, with a raised area in the centre, as though the spot originated from an injury due to a prick of some kind. (Plate 43.) The fruit may be infected anywhere on the surface, a very common point being at the insertion of the stalk. Spotted fruit have a tendency to fall especially when half grown. Under Queensland conditions it is not often that a fruit is found with more than one spot, but this is sufficient to cause it to drop.

The disease also appears on the twigs, infection occurring in two forms. Terminal shoots are frequently observed to be discoloured brown, and are curled over as though scorched by fire. (Plate 42.) The transition from diseased to healthy tissue in this type of lesion is very abrupt. The other type of twig infection appears as dark, sunken spots, similar to those appearing on the young fruit. Large masses of gum may exude from these spots which later tend to enlarge and form cankers.

Dark-brown spots, often surrounded by a light-green to creamy coloured halo, occur on the leaves, frequently on the margin, resulting in a decided puckering and distortion. (Plate 42.) Affected leaves, like the fruit, show a tendency to fall, and after a light shower of rain followed by a breeze, a scattering of pale-green, young leaves is frequently found under a diseased tree, each leaf showing one or more spots.

Affected trees tend to produce new growth almost continuously throughout the season, and this tender tissue usually becomes rapidly infected, with the result that the tree bears a large amount of dead wood.

Causal Organism.

As yet, the identity of the causal organism of the disease is in doubt. Darnell-Smith and MacKinnon[1] claim that *Colletotrichum gloeosporioides* is responsible. Noble et alia[5] in a recent publication from the New

South Wales Department of Agriculture state, however, that there is some evidence to the effect that the disease is due to a bacterial pathogen, but this has not been definitely determined.

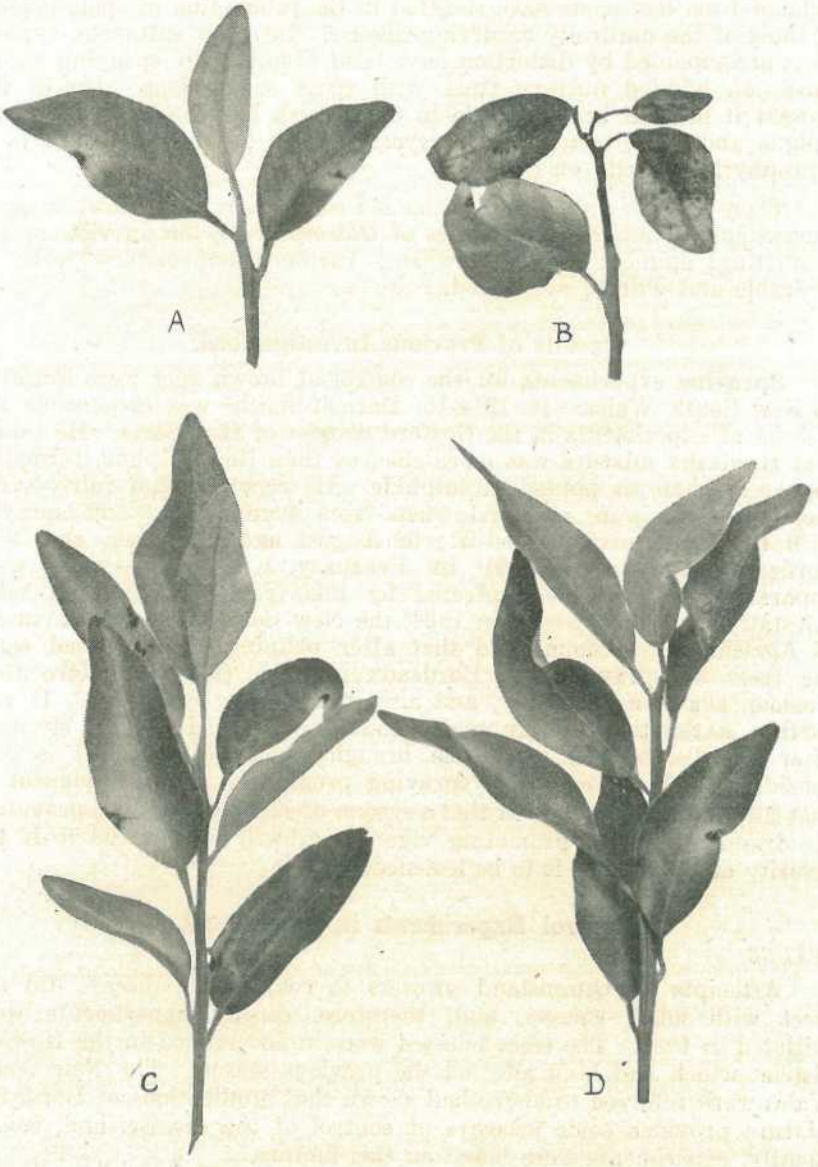

Plate 42.

Brown Spot of the Emperor of Canton Mandarin—Foliage infection.

A, C, and D—Leaf spots and distortion.

B—Twig infection, withertip stage. (Slightly reduced.)

Isolations made by the junior author in Queensland have demonstrated the frequent presence of a species of *Gloeosporium* in both the fruit and leaf spots. This fungus has also been cultured from pustules

of spores found on the surface of the brown spots on fruit kept under moist conditions. Inoculations on the uninjured rind of picked fruit with loopfuls of spore suspensions of certain strains of this fungus isolated from leaf spots have resulted in the production of spots typical of those of the naturally occurring disease. In a few instances, typical spots accompanied by distortion have been produced by spraying young leaves on budded nursery trees with spore suspensions. Up to the present it has not been possible to distinguish between the pathogenic fungus and *Colletotrichum gloeosporioides* as the latter occurs in a saprophytic capacity on citrus.

There is thus some justification for concluding that brown spot in Queensland is caused by a species of *Gloeosporium,* but in view of the conflicting opinions held elsewhere, further confirmatory work is desirable and will be attempted.

Results of Previous Investigations.

Spraying experiments for the control of brown spot were initiated in New South Wales. In 1914-15, Darnell-Smith[2] was responsible for a series of experiments in the Gosford district of that State. He found that Bordeaux mixture was more efficient than lime sulphur, formalin, copper sulphate or potassium sulphide. He reported that fairly satisfactory results were obtained when trees were pruned and sprayed with Bordeaux mixture (6-4-50) in August and December, and with Bordeaux mixture (3-2-50) in February. Mandarin trees were apparently not adversely affected by this treatment, but red scale infestation was increased. In 1924, the New South Wales Department of Agriculture[3] recommended that after pruning out the dead wood the trees be sprayed with Bordeaux mixture (6-4-50) before they blossom, again in December, and also in February or March. It was further stated that this fungicide could be reduced to half strength after the disease had once been brought under control. It is now considered that an extensive spraying programme is uneconomical in that State and it is suggested that a system of skeleton pruning providing air drainage without promoting vigorous growth be resorted to if the severity of the disease is to be lessened.[5]

Control Experiments in Queensland.

1931-32.

Attempts by Queensland growers to combat the disease did not meet with much success, and, therefore, control experiments were initiated in 1931. The trees selected were in an orchard in the Howard district which had been affected the previous season. The New South Wales work referred to above had shown that applications of Bordeaux mixture provided some measure of control of the disease, and, consequently, experiments were based on this finding.

It was anticipated that such a treatment under Queensland conditions, though maybe proving a suitable control measure, would result in a big increase in the scale population. Accordingly, an attempt was made to combine an insecticide with the copper fungicide in the two later applications. Bordeaux mixture (3-2-40 plus 1 per cent. red oil) was applied in late September (when half the blossom had fallen) and mid-October. In November and February, sprays consisting of combinations of Burgundy mixture with the soap-washing soda insecticide

together with 2 per cent. red oil were used. These combination sprays were not a success, however, as the mixture formed a thick, paint-like precipitate which made spraying difficult. However, the trees suffered no injury and the percentage of diseased fruit was reduced from 39·2 (unsprayed trees) to 19·1.

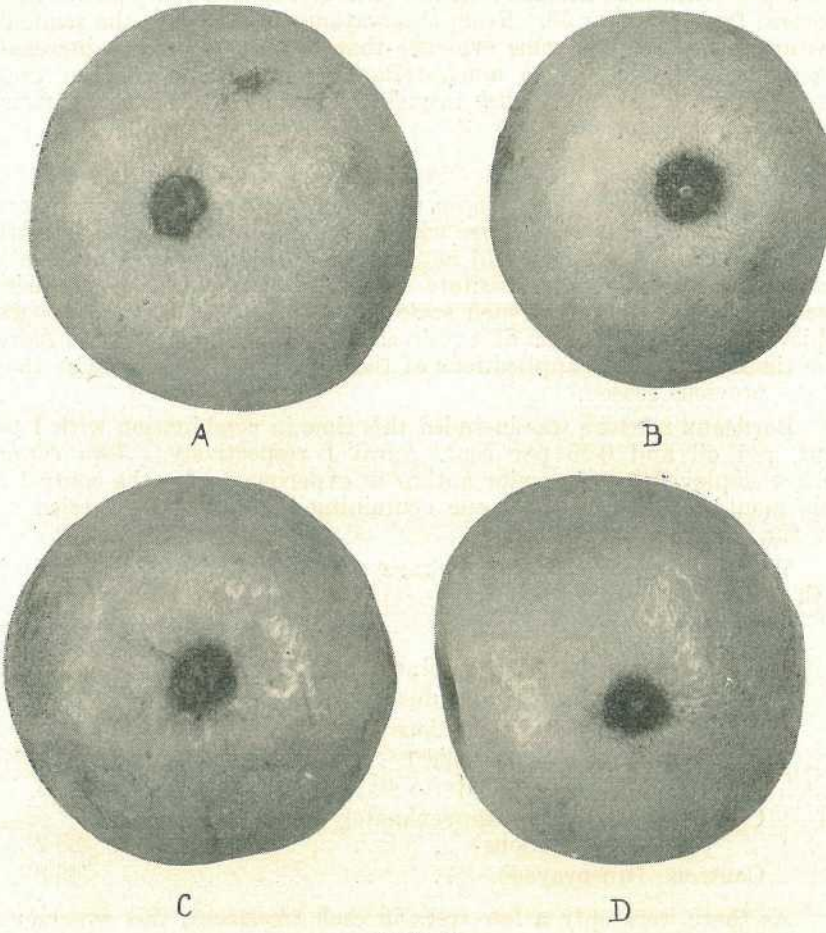

Plate 43.

Brown Spot of the Emperor of Canton Mandarin—Fruit Spots.
A—Stylar end infection. C—Stalk end infection.
B and D—Cheek infection. (Slightly reduced.)

1932-33.

In this season's experiments, no attempt was made to combine the fungicide with insecticides, the control of scale insects being effected by a resin-caustic soda-fish oil spray in April. The block of trees sprayed in the previous year was again used in this and all subsequent experiments.

A comparison was made of a four-spray schedule with a shorter one of three applications. In the longer schedule Bordeaux mixture (3-2-40) was applied in late September (when half the blossom had fallen), late October, mid-November, and late February, the late February spray being omitted in the shorter one.

Unfortunately, an infestation of Rutherglen bug caused a serious loss at blossoming time, some of the plot trees being badly affected, necessitating their exclusion from the experiment when considering the results. However, the experiment demonstrated the effectiveness of the longer schedule which reduced the disease incidence from 53·2 per cent. to 9·9 per cent. The shorter schedule merely reduced the percentage of diseased fruit to about 30. From observations made before the scalicide was applied, there was some evidence that Bordeaux mixture increased the scale population. Too much reliance cannot be placed on these results as the trees varied much in yields, but the value of the February application is apparent.

1933-34.

In the experiments this season an endeavour was made to find some substitute for Bordeaux mixture which would provide adequate control of the disease and which would not cause such an abnormal increase in scale population as to necessitate the application of special control measures. The control of such scale infestation as did eventuate was achieved by the application of a resin-caustic soda-fish oil spray in April. The times of the four applications of the sprays were the same as those of the previous season.

Bordeaux mixture was included this time in combination with 1 per cent. red oil and 0·25 per cent. Agral I respectively. Two copper sprays employed by the senior author in experiments for the control of blue mould in tobacco,[4] and one containing no copper were tried out for the first time.

The sprays used and the average percentage of diseased fruit in each treatment were as follows:—

	Diseased fruit. Per cent.
Bordeaux mixture (3-2-40 plus 1 per cent. red oil) ..	11·7
Bordeaux mixture (3-2-40 plus 0·25 Agral I)	12·2
Shirlan AG 2 lb. to 40 gallons	45·9
Home-made colloidal copper 1 : 25 (= approximately 1½ lb. copper sulphate to 40 gallons)	25·3
Copper emulsion (= approximately 3 lb. copper sulphate to 40 gallons)	23·2
Controls (unsprayed)	45·8

As there were only a few trees in each treatment, this experiment must be treated as being merely of a preliminary nature. Bordeaux mixture provided the best measure of control. Home-made colloidal copper and copper emulsion showed promise, but Shirlan AG did not prove at all successful.

It was observed that Bordeaux mixture caused an increase in scale infestation. The quality of the fruit from trees sprayed with Bordeaux mixture was also inferior to that on control trees. On the other hand, the home-made colloidal copper and copper emulsion sprays did not have these detrimental effects. Of these two sprays, the former has the advantage that it is easier to prepare.

1934-35.

As colloidal copper showed promise in the previous experiment, this year's work aimed at comparing this fungicide at varying strengths and with different spreaders with Bordeaux mixture. The strength of approximately 1 in 13 colloidal copper (3 gallons of stock solution to

TABLE 1.

SPRAY SCHEDULES IN 1934-35 EXPERIMENTS.

Treatment.	August.	September.	October.	December.	February.	Per cent. Diseased Fruit.
A		Bord. (3-2-40 + 1% oil)	Bord. (3-2-40 + 1% oil)	Burgundy (+ soap and soda)	Bord. (3-2-40 + 1% oil)	10.3
B	Bord. (3-2-40 + 1% oil)		C.C. (1 : 13 + soap) ..	C.C. (1 : 13 + soap and soda)	C.C. (1 : 13 + soap) ..	5.2
C			CONTROLS.			24.7
D		Bord. (3-2-40 + 1% oil)	C.C. (1 : 13 + soap) ..	C.C. (1 : 13 + soap and soda)	C.C. (1 : 13 + soap) ..	9.2
E		C.C. (1 : 13 + soap) ..	Bord. (3-2-40 + 1% oil)	C.C. (1 : 13 + soap and soda)	C.C. (1 :13 + soap) ..	7.8
F		C.C. (1 : 13)	C.C. (1 : 13)	C.C. (1 : 13 + soap and soda)	C.C. (1 : 13)	4.6
G		C.C. (1 : 22)	C.C. (1 : 22)	C.C. (1 : 22 + soap and soda)	C.C. (1 : 22)	12.6
H		C.C. (1 : 13 + oil) ..	C.C. (1 : 13 + oil) ..	C.C. (1 : 13 + soap and soda)	C.C. (1 : 13 + oil) ..	8.0
J		C.C. (1 : 13 + soap) ..	C.C. (1 : 13 + soap) ..	C.C. (1 : 13 + soap and soda)	C.C. (1 : 13 + soap) ..	8.4
K		C.C. (1 : 13 + Agral I) ..	C.C. (1 : 13 + Agral I) ..	C.C. (1 : 13 + soap and soda)	C.C. (1 : 13 + Agral I) ..	10.9

40 gallons of water) was decided on, as this spray, when ready for use, has the same copper content as Bordeaux mixture 3-2-40. In all the schedules except that involving Bordeaux mixture, the spray concerned was combined with the soap-washing soda scalicide in December. In the case of the Bordeaux mixture schedule, washing-soda was used instead of lime for the scalicide combination so that the spray for this application was strictly a Burgundy mixture. The soap and washing soda were added to the fungicide in considerably smaller proportions than those used in the 1931-32 experiments in order to avoid mechanical difficulties. The details of the schedules used are given in Table I.

Owing to the large number of treatments and the limited number of suitable trees available, only a few trees could be included in each treatment. A hailstorm considerably damaged the crop in late February and the yields of individual trees were very variable, due partly to this factor. This forms an additional reason for the results being interpreted with caution.

However, a few points are outstanding. Treatment F with colloidal copper proved effective in reducing the incidence of the disease and compared favourably with any of those in which Bordeaux formed a part. The addition of spreaders did not improve the efficiency of this spray to any extent. Bordeaux mixture applied as a pre-blossom spray appears to be superior to the same spray applied at half blossom, but the significance of this small difference is uncertain. The weaker strength of collodial copper, treatment G, did not reduce the incidence of the disease as effectively as the spray at full strength.

It was observed that where Bordeaux mixture appeared in a schedule, an abnormal increase in scale population was evident. This was particularly so the later in the season the Bordeaux mixture was applied. Colloidal copper, however, did not show this effect.

1936-37.

A four-spray schedule for the control of a disease is a big item of expenditure, both of time and money in the citrus orchard. For this reason an attempt was made in this season's experiments to reduce the number of spray applications necessary, employing home-made collodial copper, 1 in 13, as it had proved of most value in previous work. Five different schedules were tried, the details of which are given in Table 2.

TABLE 2.

SPRAY SCHEDULES IN 1936-37 EXPERIMENT.

Treatment.	Mid September.	Mid October.	Mid November.	Mid December.	Late February.
1	*B.	†C.C.	..	C.C.	C.C.
2	C.C.	C.C.	..	C.C.	C.C.
3	C.C.	C.C.	..	C.C.	..
4	C.C.	C.C.	..	..	..
5	C.C.	..	C.C.	..	C.C.
6	Controls (Unsprayed).				

* B = Bordeaux mixture (3-2-40)..

† C.C. = Colloidal copper (1 in 13).

The first spray was applied when half the blossom had fallen. The control of scale infestation was achieved by the application of a soap-washing soda-oil spray in late November, and a white oil spray in mid-March. These sprays were chosen and applied at the discretion of the orchardist.

Thirty trees were used in the experiment and were divided into five blocks, so that the experimental layout conformed to that of five randomised blocks with six trees each.

As in previous experiments, a count of diseased fruit was made at the time of picking, which was carried out in three stages. As brown spot causes a large amount of fruit to fall, the fruit on the ground under the trees was gathered at the first picking, classified, and counted. These counts appear in Table 3.

As the layout of the plot permitted statistical analysis, several analyses were made in order to avoid taking into consideration, when drawing conclusions, any differences due to external factors in the experiment. The two most important analyses are given in Tables 4 and 5.

From the abovementioned tables and analyses the following conclusions can be drawn:—

(1) There were no significant differences in the original number of fruit (the sum of those picked and fallen), on the trees in the various treatments. It may be taken that subsequent differences in yield of healthy fruit can be attributed to the effects of sprays.

(2) Treatments 1, 2, and 5 have resulted in a considerable reduction in the number of fallen fruit (the majority of which were infected with brown spot) when compared with the unsprayed trees.

(3) These same treatments have also reduced the number of diseased fruit picked.

(4) The three treatments which provided the most effective control showed the highest yield of healthy fruit. Of these three treatments, treatment 5, under the conditions of 1936-37 season, showed slightly the better yield, and being of three spray applications is naturally to be preferred to No. 1 or No. 2 of four applications.

An increase over unsprayed trees of at least a case of healthy fruit might be expected from the application of three colloidal copper sprays as in treatment 5, when trees of size and yielding capacity similar to those of the experiment are being considered. Treatments 1 and 2 did not give such a big increase in yield.

It must be noted that the three spray schedule which proved so successful in the 1936-37 experiments was tried out in an exceptional season. In the months September, October, and November, barely 3 inches of rain fell in the district.

1937-38.

In further investigations with collodial copper in this season, in which the control of brown spot was incidental, the three-spray schedule was used together with one in which Bordeaux mixture (3-2-40) was substituted for the first two applications. These schedules reduced the incidence of brown spot from 16·4 per cent. on unsprayed trees to 4·2 per cent. and 4·5 per cent. respectively. In contrast to the previous season the rainfall in the September-November period was 10 inches, so that even under heavier rainfall conditions the three-spray schedule can be expected to provide good control, colloidal copper being just as efficient as Bordeaux mixture (3-2-40).

TABLE 3.

FRUIT COUNTS—1936-37 EXPERIMENTS.

Details of Sprays.		Number of Tree.	PICKED FROM TREE.			GROUND PICK-UP.			Total.	Per cent. of Total Diseased.	Average.
			Diseased.	Healthy.	Total.	Diseased.	Healthy.	Total.			
Treatment 1.	Bord. Mid September	15	19	789	808	15	2	17	825	4.1	4.9
	C.C. Mid October	14	39	1,178	1,217	26	12	38	1,255	5.2	
	C.C. Mid December	13	16	323	339	2	3	5	344	5.2	
	C.C. Late February	12	40	1,255	1,295	32	12	44	1,339	5.4	
		11	51	1,329	1,380	14	20	64	1,444	4.5	
Treatment 2.	C.C. Mid September	25	9	988	997	10	5	15	1,012	1.9	4.5
	C.C. Mid October	24	33	812	845	10	11	21	866	5.0	
	C.C. Mid December	23	28	658	686	5	5	10	696	4.7	
	C.C. Late February	22	47	1,432	1,479	39	12	51	1,530	5.6	
		21	34	884	918	18	15	33	951	5.5	
Treatment 3.	C.C. Mid September	35	42	575	617	27	8	35	652	10.6	16.5
	C.C. Mid October	34	105	486	591	45	11	56	647	23.2	
	C.C. Mid December	33	56	610	666	26	14	40	706	11.6	
		32	148	1,291	1,439	74	32	106	1,545	15.3	
		31	111	604	715	61	11	72	787	21.8	

Treatment 4. C.C. Mid September / C.C. Mid October	45	89	434	523	28	2	30	553	21.1	22.6
	44	121	665	786	42	10	52	838	19.5	
	43	102	301	603	88	11	99	702	27.1	
	42	74	390	464	58	3	61	525	25.3	
	41	83	552	635	60	13	73	708	20.2	
Treatment 5. C.C. Mid September / C.C. Mid November / C.C. Late February	55	48	1,240	1,288	11	3	14	1,302	4.5	5.2
	54	52	1,126	1,178	23	10	33	1,211	6.2	
	53	32	1,025	1,057	10	3	13	1,070	3.9	
	52	67	1,180	1,247	27	9	36	1,283	7.3	
	51	18	655	673	13	10	23	696	4.4	
Controls—No spray.	65	129	288	417	30	6	36	453	32.9	38.9
	64	331	783	1,064	79	4	83	1,147	35.7	
	63	151	347	498	69	2	71	569	38.7	
	62	183	379	562	118	11	129	691	43.5	
	61	118	269	387	101	13	114	501	43.7	

TABLE 4.

ANALYSIS OF VARIANCE OF HEALTHY FRUIT.

Source of Variation.	D.F.	Sum of Squares.	Mean Square.	S.D.
Blocks	4	564,578.2	141,144.55	..
Treatments ..	5	1,789,814	357,962.8	..
Error	20	1,314,647.8	65,732.39	±256.383
Total ..	29	3,669,040	..	..

F for treatments = 357,962.8/65,732.39 = 5.44 which is significant. (P. < .01).

S.E. of mean = $\pm 256.383/\sqrt{5} = \pm 114.66$.

S.E. of difference of means = $\pm 114.66 \times \sqrt{2} = \pm 162.129$.

Throughout all experiments, pruning, fertilizing, and cultivating were left to the discretion of the orchardist. Trees were kept well pruned so that the growth was open, allowing greater ease in spraying. No attempt was made to estimate the value of pruning as a factor in the control of the disease. Data relating to the effect of sprays on the incidence of the disease on leaves and twigs was not taken as it was not considered of value. Spray applications to control these phases of the disease would have to be very frequent, as the trees produce susceptible young growth right through the season.

TABLE 5.

MEAN NUMBER OF HEALTHY FRUIT PER TREE.

Treatment.	Mean of 5 Trees	S.E.	Significantly Exceeds (P. = .05).
1	974.8	±114.66	4, 6
2	954.8	..	4, 6
3	713.2	..	..
4	508.4	..	..
5	1,045.2	..	4, 6
6	403.2	..	..

Summary.

Brown spot is a serious citrus disease affecting the Emperor of Canton mandarin in Queensland. A description of symptoms on leaves, twigs, and fruit is given.

Five seasons' experiments with sprays for the control of the disease are described.

Four applications of Bordeaux mixture (3-2-40 plus 1 per cent. red oil) reduce the incidence of the disease.

The continued application of this spray mixture results in a marked increase in the scale population of the trees.

A spray mixture, home-made collodial copper, with a copper content equal to that of a Bordeaux mixture of 3-2-40 strength proved effective in trials.

With three applications of this spray, at half blossom-fall when most of the fruit has set, eight weeks later and in late February, the incidence of the fruit spot phase of the disease is considerably reduced and the yield of marketable healthy fruit increased.

Colloidal copper sprays did not seem to increase scale infestation of the trees.

Acknowledgments.

The writers wish to express their appreciation of the help of Mr. C. E. Farmer, of Howard, who made the trees available for the experiments and who co-operated wholeheartedly in the work of spraying. Acknowledgment is also made of the help of Miss B. Shield, Assistant to Research Officer, who is responsible for the analyses of results of the 1936-37 experiments, and also of those members of the plant pathology staff who assisted at various times in carrying out the work.

LITERATURE CITED.

[1] Darnell-Smith, G. P., and E. MacKinnon: Fungus and Other Diseases of Citrus Trees. Agric. Gaz. New South Wales, XXV., 11, 945-954, 1914.

[2] Darnell-Smith, G. P.: "Brown Spot" of Emperor Mandarins. Agric. Gaz. New South Wales, XXVIII., 3, 190-196, 1917.

[3] Anon.: Dept. Agric. New South Wales. Plant Disease Leaflet No. 10, 1924.

[4] Mandelson, L. F.: Additional Recommendations for the Control of Blue Mould of Tobacco. Queensland Agric. Jour., XL., 6, 465-469, 1933.

[5] Noble, R. J. et alia: The Occurrence of Plant Diseases in New South Wales. Dept. Agric. New South Wales, Sc. Bull. No. 57, 1937.

VALUE OF TREES ON THE FARM.

Trees serve many important purposes on farming and pastoral country.

Trees are valuable as—

1. Windbreaks and shelter belts.
2. For isolated or scattered shade and shelter.
3. A reserve supply of fodder for periods of drought.
4. Timber and fuel supplies.
5. Screens around dams and tanks to prevent silting up by dust, and undue evaporation of the water.
6. For the prevention of erosion on slopes and along the banks of creeks and rivers.
7. For ornamental plantations in improving the appearance of the home.

The Control of Banana Rust Thrips.

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I. HISTORY OF THE PEST IN QUEENSLAND.

THE history of the banana rust thrips, *Scirtothrips signipennis*, Bagn., (Plate 44) and its relation to the development of rust on banana fruit is rather a long one. It has been excellently reviewed by Smith (1934). Briefly, the species was definitely determined as the causal organism early in the century (Tryon, 1901), but rust was a well known cause of loss to banana growers in the Cairns and Goondi areas as far back as 1897 (Froggatt, 1928). Little attention was paid to the pest for a number of years, and only general recommendations were made regarding its control. It appeared to be restricted to North Queensland. However, in 1924, following the growth to vast proportions of the banana-growing industry in southern Queensland, a serious outbreak—probably actually the culmination of several years' increasing intensity of infestation—occurred in the Gympie district, at that time the largest banana-growing centre in the State. Girault (1925) made extensive observations on the bionomics of the pest and carried out certain preliminary control experiments. In 1926 Froggatt (1927) performed control experiments in North Queensland and suggested the posssbility of using calcium cyanide dusts. From 1929 to 1934 Smith (1934), from the Entomological Field Station at Cairns, devoted considerable attention to this pest and arrived at some definite conclusions concerning the control of rust in North Queensland. In the summers of 1931-32 and 1932-33, during another banana rust thrips outbreak, Weddell (1932 and 1933) in southern Queensland investigated the value of certain control measures which had received considerable publicity. Veitch (1934) summarised the then current ideas on control.

II. SCOPE OF THE PRESENT INVESTIGATION.

When the present studies were initiated, the accumulated information on the bionomics of the pest was more or less adequate for a good understanding of the problem and precluded the necessity for further detailed investigations along these lines. In addition, the rather extensive previous inquiries into the possible control measures indicated the most profitable field for further work. Thus the greater part of the time has been spent in carrying out a number of elaborate field experiments designed to assess accurately the relative merits of various control measures. The progressive waning of the thrips epidemic, coupled with a very considerable decrease in the acreage under bananas in the affected districts, hindered the investigations somewhat, but these disadvantages were, to some extent, counter-balanced by the comprehensiveness of the field work and the very careful selection of experimental sites.

In this paper, all previous information is summarised as briefly as possible and recently acquired data added. On practically every phase of the problem additional data, supplementary, confirmatory or contradictory, are available. Though the facts are sometimes meagre it is obviously desirable that all information pertaining to control measures should be marshalled together in the one account.

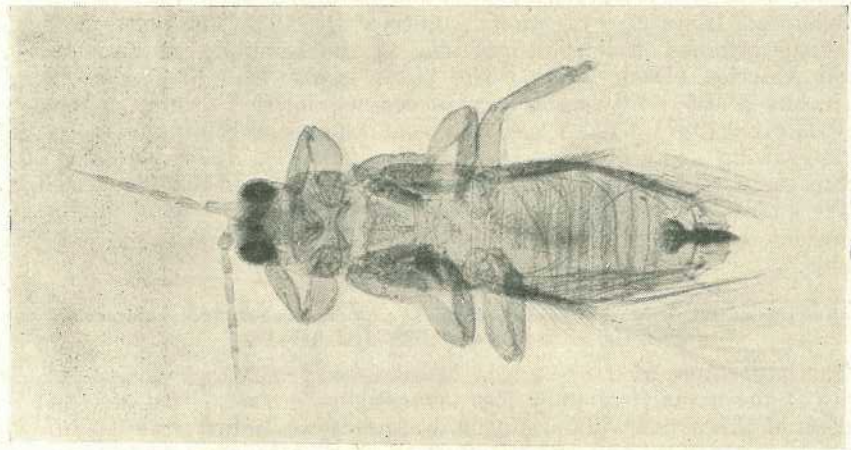


Fig. 2.

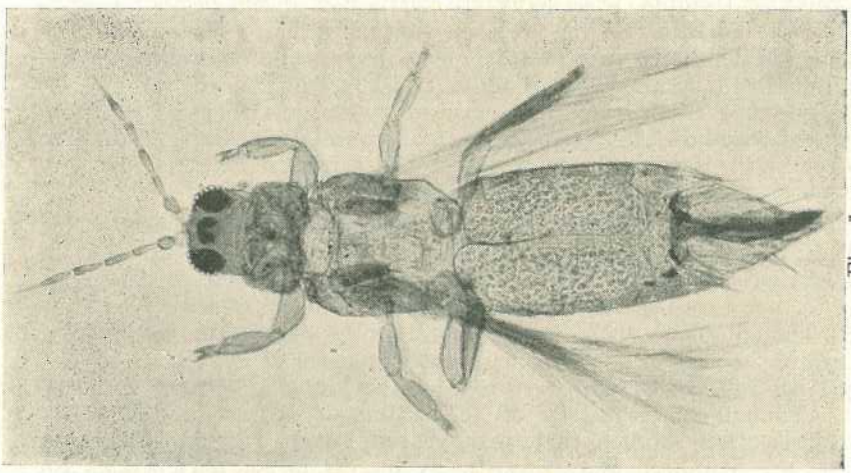


Fig. 1.

Plate 44.

The Banana Rust Thrips, *Scirtothrips signipennis* Bagn. Fig. 1, Female x 60; Fig. 2, Male x 60.

[*Photomicrographs by I. W. Helmsing.*

III. OCCURRENCE IN OTHER PARTS OF THE WORLD.

Until recently Queensland appeared to be the only country where *S. signipennis* was regarded as a pest. The species was originally described in 1913 from specimens collected on bananas in Ceylon (Bagnall, 1913). Nevertheless, it is not recorded as a pest in the entomological literature of that country. In 1935 the pest had apparently attained serious proportions in the Republic of Panama, Central America (Deal, 1935). The insect is also said to be present in Fiji, but is apparently not a pest of commercial significance in that colony (Lever, 1937). There are no recent reports of the insect in the banana-growing areas of New South Wales (Gurney, 1936), but, considering early records from the Tweed Valley (Tryon, 1920 to 1924) and the known distribution of the pest in southern Queensland during the present decade, its presence in northern New South Wales is very probable.

IV. IMPORTANCE OF THE PEST TO THE BANANA GROWING INDUSTRY OF QUEENSLAND.

The importance of the pest may be discussed from three viewpoints, viz.:—(1) the actual monetary loss incurred by growers, (2) the contribution of the banana thrips to the decline of the industry in certain centres of production, and (3) its effect on the development and expansion of the industry in the future.

(1) Broadly speaking, the banana rust thrips is found throughout all banana-growing areas north of Gympie, while south of that centre distribution is irregular. The extent of these regions is, however, no indication of their relative importance, for the area south of Gympie supplies practically all the bananas for export to the southern States, and it is in the southern markets that the grower of rusty fruit is most heavily penalised.

North of Gympie, practically all production at the present time is for the local markets. While fruit showing more than a certain severity of damage is definitely unsaleable, the local buyers and consumers appear to be tolerant of a considerable amount of blemish, and growers do not normally suffer much loss. In a year of severe rust there is a certain amount of wastage. In recent years, too, several large-scale production ventures in the far north, growing for the southern markets, have, in bad seasons, suffered very considerable loss of fruit.

In an average bad infestation, growers whose plantations are located south of Gympie may discard as much as 20 to 25 per cent. of their fruit as unmarketable, while much of the remainder will realise from 2s. to 6s. per case less than fruit of similar size and quality free from rust. Though losses vary from plantation to plantation, an average wastage of 20 per cent. and a depression in price of 2s. 6d. a case for rusty fruit is a conservative estimate of the losses in severely infested areas. Though the accuracy of the statement is rather difficult to check it is often claimed that, in a year of severe rust incidence, the growers are penalised more severely by buyers in southern States for similarly affected fruit than in a season when rusty fruit is not so prevalent.

Owing to the seasonal incidence of thrips, rusty fruit is cut only at certain periods of the year. Thus the loss referred to above is only a seasonal one, affecting, on the average, fruit cut between January and August.

(2) In the far north, rust has unquestionably proved a serious bar to banana growing, especially in large scale propositions catering for southern markets. In the south, thrips have been held largely responsible for the decline of the industry in many parts, notably the Gympie district. In both cases, however, it would appear that the importance of the pest has been somewhat over-rated. The banana rust thrips has been made the scapegoat for most of the ills to which banana production has been subject during the last decade. In the far north, fruit-fly and transport difficulties, in addition to certain fundamental cultural problems, have been important contributing factors. In the south—the Gympie district is a typical example—cultural difficulties and the incidence of adverse weather conditions during several seasons have been largely responsible for the decline. Moreover, during the years 1933-35, disastrously low prices for even good quality fruit overshadowed all other adverse influences. In many cases, however, rust proved the "last straw," and during this period it no doubt had its greatest effect in bringing about a decrease in production in certain centres.

It seems quite clear that low prices following excessive planting have resulted in a general decline of the industry in Queensland. Nevertheless, in certain areas, quite circumscribed in extent, banana rust thrips has been a major contributory factor. For several reasons, chief among which are—(*a*) severe outbreaks of the pest have been only irregularly distributed in the main areas of production, (*b*) much of the acreage which passed out of production prematurely in thrips-infested districts would have done so in any case for cultural reasons, and (*c*) a number of the growers in thrips-infested localities have transferred their activities to less susceptible areas, only a small proportion of the decrease in the acreage under bananas can be directly attributed to banana rust thrips.

(3) The rôle of the banana rust thrips in determining the progress of the industry in the future will undoubtedly be an important one. It seems probable that, unless cultural methods undergo a drastic revision, banana growing will tend to move northwards—that is, into areas particularly subject to thrips. In addition, there is no guarantee that areas in the south, which have hitherto been more or less free from the pest, will escape injury during future outbreaks. Thrips will certainly retard the rate of planting of new areas in the seriously-infested regions of the State, but in some respects this will be an advantage for only careful growers who fully understand the problem of thrips control will undertake production.

While these remarks apply equally to all parts of the State, it seems that the pest will assume its greatest importance in restricting the development of the industry in the far north where the incidence of the pest is more regular and more severe. The control measures discussed later apply only to the south. The most efficient have not yet been tested north of Gympie, and, in the light of previous experience (Smith, 1934), one hesitates to express a definite opinion concerning their possible efficacy in tropical areas. Nevertheless, they hold distinct promise for the control in such regions, not only of this pest but also of fruit fly.

V. BIONOMICS OF THE BANANA RUST THRIPS.

(1) Seasonal Life Cycle.

The insect is found in all stages throughout the year. Though there is no actual cessation of reproduction or development during the winter,

there is a marked retardation of the rate of the various life processes. The numbers reach a minimum in the late winter, there being a definite time lag between the onset of the cold weather and its effect on the insect population. Thus the lowest population level is probably reached early in August, though, by this time, even in the south, the weather has become perceptibily warmer.

In August a relatively large number of very small larvæ have occasionally been observed, indicating a slight flush of reproduction at this period. However, generally speaking, there is no perceptible increase on the winter low level before September. Thereafter, the population increases rather slowly until about November, the rate of increase apparently depending on the season. From December onwards the growth of the population is accelerated considerably and the peak is usually reached about February. There is little or no decrease in numbers until after April as a rule, and in 1935 it was the end of May before such a decrease became obvious. From then on the population decline proceeds at a rapid rate to reach the lowest level at the end of July or the beginning of August.

(2) Life History Details.

Girault (1925) made a comprehensive study of the life history and habits of the banana rust thrips during the months October to February, and the following account is based on his records, amplified, where necessary, by data accumulated in later investigations.

Egg.—The egg is most commonly laid in the soft tissues of the pseudostem and in the fruit. A few are probably normally deposited in the bunch stalk while, under some conditions, egg-laying takes place on the leaf.

The site of oviposition is usually unmarked in any way, but in some cases on the fruit "minute round pustules were formed over the egg and the larva hatches from a minute slit to one end of the centre of the pustule." Pustules on the surface of the fruit may, of course, be due to other causes, for they are commonly found on fruit free from thrips, particularly on surfaces adjacent to, or contiguous with, those of neighbouring fruits. The majority of the eggs are laid in the basal half of the fruits, as would be expected from a consideration of the habits of the adults. On the pseudostem, eggs are presumably laid in all parts frequented by the adults. On the bunch stalk the portion between the top hand and the throat of the plant, beneath the shelter of the bracts subtending the bunch, is most commonly selected as an oviposition site, as indicated by the presence of larval colonies. In the 1936-37 summer, large colonies of thrips in all stages were frequently observed on funnel leaves or on recently unfurled leaves, and there is little doubt that oviposition must have taken place in the leaf itself. This phenomenon has not been recorded previously, and it was probably brought about or accentuated by the rather exceptional weather conditions prevailing during the season. Eggs have never been found in the corm, nor have larvæ appeared on corms kept under close observation.

The average duration of the egg stage as determined by Girault was about a fortnight with a range of 12 to 19 days.

Larva.—On emergence from the egg the larva pushes its way through the surface of the plant tissue. The point of exit may often be discerned as a "minute cross-slit." In addition, the delicate amnion,

shed by the larva as it emerges, often remains as a "minute, hair-like, semi-prostrate, white thread," which further serves to distinguish the point of exit. Hatching takes place at any time of the day, but the great majority of larvæ emerge during the forenoon.

During the period of Girault's work the larval stage on the plant ranged from 6 to 10 days, and in recent investigations a duration of 8 days was recorded in April. A definite pre-pupal stage lasting 2 to 5 days is spent in the ground.

Pupa.—Pupation takes place at shallow depths in the soil. A maximum depth of 3 inches has been recorded, but lesser depths are more common. There is no pupal cell, and both prepupæ and pupæ are able to crawl slowly. Pupæ are not commonly found on any part of the plant in the field, and only three or four larvæ have ever been induced to pupate in the absence of soil in the laboratory. Full-grown larvæ confined on bananas in tubes without soil usually wander about for some time and ultimately die without completing their development.

The pupal stage has been recorded to range from 6 to 10 days. After transformation the adult remains in the soil for a short period—24 hours or less.

Adult.—After emerging from the soil the adults presumably make their way immediately to a nearby host, though whether by alar or pedal movement is not certain.

Girault records a maximum length of life of 72 days for an adult female, though the average adult life is given as about 28 days. This latter figure was computed from both adults collected in the field and laboratory-bred insects. In recent studies adults frequently lived from 50 to 55 days in confinement. Females appear to live considerably longer than males.

In the laboratory the total period of development was found to range from 29 to 38 days. The maximum duration of the whole life cycle, including the free-living adult stage, thus approaches about three months in the summer.

Mating may take place within a few days after the emergence of the adults. Parthenogenetic reproduction was observed by Girault 3 days after emergence of the imago. Thus mating may bear little relation to oviposition. The details concerning parthenogenesis, such as sex of offspring, rate of reproduction, &c., have not been elucidated.

The proportion of the sexes suggests the possibility of parthenogenesis. Although the proportion of males in field collections of the banana rust thrips has reached 50 per cent., it is usually in the vicinity of 30 per cent., and as low a figure as 13 per cent. has been recorded. There does not appear to be any correlation between the season of the year and the sex ratio.

The length of the reproductive life is considerable, and females may lay eggs for the greater part of their adult life. Girault records the case of an individual female laying eggs over a period of 64 days. Miscellaneous observations gave a range of egg-laying life of 17 to 64 days, with an average for seven individuals of 37 days. Records of the reproductive capacity of the female are rather incomplete, and suggest about 60 eggs. This figure is almost certainly too low. Eggs are laid more or less continuously, a few being deposited in the plant every day or at similar short intervals. The rate of oviposition appears to decline with increasing age.

An attempt has recently been made to determine the effect of shade on the rate of reproduction. Adults taken from bananas in the field were divided, without reference to sex, into six lots of 20 individuals each. These lots were distributed at random between single bananas, taken from the same hand of a bunch in a rust-free locality and enclosed in cotton-wool-stoppered tubes. Three tubes were wrapped in several thicknesses of hessian, while the other three were exposed to ordinary lighting conditions of the laboratory. After 15 days the first larvæ had just hatched from the unshaded fruits, but on the shaded fruits, many were several days old, and the total number was much greater. In 20 days the aggregate number of larvæ on the unshaded fruits was approximately 70 and on the shaded ones at least 350. Some of the latter were mature and had left the fruits to seek pupation sites. No larvæ appeared to be mature on, nor had any left, the unshaded bananas.

The survival rate of the adults was the same under the two sets of conditions. Owing to the ripening of the fruit the development of the insects was not followed through to maturity, but the experiment indicated clearly that reproduction is increased rather than retarded under conditions of heavy shading, the point concerning which information was required. The experiment was repeated in a subsequent season. The difference between the numbers of larvæ, while not so marked as in the above experiment, was still appreciable.

(3) Habits.

On the plant, adults and larvæ are found most commonly beneath the edges of the sheathing leaves of the pseudostem and on the fruit, somewhat less frequently on the bunch stalk and occasionally on partially-opened leaves.

On the pseudostem, the insects may be found under any leaf sheath which is not too close fitting. In the case of young suckers large colonies may be found under the leaf sheaths quite close to the ground, but on older plants the insects are usually not numerous near the base of the pseudostem. Adult and larval stages have never been found on the plant below ground level, i.e., on the corm. Towards the top of the pseudostem where the leaves diverge the insects can be readily located by tearing back the edges of the leaf sheath, although the colonies here are often not so strong numerically, particularly from the point of view of larvæ, as colonies further down the pseudostem.

Sometimes large numbers of adult insects may occur in the unfolding funnel leaf of the plant, often some distance from the throat. This phenomenon is quite common in the north during the summer months, and is not unusual in the south at the same season if the insects are at all abundant. In the cooler months the insects remain beneath the leaf sheaths.

Larvæ were not recorded on any part of the leaves until the 1936-37 summer when very large colonies of both adults and larvæ were frequently found on recently opened, as well as on still-furled funnel leaves. On the funnel leaves they were found on both surfaces; on the open leaves they usually occurred on the upper surface only. The season was an exceptionally dry one. For many weeks growth of the bananas was almost at a standstill and the funnel leaves opened very slowly. It is presumed that the persistent shelter in this leaf permitted colonisation along its whole length. An appreciable number of these

insects, especially the larvæ, apparently remained on the open leaf and completed their development in a normal fashion. The circumstances leave no room for doubt that eggs were actually laid in the leaf tissue, but the phenomenon is probably abnormal because the sheltered conditions favoured by ovipositing females are seldom available for any length of time in the funnel leaves of the normally growing plant.

On the bunches the insects are found primarily at, or near, the points of contact between fruits. They also commonly frequent any other part of the fruit which is sheltered by a closely adhering cover, such as a persistent bract or an abnormally placed leaf. At times larvæ, and much less frequently adults, may be seen on all parts of the fruit, even exposed to direct sunlight. This phenomenon has been observed only during the summer months under conditions of heavy bunch infestation. It was most noticeable during the 1936-37 summer which was exceedingly dry. On those parts of the bunch stalk separating the hands of fruit, a few larvæ have been observed from time to time, but on the stalk between the top hand and the throat of the plant, under the shelter of the two bracts subtending the bunch, small, diffuse colonies usually occur. These normally disappear after a time, following the disintegration of the sheltering bracts and the hardening of the surface of the stalk, though sub-mature larvæ have at times been observed on the stalk after all sheltering bracts have disappeared. The insects may also frequent aborted fruit towards the flower end of the bunch, and they have been found amongst male flowers still closely wrapped in bracts. It is, however, doubtful if they ever penetrate right to the end of the inflorescence. Occasionally small numbers of adults and larvæ were observed on the undersides of the bracts subtending the bunch. The insects appear to show no preference for the fruit as compared with the pseudostem.

Owing to the disposition of the banana fruits on a bunch, the most favourable area for the insects is near the base of the fruit. In this region, optimum conditions of shelter are available for the greatest length of time.

The population of the bunch is primarily derived from the population of the throat and upper portions of the plant. The adult thrips harbouring there penetrate beneath the bracts ensheathing the hands as the bunch is being everted (Smith, 1934). The hands first invaded ultimately become the top hands, though until the bunch is fully pendant they are bottom-most. Thus the thrips population of the hanging bunch is normally greatest in the top hands, the numbers decreasing towards the "flower" end. In cases of very severe infestation this gradation is more or less eliminated. Migration of flying adults on to the bunch subsequent to its being thrown may also tend to equalise the distribution of the population throughout the bunch. Once the bunch is thrown, there is little or no migration from the plant throat along the bunch stalk on to the bunch. Some insects from the colonies established on the stalk may, however, move on to the bunch as the former habitat becomes unsuitable, but these could scarcely play a significant part in the colonisation of the bunch.

The existence of thrips colonies indicates a gregarious habit, but the insects will not tolerate more than a certain degree of crowding, particularly in the adult stage. Girault (1925) records the apparent distress of very large mixed colonies in glass containers. Smith (1934) considers that the crowding of the colonies on the pseudostem causes the

population to move upwards to the plant throat and finally on to the emerging bunch. This aversion to overcrowding apparently determines the population density in any one spot, and may explain the definite upper limit to the numbers in the colonies, which vary, of course, with the habitable area. The number of insects in single colonies on the pseudostem is much larger than that on single fruits, or even on pairs of adjacent fruits, but in the first case, the area which can be occupied by a colony is much greater.

Both the size and density of colonies depends naturally on the degree of infestation and on the time of the year.

The age composition of the colonies varies with the season and the site on the plant. In well-established colonies the larvæ predominate during the summer; in the winter the adults are relatively more numerous, though probably never outnumbering the larvæ. The initial population of the bunch is wholly adult and, until reproduction has progressed sufficiently, adults predominate in the population in this site. Insects clustered in the funnel leaf during the summer are usually all adults, and in the winter, colonies of about a score of insects, all adult, have been observed under leaf sheaths. Girault records data on the composition of colonies. In the late summer 337 individuals drawn from a number of colonies included 92·7 per cent. larvæ. In July, of 1,531 specimens from the fruit 73 per cent. were larvæ, and of 2,185 specimens from the whole plant 59 per cent. were in the immature stage.

The natural gregarious behaviour is well illustrated by the distribution of small populations, which will, for the most part, be aggregated into a few colonies. No attempt is made to occupy all the suitable niches in the environment. Thus, the total population of a lightly infested, small, non-bearing plant may, for example, be found under two or three leaf sheaths.

The species has generally been considered to exhibit definite negative phototropism, but an examination of the evidence suggests that this thesis requires some modification. In the first instance, adults emerging from the soil must at least be indifferent to light, if not positively phototropic. Freshly-emerged adults in the laboratory have also been observed to ignore banana fruit in glass containers and to make their way towards the source of light. The habit of flight is also clearly indicative of at least the absence of negative phototropic reactions in the adult. The previous remarks concerning larvæ on the "outside" of banana bunches show that, under some conditions, this stage is also at least indifferent even to direct sunlight. It is worthy of note that larvæ thus exposed tend to be much more highly coloured, acquiring a deep yellow and even at times a reddish hue as compared with the pale yellow to almost white of average specimens. (*Cf.* Bailey, 1933.)

On the other hand, there is no doubt that adults require sheltered conditions for reproductive activities. Also, if colonies under leaf sheaths, for instance, are exposed by striping away the cover, all individuals, both larval and adult, quickly disperse into adjoining sheltered spots.

Thus, the phototropic reaction of the adult of this species appears to undergo a change, to which age may bear some relation, while larvæ are usually negatively phototropic but appear, under some circumstances, to be conditioned to a state of indifference to direct light.

Girault records that the distribution of the insects on the pseudostem bears no relation to the orientation of the plant in regard to the sun. He examined plants, one side of which was exposed to direct sunlight for several hours each day, but could detect no difference in the colonies in any part. In this case it might be expected that any reaction would depend on heat, rather than light. Recent attempts to detect any characteristic orientation of the colonies in the winter have similarly been unsuccessful. In normal plantation conditions, the pseudostems are more or less completely shaded, but in winter, when the effects of leaf diseases are most pronounced, foliage may become fairly sparse, and exposure of the pseudostems to a considerable amount of direct sunlight is not uncommon.

An attempt to demonstrate surface reactions was not successful. A large mixed colony was established on a banana contained in a cotton-wool-stoppered glass tube which was then wrapped in dark coloured paper so that all light was excluded. Examination at intervals over a period of a week failed to show any marked inclination on the part of either larvæ or adults to congregate at or near the points of contact between fruit and glass. Any aggregations were only of a temporary nature, and apparently due to the progress of wandering individuals being momentarily impeded by the points of contact between the two surfaces. The fairly even distribution of feeding blemishes all over the fruit also indicated the absence of surface responses.

Though a "short flying skip" was reported by Girault (1925), little information was available concerning the importance of flight in the economy of the banana rust thrips. During recent investigations, adults were captured on a 6 ft. by 3 ft. calico screen coated with adhesive material. The screen was erected in a vertical position between two rows of bananas, the bottom edge being 3 ft. from the ground. Approximately forty adults were observed in an area, 42 in. by 30 in., after two weeks' exposure, but, owing to the difficulty of detecting specimens caught in the adhesive, the number trapped may have been much greater. That the adhesive mixture exerted no chemotropic attraction for the insects was shown by the failure of smears of the material on different parts of banana plants to catch any specimens whatever. Thus there seems no doubt that the insects were trapped during normal movement, though whether from plant to plant or from ground to plant is not clear. This movement may not necessarily be true flight. Once on the wing, such small insects may be carried by air currents for considerable distances. However, for all points of practical importance, this may be regarded as equivalent to flight. True flight has since been observed in the laboratory; as a preliminary to taking off, there is a noticeable movement of wings and abdomen, suggesting that the fringing hairs of the wings are being combed out.

Adult and larval stages are very susceptible to lack of food. Experiments in the laboratory have indicated a minimum longevity of 2 to 4 hours and a maximum of 36 hours in the absence of food. Mortality is more rapid under conditions of low humidity.

Contact with soil exposed to the sun may be fatal to both adults and larvæ (Girault, 1925), but this has little practical importance. Under plantation conditions the greater part of the ground is shaded and, in any case, the majority, if not all of the larvæ, probably drop to the ground for pupation when lethal temperatures do not prevail. (*Cf.*

Bailey, 1933.) Insects already in the ground are doubtless protected by an adequate layer of soil. The effect of high soil temperatures on emerging adults is not known.

Though differences in seasonal habits may be largely correlated with differences in population density, several changes are probably due entirely to weather conditions. Locomotion is certainly slower in winter and flight is probably curtailed. During the cold weather the adults tend to cluster closely together in the colonies, either with larvæ or alone. Also the proportion of adults in mixed colonies increases markedly, probably on account of the depressed rate of reproduction. It has often been observed during the winter that all larvæ in any one colony were at the same stage of development, instead of exhibiting the normal age variation. This phenomenon is no doubt bound up with climatic effects on embryonic and larval development.

With the onset of winter, the numbers of the insect on the bunches diminish more rapidly than on the pseudostems until finally, during the winter months, the bunches are practically thrips-free. Odd adults may be found on young bunches thrown during the winter, but on more mature bunches which have carried a large population during the late summer and autumn the insects usually completely disappear. Thrips appear to be more numerous on the pseudostems of younger than older plants during the winter, though this may be partly an illusory effect due to the greater conspicuousness of the insects against the somewhat darker-coloured tissues of the younger plants.

The seasonal distribution of the insects on the plant is undoubtedly related to population density. The initial infestation of the plant is under the leaf sheaths of the pseudostem and, when the population is small, it is practically confined to this situation. As the numbers increase they tend to move upwards on the plant, firstly into the throat and the base of the unfolding leaves and then into the emerging bunch. With the winter decrease in population,, the adults tend to remain on the lower parts of the plant, from which there is little or no upward migration.

The important practical consideration in connection with this seasonal distribution is the almost entire freedom from infestation of bunches thrown between about the end of June to about the middle of September in southern Queensland, while the infestation of bunches thrown some time prior to, and after this period, is too slight to cause commercial damage to the fruit.

(4) Relationships With Other Insects.

Other insect species appear to be of little or no importance in the economy of the banana rust thrips. No natural enemy of any significance has been recorded. Most of the investigators concerned with the problem have handled fairly large numbers of the insects in the laboratory, but none has encountered any parasite of egg, larval or adult stages. Pupal parasites or predators may have escaped observation since pupæ have never been collected in any numbers from natural habitats.

Girault records that a red mite was occasionally seen fastened to both adult and larval thrips. Smith (1935) mentions the presence of a Capsid bug, commonly found in North Queensland, and considers it almost certainly predatory but of negligible importance.

In South Queensland adults and larvæ of the beetle *Cryptamorpha desjardinsii* Guer. (Fam. Cucujidæ) are commonly found in banana bunches, the former amongst the fruits and in the "flower" end, the latter only in the "flower" end. The affinities of the species and the appearance of the larvæ suggest that it is almost certainly predatory. Small dipterous and other larvæ which abound in the decaying inflorescence probably form its normal prey. Adults may feed on thrips larvæ amongst the fruits. Beetles have been reared from the larval stage in tubes containing *S. signipennis* colonies on bananas, together with a little soil, but there was no certain indication that the larvæ fed upon the thrips.

In southern Queensland adults and larvæ of a small Hemipteron (Fam. Anthocoridæ) have occasionally been seen on banana bunches, but attacks on *S. signipennis* was not observed.

Large colonies of mites were often bred in the laboratory on bananas harbouring thrips, but they were not observed to attack the thrips nor did they prevent the normal increase in population.

The chief interest of other insects in connection with the banana rust thrips problem lies in the confusion caused by two other species of Thysanoptera. These are *Thrips florum* Schmutz and *Physothrips bilongilineatus* Girault, the latter having been recorded by Girault (1925). Girault also mentions a third species, black in the adult stage, which is comparatively rare on the banana plant. It is probably *Haplothrips bituberculatus* Girault, a species commonly found on other hosts and doubtless only incidentally on bananas.

Thrips florum (Plate 45) occurs in enormous numbers co-seasonally with *S. signipennis*. The male is a small, active insect, yellowish in colour with light markings on the wings, but the female is much larger, and conspicuously red and black. The larva in both sexes is bright red. The male bears some resemblance to *S. signipennis*, but may be readily distinguished by its small size, more active movements, somewhat different shape (being tapered posteriorly and showing no signs of dorso-ventral compression), and most definitely of all, by the absence of the dark dorsal, abdominal line, due to the shading of the folded wings, and the two dark thoracic spots characteristic of *S. signipennis*. The folded wings of the male *T. florum* do give a dorsal line rather deeper in colour than the ground colouring of the insect, but this line is much less distinct than that of the other species.

The insect has a rather curious distribution on the plant. The males predominate on the outside of the bracts subtending the fruits and flowers of the bunch, the females mainly occur on the undersides of these bracts and on the floral organs of the bud and the larvæ chiefly on the floral organs of the bud. Adults of both sexes may be observed amongst the fruits of very young bunches which have not yet shed their bracts, and also in small numbers within the throat of the plant. They are not usually found under the leaf sheaths of the pseudostem.

The species seems to be rather more generally distributd than *S. signipennis*, though the largest numbers occur in "rust" localities, thus indicating somewhat similar general climatic requirements on the part of the two species.

Little attention has been paid to the life history of *T. florum*. The egg is presumably laid in the plant tissues. The duration of larval

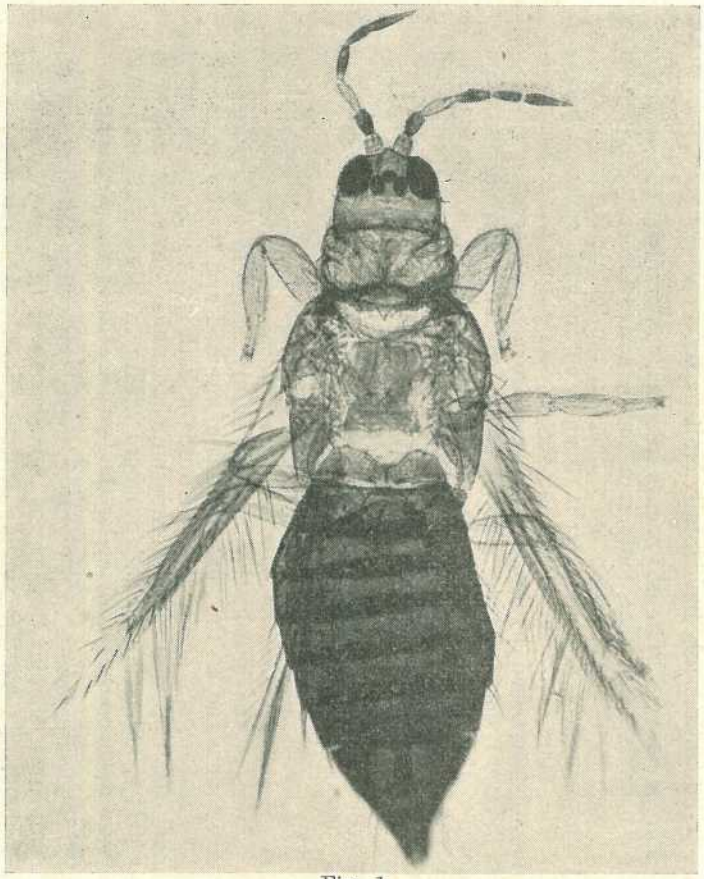


Fig. 1.

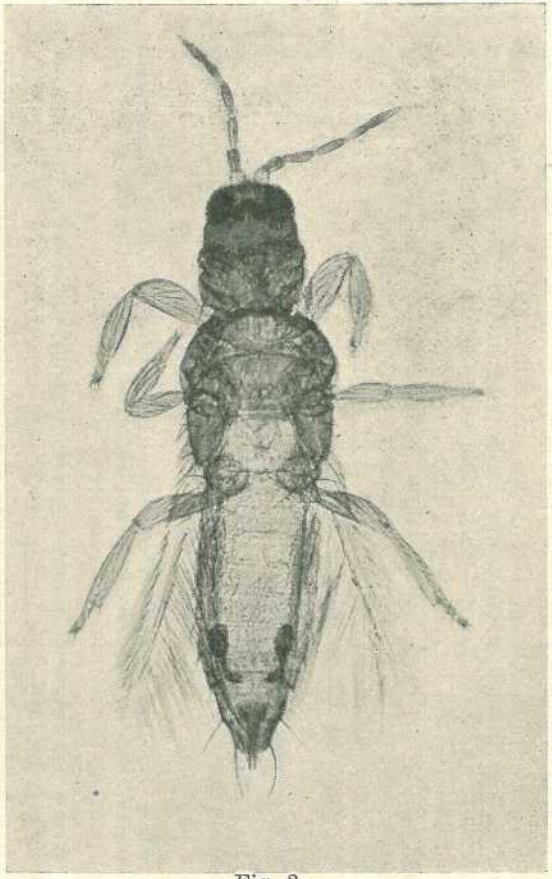


Fig. 2.

Plate 45.

Thrips florum Smutz. Fig. 1, female x 60; Fig. 2, male x 60.

[*Photomicrographs by I. W. Helmsing.*

and pupal stages was found to be comparable with that of the pest species. In the laboratory larvæ pupated in and on the soil. Under natural conditions they may pupate on the plant, perhaps on the decaying "flower" end. The insect appears to build up large populations rather more quickly in the spring and early summer than *S. signipennis*, but it is apparently more susceptible to cold weather, as the numbers diminish somewhat earlier in winter.

The species has been reported to cause a rusting of very young fruit in north Queensland (Froggatt, 1928). In New South Wales occasional damage similar to true rust is ascribed to *T. florum* (Gurney, 1936). Recent observations in southern Queensland have failed to incriminate the species in any type of fruit injury. Its chief importance lies in the common confusion among growers as a result of the similarity between the adult male and both sexes of *S. signipennis*. Seeing the vast numbers of little yellow insects, rather conspicuous against the dark red of the bracts, growers imagine they are about to suffer severe losses from rust.

Physothrips bilonglineatus (Plate 46) may quite pardonably be confused with *S. signipennis* in all stages by the layman. The adult, of

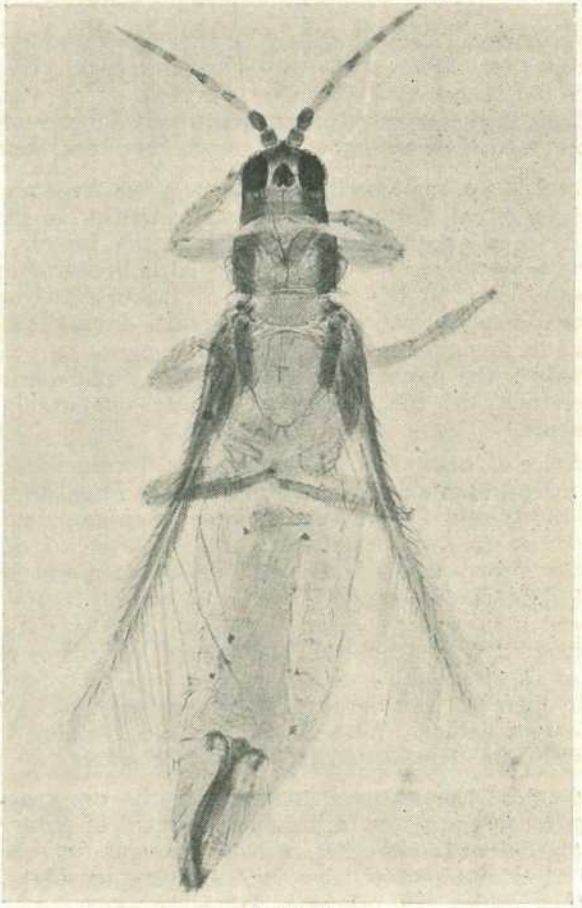


Plate 46

Physothrips bilongilineatus Gir.—female x 60.

[*Photomicrograph by I. W. Helmsing.*

which only female specimens have so far been collected, is about the same size; the ground colour is lemon-yellow rather than golden, and the two dark thoracic spots of *S. signipennis* are lacking. The dark coloured dorsal line, due to the colouration of the folded wings, is present and very conspicuous against the pale body colour. In addition, there is a distinct black band along the lateral margins of the head and thorax. The abdomen tapers posteriorly, and the whole insect, therefore, looks rather different from the elongate oval *S. signipennis*. The species also does not exhibit the dorso-ventral compression of the latter. In habits the adult is more alert. It moves much more quickly and takes to flight fairly readily.

The larvæ are lemon-yellow in colour, and when viewed under low powers of magnification, present a glistening appearance quite different from that of *S. signipennis*. Like the adult they are slender and regularly tapering. A more detailed examination shows that the larval antennæ are ten-segmented (those of *S. signipennis* being twelve-segmented) and that the characteristic funnel-shaped or sub-capitate abdominal setæ of the latter species are lacking. These two characters provide a ready and sure method of differentiating between the larval stages of the two species if suitable microscopic facilities are available.

P. bilonglineatus is fairly widely distributed in southern Queensland, but ordinarily it is found in very small numbers. Without a very careful search only occasional adults are detected. However, during the summer of 1935-36 it was noted in comparatively large numbers in one plantation, and a brief discussion of the insect, therefore, seems desirable.

Adults and larvæ are usually observed on the fruit and occasional adults have been found in the throat of small plants. In the laboratory some difficulty was experienced in handling the insect. It did not thrive under the conditions normally employed in breeding other species, and in no case was the life cycle carried through to completion on banana fruits. Nevertheless, eggs laid in fruits during April and May hatched in 12 to 19 days and larvæ were full grown in about 10 days. In June and July the pupal stage lasted about three weeks. In many respects, therefore, the life history stages are comparable with those of *S. signipennis*.

In its choice of habitat *P. bilongilineatus* differs slightly from the banana rust thrips. Larvæ and adults are usually found in more exposed positions on the bunch. While some colonies may contain both species, *P. bilongilineatus* does not usually occur in colonies of *S. signipennis* between closely appressed surfaces. The appearance and general shape of the adult particularly suggest that it does not frequent the same confined spaces as the other species. Furthermore, there is not the same strong tendency to form colonies. In no case has the population of a bunch been at all comparable with that of *S. signipennis* and, were the population to increase considerably, the insect may, of course, display similar gregarious habits. With *S. signipennis*, however, even a small population would be congregated into definite colonies.

To some extent the seasonal incidence of the two species coincides but *P. bilongilineatus* appears rather more tolerant of winter conditions, and the population on the bunches remains constant for some time after the numbers of *S. signipennis* have declined considerably. Thus fairly mature bunches, which, by inference from the amount of rust on the fruit, must have carried a large population of banana rust thrips at

one stage, harboured only *P. bilongilineatus* in June. Similarly, very young bunches thrown in winter and free from *S. signipennis* have carried a small population of the other species. However, the population density ultimately reaches the same low level. Despite this apparent greater tolerance of cold weather, its geographical range is not known to be greater than that of *S. signipennis*.

In the laboratory, colonies of this insect injured banana fruits in much the same way as the banana rust thrips in the same environment. (Rust produced in the laboratory on single fruits differs slightly from that produced on the plant, no doubt due to the fact that no growth is taking place in the fruit.) In the field it has not been possible to detect any type of injury peculiar to the species. The relative population densities of the two species on certain selected bunches suggested, however, that incipient rust markings, apparently normal in all respects, had been caused by loose colonies of *P. bilongilineatus*. The solitary individuals wandering and presumably feeding on the outside of the bunch have not been observed to cause any blemish.

At present, *P. bilongilineatus* is of no importance in southern Queensland. The numbers present in all plantations where it has been recorded have been, with one exception, completely negligible. Even in that one area it is very doubtful if the species played any significant part in the development of the severe rust which occurred during the 1935-36 summer. Should its numbers increase considerably it may introduce complications into the problem of rust control by, firstly, prolonging the rust season, and, secondly, causing an extension of the damaged area on individual fruits. Owing to the low numbers present in the plantation, it is unlikely that this insect will cause any confusion to banana growers.

Still another species of Thysanoptera (*Hercinothrips bicinctus* Bagnall) occurs on bananas in some districts, e.g., the Byfield area near Rockhampton, and in isolated localities south of Brisbane. It causes what is popularly known as "silver rust." The adult is a fairly stout, brownish-black insect, the larvæ is pure white to yellowish in colour (depending on age), and carries a conspicuous brownish blob of excrement at its anal extremity. The damage caused to the fruit is at first a distinct silvering on the surface, marked with black or brown excretal stains. In cases of severe injury the blemish may turn red and ultimately the skin of the fruit may crack. The typical injury is, however, quite different from true rust. The colonies of the insects are found more on exposed portions of the fruits than in between closely-appressed surfaces. There should be no confusion whatever between this species and *S. signipennis*. Its control constitutes a separate problem, which is at present the subject of a subsidiary investigation.

(5) Alternate Hosts.

Little attention has previously been given to the question of alternate hosts of the banana rust thrips. The insect is known to occur in vast numbers on the wild bananas in north Queensland (Froggatt, 1928), where it presumably frequents all three native species. In fact, Froggatt (1928) considers it to be indigenous on this host to North Queensland. The same worker has also collected the species in the flowers of the cunjevoi (*Alocasia macrorrhiza* Schott) in the Innisfail

district. Girault (1925) records one instance of adults feeding on tomato fruits but, as no larvæ were located, they were presumed not to be breeding on this host.

In 1935 one farmer reported their occurrance on French beans (*Phaseolus* sp.) but the report could not be investigated before the destruction of the plants. In the same year *S. signipennis* was located on a citrus orchard at Traveston, near Gympie, where sundry varieties of citrus fruits, particularly oranges, were severely blemished. Since that time the pest has been found on other orchards at Gympie, Nambour, and Palmwoods, and characteristic injury was seen on a few fruit grown at Cardwell, North Queensland. The varieties affected are oranges (several varieties), mandarins (several varieties but only to a very slight extent), lemons, citrons, and grapefruit. Strangely enough, neither thrips nor rust have ever been recorded on banana plantations at Nambour and Palmwoods, although they have been under fairly close observation for some years. The other two centres have, of course, long been notorious for rust in bananas.

In all cases, the citrus orchards have been associated to a greater or lesser extent with bananas. At Traveston, bananas heavily infested with thrips were actually growing amongst the citrus trees while there were two banana areas adjacent to the orchard. The bananas were eradicated from the orchard in 1935 but the thrips have persisted. At Gympie citrons were planted, after the eradication of the bananas, on the site of a plantation where rust had occurred. Bananas have since been grown in very close proximity to the citrus and have always been infested with thrips. The Nambour orchard adjoins a banana plantation. Although rusty fruit has been reported by some growers in the district, attempts to locate thrips on the bananas have been unsuccessful. The citrus at Palmwoods is planted on the site of an old banana plantation and a few stools of the latter remain at the edge of the orchard. Thrips were found in very small numbers on these plants and also in a plantation a few hundred yards distant.

The insects concentrate on the fruit and, as on bananas, prefer surfaces in close proximity, i.e., between fruits or between fruits and leaves, where they breed freely. They have also been observed breeding on the foliage of grapefruit when the trees were not carrying fruit. In the laboratory thriving colonies have been maintained for a year on potted orange seedlings and no difficulty is experienced in colonising orange fruits. Mandarin fruits do not seem to be suitable breeding media in the laboratory. The occurrence of *S. signipennis* on citrus is peculiar in that the population density bears little relation to that on adjacent bananas or to expectations based on topography. Biological abnormalities, such as the complete absence of males on citrus, have also been noted. These and other matters of importance are being studied at present but, as they have no direct bearing on the banana rust thrips problem, they need not be discussed in detail here.

The occurrence of *S. signipennis* on citrus prompted a more detailed search for other alternate hosts. As a result it was found on four native plants, viz., *Cordyline terminalis* and *Smilax australis* (Fam. Liliaceæ), *Gymnostachys anceps* (Fam. Araceæ) and *Flagellaria indica* (Fam. Flagellariaceæ). All were growing in plantations badly affected with rust. The insects have not been found on these or any other species growing elsewhere than among bananas, e.g., in the vegetation at the edge of banana plantations. Particular attention has been paid to those

species which form the bulk of the weed growth in plantations, e.g., cobbler's pegs (*Bidens pilosa*), rag weed (*Erigeron canadensis*), stinking roger (*Tagetes glandulifera*), sow thistle (*Sonchus oleraceus*), pigweed (*Portulacca oleracea*), shepherd's purse (*Capsella bursa-pastoris*), blue top (*Ageratum conyzoides*), and yellow weed (*Galinsoga parviflora*). Scotch thistle (*Cnicus lanceolatus*) and pineapples growing in heavily-infested banana plantations have also been examined with negative results.

The four hosts discovered form only a very small part of the weed growth; in fact, since they are all perennials, they rarely obtain a footing in well-managed plantations. In all instances where these plants were being utilised as alternate hosts little cultural attention had been given to the plantations and there was a more or less copious growth of both annual and perennial weeds.

C. terminalis, G. anceps and *F. indica* all have leaf petioles which ensheath the stem for some distance and provide shelter similar to that of the banana. In the case of *S. australis,* the position is quite different. This plant has a more or less woody stem with entire leaves and short petioles which are not sheathing. The leaves are naturally attacked by two species of Thysanoptera, probably *Euoplothrips bagnalli* Hard. and *Cryptothrips* sp., which cause a pronounced curling of the leaf margins inward to the midrib. In such curled leaves *S. signipennis* has been found, though not in association with any other species. Whether the banana rust thrips first attacked the normal leaf which then curled as a result of the damage or whether they took possession of leaves already curled could not be determined. The latter is perhaps the more likely explanation.

On all four alternate weed hosts breeding has been observed but not as prolifically as on citrus. *C. terminalis* harboured the greatest number of insects but in this case no more than 2 to 3 larvæ were found under each leaf sheath, in association with a similar number of adults. On the other weeds, the number of insects, both adults and larvæ, were small. Owing to the great difference in form and size between bananas and the other hosts, comparisons of population density are difficult.

The economic importance of alternate weed hosts is somewhat doubtful in southern Queensland. Several aspects may be considered.

It is a well-established fact that rust incidence is usually not severe on neglected plantations, especially if deprived of cultural attention for several seasons. Such areas would naturally carry a large body of weed growth. The obvious supposition that many adults emerging from the soil are diverted from banana plants to weeds is not supported by facts. Were such the case, at least some of the more commonly distributed weeds in plantations would be effective hosts. Detailed examination of the weed flora has yielded no evidence in favour of this explanation of the phenomenon.

Though the insects might travel per medium of alternate hosts across the intervening country between banana plantations, it is unlikely that this method of dispersion would have much effect on the spread of the species. Other obvious facilities for dispersion, such as the transport of infested planting material, wind, &c., would appear to be much more important. As the insect has been established in southern Queensland for many years, any marked adaptibility to native host plants would have ensured a more general distribution in the banana districts than at present.

The importance of native host plants in providing a natural reservoir for the infestation of thrips-free bananas in southern Queensland is questionable. This point must be considered in view of the possible development of methods designed to provide clean planting material. In many rust-affected areas where banana growing has declined very considerably in the last few years, much replanting will probably take place in the near future, either on land previously under bananas or on land in the vicinity. If a population of thrips has persisted on native plants, the rapid infestation of new areas established with clean planting material would be greatly facilitated. In actual practice, however, it is improbable that infestation in this way would be of any great significance. In the first place, as recorded above, *S. signipennis* does not appear to be establishing itself readily on the native vegetation. Secondly, there is no locality in which rust has previously been severe where banana culture has completely ceased. Existing plantations would, therefore, provide a reservoir of insects for the reinfestation of new plantations.

(6) Dispersion and Migration.

(*a*) *Natural Means.*—It must be assumed that, under natural conditions, *S. signipennis* is capable of a certain amount of dispersion by virtue of its habit of occasional flight in the adult stage. There is no evidence of mass migration such as occurs under some conditions in the case of *Thrips imaginis* Bagn. (Evans, 1932). A purely voluntary flight would probably cover only a few feet or a few yards but, once the insect is launched into the air, it comes under the influence of air currents. No experimental or observational data are available to demonstrate that the insects are carried over considerable distances by air currents but it does not seem unreasonable to suppose that this actually happens. The history of plantations in many localities indicates a natural method of dispersion and wind-borne flight seems the most probable. Although banana plantations are usually established in sheltered situations most of them in the southern Queensland coastal areas are sufficiently exposed for infestation to be effected in this way.

Natural dispersion by wind is probably only local in its effect. It is therefore postulated that the insects have been first introduced into various districts in southern Queensland by other means, e.g., on infested planting material, while wind dispersal has assisted in spreading them to areas of bananas in the immediate vicinity. By modifying the prevailing winds, local topography would play an important part in the direction of such dispersal. This hypothesis at least accounts for the irregular distribution of the pest in some localities where the history of the plantations does not provide an alternative explanation. Evidence to suggest that natural dispersion is rather a slow process, is found in the frequent very irregular distribution of the pest within plantations with apparently fairly uniform environmental features.

The insect may possibly be carried by flood waters as it is tolerant of a certain amount of immersion but the location of most plantations towards the headwaters of streams does not favour this method of dispersal. It may also be spread by other natural agencies, such as birds and wild animals, but the likelihood of this occurrence seems rather remote.

Natural dispersion is of importance in considering the possibility of maintaining a thrips-free plantation in an infested locality. Though exact data is lacking, there is some justification for supposing that the greater

the distance of the plantation from an infested area, and the greater the natural obstacles, e.g., timbered areas and broken country, between the two sites, the better will be the prospects of a plantation remaining free from the pest.

(*b*) *Artificial Means.*—The movement of infested planting material is undoubtedly the most important method of disseminating the pest. By far the greatest part of banana planting material consists of suckers and it is precisely on these suckers where the greatest density of population is found during the summer and where the majority of the insects overwinter. Thus, no matter what the season of the year, suckers from an infested plantation will almost certainly carry a population of thrips, in adult, larval or egg stage. It is possible, too, for soil adhering to suckers to contain the pupal stage. The paring of suckers for banana weevil borer control and the cutting back of the top as far as possible no doubt eliminates a great part of this population but these measures are insufficient to ensure clean planting material.

In the past, planting material was transferred more or less over the whole State to meet the requirements of new areas, and the occurrence of thrips in several localities has been definitely traced to the introduction of suckers from infested areas. Restrictions have for some time been imposed on the movement of planting material and they unquestionably have had, and will continue to have, a beneficial effect in retarding the spread of the pest.

The possibility of transportation in empty packing cases, either with or without packing material, is practically non-existent, owing to the inability of the species to survive for any length of time without food. This point has arisen where banana foliage, which, of course, would be very unlikely to be harbouring thrips, has been used in packing pineapples, and the cases, with the packing material, have been returned to wrong addressees, in different districts.

The carriage of adult and larval thrips on implements, clothing, &c., would naturally be of little importance and seems a very remote possibility, though earth containing pupæ is liable to be moved about with implements.

In considering all methods of dispersal, the inability of the insect to live without frequent access to food and the necessity for the close proximity of a suitable host plant must be emphasised. These two factors place severe limitations on most methods of dispersal of this pest in southern Queensland.

[TO BE CONTINUED.]

PAY WHOM?

"Farming must be made to pay," we were told. In my innocence I thought that this meant that a new and profitable era for farmers was about to begin. Now I learn from a rather cynical correspondent that what was really meant was that farmers would have to pay—more for insurance, fertilizers, stock foods, machinery, and other equipment and material. The real issue is that farming must be made to pay the farmer.—"Blythe," in *The Farmer and Stockbreeder* (England).

Some Observations on the Establishment and Management of Pastures on the Tropical Coast.

A. F. SKINNER, Field Assistant, Agricultural Branch.

Because of the widespread interest taken in the Far-Northern coastal cattle fattening project, the following notes—which are more or less in the nature of a progress report—are published.—Editor.

DURING the past two years wide interest has been focussed on the possibility of fattening beef cattle in the heavy rainfall belt of North Queensland, as it is one of the few places in the world where such a scheme has been attempted under similar climatic conditions.

The high average annual rainfall coupled with high average temperatures promotes very vigorous vegetative growth throughout the greater part of the year, and an abundance of luscious fodder is usually available at times when grasses are scarce in the drier grazing districts of Queensland.

Because of these unusual climatic conditions, much of the work so far has been exploratory, and it is the object of this article to outline those methods of establishing and managing pastures which have, so far, proved to be the most practical and economical.

Chief Pasture Grasses.

It may be said that Para grass* (known also as giant couch, *Panicum muticum,* and "panicum") and molasses grass† are best suited to the climatic conditions peculiar to the wet coastal country of North Queensland. Three major factors which qualify them for these conditions are (*a*) their capacity to make vigorous growth during the wet summer months and consequent ability to compete successfully with other rank vegetative growth; (*b*) their being perennial, a character which present evidence indicates to be essential; (*c*) their habit of forming a complete ground cover.

In the past molasses grass has been sown more generally than Para grass, mainly because of the fact that the former seeds freely and its seed is readily available, whereas Para grass seed of good germinable quality has been difficult to obtain. With a ready market for Para grass seed, greater quantities will be undoubtedly available in the future.

Para grass is favoured for the lower country, while molasses grass usually is preferred for rough or hilly scrub country.

Molasses grass is frequently sown as a mixture with Para grass because, by its quick establishment, it forms a cover and suppresses weed growth while the Para grass, in turn, is becoming established. It

* *Brachiaria mutica* Stapf.

† *Melinis minutiflora* Beauv.

also burns more readily than Para grass, and for this reason it has the advantage of ensuring a good running fire when, after the first year, it again becomes necessary to burn off. Obviously, a good secondary fire consumes much of the fallen timber and rubbish left after the original burn.

Where Para and molasses grasses are sown as a mixture, the former almost invariably takes possession after the second year. Where it is intended to establish an unmixed stand of molasses grass, great care is necessary to guard againt fierce fires, as there is a likelihood of its being destroyed if other than a quick-running fire is permitted. As to the results, much depends on the condition and density of the pastures, also the degree of moisture in the soil at the time of burning. However, as a general practice, caution should always be exercised when burning molasses grass pastures.

Plate 47.

Molasses grass pasture at eighteen months, showing Para grass in foreground. This pasture has been grazed four times.

Para grass shows a rapid change in appearance and rate of growth in accordance with fluctuating weather conditions. On hilly virgin scrub country, molasses grass makes particularly tall, dense, and succulent growth. This is relished by stock, and its fattening qualities are reflected in the condition of the animals.

Grasses suitable for sowing in admixture with Para and molasses grasses are Guinea grass,* purple-topped Guinea grass or *Panicum coloratum*.† Paspalum‡ has been tried throughout the district, but unless frequently renovated, is of little permanent value. Rhodes grass grows readily, but the stock indicate a preference for the other grasses

* *Panicum maximum* Jacq.

† *Panicum maximum* var. *coloratum*.

‡ *Paspalum dilatatum*.

and will not eat the Rhodes grass at all if it is allowed to become tall and rank; also it does not stand the competition of the stronger-growing grasses. Guinea grass is a valuable addition to the pasture, and is sought by stock. During the dry weather of October and November, 1937, it provided much grazing in mixed pastures.

Plate 48.

Para grass pasture showing stools of Guinea grass; established from cuttings after burning off scrub.

Clearing.

Scrub falling is usually commenced in October and completed not later than the first week in December. The work is almost invariably done by contract. Suitable patches of scrub are left for shade and shelter. Where possible, these are located close to water, but above flood level.

Plate 49.

A field of succulent Guinea grass 6 feet high. This grass is a valuable addition to a mixed pasture.

Little time is required for the fallen scrub to dry out sufficiently to permit of a good burn. The time of firing is important, early December being regarded as the most suitable time. If left until later, there is a risk of an early wet season delaying burning and sowing for six months or longer.

Plate 50.

A Herd of Herefords on Para Pastures on Coastal Country.—Well-established Para grass paddocks are capable of heavy stocking.

Sowing.

Where large areas are to be sown to pasture, work is usually commenced in late November or early December. Often sowing is not completed until the middle of January, the work being delayed until the beginning of the wet season to ensure a strike.

Plate 51.

Rotational Grazing is an Important Factor in Successful Pasture Management.—The paddock on the right of the picture shows the growth of grass before grazing; that on the left shows its condition after grazing.

To sow large areas by broadcasting, a gang of men is usually employed to do the work as expeditiously as possible while weather conditions are favourable. It is estimated that each man can cover

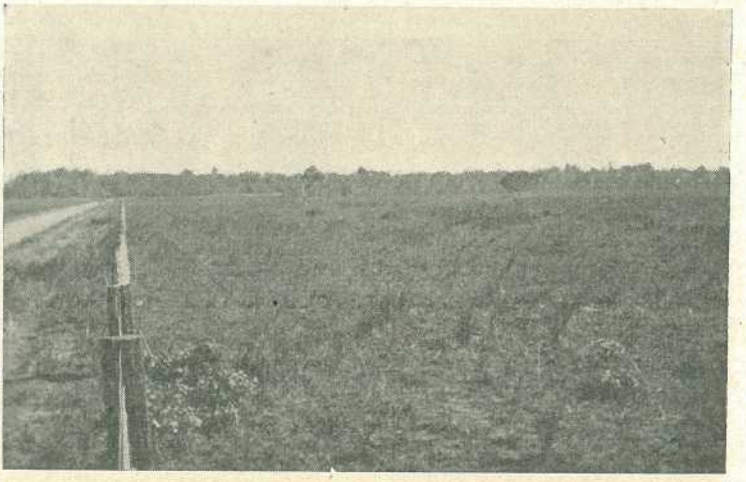


Plate 52.
This area of open country was ploughed and planted with Para grass, but received no further treatment.

3 acres of newly-burnt scrub country in a day. Molasses grass seed is sown at the rate of 2 lb. to the acre, and Para grass seed at 3 to 4 lb. an acre. This amount of seed is thoroughly mixed with a 3-bushel bag of sawdust.

Plate 53.
This paddock of Para grass was planted at the same time as the paddock pictured above (Plate 52), but was disc ploughed twelve months later. Note, for comparison, the intensity of the stand.

Planting.

On newly-burned scrub lands it is a case of sowing seed of Para grass—where seed is available—or planting cuttings by hand. In hand planting, one man digs the holes—one blow from a mattock usually being sufficient for each hole—another follows, dropping the cuttings into the hole as he goes and pulling the sod back over the cutting and pressing it down with his foot. Where it is possible to use a plough, cuttings are dropped along the furrows about 6 feet apart; in this way a quick and close cover is obtained. A second discing about twelve months later has proved a valuable way of intensifying the stand of grass.

Plate 54.

Field of Para grass and Molasses grass immediately after burning to destroy stumps, logs, and undergrowth.

Large-scale planting of Para grass cuttings is now being tested. This method can only be applied, however, to open plain country. It comprises the distribution from a motor truck of Para grass stem material which is lightly covered by means of harrows. The grass is cut by a chaff cutter with only one blade attached. By this means it is chopped into pieces of sufficient length to retain several nodes or joints. The material is distributed from a truck by two men, and is partially covered by harrows drawn behind the truck. Strips of 12 feet are covered in this way, and a considerable area can be planted in a day. The land is ploughed in October and broken down with bumper disc cultivators in November or early December. It is important that planting should coincide with the breaking of the wet season to avoid as far as possible the risk of dry weather after planting. A truck equipped with twin rear wheels and chains is required to prevent sinking on the wet ploughed ground. Under favourable conditions, Para grass cuttings will take root on the surface within several days, and the plants will grow rapidly throughout the wet season. More than one disc ploughing may be necessary, the first being made

about twelve months after planting. A second, probably, would be justified after another two years. In this way, the long runners are cut into many pieces and partially covered. An excellent stand of pure Para grass may thus be established within a few years.

Management of the Pasture.

The initial care taken in establishing either Para grass or molasses grass pasture is of great importance, and is reflected in the life and density of the stand. A close and dense cover is always the primary aim. Once established, such a pasture can stand, apparently, without injury, the heavy grazing which is at times necessary to prevent the development of rank growth.

Plate 55.
The same paddock as pictured in plate 54 three weeks later, showing the rapid recovery of the Para grass after a fire.

Following the germination of seed on a new area, it is usual to make a careful inspection and re-sow all bare patches. Early grazing is most injurious to the young pasture, as the young runners are pulled up, with the result that other grasses and weeds often gain an early footing, and may ultimately become a serious invasion of the pasture. Over-stocking during the first twelve months occurs too often. It appears that grazings should be light and brief until a complete cover is obtained and the nodes are firmly rooted in the ground.

To date, the renovation of Para grass and molasses grass pastures has not been attempted. There is little doubt, however, that, where practicable, periodical disc ploughings would prove an excellent way of intensifying the stand. In addition, such a practice probably would tend to sweeten and generally improve the quality of the grass. This work would require to be done shortly before the commencement of the wet season to ensure a rapid recovery.

In view of the low pH values of the soils in some coastal regions of heavy rainfall, it is possible that the application of lime to pasture soils would prove economical. This aspect is at present receiving attention.

Subdivision and Rotational Grazing.

The usual advantages claimed for this phase of pasture management cannot be overrated when the method is applied to the grazing of Para grass and molasses grass pastures. Stock always benefit by a change to fresh pasture, but particularly so during dry weather, when the rate of growth is slow. During the wet season frequent changes are considered necessary to take the maximum advantage of the rapid rate of growth.

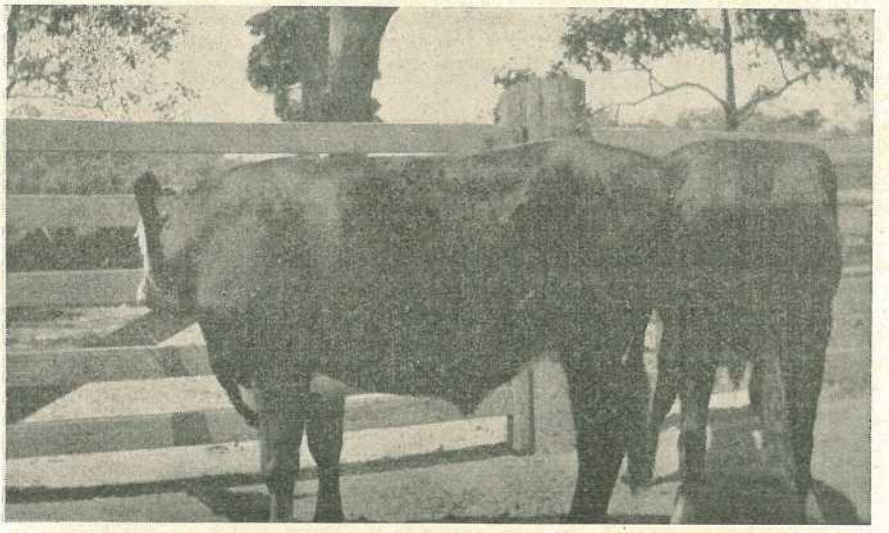


Plate 56.

Hereford bullocks approaching their final topping off on Para grass pastures.

Heavy stocking or prolonged grazing during dry weather results in considerable waste of grass through trampling, and recovery is very slow. Molasses grass, particularly, is often injured by trampling, and large patches are sometimes practically killed, permitting the intrusion of weeds and inferior grasses. There is, apparently, less risk of lasting injury from this cause to a well-established sward of Para grass.

Paddocks of from 60 to 100 acres have proved a convenient size for rotational grazing on holdings of approximately 1,000 acres. On smaller holdings, however, it is an advantage to have paddocks of about 30 to 40 acres to obtain a uniform and economical grazing of the pastures.

A THOUGHT.

The effect of cultivation upon the farmer's own mind, and, in reaction through his mind, back upon his business, is, perhaps, quite equal to any of its effects. Every man is proud of what he does *well;* and no man is proud of that he does *not* well.

—*Abraham Lincoln.*

THE WORLD'S MARKET FOR WHEAT.

The Imperial Economic Committee's annual review of "Grain Crops," just published by H.M. Stationery Office (price 2s. 6d. net, 2s. 8d. post free), shows how rapidly conditions in the world market for wheat have changed in recent years.

The world's visible stocks of wheat totalled over 32,000,000 tons at the end of the 1933-34 season. From this peak they had been so much diminished by August, 1937, that the total of 14,250,000 tons was the smallest figure for over ten years. Prices rose sharply in 1936-37 with the fall in supplies, and farmers all over the world sowed an appreciably larger area with wheat for the 1937-38 crop than in the previous season. Though there was not a proportional increase in the world production of wheat (excluding Russia and China), nevertheless the harvest was larger than in any of the three preceding seasons. Consequently, stocks this August are expected to show an increase of some 2,000,000 tons over last year, much of this increase occurring in the United States, where the wheat crop in 1937 was bigger than at any harvest since 1931. Stocks in Canada and Argentina are unlikely to differ much from the totals recorded in August, 1937, for in both countries the last crop was small, as a result of drought and frost damage respectively.

The Imperial Economic Committee's review describes the recent changes in the wheat trade of the principal countries. The United States, having bountiful supplies in the current 1937-38 season, has resumed its old position as a wheat exporter, whereas last season it was importing heavily. The Soviet Union has increased its exports, whilst Australia also has larger supplies available. On the other hand, both Canada and Argentina have only a small exportable surplus. Last season Italy and Germany were large importers. This season Germany has again been importing on a considerable scale. Italy's immediate import requirements were less because of the large harvest reaped in 1937. In some parts of Europe, notably in Italy, the harvest from the 1938 crop is likely to be comparatively small, due to adverse weather this spring; larger imports may therefore be necessary. In the Far East hostilities have curtailed imports.

As to the future position, the review draws attention to the fact that in few parts of the world has there been any indication that the area devoted to wheat for the 1938-39 crop will be substantially reduced as compared with the last sowings. Since last autumn the price of wheat has shown a downward trend, and recently the decline has been rapid, due very largely to the prospect of a bumper harvest in the United States this year. It is too early yet to judge what the final outturn will be, but it seems that the world crop, providing the harvests are normal, may be substantially larger than the demand, even if the European demand is stimulated by government purchases to build up reserves of wheat against possible emergency needs.

The review also covers barley, oats, maize, rye, and rice. It forms a convenient source of information on world cereal production and trade in the years 1930-37, and particularly on the part played by British Empire countries. Special sections deal with the net trading position of the Empire, imports into the United Kingdom, the trend of prices, and on customs duties and import restriction in the chief European importing countries.

THE BRANDING OF STOCK.

The attention of stockowners is directed to the necessity for following the rules of branding, especially in regard to re-branding.

The Brands Act provides that the second or subsequent brander must, if there is room, imprint his brand on his stock at a distance of not less than 1½ inches nor more than 2½ inches from and directly underneath the previous brand.

If there is not room, the re-branding must be done on the next succeeding position, *and on the same side of the animal as the preceding brand in the case of cattle*, thus confining the branding of cattle to one side.

The size of all brands is restricted to not less than 1½ inches in length, or more than 2½ inches in length for horses and cattle.

Owners are advised to note their obligations in these matters, the observance of which will help to lessen the present unnecessary deterioration of hides through excessive and incorrect branding.

Milk Grading Tests.

M. J. GRIFFITHS, B.Sc. (Dairying), Dairy Research Laboratory.

THE METHYLENE BLUE TEST.

FOR the determination of the hygienic quality of raw milk samples, the Methylene Blue Test (known also as the Methylene Blue Reduction or the Methylene Blue Reductase Test), has been found to be a very useful method of grading. It is of special value where milk from many different sources is received, either for human consumption or for cheese making purposes, for it enables the grader to classify the supplies more accurately than is possible simply by smell and taste. It will not, of course, take the place of the usual regular inspection and grading of the milk, which must always be carried out by a qualified grader on the receiving platform. No amount of description and no scientific test at present known can replace the practical knowledge gained by long experience of grading milk and dairy products, and it is therefore essential to the making of a good grader that he should spend as long a period as possible training under the instruction of an experienced man.

Advantages of the Methylene Blue Test.

1. The Methylene Blue Test carries grading a step further than is possible by judging the aroma and palatability only of the milk.

2. It is a fairly rapid test, taking only a few hours to complete, so that a report or complaint can be made to the farmer when he next delivers milk.

3. The cost is very small, once the necessary apparatus, which is not expensive, has been purchased.

4. It is of great value to the cheesemaker, for a fermentation test can be made on the same samples of milk, showing the type of curd which each will form.

5. Unlike other methods of estimating the amount of contamination in milk, it is easily carried out under factory conditions by a worker with no special technical knowledge. The Plate Count method and the Direct Microscopic Count, by which the numbers of bacteria may be found, both call for skill and special training for their performance, and laboratory facilities are necessary for the former. These tests are used by the bacteriologist when he wishes to discover—

(*a*) The actual numbers of living bacteria present;

(*b*) The types of the bacteria present.

Explanation of the Methylene Blue Test.

The Methylene Blue Test is so called because it depends on the decolourisation of a known quantity of the dye, methylene blue, by the action of bacteria which absorb the dissolved oxygen in the milk at a rate roughly depending on the number present. When the oxygen has been completely used up, the colour disappears, and it is the time taken for this stage to be reached which indicates the extent of bacterial contamination of the milk. The action is hastened by raising the temperature, so that a standard temperature has been fixed at 37 deg. C., and the test is conducted in the dark on account of the methylene blue being slightly affected by light.

Practical Directions for Carrying Out the Test.

A. *Apparatus required.*

1. A water bath, fitted with a lid and test tube racks, capable of maintaining a constant temperature of 37 deg. C. (98 deg. F.)

2. An accurate thermometer.

3. Test tubes (6 in. x $\frac{5}{8}$ in.) with a mark at the 10 ml. level. (Plain tubes may be used and the milk measured by means of a 10 ml. pipette. This must, of course, be rinsed in cold and then boiling water between each test, which is tedious, and therefore the pouring method, in which there is no risk of contamination, is to be preferred.)

4. Rubber stoppers to fit test tubes.

5. Standard Methylene Blue Tablets.*

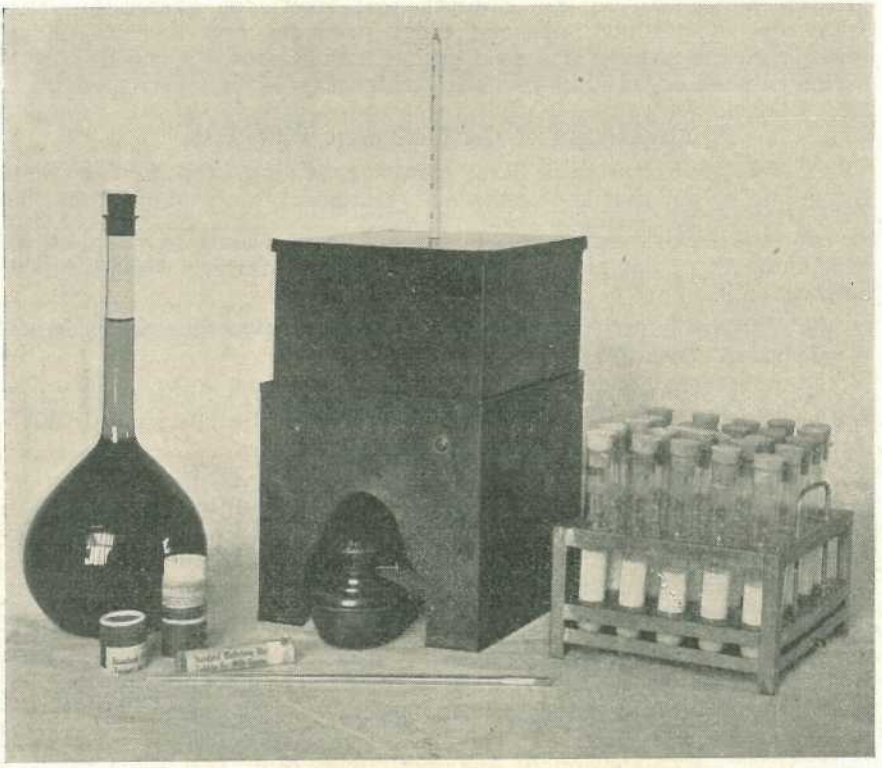


Plate 57.
Apparatus needed for carrying out the Methylene Blue Test in the factory, using a kerosene lamp.

6. A 1-ml. pipette for measuring Methylene Blue solution.

7. An 800-ml. measuring flask for use in making up the Methylene Blue solution, and a rubber stopper to fit.

* The names of firms supplying apparatus and Standard Methylene Blue tablets will be supplied on application to the Department of Agriculture and Stock, Brisbane.

B. *Factory Sterilisation of Water and Apparatus.*

Distilled or tank water, for making up the standard solution, may be sterilised by boiling for five to ten minutes and allowing to cool in the same vessel.

Measuring flask, test tubes, corks, and pipette may be sterilised in a steam chest or by boiling in water for five to ten minutes. The tubes should be placed upright in their rack and filled to the brim with clean water, before immersion for boiling. The corks may be tied in a piece of clean muslin. The apparatus should be sterilised immediately before use, and allowed to drain dry.

C. *Making up the Standard Solution.*

It is essential that Standard Methylene Blue Tablets be used in carrying out the test. These are prepared by certain firms only and are sold in packets containing twenty tablets (sufficient for 16,000 tests).

Dissolve one tablet in about 200 ml. of cold sterile distilled water in the 800-ml. measuring flask, by shaking, then fill up to the mark.

This stock solution, when corked and stored in the dark, will keep for periods up to two months. It should not be used after this.

D. *Regulation of Water Bath.*

The water bath should be filled some time before the proposed commencement of the test, with water at about 37 deg. C. The temperature should be checked several times at intervals to make sure that it will remain steady at 37°C. during the test.

The level of water outside should be above or equal to that of the milk inside the tubes.

E. *Sampling.*

Samples should be as far as possible the same age at testing, so that separate morning's and evening's milk samples are advisable rather than one sample of mixed milk.

As with all bacteriological samples, special precautions must be taken to exclude contamination. If sample bottles and corks or screw-tops are used, they must be sterilised by heat prior to use. Care must then be taken not to handle the mouth of the bottle or to touch any part of the cork other than the top ¼ inch, and the bottles must not be opened until just before filling and must be closed immediately afterwards.

A composite sample is taken to include a proportional amount of milk from each can received. This may best be done with a cream sampler of the long-handled saucer type, with which the stirring and sampling may be carried out in one operation and the milk placed in a sterile bottle. Alternatively, the cans may be stirred with a plunger, and a small dipper used to extract the sample. This makes it possible to place a proportion of milk direct in the sterile test tube.

Two samplers (or dippers and plungers) should be available. They must be sterilised for two minutes or more in a jet of live steam, or for ten minutes in boiling water, before use. They can then be used for alternate samples, one set being rinsed thoroughly in cold water then in boiling water, while milk is taken with the second set.

Sampling direct from the weighing vat is not satisfactory for milk intended for bacteriological tests.

F. *Method of Testing.*

When all samples have been taken, each is shaken thoroughly and a 10-ml. quantity is poured into a sterile test tube, or, if bottles are not used, this quantity is poured direct from the dipper. To this is added 1 ml. of Standard Methylene Blue solution, and the tube corked with a previously boiled rubber cork. The test tube is then gently inverted two or three times to mix, and placed in the covered constant-temperature water bath at 37 deg. C. (98 deg. F.). After thirty minutes the tubes are removed for inspection, and each is inverted once to distribute the cream, and replaced in the water bath. This is done every half-hour. Any samples which have decolourised entirely, or to within 5 millimetres (one-fifth of an inch) of the surface, are removed and the time noted. This is the end of the test.

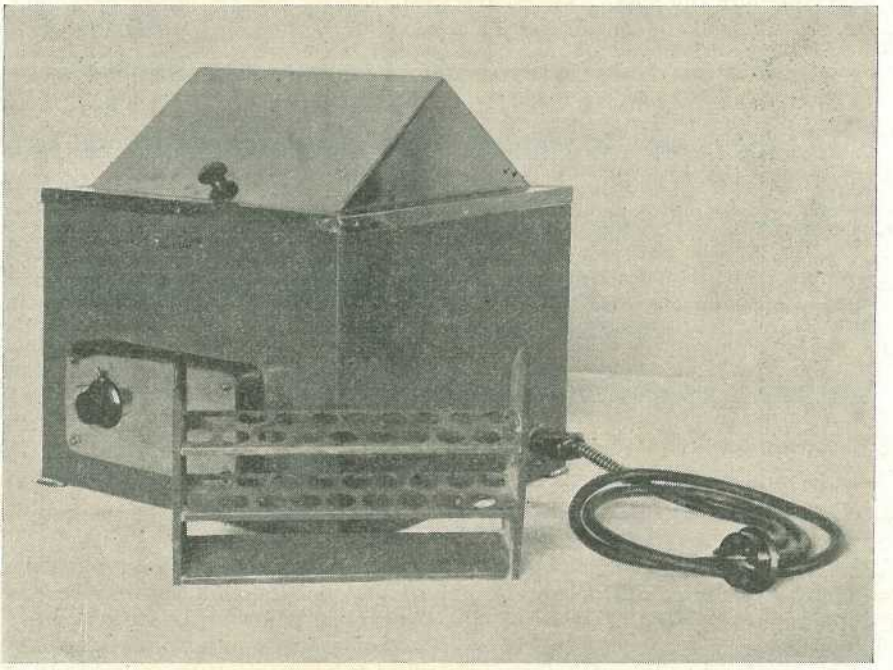


Plate 58.
Electrically-heated and controlled Methylene Blue Test Water Bath for Laboratory use, showing one test-tube rack.

Interpretation of Reduction Times.

A slow reduction time indicates comparatively little bacterial activity and therefore a cleanly produced and handled milk. Rapid bleaching indicates large numbers of bacteria and lack of care in production, with a consequent shortened keeping quality.

Thus it is possible to divide the supplies into three or four classes, similar to those given below:—

Time taken to decolourise.	*Grade of milk.*
30 minutes or less	.. Bad
30 minutes to 2 hours	.. Poor
2 to 5 hours	.. Fair
Over 5 hours	.. Good

No hard-and-fast rule can be laid down, but after some experience with the test the grader is able to set a standard to which most of the supplies in his locality will conform. Attention can then be given to improving those which fall below the highest grade.

Here again, in interpreting the results, the grader must take into consideration the age of the milks being tested. Evening's milk, which may be twelve to fifteen hours old before it is tested, is not to be compared with the morning supply, which is perhaps two to five hours old.

In milk sampled and tested only a short time after being produced, the natural bactericidal property common to all freshly-drawn milk will still be active and will assist in lengthening the reduction time, by preventing, to some extent, the multiplication of the bacteria. This resistance disappears after a few hours, and there is then a rapid rise in numbers and activity.

Regular testing of each supplier's milk should be carried out. Twice-monthly samples, taken without warning to the farmer beforehand, tested over several months, will give a good idea of the average quality of each.

The Methylene Blue Test has been used largely in Scandinavian countries and in America for grading milk. It was adopted in England in January, 1937, to replace the Plate Count as the official method of testing all Accredited milk to be sold for human consumption. It is less suitable for use with pasteurised milk owing to a number of factors, but for comparative grading of raw milk it is a cheap, reliable method which can be of assistance to the factory in eliminating the undesirable milk and selecting the best, and to the whole industry by stimulating the production of milk under better hygienic conditions, which forms the basis of a higher standard in dairy products. It is too often forgotten that consistently high-quality butter and cheese, as well as liquid milk, cannot be produced unless the original milk supply is also of good quality, and that a low-grade supply will bring down the standard, not only of any milk with which it may be mixed, but also of the resulting product.

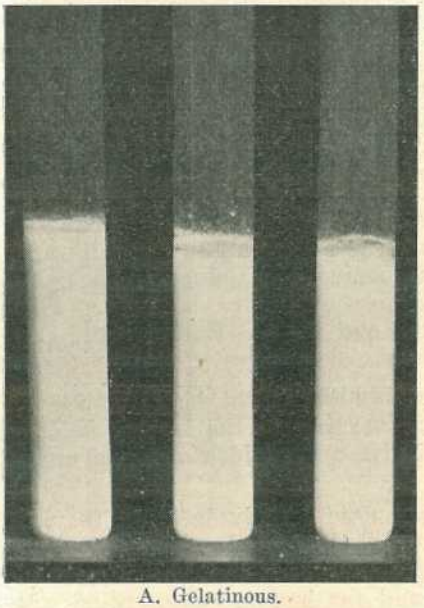
FERMENTATION TEST.

If a fermentation test is to be conducted, the tubes are replaced in the water bath after noting the reduction time, and allowed to remain overnight at 37 deg. C. The milk will have coagulated by next morning, and the plug of curd may be inspected for smoothness, freedom from gas-holes, undesirable aromas and wheying off. A good milk for cheese-making purposes will show a clean, smooth curd with a pleasant acid smell, while the presence of peptonisation or of gassiness indicates unclean production conditions, with the possibility of tainted and gassy cheese.

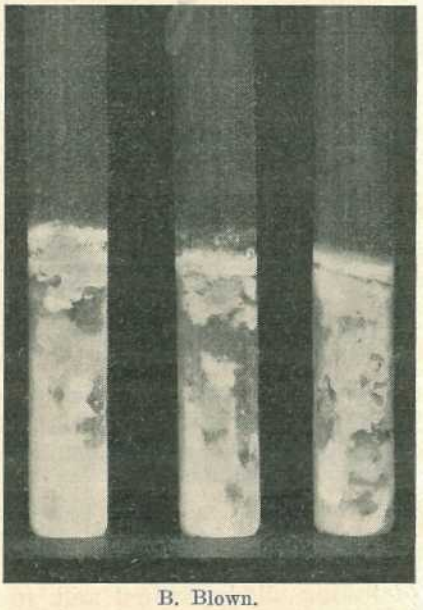
The types of curds most commonly met with (See Plate 59) may be classified according to the kind of bacteria predominating:—

Gelatinous.—Even smooth curd without gas bubbles: due to desirable lactic acid types.

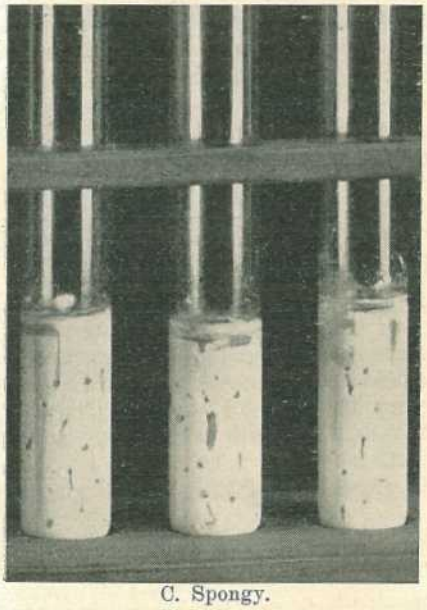
Blown.—Gassy with curd collected towards the surface, and whey beneath: due to undesirable acid and gas-producing types, coliform organisms.



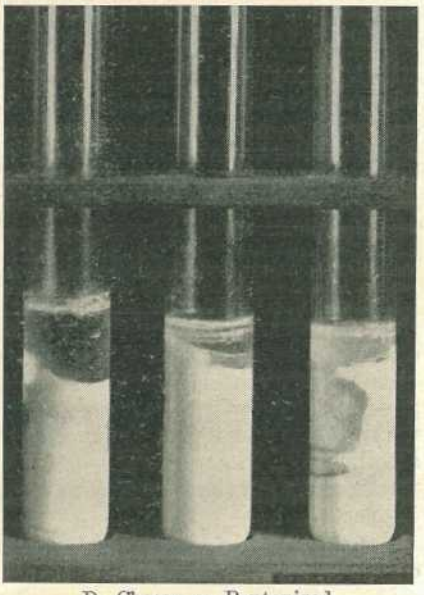
A. Gelatinous.



B. Blown.



C. Spongy.



D. Cheesy or Peptonized.

Plate 59.

COMMON TYPES OF CURD OBTAINED IN THE FERMENTATION TEST.

Spongy.—Gassy, with fine bubbles distributed throughout curd, little or no separation of whey: milk containing few desirable lactic acid types and gas-forming organisms predominating.

Cheesy or Peptonised.—Solid curd, with clean separation of whey: due to the presence of bacteria secreting rennet, not to acid-producing types.

This test may, of course, be carried out quite separately from the Methylene Blue Test, in which case the milks should be judged after twelve, twenty, and twenty-four hours.

In actual practice distinction is only made between the very objectionable blown and gassy types and the other classes, but the fermentation test is an additional aid to the cheesemaker in grading his milk supplies, and in selecting the milks having clean lactic acid rather than those showing other changes.

[TO BE CONTINUED.]

THE STRAINING OF MILK.

On the most carefully managed farm, a certain amount of visible dirt finds its way into the milk. The term "visible dirt" covers such matter as dust, cow hairs, flies, and manure, as distinguished from bacteria, which are not visible to the naked eye. Bacteria may be present in milk which appears perfectly clean, fresh, and pure—and their presence may not be realised until souring begins several hours after contamination. If visible dirt is present in the milk, however, bacteria will be there also, hence the necessity for straining through a suitable strainer. The cotton wool disc type prescribed by the Dairy Regulations is preferable to any other. It can only be used once, and there is no risk of contaminating fresh supplies of milk, as sometimes happens with a cloth strainer which has not been properly washed and boiled.

It is better to keep visible dirt out of the milk than to strain it out. Early straining is better than last-minute straining, for the longer dirt is allowed to remain in the milk the greater will be the number of organisms passing into the liquid. The progress may be understood more clearly by a rough analogy with making a brew of tea. If the tea leaves are removed soon after the addition of the hot water, the tea remains weak. If they are stirred in the teapot, or left for any length of time, the brew becomes much stronger. Similarly, if dust and dirt are left in the milk, undesirable bacteria, with which every particle of dirt is teeming, pass into the milk and increase the tendency to early scouring and bacterial taints.

The milk from each cow should be removed immediately milking is completed and tipped through the straining disc into the can or better still direct into the receiving tank above the cooler. It will not require a second or even a third straining, for one straining, together with proper cooling, will be sufficient to lengthen the life of the milk and help to give it a satisfactory keeping quality.

—*M. J. Griffiths.*

A Plant Poisonous to Sheep.*

R. E. CHURCHWARD, B.V.Sc., Government Veterinary Surgeon, and
E. H. GURNEY, A.A.C.I., Agricultural Chemist.

IN cases where mortalities in sheep have occurred and plant poisoning is suspected, it is the practice of stockowners and field officers of the Department of Agriculture and Stock to collect and forward to the Government Botanist specimens of the plants growing in the paddocks in which the mortalities took place. On a number of occasions the plant, *Andrachne decaisnei*, has been included. A collection of plants from a certain railway trucking reserve where frequent mortalities in mobs of resting sheep had occurred was found to include *Andrachne decaisnei*. The matter was brought before the Poison Plants Committee† of the Department of Agriculture and Stock and the Committee decided that as the plant was known to contain a poisonous principle (prussic-acid-yielding glucoside) it was desirable to undertake chemical and feeding tests with the plant in order to determine the quantity of the poisonous principle present and how far, if at all, the amount varied with different periods in the plant's growth.

Botanical Description.

Andrachne decaisnei is a native plant 9 to 15 inches high, inclined to be woody in its older stages. It is generally much branched and the branches and leaves are clothed with fine hairs. The leaves are $\frac{1}{2}$ to $\frac{3}{4}$ inch long. The flowers are very inconspicuous and are soon followed by seed pods, which are borne in great abundance. These are like a small flat pea about $\frac{1}{8}$ inch diameter, and are thinly clothed with fine hairs. The seed capsules when ripe burst into three pods each containing two seeds; these latter being triangular in shape, straight on the sides and curved on the back. Both back and sides of the seeds are strongly wrinkled. No common or local name for the plant has been recorded.

Experience of Field Officers.

On 17th March, 1938, Mr. C. C. Barth, District Inspector of Stock, Longreach, reported that he visited a shed where shearing was in progress. On 16th March a number of shorn sheep had been turned into a small paddock for a few hours prior to being moved into a larger paddock. This small paddock adjoined the shearing-shed, and contained only *Andrachne decaisnei*, all the other herbage having been previously eaten. On the following day the owner of the shorn sheep found eight ewes dead, and Mr. Barth was of the opinion that *Andrachne decaisnei* appeared to be responsible for their deaths, though possibly this was from effects associated with the shearing of the animals. He also stated that probably the sheep were hungry and ate a quantity of the plant which, under normal conditions, they appear to avoid.

Mr. Barth subsequently reported that he had observed, later in the season, a small paddock which contained about 4 acres of *A. decaisnei* without any other form of vegetation. A number of shorn sheep were

* *Andrachne decaisnei.*

† A committee established by the Department of Agriculture and Stock as the result of a grant from the Australian Wool Board for the purpose of conducting investigations into plants suspected of being toxic to sheep.

turned into this paddock and within two days the sheep had eaten all the plant. No mortalities occurred in this flock and Mr. Barth, in view of his previous observations on the plant, stated that the plant appears to vary in toxicity.

Mr. Bambrick, Inspector of Stock, Hughenden, has advised that from his observations it would appear that as *A. decaisnei* grows it gradually loses its toxicity. When young it is toxic to any class of stock but after maturing it is only sufficiently toxic to cause death to hungry stock. The leaves of mature plants, eaten in conjunction with other feed by paddock stock cause no ill-effects. When eaten by hungry travelling stock, at any stage of growth, in even small quantities, it will cause death.

Chemical Analyses.

In order to ascertain whether any variation occurred in the amount of the poisonous principle (prussic acid or HCN) given off by the plant when eaten—as suggested by the observations of field officers—arrangements were made for supplies of the plant, at different stages of growth, to be forwarded to the Agricultural Chemist for analyses.

A supply of the plant collected on the 17th March by Mr. Barth at Longreach was analysed and showed that younger plants gave 86·3 mgms. HCN per 100 grams moisture-free plant, while older material gave 63·3 mgms. HCN per 100 grams moisture-free plant. These analyses proved that both plant samples contained, at this time of the year, enough of the poisonous principle to cause mortalities in stock if eaten freely.

A second sample of the plant collected on the 25th June, again by Mr. Barth, was analysed. The younger plants gave 38 mgms. HCN per 100 grams moisture-free plant, fully matured plants (old plants with some seeds fallen, some of the plants green and others dry) gave 17·3 mgms., and mature plants before reaching the drying-off stage gave 22·1 mgms.

These chemical analyses support the observations of field officers in regard to decrease in toxicity of the plant as it matures.

Feeding Tests and Drenching Experiments.*

First Test.—The initial feeding trial with the plant was commenced in April with material supplied by Stock Inspector Bambrick, of Hughenden. Two sheep (Sheep Nos. 8 and 14) had already been starved for twenty-four hours when the material arrived.

Sheep No. 8.—On the 13th April this sheep was force fed ½ lb. of the chaffed plant (leaves, fruit, and finer portions of the stem). On 14th April, the animal appeared normal and was then drenched with 750 ml. of a watery extract of the chaffed plant. This extract was prepared by soaking 1 lb. of the plant in 1 litre of water overnight and expressing the fluid through a plant press.

One hour after drenching the animal became uneasy and sudden contractions of the diaphragm and various groups of muscles were noticed. The animal had trouble in maintaining balance, especially behind, and its hind legs were set well apart in an effort to stand.

* These experiments were carried out at the Animal Health Station, Oonoonba, Townsville, by Mr. R. E. Churchward, B.V.Sc., Government Veterinary Surgeon.

Plate 60.
A PLANT POISONOUS TO SHEEP (*Andrachne decaisnei*).
(For description, see page 183.)

Breathing and pulse rate were accelerated with the former laboured. After an hour and a-half the animal was unable to stand and sat down "dog fashion" and finally collapsed on to its side. Convulsive movements were frequent and the animal was greatly distressed. After two hours the eyes became bloodshot and it appeared as though death would shortly occur. Later, spasms became less frequent and breathing approached normal. After five hours the animal was able to rise with help and maintained an upright position though somewhat unsteadily.

Sheep No. 14.—On 13th April this sheep was offered chaffed plant but did not consume it. On 14th April the animal was force fed ¾ lb. of the chaffed plant. This animal showed no ill-effects from the feeding.

Both Sheep No. 8 and No. 14 were kept under observation for a further five days but neither exhibited any ill-effects.

Second Test.—This test was carried out with further material submitted from the same district as the material used in the first test, but the sample on this occasion appeared somewhat more mature and in a fresher condition. It was noticed that on removal from the container there was a strong odour such as one finds with plants containing a high percentage of HCN (prussic acid).

Sheep No. 3.—On the same day as the plant was received this sheep (approximately 100 lb. live-weight) was force fed with the chaffed plant. Before the feeding had finished the animal was showing signs of discomfort and for this reason feeding was discontinued when less than 1 lb. had been taken. The animal soon exhibited symptoms as seen in Sheep No. 8 and within fifty minutes of the beginning of feeding the animal died.

Post-mortem of Sheep No. 3.—A post-mortem was carried out immediately, with the following observations:—

Much gas formation in the first stomach (paunch) with evidence of prussic acid poisoning in certain tissues and abnormal appearance in certain blood vessels. The fourth or true stomach was slightly congested. The intestines appeared normal but there was slight congestion of the kidneys and lungs. Plant was found in first stomach only. About 20 mls. of fluid was drained from the heart sac. The heart was very dark in colour and there was evidence of hæmorrhage in the heart muscle.

Picrate test for HCN:—

First stomach contents gave a strong (++) test.
Fresh plant gave a very strong (+++) test.

Goats.—1,000 grams (approximately 2 lb.) of the chaffed plant was soaked in 1 litre of water overnight. A male goat was drenched with ½ litre of the fluid pressed out of this mixture and died within thirty minutes, showing symptoms similar to those exhibited by Sheep No. 8 and No. 3.

DESCRIPTION OF PLATE 60.

Andrachne decaesnei, Benth.

A. Shoot, natural size.
B. Seed capsule with perianth leaves at base x 6.
C. Seed capsule with perianth leaves viewed from top x 6.
D. Seed enlarged x 20.

Post-mortem Examination.—The examination showed abnormalities varying little from those exhibited by Sheep No. 8. The fluid in the fourth stomach gave a positive test for HCN by the picrate method.

A female goat was force fed 150 grams (roughly 5½ oz.) of the chaffed plant but except for a slight unsteadiness of movement, together with laboured breathing, the animal remained normal.

Prevention of Cases of Poisoning.

In view of the dangerous nature of the plant stockowners, and particularly drovers, should make themselves familiar with it in order that sheep, especially hungry animals, can be prevented from gaining access to young growth of the plant.

It should be remembered that even the mature plant is dangerous for hungry sheep.

Conclusions.

1. *Andrachne decaisnei* contains a prussic-acid-yielding glucoside.

2. This varies with the stage of growth of the plant. Plants are most dangerous when young, becoming less harmful, except for hungry sheep, when mature—i.e., showing seed pods.

3. Sheep and goats fed about 1 lb. of the plant for every 100 lb. of live-weight die showing typical prussic-acid poisoning symptoms.

4. Post-mortem examinations confirm the supposition that death was due to poisoning by prussic acid.

Acknowledgments.

These experiments were made possible by a grant from the Australian Wool Board to the Department of Agriculture and Stock for the purpose of conducting investigations into plants suspected of being toxic to sheep. The assistance of the Wool Board is greatly appreciated by the Department.

It also is desired to acknowledge the assistance of officers of the Department who contributed to this work.

WINTER-GROWING RHODES GRASS MAY CAUSE STOCK LOSSES.

Although warnings that the so-called winter-growing or frost-resistant Rhodes grass is a potential source of danger to grazing stock have previously been issued, some farmers may not yet be aware that this grass should be grazed with caution. Winter-growing Rhodes grass should not be confused with the more common Rhodes grass which makes a very valuable pasture.

The prussic acid content of winter-growing Rhodes grass has been determined in samples collected both in Queensland and in New South Wales, and the quantity found was sufficient to indicate that the grass may sometimes be toxic to animals. Little is known about the conditions under which stock losses due to ingestion of the grass may occur, and stockowners are advised to be very careful when paddocks of the grass are being grazed.

In districts where high-yielding winter-growing grasses and clovers can be grown, the use of the winter-growing Rhodes grass for grazing purposes is not recommended.

—*C. W. Winders.*

Mosaic Disease of Sugar Cane.*

C. W. LEECE.

MOSAIC disease is one of the most widely spread diseases of sugar-cane in the world, and is one with which canegrowers in Central and Southern Queensland should be familiar. It is, however, a disease which has never received quite the full amount of attention that it deserves from farmers, and consequently it is possible that the losses resulting from it in Queensland are under estimated. In view of its widespread distribution in this State and the cultivation of many susceptible varieties it is desirable that farmers should have an adequate knowledge of the disease, and thus be in position to initiate any necessary control measures.

In many countries overseas, mosaic disease constitutes a major problem and very heavy losses have been recorded. In Puerto Rico in 1920, the sugar industry was threatened with extinction in consequence of the ravages of the disease. The same position arose in Louisiana in the Southern United States about five years later. In the Argentine, the West Indies, and in other countries strict control measures have had to be applied in order to avoid serious losses. In Louisiana the existence of different strains of the disease has been recognised, and a variety resistant to one strain may be susceptible to another, and may vary again in its reaction to a third. It is difficult to say just in which manner these strains arise, and cane breeders in Louisiana have been faced with the problem of breeding varieties resistant to all strains as part of the campaign to control the disease.

In Queensland, mosaic disease is very rarely seen in the wet tropical areas north of Townsville. Infection is, however, distributed throughout the Proserpine, Mackay, Bundaberg, and more southern districts, the most severely affected areas being foothill country and river flats, where secondary spread of the disease is rapid.

Mosaic is a virus disease, as is Fiji disease. The characteristic symptoms exhibited by an infected cane take the form of a mottling of the leaves, due to the formation of pale areas of irregular outline, with the long axis of these areas lying parallel to the midrib of the leaf. They may sometimes approximate to oval shape, but are never sufficiently well defined to allow any other term than "irregular" to be applied. They are distributed all over the leaves, and are usually yellowish-green in colour, but may vary from creamy white to pale green, and are seen in contrast to the normal green of the leaf. Variation in colour and shape of the pale areas depends on the particular variety affected and on other factors. The greatest contrast between light and dark areas is noticed on the youngest leaves, the older leaves having a tendency to become uniform in colour again. There is no marked tendency towards streaking, although large chlorotic areas sometimes run together and give a streaking effect. Because of this apparent streaking mosaic disease was originally termed "yellow stripe" disease, but the latter name was subsequently abandoned on account of the fact that the streaked effect was by no means always a characteristic. Symptoms are usually exhibited by all leaves attached to one particular stalk, and the number of obviously diseased stalks in a stool varies from one to all.

* Reprinted from *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations, Department of Agriculture and Stock) for July, 1938.

The accompanying illustration shows two diseased leaves, one young and the other an older leaf borne on the same stalk of E.K. 28.

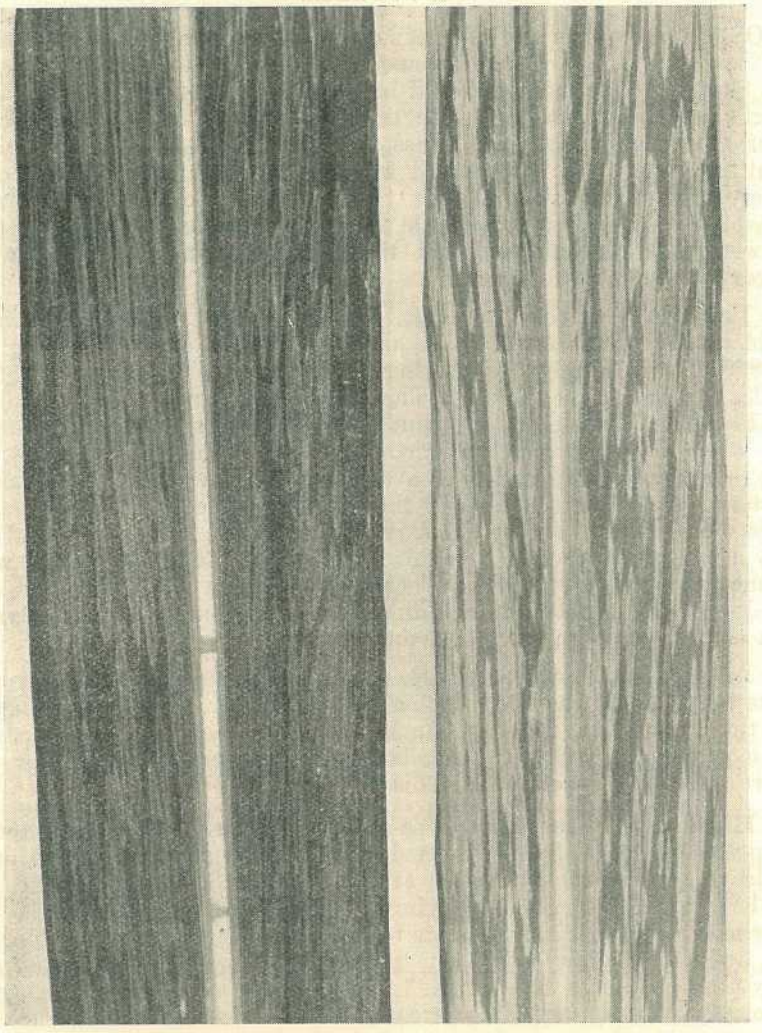


Plate 61.

Mosaic disease. Leaves of sugar-cane variety E.K. 28 bearing the typical mottling produced by mosaic disease. On the right is a young leaf, and on the left an older leaf, both taken from the same cane stalk.

The effects of the disease vary with the variety, as some varieties are more susceptible than others. If a healthy, growing, cane becomes infected, there may be little diminution in growth, as in the case of P.O.J. 36; on the other hand, if Q. 813 contracts the disease there will be a very marked stunting. In the ratoon crop there will certainly be marked stunting and poor stooling if the variety is by any means susceptible; the stalk will be shorter and thinner, and fewer stalks will be produced in a stool. A mottling similar in pattern to that on the leaves may appear on the rind, and small cankers of various types may

also be present. If a diseased sett is planted a stunted stool results, and this never regains normal vigour. Resistance to adverse conditions such as prolonged dry weather is lowered, and death of the stool may result.

The most susceptible varieties are 1900 Seedling, Clarke's Seedling, M. 189 (Black Innes), E.K. 28, B. 208, and D. 1135. P.O.J. 213 and P.O.J. 234 both contract the disease very readily, but are less sensitive than the firstnamed varieties, and losses are not so great. Badila and Oramboo are also susceptible. Resistant varieties are P.O.J. 2714, P.O.J. 2725, and P.O.J. 2878.

So far, the effect of mosaic on Co. 290 has varied according to locality. A fair amount of infection has been observed in one part of the Mackay area, but the variety appears to be tolerant elsewhere. The existence of different strains of the disease in Louisiana has been mentioned, and it is possible that new strains are beginning to develop in Queensland. It is therefore very desirable that every effort be made to control the disease before any new strains become dominant, and thus add to the complexity of the problem.

The disease is infectious, and is transmitted from plant to plant by the corn aphis, *Aphis maidis*, a small dark insect. This insect is not normally a feeder on cane, and never breeds on it. It is, however, the chief means of transmitting the disease. Experimentalists have succeeded in inducing mechanical infection by placing a diseased leaf above a healthy one and pricking both leaves simultaneously with a needle. A piece of stem tissue taken from a diseased cane has also been used to infect a healthy cane by making a hole in the latter and inserting therein the diseased tissue. Another worker has obtained diseased stools by cutting healthy cane with a knife which has previously been used to cut diseased cane. However, mechanical transmission need not worry the farmer, whose chief concern is the control of the corn aphis.

The corn aphis is most common during the summer and autumn, and it is then that most natural transmission will take place. Since young canes are more easily infected than older ones, the young spring plant cane is in a condition favourable for contracting the disease just at the time when the aphis is most plentiful.

Mosaic disease is not confined to sugar-cane. Maize, sorghum, Sudan grass, and certain other grasses, both wild and cultivated, are also liable to contract the disease, and thus act as a source of infection for canefields. Moreover, the corn plant is a natural breeding ground for the insect, and it is therefore inadvisable to have corn and cane growing in close proximity to each other.

Since losses due to mosaic disease may be of considerable importance if the disease is allowed to remain unchecked, the farmer is recommended to utilise the following methods of control:—

(1) Make regular inspections of fields, following these by digging out diseased stools.

(2) Select planting material carefully, using only those plants taken from disease-free stools.

(3) Keep all headlands and fields as clean as possible, and free from weeds and grasses, which are also liable to harbour the disease and the corn aphis, which spreads it.

(4) Avoid the cultivation of maize and sorghum. If it is necessary to cultivate these crops isolate the blocks as much as possible. The corn aphis is unable to breed on sugar-cane but multiplies very rapidly on the maize plant.

(5) Carry out planting operations in the autumn where practicable, rather than in the spring. The corn aphis is most common during the summer and autumn, and the young spring plant cane constitutes ideal material for infection.

(6) Cultivate resistant varieties if other control measures fail to keep the present varieties reasonably free from disease.

CANE SAMPLES FOR TEST PURPOSES AT EXPERIMENT STATIONS.

Attention has been drawn on several occasions to the conditions which must be observed by canegrowers desirous of having cane sample tests made by our Experiment Stations, for the purpose of determining the state of maturity of their crops, and thus giving an indication of the sequence in which respective blocks should be harvested.

Each sample shall consist of six stalks or 20 lb. of cane, whichever is the greater. Samples of burnt cane will not be accepted in any circumstances. When samples are forwarded over the railway, freights must be paid. By special arrangement with the Railway Department, test canes are consigned at a flat rate of 1s. per bundle. Where facilities for prepayment of freight are not provided, the grower should reimburse the Experiment Station by forwarding 1s. in postage stamps, enclosed in a brief letter advising that the canes have gone forward.

It should not be necessary to point out that the results of our Station tests are never intended for use in checking mill returns; for this purpose they are quite misleading and worthless.

H.W.K. in *The Cane Growers' Quarterly Bulletin.*

NEED FOR LIME ON ACID SOILS.

It is evident that many canegrowers still fail to grasp the necessity for applying adequate dressings of lime to those lands which are intensely acid. Under these conditions, the benefits of artificial manures will not be obtained until the acids have been neutralized or "killed" by lime.

We are forcibly reminded of this by the results of nine soil samples submitted to our laboratory recently by the Instructor in Cane Culture at Innisfail. Each was taken from a field where crop growth was poor, and in all cases our tests showed that the soils were in need of heavy applications of lime. In many instances the plantfood supply of the land was quite fair, but the acid condition of the soil dominated the growing conditions.

Canegrowers in the heavy rainfall areas—from Mossman to Ingham—and notably those farming other than red volcanic soil, should communicate with their local Instructor in Cane Culture for the purpose of having tests made: or a sample representative of each block to 10 in. depth may be sent, to the Director, Bureau of Sugar Experiment Stations, Brisbane. This service is given free of charge.

H.W.K. in *The Cane Growers' Quarterly Bulletin.*

Downy Mildew Disease.*

A. F. BELL.

DOWNY mildew, together with Fiji disease, constitutes the chief menace to the cultivation of the high-yielding P.O.J. canes. It is a very destructive disease and cane farmers who grow P.O.J. canes, B.147 or B.208, should always be on the watch for it.

Plate 62.

Downy Mildew.—Leaves of cane plants affected with this disease bear well-defined, long, yellow stripes; occasionally the leaves may be completely yellowish. On the under surface of diseased leaves may be borne (especially in wet weather) a powdery white fungus or "mildew." This figure illustrates the leaf stripes while the appearance of the mildew (magnified) is illustrated in the inset.

The early symptoms of downy mildew consist in the production of long yellowish stripes on the leaves and hence the name "leaf stripe" has often been applied to this disease. Stripes vary in width, from fine lines up to about ¼ inch, but individual stripes are uniform

* Reprinted from *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations, Department of Agriculture and Stock) for July, 1938.

in width. Later the stripes turn reddish and the leaves die prematurely. On the under surface of such leaves will be found a white powdery "mildew." These stripes and the mildew are illustrated in Plate 62.

Sometimes, and especially in young cane, the whole top may be yellowish. The white mildew may not always be found on the leaves and, indeed, may be difficult to find in the dry winter and early spring months.

During the winter a certain proportion of the diseased stalks suddenly elongate and grow up a couple of feet above their neighbours. These stalks are usually thin, soft, and brittle. Kanakas used to call this stage of the disease "jump-up" disease. They stand out like flags pointing to the presence of the disease.

The white mildew consists of countless numbers of the spores or "seeds" of the fungus which causes the disease. These spores fall on the eyes or buds of adjacent canes and, in wet weather, they may germinate and infect these buds. Naturally the plant will not appear infected until the fungus has grown up through the stalk and into the leaves. It very often happens therefore that certain buds of a cane stalk may be diseased, although the top appears healthy. It will be readily understood then that it is impossible to be certain of selecting healthy plants when there is a diseased stool in the vicinity.

Downy mildew spreads but slowly, if at all, during the cool dry months of winter and early spring. Obviously then the time to effect a "clean-up" on a farm is in the young plant and ratoon cane, before the rains commence.

The following methods are advocated for the control of downy mildew:—

1. Inspect cane and carefully examine any stools or shoots which appear stunted or yellowish or which bear yellow leaf stripes.
2. If there is any doubt as to the disease report the matter to the nearest Experiment Station or Field Officer.
3. Do not take plants from within 200 yards of the nearest known disease. Inspect not only the field from which it is proposed to take plants but also adjacent fields.
4. Inspect autumn plant cane immediately and spring plant and ratoon cane as soon as it is knee high. Dig out and destroy any diseased stools as soon as they are observed. Continue inspections as long as possible.
5. Do not plant susceptible varieties near a known diseased field.
6. Exercise particular care with P.O.J. 2878, P.O.J. 2714, P.O.J. 213, B.208 and B.147, but most varieties will take this disease if exposed to heavy infection. The variety P.O.J. 2725 is resistant.

Special Fertilizer Mixtures for Sugar Cane.*

H. W. KERR.

THE number of possible fertilizer mixtures which could be manufactured is without limit; and, indeed, the number of mixtures actually marketed in Queensland to-day is so great that the farmer can only become confused by the range and selection available.

Some four years ago, this situation was reviewed for the benefit of canegrowers, and a small selection of mixtures was made, with the object of framing all future recommendations on this basis exclusively. Only two plantfood materials—phosphate and potash—were considered in this respect. It was felt that applications of the third plantfood—nitrogen—could well be regarded as a separate factor, to be introduced as required. It was therefore possible to restrict the mixtures to three, which contained—

No. 1.—High phosphate, low potash.

No. 2.—Medium phosphate, medium potash.

No. 3.—Low phosphate, high potash.

By applying a suitable dressing of the appropriate mixture, the farmer could provide his plant cane with its full requirements of phosphate and potash in one application. The need for nitrogen for the plant crop would be governed by such considerations as whether a green manure crop had been ploughed under during the preceding fallow, or whether it was a "plough-out and replant." Such treatment would take the form of top-dressings of sulphate of ammonia, applied to the crop when the land was free of weeds, and the roots of the young crop were ready to absorb it without delay. This is generally in the spring of the year.

TABLE I†.—Composition of Sugar Bureau Fertilizer Mixtures.

Mixture.	Nitrogen.		Phosphoric Acid.		Potash (as muriate).
	As sulphate of ammonia.	As bone and offal	As super.	As bone and offal.	
	%	%	%	%	%
No. 1 Planting	..	1·0	13·0	4·0	7·5
No. 1 Ratooning	3·0	1·25	9·5	3·5	6·25
No. 2 Planting	..	1·25	9·0	3·75	15·0
No. 2 Ratooning	3·0	1·25	7·0	3·75	12·5
No. 3 Planting	..	1·75	2·5	5·5	25·0
No. 3 Ratooning	3·0	1·5	2·0	4·5	22·5

* Reprinted from *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations, Department of Agriculture and Stock) for July, 1938.

†It should be pointed out that these analyses represent the *actual* composition of the mixtures as prepared by reputable fertilizer companies. The guarantee printed on the bag labels may, however, show figures slightly lower than those of this table. The explanation lies in the fact that such companies are protecting themselves in the (unlikely) event of a particular batch of mixture not measuring up to the full standard as set out, which would render them liable to prosecution under the Fertilisers Act.

Now ratoon crops are always in greater need of nitrogen than plant cane, irrespective of the area or the farming rotation followed. It was therefore considered desirable to devise "ratooning" mixtures corresponding to the "planting" mixtures already discussed; the main difference then between No. 1 plant and ratooning mixtures, for example, would be the addition of sufficient sulphate of ammonia to supply 3 per cent. of nitrogen, to give a rapid start to the young ratoon crop.

We have, then, six actual mixtures in the Sugar Bureau series, and the respective compositions are shown in Table I.

It should be stressed that these mixtures provide for the requirements of even the most discriminating canegrower, and nothing is to be gained by going outside this range. Furthermore, as all Bureau recommendations, following soil analyses, are made on the basis of these mixtures, the canegrower would be well advised to "get the habit" of adopting the Sugar Bureau mixture best suited for his soil. It will be either No. 1, No. 2, or No. 3—using the planting mixture for plant cane, and the ratooning mixture for ratoons.

The best index to the precise needs of any soil type is an analysis of the soil from the particular field; and growers are again urged to take advantage of this assistance, for which there is no special charge. Indeed, the Instructor in Cane Culture will take the samples and despatch them, on request. In the absence of this information, however, the farmer may accept the following general recommendations, on the broad basis of soil type:—

No. 1 *Mixtures.*—Generally suitable for lands deficient in phosphates. Such are the alluvials and forest soils of most areas.

No. 2 *Mixtures.*—Suitable for those lands generally deficient in both phosphate and potash. The red schist soils of North Queensland, or alluvial and forest lands on which meatworks fertilizer only has been used, are examples of this class.

No. 3 *Mixtures.*—These are specially compounded for use on soils showing marked potash deficiency. The red volcanic loams of all cane areas are the best examples of this class.

As a very general recommendation, these mixtures should be applied at the rate of 4-5 cwt. per acre. For poor soils (sandy loams, &c.) the dressing might be increased to 6 or 8 cwt. per acre, while on the rich alluvials of the Burdekin area, 3 cwt. per acre would suffice.

It should be noted carefully that, except for a small proportion in the ratooning mixtures, this series supplies virtually no nitrogen to the cane. It is now well recognised that nitrogen is generally the plant-food most seriously lacking in Queensland cane soils. The farmer must therefore utilise sulphate of ammonia in addition to these mixtures, to provide a "balanced" treatment.

Except where green manuring has been practised before planting, plant cane will usually benefit from a top-dressing of sulphate of ammonia at the rate of 2-3 cwt. per acre. Ratoons will always demand more nitrogen than plant cane, and such crops should invariably be top-dressed with sulphate of ammonia. Usually 3-4 cwt. per acre is sufficient, applied in two dressings; ratoons under irrigated conditions may, however, require up to 5 cwt. per acre.

P.O.J. 2878 in Southern Queensland—Can it be Retained?*

ARTHUR F. BELL.

IN addressing you as head of the Division of Entomology and Pathology, I am thankful to be able to say that the damage caused by insect pests in the Bundaberg district remains very slight. A slightly increased amount of damage, due to the Childers cane grub, has appeared with the extension of two-year cropping. Mr. Mungomery, who has had a great deal of experience with this pest, paid a visit to the Bundaberg-Isis district during February and March. He recommends that grub-infested ratoons should not be stood over, and strongly deprecates the practice of "plough-out and replant." In particular he commends for your consideration the more widespread use of high-speed rotary hoes. These implements, used in the summer months, when the grubs are near the surface of the ground, effect a large-scale reduction in grub populations and allow subsequently planted cane to get off to a clean start which should be maintained through to the second ratoon crop.

When we come to the subject of diseases, however, it is a different story. This district has suffered so much from the effects of sugar-cane diseases in the immediate past that it is absolutely astounding to note the apathy displayed by some farmers towards Fiji and downy mildew diseases. On the other hand it is very gratifying to know that your elected representatives are fully alive to the dangers of the present disease situation, and we would like to place on record our great appreciation of the interest shown and the assistance rendered by your District Executive and the Secretary, Mr. Wheeler.

There should be no need for me to point out the good qualities of P.O.J. 2878; you have all seen thousands of acres in this district and know what a great part it has played in helping you out of the slough of despair in which, some ten years ago, the industry in this district was sunk.

Probably most farmers know that P.O.J. 2878 contains one-eighth "wild blood"; that is to say its great grandfather was a so-called wild cane, a thin, hardy, strong rooting and strong stooling cane which contains no sugar whatever. It is from this great grandparent that P.O.J. 2878 has inherited its vigorous growth, strong rooting system, strong ratooning, upright habit, drought resistance, ability to stand over, and also its resistance to gumming and mosaic diseases. However, we know from the bitter school of experience that there is no rose without its accompanying thorn, and in this case the catch lies in the fact that P.O.J. 2878 is highly susceptible to Fiji and downy mildew diseases. But it must be emphasised, and re-emphasised, that at this stage of development of these two diseases in the Bundaberg district it would be an easy matter to control both diseases completely, *provided a little care is constantly exercised by all sections of the cane-growing community.*

* Address delivered at the Farmers' Field Day, Bundaberg Sugar Experiment Station, 29th June, 1938.

We have here, displayed for your inspection, specimens of both Fiji and downy mildew diseases, and I would urge you to take advantage of this opportunity of putting yourselves into the position of being able to recognize these diseases when you see them. But even if a farmer is not able to recognize them I think all will admit that in any case, when confronted in the field with stools such as these, he must know that *something* is wrong with the cane.

Now as to the control of these diseases. Both are spread almost entirely during the summer and autumn months, Fiji disease by the sap-sucking sugar-cane leaf hopper, and downy mildew by means of fungus spores or "seeds" which are borne on the under-surface of diseased leaves, and which blow or splash on to healthy canes. In the case of Fiji disease, the leaf hoppers are very numerous in the summer and early autumn, but die out and become very scarce in the winter and spring; consequently there is very little spread during the latter period. The leaf-hopper, passing from a diseased to a healthy plant, infects it by injecting diseased sap, but it takes weeks and sometimes many months before the disease shows up. In the case of downy mildew the spores of the fungus are produced in greatest numbers during warm, moist weather. Healthy plants become infected through the spores falling upon the young buds in the stalk and germinating and growing into the bud; again it may be months before the disease becomes apparent.

The likelihood of a long period elapsing before symptoms show up in diseased plants makes plant selection very difficult, and to be safe no cane should be used for plants if growing within a quarter of a mile of a single stool affected with either disease. You will now appreciate the dangers which attach to getting plants off another farm, and we cannot sufficiently condemn the practice of buying plants from the four points of the compass. In the first instance both these diseases are spread from district to district, and to a great extent from farm to farm, by the use of infected planting material. Therefore, farmers should plan as far as possible to grow their own plants, in special plots if need be, but, if it is absolutely necessary to get plants from an outside source, then the assistance of Bureau officers should be called in.

The second point in control is that farmers should carefully inspect their young plant and ratoon cane and dig out and destroy any suspicious stools. If this practice is conscientiously followed by every farmer, then both Fiji and downy mildew diseases can be kept down to insignificant proportions and P.O.J. 2878 saved for the future. But this work must be done at the right time and not postponed until January or February.

Where fields of mature cane are already infected they should be burnt before harvesting and *cut early*. When cane becomes infected during growth it may take some time for the disease to penetrate down to the roots, and therefore the sooner the cane is cut the more likely are the ratoons to come away healthy.

Particular care should be taken in the inspections of ratoons when the previous crop was known to be diseased, but, if infection is above, say, one-half per cent. the cane should be ploughed out without further question.

P.O.J. 2878 is highly susceptible to both these diseases. P.O.J. 213 and Co. 290 are both highly resistant to Fiji disease, but both, and

especially P.O.J. 213, are susceptible to downy mildew. Therefore, if P.O.J. 2878 is allowed to become infected with downy mildew it will menace these two varieties also.

We sincerely trust that no farmer will be deluded into thinking that we are making a great deal of fuss about a little matter. We have already been forced to prohibit the growth of P.O.J. 2878 in the Lower Burdekin and Mackay districts on account of downy mildow, and we have also prohibited its growth in the Maryborough and Beenleigh districts on account of Fiji disease. Thus it will be seen that its further cultivation in the Bundaberg district is menaced on two counts.

I have just returned from a visit to the Richmond River district of New South Wales. Ten years ago this district was in the same position as Bundaberg, the sugar industry being in a very parlous condition as a result of the ravages of gumming disease. In the last few years, due entirely to the introduction of P.O.J. 2878, the situation has been completely transformed and the district has moved to prosperity and record crops. Unfortunately, Fiji disease had been in the district for many years and, at the time of the introduction of P.O.J. 2878, was rather more widespread than it is in Bundaberg at the present time (but not worse than the situation will be in Bundaberg in a year or two if adequate steps are not taken). As a result the retreat has now commenced, and already the planting of P.O.J. 2878 has had to be abandoned in certain areas and less attractive varieties substituted. Realising the outstanding value of P.O.J. 2878, the Colonial Sugar Refining Company is making strenuous efforts to save this cane, but of course the success of the campaign, there as here, will depend upon the vigilance of the farmers.

It is a very serious problem which confronts you, gentlemen. We, for our part, are collecting and trying out all available disease resistant canes, but we have nothing in sight which could adequately replace P.O.J. 2878—and even if we had such a variety, it would necessarily be some years before it could be planted to the large areas now occupied by P.O.J. 2878. The job in hand calls for action right now, and, if you have not already done so, I trust that you will all commence a careful inspection of your autumn plant cane to-morrow morning.

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A New Service to Pig Breeders.

THE provision of a service for valuing and reporting on the carcase quality of particular pigs nominated by producers, has resulted from the efforts of the Queensland Pig Industry Committee, which is representative of the Commonwealth and State Governments, pig producers, and the managements of bacon curing and pork exporting firms.

The introduction of this scheme paves the way for pig breeders who are striving to produce desirable pigs securing definite guidance by receiving reports on the carcases of particular pigs; and the discussions which frequently occur between producers and agents at time of trucking, regarding the merits of particular pigs, could be put to good use if a report was obtained on the carcase quality of the pigs under discussion.

To provide such a service, it has been agreed that on the request of the supplier, and upon payment by him of a fee of 2s. 6d. to the firm purchasing his pigs, any pig nominated and suitably identified by the supplier, will be appraised after slaughter and reported on by a Government officer.

The report will be forwarded direct to the Department of Agriculture and Stock, who will analyse and comment on the details of the report and forward it to the supplier of the pig. The charge of 2s. 6d. per pig by the firm who has purchased the pig from the producer, or who is treating it on his behalf, is compensation for loss occasioned in cutting up the side for appraisal purposes.

The use of this service by pig breeders should help considerably towards solving many problems of the industry, and it should be of special value in enabling producers to more confidently recognise desirable conformation and condition in live baconer and porker pigs. To stud breeders this scheme should prove a valuable aid in demonstrating definitely the good features, and deficiencies, in their particular families and breeds of pigs, which are distributed to form the basis of commercial herds.

The standard method of pig carcase appraisal to be used is that provided by the British authorities, as published in the "Pig Breeders' Annual" for 1936-37, and now adopted by the Australian Meat Board. This method, which is described in the following pages, provides a standard for comparison which is based as far as practicable on measurements and facts, rather than on individual opinion; pig raisers can, therefore, have every confidence in the reports issued on their pigs, when this method of appraisal is used.

The following form of report gives the scale of points used.

Report on carcase of pig consigned by .....

..... to.....

Date of slaughter .....

Weight of carcase.....lb. Brand of carcase.....

—	Possible Marks.	Standard Measurements in millimetres* for carcase of this weight.	Actual Measurements in millimetres.	Marks Obtained.	Percentage of Possible Marks.
(*a*) (By Inspection).					
Colour—clean, fresh, white	5	..	..	..	..
Skin—smooth and fine ..	5	..	..	..	..
Hams—well-filled and fine boned	8	..	..	..	..
Shoulders—light	7	..	..	..	..
Fat—firm and white ..	10	..	..	..	..
Streak—thick, full of lean meat	12	..	..	..	..
(*b*) (By Measurement).					
Body length in proportion to weight	20	..	..	..	..
Leg length—short.. ..	5	..	..	..	..
Backfat thickness — correct proportion	20	..	..	..	..
"Eye muscle" of loin—thick	28	..	..	..	..

*Measurements are taken in millimetres rather than in inches to avoid fractions. (25 millimetres = 1 inch.)

Remarks.

Conclusions.

Method of Appraisal.

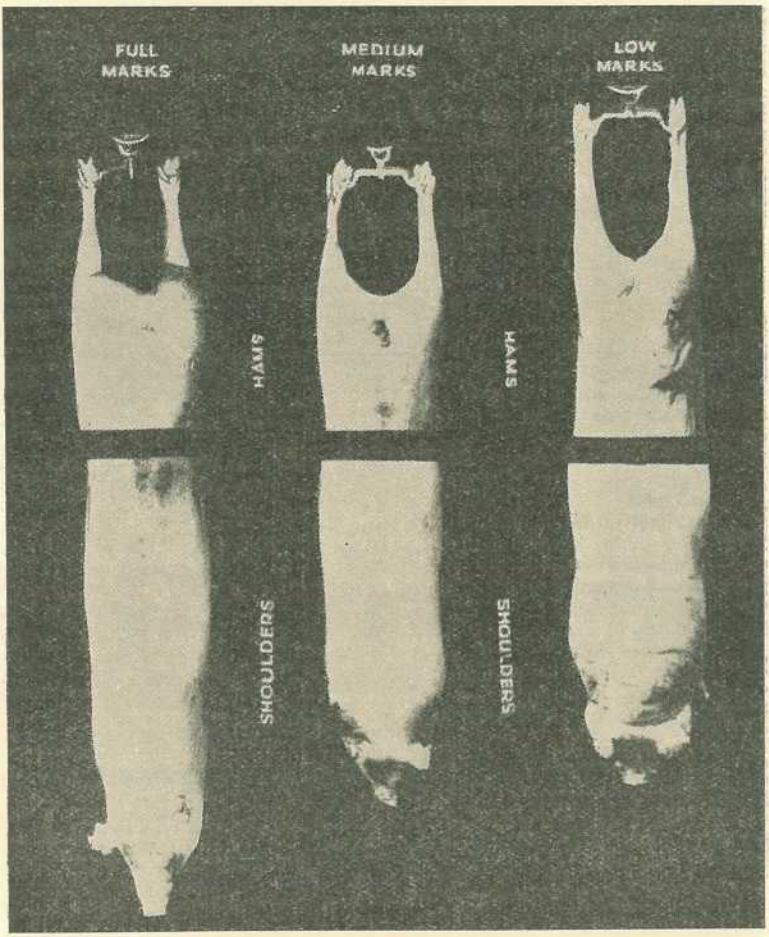
The carcase is first weighed, as all values for measurements are based on the weight of the carcase.

The skin is then examined for colour and texture. The colour, for which a maximum of 5 points is allotted, should be a clean, fresh and white one. The skin should be smooth, and not too thick or coarse; 5 points are allotted for this feature.

The examiner then stands behind the carcase and values the hams in comparison with the photographic standards illustrated in Plate 63, which show the ideal hams, which receive 8 marks, the worst hams, which receive 1 mark, and medium hams, which receive 4 marks. Good hams should have fine leg bone, and be well filled out with lean meat, being U-shaped rather than V-shaped between the legs.

JUDGING BY EYE APPRAISAL.

STANDARDS FOR AWARD OF MARKS.



[*Produced for New Zealand Evaluation Committee by Jos. B. Swain. Reproduced by courtesy of "The Pig Breeders' Annual,"* 1936-37.

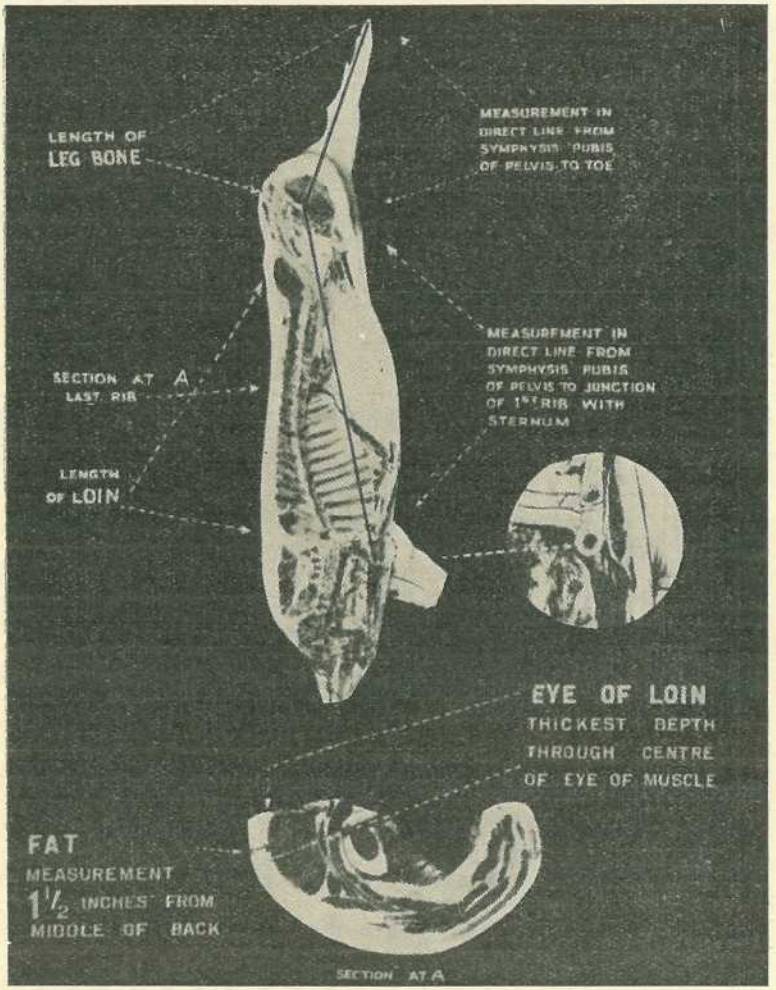
Plate 63.

The shoulders are similarly valued, using the photographic standards illustrated in Plate 63, the maximum marks being 7, minimum 1, and intermediate 4. The shoulders should be comparatively light.

At this stage the carcase is split down the middle line into two sides.

Then using a tape measure graduated in millimetres, the body length is measured from the edge of the symphysis pubis bone (aitch bone) in a direct line to the junction of the sternum (breast bone) with the first rib (see Plate 64). This is an important feature of the carcase and so a maximum of 20 points is allotted. As body length can only be valued in relation to the carcase weight, reference must be made to table 1, and the measurements converted into marks according to the weight of the carcase.

JUDGING BY AWARD OF MARKS FROM MEASUREMENT.



[*Produced for New Zealand Evaluation Committee by Jos. B. Swain. Reproduced by courtesy of "The Pig Breeders' Annual," 1936-37.*

Plate 64.

The leg length is then measured from the same point on the aitch bone in a straight line to the tip of the toe as shown in Plate 64. This measurement is converted into marks using table 2. A maximum of 5 points is allotted for leg length, which should be as short as possible, as it gives an indication of the proportion of bone throughout the carcase.

TABLE I.

MARKS FOR BODY LENGTH (SYMPHYSIS PUBIS TO FIRST RIB). Measurements in mm.

Carcase Weight lb.	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89	90 to 94	95 to 99	100 to 104	105 to 109	110 to 114	115 to 119	120 to 124	125 to 129	130 to 134	135 to 139	140 to 144	145 to 149	150 to 154	155 to 159	160 to 164	165 to 169	170 to 174	175 to 179	180 to 184	185 to 189	190 to 194	195 to 199
Marks																												
1	550	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820
2	555	565	575	585	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825
3	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830
4	565	575	585	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835
5	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840
6	575	585	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845
7	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850
8	585	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855
9	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860
10	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865
11	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870
12	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875
13	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880
14	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875	885
15	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890
16	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875	885	895
17	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900
18	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875	885	895	905
19	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900	910
20	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875	885	895	905	915

TABLE II.

MARKS FOR LEG LENGTH (SYMPHYSIS PUBIS TO TOE). Measurement in mms.

Carcase Weight lb.	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89	90 to 94	95 to 99	100 to 104	105 to 109	110 to 114	115 to 119	120 to 124	125 to 129	130 to 134	135 to 139	140 to 144	145 to 149	150 to 154	155 to 159	160 to 164	165 to 169	170 to 174	175 to 179	180 to 184	185 to 189	190 to 194	195 to 199
Marks		and o	ver																									
1	450	460	470	480	490	500	510	520	530	540	550	560	570	575	580	585	590	595	600	605	610	615	620	625	630	635	640	645
2	449 to 440	459 to 450	469 to 460	479 to 470	489 to 480	499 to 490	509 to 500	519 to 510	529 to 520	539 to 530	549 to 540	559 to 550	569 to 560	574 to 565	579 to 570	584 to 575	589 to 580	594 to 585	599 to 590	604 to 595	609 to 600	614 to 605	619 to 610	624 to 615	629 to 620	634 to 625	639 to 630	644 to 635
3	439 to 430	449 to 440	459 to 450	469 to 460	479 to 470	489 to 480	499 to 490	509 to 500	519 to 510	529 to 520	539 to 530	549 to 540	559 to 550	564 to 555	569 to 560	574 to 565	579 to 570	584 to 575	589 to 580	594 to 585	599 to 590	604 to 595	609 to 600	614 to 605	619 to 610	624 to 615	629 to 620	634 to 625
4	429 to 420	439 to 430	449 to 440	459 to 450	469 to 460	479 to 470	489 to 480	499 to 490	509 to 500	519 to 510	529 to 520	539 to 530	549 to 540	554 to 545	559 to 550	564 to 555	569 to 560	574 to 565	579 to 570	584 to 575	589 to 580	594 to 585	599 to 590	604 to 595	609 to 600	614 to 605	619 to 610	624 to 615
5	419	429	439	449	459	469	479	489	499	509	519	529	539	544	549	554	559	564	569	574	579	584	589	594	599	604	609	614
		and	under																									

One side is now cut across, straight, at the level of the last rib, and the hind part laid with the cut surface to the examiner. The backfat is now measured, in the case of porkers 1 inch and with baconers 1½ inches from the middle line, using callipers, with one point on the edge of the "eye muscle" and the other point on the inner layer of the skin (see Plate 64). By referring the backfat measurement to table 3 the measurement can be converted to marks, and it will be found that the possible of 20 marks is provided for an optimum measurement in accordance with the weight of the carcase; marks are lost for excessive fat or insufficient fat.

STANDARDS FOR AWARD OF MARKS.

BY EYE APPRAISAL.

STREAK (BACONER).

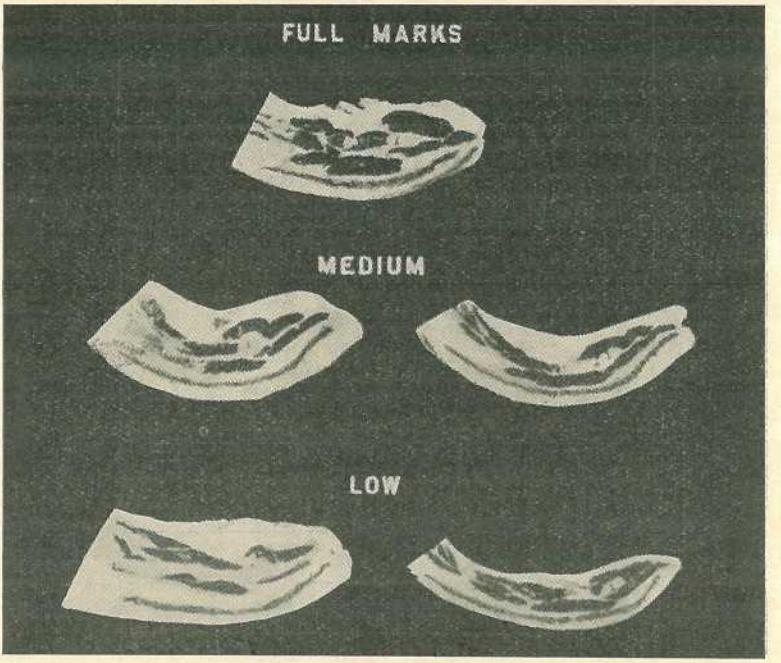


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Plate 65.

The "eye muscle" of the loin is then measured with callipers halfway along its width as illustrated in Plate 64. Table 4 is provided for converting the measurement into marks, and this measure of the proportion of lean meat in the carcase is the most important feature, being allotted a possible of 28 marks.

The backfat should now be valued for firmness by rubbing the thumb across it. The most desirable fat is hard (not oily) to the touch. In colour the fat should be a clean white.

TABLE III.

Marks for Thickness of Fat over Loin.

Measurements in mms.

Carcase wt., lb.	60 to 69	70 to 79	80 to 89	90 to 99	100 to 109	110 to 119	120 to 129	130 to 139	140 to 149	150 to 159	160 to 169	170 to 179	180 to 189	190 to 199
Marks														
1	1	1	2	3	4	5	7	8	9	10	11	12	13	14
4	..	2	3	4	5	6	8	9	10	11	12	13	14	15
7	2	3	4	5	6	7	9	10	11	12	13	14	15	16
10	3	4	5	6	7	8	10	11	12	13	14	15	16	17
12	4	5	6	7	8	9	11	12	13	14	15	16	17	18
14	5	6	7	8	9	10	12	13	14	15	16	17	18	19
15	..	..	..	..	..	..	..	14	15	16	17	18	19	20
16	6	7	8	9	10	11	13	15	16	17	18	19	20	21
17	..	..	..	..	..	..	14	16	17	18	19	20	21	22
18	7	8	9	10	11	12	15	17	18	19	20	21	22	23
19	8	9	10	11	12	13	16	18	19	20	21	22	23	24
20	9	10	11	12	13	14	17	19	20	21	22	23	24	25
19	10	11	12	13	14	15	18	20	21	22	23	24	25	26
18	11	12	13	14	15	16	19	21	22	23	24	25	26	27
17	..	..	..	..	..	..	20	22	23	24	25	26	27	28
16	12	13	14	15	16	17	21	23	24	25	26	27	28	29
14	13	14	15	16	17	18	22	24	25	26	27	28	29	30
12	14	15	16	17	18	19	23	25	26	27	28	29	30	31
10	15	16	17	18	19	20	24	26	27	28	29	30	31	32
7	16	17	18	19	20	21	25	27	28	29	30	31	32	33
4	17	18	19	20	21	22	26	28	29	30	31	32	33	34
1	18	19	20	21	22	23	27	29	30	31	32	33	34	35

TABLE IV.

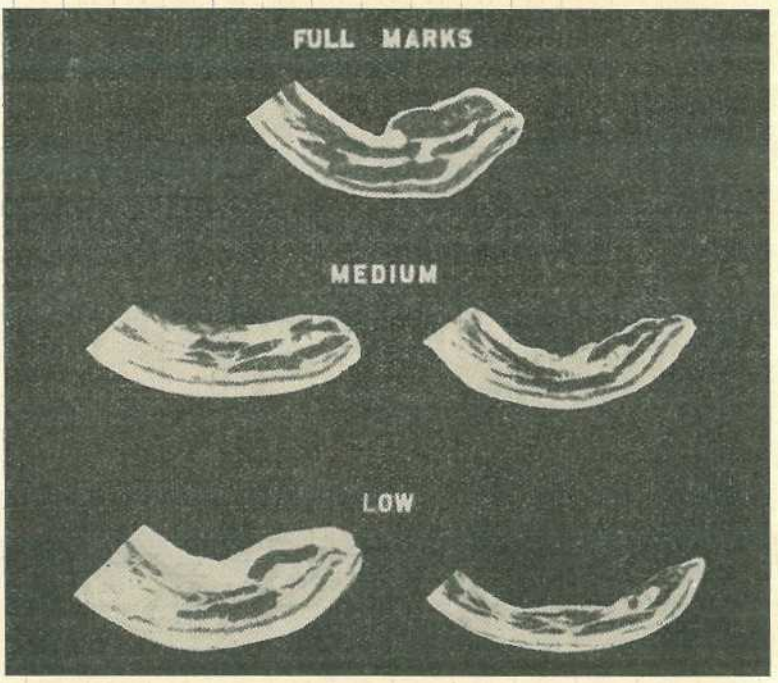
Marks for Thickness of Eye Muscle of Loin.

Measurements in millimetres.

Carcase wt., lb.	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89	90 to 99	100 to 109	110 to 119	120 to 139	140 to 159	160 to 179	180 to 199
Marks													
1	23	24	25	26	27	28	29	30	31	32	33	34	35
3	24	25	26	27	28	29	30	31	32	33	34	35	36
5	25	26	27	28	29	30	31	32	33	34	35	36	37
7	26	27	28	29	30	31	32	33	34	35	36	37	38
9	27	28	29	30	31	32	33	34	35	36	37	38	39
11	28	29	30	31	32	33	34	35	36	37	38	39	40
13	29	30	31	32	33	34	35	36	37	38	39	40	41
14	30	31	32	33	34	35	36	37	38	39	40	41	42
15	31	32	33	34	35	36	37	38	39	40	41	42	43
16	32	33	34	35	36	37	38	39	40	41	42	43	44
17	33	34	35	36	37	38	39	40	41	42	43	44	45
18	34	35	36	37	38	39	40	41	42	43	44	45	46
19	35	36	37	38	39	40	41	42	43	44	45	46	47
20	36	37	38	39	40	41	42	43	44	45	46	47	48
21	37	38	39	40	41	42	43	44	45	46	47	48	49
22	38	39	40	41	42	43	44	45	46	47	48	49	50
23	39	40	41	42	43	44	45	46	47	48	49	50	51
24	40	41	42	43	44	45	46	47	48	49	50	51	52
25	41	42	43	44	45	46	47	48	49	50	51	52	53
26	42	43	44	45	46	47	48	49	50	51	52	53	54
27	43	44	45	46	47	48	49	50	51	52	53	54	55
28	44	45	46	47	48	49	50	51	52	53	54	55	56

The streak or belly as shown in the section of the side is valued by inspection and comparison with the photographic standards for baconers and porkers, illustrated in Plates 65 and 66 respectively. The streak or belly should be thick and it should also contain a high proportion of lean meat. Maximum marks (12) are given for a streak which is both thick and full of lean meat. A minimum mark (1) is given for either thin streaks or those which have a high proportion of fat. Streaks of medium value receiving 6 marks are also illustrated.

STANDARDS FOR AWARD OF MARKS.
BY EYE APPRAISAL.
STREAK (PORKER).



[*Produced for New Zealand Evaluation Committee by Jos. B. Swain. Reproduced by courtesy of "The Pig Breeders' Annual,"* 1936-37.

Plate 66.

All the illustrations and tables used herein are taken from "A Method of Judging Pork and Bacon Carcases," Pig Breeders' Annual, 1936-37.

SWEET POTATOES AND ARROWROOT FOR PIGS.

With the approach of spring, farmers are planning their cropping programmes, and so the time is opportune for considering the value of such root crops as sweet potatoes and arrowroot as pig foods. These two crops are well known to most coastal pig farmers and can be grown in most places where there is a sufficient rainfall and a long summer season.

Under similar conditions, the yield of pig feed per acre from arrowroot and sweet potatoes is several times that from maize grain. This fact alone makes these crops worthy of consideration, but they also have the advantage of being more or less drought-resistant and are usually freer from pests. In the case of sweet potatoes, some growers claim that they are worth growing for the vines alone. The vines of the sweet potatoes and the stalks and leaves of the arrowroot provide a large quantity of succulent green food.

If it is necessary to harvest and feed these crops by hand, the labour involved is considerable; but both crops can be fed off by pigs, and where the paddocks are made pig-proof, and some temporary fencing is used to partition off a small portion of the crop for the pigs to harvest, excellent results are obtained. If pigs are allowed to run over the whole crop a good deal of waste results. They should, therefore, be confined on an area which they can clean up in about one week.

Arrowroot is frequently boiled before being fed to pigs; but, although the boiling does increase its nutritive value somewhat, it is doubtful whether the increase warrants the labour required to dig, cart, and boil the bulbs, especially when it has been demonstrated that pigs do remarkably well by harvesting the crop for themselves.

Sweet potatoes and arrowroot are not complete foods in themselves, and must be fed in combination with foods rich in protein, such as separated milk or meatmeal. The more extensive use of these two crops, in conjunction with the separated milk at present available, would enable coastal dairy farmers to increase their output of pigs greatly, and this is very desirable to the pig industry at present.

—*L. A. Downey.*

PIG BREEDERS' ANNUAL.

The eighteenth volume of the Pig Breeders' Annual (1938-39) has just been issued by the National Pig Breeders' Association.

The Pig Breeders' Annual is the only publication of its kind in the world. Although issued by a breed society, it is far from being breed propaganda; in fact, it comprises a survey of the latest developments in breeding, feeding, and management, and is therefore of interest to all concerned in pig production at home or overseas.

The President, Major-General Sir Wyndham Knight, K.C.I.E., contributes the foreword.

The subjects dealt with include "The Management of a Breeding Herd," by Mr. S. H. Hart (a Past-President of the N.P.B.A.); "The Progress of Danish Pig Breeding," by Dr. Clausen; "Mortality in Pig Production," by Mr. A. W. Menzies Kitchin, Cambridge School of Agriculture; "The Experiences in Judging Pig Carcasses," by Mr. H. R. Davidson; "Tethering System of Pig Breeding," by Mr. R. B. Peacock, of Cambridge; "The Grocer's View of Pig Production;" "Costs —a Breeder's Experiences"; and a "Review of the Australian Show System," by E. J. Shelton. Dr. K. A. H. Murray, of the Agricultural Economics Research Institute, Oxford, contributes a comprehensive "Survey of the Pig Industry in 1937," and the regular features—perhaps the most interesting and valuable section of this annual publication—include summaries of research and experimental work carried out during the past year, and notes on the progress of the pig industries in the principal pig-producing countries of the world. An enlarged statistical section, with pig-feeding tables, is also included, and the whole volume (270 pages, illustrated and attractively bound) represents remarkably good value. The cost, including postage, is 3s., from the National Pig Breeders' Association, Victoria House, Southampton Row, London, W.C. 1.

Sheep Grazing and Lamb Raising Trials at Mackay.*

D. L. McBRYDE and H. W. KERR.

Introduction.

MANY of the Mackay lands have been reduced to a low state of fertility due to continuous cropping to cane over a long period of years, without due attention to the conservation of humus and soil plantfoods generally. So long as cane cultivation is continued as the only form of agriculture, the costly and slow process of fertility building by means of substantial fertilizer applications, combined with the growth of an occasional green manure crop, is the only method at the command of the farmer.

The average cane yield per acre for the district is one of the lowest in Queensland; it varies from about 11 to 15 tons, which is doubtless much below what would be expected having regard for the average climatic conditions under which the crop is produced. If the lands could be restored to even a moderate level of fertility, crops substantially in excess of this could reasonably be anticipated, and costs of production could be reduced proportionately. Now it is a happy circumstance that many of the cane farms of the district are appreciably larger than the net harvestable area, and it would be possible for farmers to adopt a system of crop rotation whereby nature's own remedy of long fallowing under grass could be invoked to rejuvenate the worn-out soils, while allowing of intensive cultivation methods on the area cropped annually to cane.

Planning the Rotation.

The main objection to such a policy is that the land thus thrown out of production would still be subject to rates and taxes, whilst yielding no revenue to the farmer; and it was with the object of demonstrating the value of a well-designed rotation system, combined with

* Reprinted from *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations, Department of Agriculture and Stock) for July, 1938.

some revenue-producing accessory crop, that one block of the Mackay Sugar Experiment Station was set aside, when the new Station site was acquired some three years ago. The block selected was actually a low-lying area, much of which is subject to flooding during periods of heavy rainfall, and on which young cane crops were regularly affected by wireworms as a consequence. When it was brought into the experiment, the block carried a rank growth of para grass (*Panicum muticum*), which proved very difficult to destroy by cultivation methods. The field is 16 acres in area, and it was sub-divided into eight plots, each of approximately 2 acres. It was planned to follow an 8-year rotation; each year two plots would produce a plant and first ratoon crop of cane respectively, while the balance of the area would be under pasture. A well-planned system of surface drainage was necessary, first of all, and considerable difficulty was experienced in eliminating the minor topographical irregularities which had been brought about by previous cultivation methods.

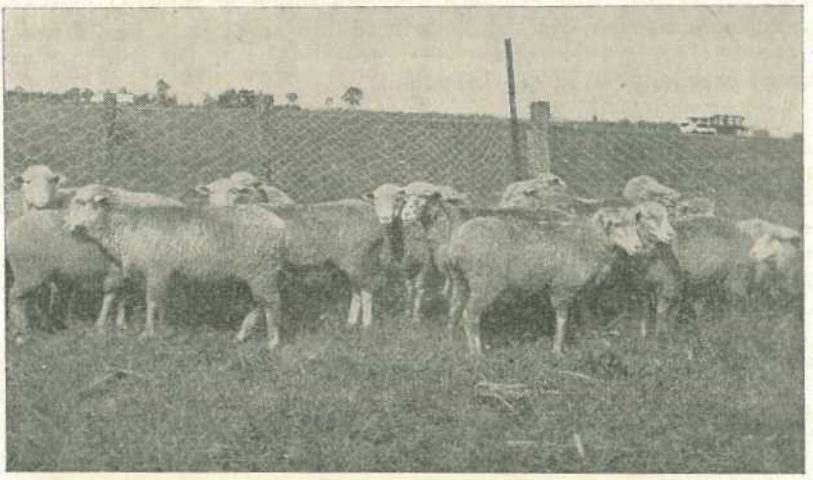


Plate 67.
Merino-Corriedale ewes, Mackay Experiment Station.

The first plot was planted to cane in 1936, and a moderate application of mixed fertilizer and sulphate of ammonia was given. In 1937 this plot was harvested and ratooned, while the second plot was planted to cane. During 1938, two plots of cane will be harvested; that carrying the present ratoon crop will later be ploughed out, a green manure crop grown and turned under, and then seeded once more to grasses. Cane will not be planted again on this plot until 1944, following a further green manure crop after the sod has been broken up. The trash from all cane crops will be conserved as a surface mulch and returned to the soil in due course.

Revenue will be derived from the grasslands by the process of stock grazing. This method ensures the best utilization of the grass crop, while the bulk of the plantfood and humus forming materials are voided by the animals, to rot down and enrich the land. During periods of fodder shortage, the use of cane tops or other roughage, supplemented

by a modest molasses ration, will both benefit the animals and add further to the potential humus-building residues and soil plantfood reserves.

Sheep were selected as the most suitable stock for the purpose. It had been demonstrated that they would thrive on the coastal lands, though perhaps not on an area so "wet" as that represented by the experimental block under consideration. Furthermore, in small flocks these animals would impose a minimum demand on the time of the canegrower, and could be expected to return a reasonable income from the sale of their wool, and their progeny. A selection of twenty-five young Merino-Corriedale ewes was obtained, and mated with a Romney Marsh ram for the production of good-type crossbred lambs.

Progress Results.

The results of the experiment to date are highly encouraging. The sheep have survived two wet seasons, with intermittent flooding of the block, without ill-effects, and though they have been inspected at frequent intervals, little evidence has been found of internal parasites; an occasional drench has served to maintain them in a healthy state. No serious foot troubles have been observed, and the animals have retained excellent condition throughout.

The first lambs from the cross made rapid progress from the start. The plan is to retain the crossbred ewes for breeding purposes, while slaughtering the wethers for the local trade. The rapid development shown by the lambs may be gauged from the following table recording ages and weights:—

Lamb No.	Age (7/2/38).	Live Weight.		Gain in Weight.
		14/1/38.	7/2/38.	(24-day period).
		Lb.	Lb.	Lb.
61	14 weeks	34	48	14
67	16 weeks	46	58	12
68	16 weeks	47	61	14
69	18 weeks	63	77	14

During this period the ewes and lambs were on natural pasturage only.

Quality of Lambs.

Four wether lambs were slaughtered at ages of 19-20 weeks, and special attention was paid to the quality of the carcases. The live and dressed weights were:—

Live weight.	Dressed weight.
73 lb.	40 lb.
69 lb.	33 lb.
59 lb.	29 lb.
64 lb.	32 lb.

The average dressed weight was just over 50 per cent. on the live weight. Three of the carcases were graded as good average quality, while the fourth was classed as good export grade. It is interesting to note that

this was the smallest of the four, and was more strongly of Merino type than the others. The average value of the animals was about 18s. per head.

Comments by consumers on the quality of the cuts were most favourable, and it may be concluded that animals of suitable type can be produced under these conditions. Absence of a regular supply of lambs for the Mackay market makes it difficult to assess probable demands, but doubtless such would follow. At the present time the trade tends to favour an animal dressing to 40 or 45 lb.

Value of Rotation.

It is, of course, too early as yet to draw any conclusions regarding the value of the rotational system on the productivity of the soil. Two of the plots have produced mature crops of cane, while the third is now under young plant cane. Doubtless the plots which are brought under cane in succeeding years will give progressive indications of the benefits to be expected. For the present, one can only say that the experiment shows good prospects of success, and is sufficiently advanced to warrant an expansion of the project by canegrowers of the Mackay district.

THE ADAPTABILITY OF THE MERINO.

Large areas in Western Queensland carry a good covering of high-quality grasses, but are largely devoid of either shrubs or trees. On these exposed plains the breeding of sheep cannot be carried on successfully, but, fortunately, they are within reasonable distance of other areas which, while similar in other respects, are shaded by a variety of shrubs and trees. Many western holdings include both classes of country, and ewes and growing sheep can be held on the shaded area, while wethers for wool production are run on the open plains. On holdings where no shade exists, fully-developed wethers are purchased from properties more favoured for breeding, and are then run for wool production.

In the southern division of the State, the country ranges from the cold granite and traprock country of the Stanthorpe district to the rich plains along the New South Wales border. Intermediate types are the poor ridges interspersed between fertile plains, the vast areas of brigalow and belah which were held in the grip of the prickly-pear until a few years ago, and the excellent mulga country in the St. George-Charleville-Cunnamulla and far western districts.

Although the mulga country has a low carrying capacity, it is, when partly improved, suitable for breeding purposes, and supports some excellent stud flocks.

Brigalow country in its natural state is next to useless for sheep. When improved by ringbarking, it generally develops a rank weed growth. By stocking heavily with cattle, the weeds will be kept in check, and, subsequently, will give way to a good mixture of grasses, suitable for sheep. When cleared of excess timber, breeding can then be carried on successfully. As a general rule, however, the land should be seeded down to Rhodes or other suitable grasses after ringbarking.

Plate 68.
A mob of travelling sheep near Barcaldine Downs, Central Queensland.

The granite and traprock country is most suitable for running wethers for wool production. The extreme conditions under which merino wethers can be used to advantage is illustrated by the fact that wethers selected for wool production on the open plains of the West also do well on the high, cold country of the South-East. The type generally favoured for the western plains is a large-framed, plain-bodied, robust sheep which produces a good length of bold-growing, medium to strong wool. Wethers of this type thrive on treeless plains, with no protection of any kind, and suffer no ill-effects when the shade temperatures are high for days, and sometimes weeks, at a time.

The sheep selected for the granite and traprock belt of the South-East are usually four-tooths of the finer-woolled type, but of similar strain to those selected for the West. Each season, after they have been placed on the granite or traprock country, their wool fines down, probably owing to a combination of climatic influences and the finer nature and less nutritive quality of the grasses. They do not cut as heavy a fleece as western wethers; but, if kept free from parasites, they do well even on the cold bleak heights ranging up to 3,000 feet above sea level. The adaptability of the merino to such extremes of climatic conditions is quite remarkable.

—Jas. Carew.

FAT LAMB PRODUCTION.

Gratifying results have followed the scheme initiated by the Minister for Agriculture and Stock with the object of stimulating the production of fat lambs. Rams of British breeds, comprising Border Leicesters, South Downs, Dorset Horns, Shropshires, and Romney Marsh, were purchased in the South and distributed to farmers who had cultivation available, or who were prepared to cultivate. In certain cases in which a farmer owned a stud ram of a particular breed, stud ewes were supplied with the idea of fostering the breeding of pure stock. All sheep supplied to farmers are on loan, and remain the property of the Department. The progeny and wool, however, become the property of the farmers concerned.

The greatest drawback to the production of fat lambs on the Darling Downs in quantity has been, and still is, the difficulty of purchasing good crossbred ewes as the mother flock.

If a start has to be made with merinos the best ewe for fat lamb raising is bred by the introduction of one of the long wools, such as Border Leicester, Lincoln, or Romney Marsh into the strong-woolled, robust type of merino ewe. The ewe lambs of this drop should then be retained as the future dams of the lamb-raising flock.

As to suitable ewes for the fat-lamb industry, it is believed that graziers on the fringe of the Darling Downs or further out would find it profitable to join long-woolled rams of British breed with their cast-for-age ewes with the idea of selling the progeny annually as fat lamb mothers on the Downs. Into the crossbred ewe flock, as described, should be introduced a ram of the Downs type. Opinions necessarily differ in the matter of crosses. The South Down is the fashionable lamb at the

present time, but it should be remembered that this cross must suffer no check from birth to block. The Dorset Horn gives a very nice lamb, early maturing and hardy. The use of the Border Leicester should be encouraged in every way. In addition to producing an early-maturing lamb that fills every want, it must be remembered that the skin value of this lamb is worthy of consideration to a far greater extent than either the Dorset or the South Down.

Pure-bred Corriedale ewes are hard to come by, but should the opportunity occur a farmer would be well advised not to let it slip. Pure Corriedales are hard to beat, good mothers and heavy milkers, besides growing a profitable fleece.

Generally, the wool from a flock retained for fat lamb breeding is a secondary consideration when compared with the production of fat lambs.

—*J. L. Hodge.*

CONCENTRATES AND LICKS FOR DAIRY CATTLE IN WINTER.

Stock licks are necessary in many districts throughout the year. However licks plus dry grazing will not be sufficient to maintain stock in reasonable condition, because the protein present in such a combination is not sufficient.

The provision of a protein concentrate is essential if condition and production are to be maintained. The actual form in which the concentrate is to be fed will be largely a matter of convenience and cost.

Most farmers are acquainted with the commercial protein concentrates, e.g., linseed meal, cotton seed meal, coconut oil cake, blood meal, and the various nut cakes commonly used for drought feeding of sheep. Advice on the use of these can be obtained from the Department of Agriculture and Stock, Brisbane.

Farmers are urged to provide protein in the form of any of the well-known protein-rich foods mentioned, selecting the particular one that best suits their convenience and economic requirements.

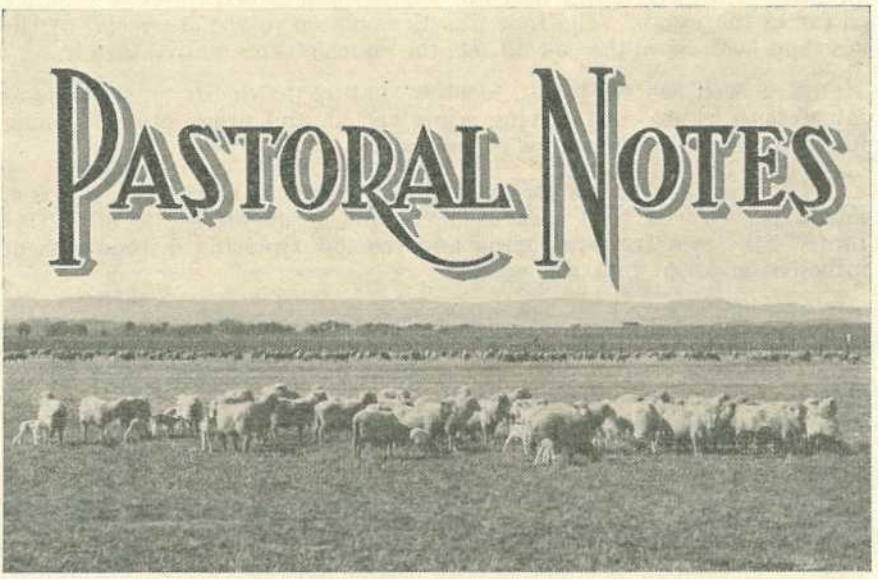
RADIO SERVICE FOR FARMERS.

From National Station 4QG (or 4QR) (Relayed to 4RK Central Regional and 4QN North Regional).

Arrangements have been made with the Australian Broadcasting Commission (Queensland) for the regular delivery, in interesting dialogue form, of talks to farmers by officers of the Department of Agriculture and Stock during the

COUNTRYMAN'S SESSION 4QG (or 4QR) EVERY SUNDAY MORNING,

Beginning at 9.10 a.m.



Difficult Parturition.

W. DIXON, District Inspector of Stock.

CASES of difficult calving are fairly common, and a few hints as to what to do and what not to do may be of value.

When calving becomes imminent, the cow leaves the herd and seeks a quiet spot. There she will become restless—getting up and lying down—and show evident signs of pain.

As labour advances the back is arched, the hindquarters are drooped, and straining becomes violent and continuous. Meanwhile blood may appear on the vulva and tail, and the waterbags protrude between the lips of the vulva. They increase rapidly and the feet of the calf may be seen within them.

The waterbags furnish a soft uniform pressure for the preliminary distention of the womb and passages, and prepare the way for the delivery of the calf. In normal presentations, it is wrong to break these bags prematurely.

When the cow calves standing up, the navel string breaks when the calf falls to the ground; but, when she calves lying down, the string is broken when she rises. A few hours after calving normally, afterpains commence and the placenta or afterbirth is expelled. If this is not expelled within twenty-four hours, it should be removed by careful traction. A good method is to take two sticks about two feet long, between which the end of the afterbirth is grasped, and rotated around them until close to the vulva, when gentle traction is applied, from side to side, and backwards and downwards, care being taken not to break it. A vaginal douche of boiled water at blood heat, to which has been added a mild antiseptic, should be given. A cheap and efficient outfit for this purpose consists of about 4 feet of ½-inch rubber hose and an ordinary funnel. The end of the hose should have its edge pared off with a sharp knife, and, after having been smeared with carbolic

vaseline, it is introduced into the vagina, and gently pressed forward as far as the womb. The funnel is then placed in the other end of the hose and held above the cow's back, the douche being poured into it.

It is well, at all times, to allow nature to do its work without interference; but, when calving is protracted, and progress is not being made, a careful examination is necessary.

The operator should wear a clean sleeveless shirt, and his arm should be smeared with carbolised vaseline or an antiseptic oil. This protects the arm from poisoning and the cow from the introduction of infective material into the passage.

The hand should now be introduced into the vagina and a careful examination made. It may be found that (1) the waterbags have burst, and that neither the feet nor head of the calf are presented, or that there is a presentation of (2) one fore foot and head; (3) both fore feet, and head back; (4) head with both fore feet back; (5) one hind foot without the other; or (6) other abnormal presentation.

Whatever part is presented should first be secured by a rope with running noose, so that it will not be lost during subsequent manipulation, and may be readily brought into position when the missing parts are found. If the cow is standing, her head should be turned downhill so that the fœtus and abdominal organs lie forward to give more room to bring up the missing head or limb. If lying down, she should be turned over on to the side opposite to that on which the limb is missing. When the missing part is located, no attempt should be made to bring it up during a labour pain, but after the pain has ceased an effort should be made to secure it before the next pain comes on.

If the pains are continuous and violent, they may be checked by putting a tight surcingle round the body in front of the udder. If it is found that the passages are dry, pure olive oil may be run into the womb through a rubber tube. If the head is back, the limbs which are presented should be first secured with a rope having a running noose, then the fœtus should be pushed as far back as possible and an attempt made to secure the head with a noose or hook, and to bring it up into the passage. Having brought the limbs and head into a suitable position, traction should now be applied in a downward and backward direction, but only when the cow is straining.

Pulling when the cow is not straining should not be attempted. Patience and care are necessary. The extraordinary practice of attaching a draught horse or motor car to the fœtus and pulling it out by sheer force is not only cruel, but usually results in the death of both the cow and the calf. After a protracted calving the cow will be exhausted, and she should be provided with a warm rug and bed, also a few bottles of warm gruel.

Points to remember are:—

Do not interfere too soon.

When interference is necessary, exercise patience and take time.

Do not use force until the fore feet and head or the hind feet are secured in position.

Remember to pull only when the cow is straining.

ACTINOMYCOSIS OF CATTLE.

Actinomycosis, "lumpy jaw," or "wooden tongue," is a common disease of cattle. There are two forms of the disease, indicated by the foregoing terms, one of which attacks the bones of the jaw and the other the tongue. Strangely enough, each form is caused by a different type of organism.

These organisms are found on the grass, and infection probably takes place through a small injury to the gums. From there they penetrate the tongue or the jawbone, as the case may be.

Advanced cases are easily recognised by the stockowner. In one form, the tongue is increased in size and may be so large as to project out of the mouth. It is very hard to the touch—hence the term wooden. When the jaw is attacked there is often considerable swelling and pus formation. The pus works its way to the exterior, and openings are produced through which the pus flows. Extension of the process leads to the formation of several openings and the jaw may, as a result of the formation of new bone tissue and inflammatory swelling, grow to an enormouse size.

Bad cases, whether of the tongue or jaw form, lead to emaciation of the animal because of the difficulty in taking food. Owners are not advised to attempt treatment of bad cases. It is better to destroy the animals, as they may cause infection of other stock.

In the case of valuable animals, if the disease is not too far advanced, treatment may be possible, and owners are asked accordingly to get in touch with the Animal Health Station, Yeerongpilly.

Dr. John Legg.

A CRUSH FOR CATTLE AND HORSES.

A crush for holding cattle or horses should be built on every farm. It costs little and occupies a small area; yet it saves much time and labour when full-grown stock are to be dehorned, branded, castrated, speyed, drenched, or otherwise treated. For these operations, the animal should be held in a position which allows of no movement.

The ordinary crush can be arranged to accommodate large or small animals. A series of auger holes ($\frac{1}{2}$ in. diameter) are bored about 6 in. apart along two rails of convenient height on each side of the crush. The holes should be deep enough to seat a bolt or iron pin firmly. The bolt or pin should stand 4 to 6 in. above the rail. These pins—one on each side—serve as chocks against which a cross rail may be placed. By working the animal right to the front of the crush, the pins and rails may be arranged to prevent any "backing." In a similar way the width of the crush may be adjusted to prevent lateral movement.

To secure the head of the animal, the "A" shaped bail-type of structure may be made from a double cross rail between which slide vertical poles attached to the base of the crush posts by stout hinges. With such a crush, many farm operations usually requiring four men can be done quickly and efficiently by a man and boy.

POLLED CATTLE AND THE CHILLED BEEF TRADE.

The need for hornless stock in the chilled beef trade has been stressed repeatedly by every section of the beef cattle industry.

In any programme of breeding or of grading up existing herds, the introduction of polled stock must be regarded as a necessity. Shorthorns and Herefords represent the bulk of the beef cattle in Queensland. Increased numbers of polled bulls of both these breeds are being imported. The polled Shorthorns and Herefords are a comparatively recent development, and the percentage of polled stock which will result from crossing with horned breeds is uncertain.

With the so-called "natural polls," the power to transmit this characteristic is marked. It is most noticeable in the Galloway breed, but this type is not well represented in Australia.

Red polled bulls crossed with horned breeds or their crosses may produce a large percentage of hornless stock, but the prepotency of Aberdeen Angus bulls with respect to colour, confirmation and hornlessness is superior. From 80 to 90 per cent. of the calves obtained when Aberdeen Angus bulls are mated with horned stock of mixed breeding are black in colour and most of them are hornless.

RED-WORMS IN HORSES.

Red-worm disease is one of the most important diseases of horses in Queensland. The disease is caused by the presence of large numbers of red-worms, which inhabit the first part of the large bowel. These worms vary in size from about ½ inch to 1½ inches in length and, in a freshly-killed carcase, may be found adhering to the membrane on the inside of the bowel. Their reddish colour is due to the fact that the worms suck blood.

If the worms are numerous, the infested animal does not thrive well, the coat becomes rough, and loss of condition and weakness follow. Diarrhœa is frequently present, and in severe cases the blood becomes thin, the eyes become sunken, the whole appearance of the animal becomes very dejected, and finally death may supervene. The symptoms are gradual in their onset, and the disease may thus be in an advanced stage before it attracts the attention of the owner.

The worms do not multiply within the bowel, and each one of the many thousands that may be present has been picked up as a young worm from the pastures. These young worms in the pastures have arisen from worm eggs which have been passed from the body of the horse in the dung. As these young forms may live among the grass as long as four years, a paddock on which horses are permanently grazed may become heavily infested.

The most efficient drug for the treatment of red-worm disease is oil of chenopodium, which may be most easily administered, after mixing with raw linseed oil, by means of a bottle or a drenching bit. The animal to be treated should be starved for thirty-six hours before, and for four

hours after the administration of the drug. The oil of chenopodium is given at the rate of 1½ drams for every 250 lb. live weight in 1 to 2 pints of raw linseed oil. Oil of chenopodium is a highly poisonous drug, and those wishing to use this treatment are advised to get in touch beforehand with the Animal Health Station, Yeerongpilly. In areas possessing a high rainfall, three or four treatments should be given during the year.

In addition to treatment, an attempt should be made to prevent reinfestation. For this purpose, it would be better not to graze horses continually in a single paddock, particularly if it is swampy. Attention should be given to the regular collection of manure from stables and yards. Heavy stocking is not to be recommended, and young horses (up to three years) should, if possible, be kept away from pastures that have been much grazed by horses.

—Dr. F. H. S. Roberts.

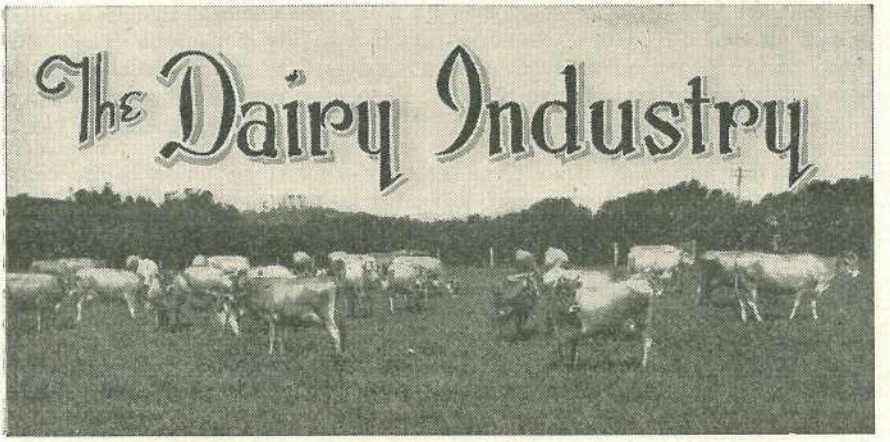
TWO WEEDS POISONOUS TO STOCK.

On the Darling Downs, in the Maranoa district, and in some other parts of Queensland, there is a very common weed sometimes seen in cultivation and along watercourses. It is upright in growth, about 3 feet high, with white flowers followed by a spiny seed pod, splitting at the top into four parts, and containing a large number of blackish seeds. In the districts mentioned it generally goes under the name of castor oil and the question is often asked if it is the true castor oil of commerce.

The fact is that the true castor oil is a different plant. The seed pods are superficially alike, but the plant is very much larger. Instead of being a small weed of cultivation, it is a shrub, or even a small tree, up to 10 feet high. It is very common around vacant allotments in coastal towns, and along creek and river banks in the near coastal districts. The seeds of the true castor oil are also poisonous and have sometimes been eaten in the mistake that they would have the same effect as a dose of castor oil. People who have accidentally or intentionally eaten the seeds have become violently ill, and it is said that in some cases even death has ensued. When the oil is expressed from castor oil seeds the residue contains a poisonous principle, and this precludes the use of castor oil cake as a stock food.

The other plant is strammonium or thorn apple, and all parts of this plant are poisonous. It possesses a nauseating odour and flavour, and, because of this, the standing plant is rarely eaten by stock. On several occasions, however, the seeds and parts of the dried plant have been found as an impurity in chaff, and have caused the deaths of working horses and town cows. The seeds of this plant are the most poisonous part and poultry should not be allowed to run where the plant is growing.

—C. T. White.



Tuberculosis in Dairy Cattle and Pigs.*

J. C. J. MAUNDER, B.V.Sc.

THE influence of dairy cattle in the transmission of tuberculosis to pigs, resulting in partial and complete condemnations of carcases, is universally recognised. Much confusion seems to exist, however, concerning the relative importance of the various channels of infection.

The popular belief is undoubtedly that milk from infected cows fed to pigs is the most important source of infection. Actually, in conditions under which pig-raising is carried out in Queensland, milk infection is of minor importance compared to the degree of infection caused by ingestion of materials contaminated by dung of tuberculous cattle.

Consideration of the following facts will explain the relative importance of milk infection and infection from body excretions:—

It is well known that a cow with tuberculous lesions of the udder will excrete the organisms in the milk; in addition any tuberculous animal, though udder is healthy, is likely to intermittently excrete the bacillus in the milk. Personal observations obtained from tuberculin testing and post-mortem examination of reactors has revealed the fact that the percentage of udder lesions is small, not exceeding 2 per cent. of tuberculous animals. Therefore, approximately 98 per cent. tuberculous animals merely excrete the organism in milk at irregular intervals, some infected animals never excreting the organism in the milk.

Before tuberculous infection becomes established in a pig repeated ingestion of infective material is necessary. Intermittent ingestion of organisms can usually be countered by the natural body defences, and possibly increases the resistance of the animal to the disease.

* Reprinted, in a revised form, from the *Queensland Agricultural Journal* for November, 1934, in which this article was first published.

In considering the importance of excretion of the bacillus in the dung of tuberculous cattle, the following facts should be studied:—

(1) Infective sputum in cases of pulmonary tuberculosis is coughed up and swallowed by the beast, reaching the intestinal tract and being excreted in the dung, the organisms retaining their virulence.

(2) Bile of infected animals is often found to contain the bacillus, the source either being lesions of the liver or organisms in the blood stream eliminated through the liver and evacuated with the bile through the intestine.

(3) Intestinal and peritoneal lesions are responsible for the evacuation of bacilli in the dung.

When it is considered that the vast majority of cattle affected with tuberculosis have lesions in either lungs, lympathic glands, pleura, peritoneum, or liver, it will be realised that this group evacuating the bacillus in the dung must constitute a greater menace than the 2 per cent. of udder infections excreting the organisms in the milk. In addition to the presence of the tubercle bacillus in dung of affected animals the organism may be evacuated with the urine when lesions are present in kidney, pelvic lympathic glands or genital organs.

Assuming then that dung of infected animals, or material contaminated with dung, and, to a lesser extent urine, constitutes a greater menace of tuberculous infection of pigs than the ingestion of milk from tuberculous animals, evidence is produced in support of the belief.

Investigation of properties from which pig condemnations have been heavy always reveals the fact that young pigs are allowed free access to areas soiled by droppings of dairy cattle.

One interesting case is quoted. A dairy farmer had for some years suffered heavy losses from pig condemnations. Assuming the source of infection was milk from tuberculous cows he decided to feed only thoroughly-boiled milk to his pigs. In the batches of pigs that had been fed only on boiled milk condemnations showed not the slightest diminution. Therefore, a definite source of infection existed apart from the milk supply. A survey of the herd was made, suspicious cattle destroyed, and methods adopted to ensure that young pigs were not allowed access to areas soiled by droppings from the dairy cattle. Milk was fed without boiling and the condemnations of these pigs were nil. This particular farmer has since adhered to the practice of enclosing of pigs with excellent results.

Another case is worthy of recording.

An owner conducted four farms, the cattle for the four farms being drawn from a common source. Careful periodical inspection and culling revealed that each herd contained from time to time tuberculous beasts. Hence, on each farm, there existed the danger that pigs would contract the infection. Actually, over a period of years, condemnations were always confined to one farm only, and investigation showed that this was the only farm on which pigs were allowed access to areas contaminated by droppings of dairy cattle. Examination of the cattle showed that the health of the cattle in the four herds was of an even standard.

It would appear, after consideration of the incidence of tuberculous lesions in various organs of dairy cattle and the means of excretion of the organisms, and field observations, that material contaminated by

dung from tuberculous animals constitutes a greater menace to the health of pigs than does milk from infected cows.

In further consideration of the problem, the feeding habits of young pigs should be observed. Notice how the pigs roam around nosing under dried clumps of manure, seeking the small green shoots of grass and herbage. The tubercle bacillus present in the dung from affected cows has been existing under conditions ideal for the maintenance of its virulence, that is moisture and protection from light. There is, therefore, great danger of infection of scavenging pigs with virulent organisms.

When cattle have been fed on whole corn a proportion of the corn is passed out unchanged and forms a great attraction for the pigs. In picking out the grain from the manure there is great danger of infection with organisms excreted from a tuberculous beast. Young pigs having access to offal of animals slaughtered is also most undesirable, while the practice of slaughtering diseased cattle and feeding to the pigs is disastrous.

Methods of Dealing with the Problem of Condemnations in Pigs.

1. Where condemnations have been heavy over a long period, it is desirable to make a survey of the entire herd, selecting any suspicious beasts for the application of the tuberculin test. Selection of such beasts should be guided by the following clinical symptoms:—

(*a*) Deep distressing cough, sides heaving, tongue protruded.
(*b*) Difficult snoring respiration.
(*c*) General debility, staring coat, dull, sunken eye, the whole giving an impression of a sick animal, reluctant to move about.
(*d*) Enlarged lympathic glands of head and neck, pre-scapular, pre-crural and mammary regions.
(*e*) Falling away in condition following calving.
(*f*) Large swellings in the udder, usually high up at the back.
(*g*) One or more quarters not functioning.
(*h*) Muco-purulent nasal discharge periodically expelled by violent snorting.

In addition to the above select the offspring of an animal known to have been tuberculous.

By the selection of cattle as outlined, submission to the tuberculin test, slaughter and burning of reactors the herd can be cleaned of animals most likely to have been the source of the trouble.

It is well known that cattle may be tuberculous to a considerable extent and exhibit no symptoms, and it is likely that such cattle would still remain in the herd after selection.

Infection from such cattle is effectively prevented by strict enclosure of young pigs from time of birth until marketed, thus preventing access to infective droppings and material contaminated by same.

2. Where it is not possible to have the tuberculin test applied, culling of animals exhibiting the symptoms outlined, and enclosure of pigs will yield good results. However, this method, i.e., culling without the aid of the tuberculin test, is likely to result in culling of non-tuberculous animals.

3. Where condemnations are light, consisting chiefly of heads with only an occasional carcase, it will often be impossible to select any really suspicious beast that may be responsible. In such cases, excellent results are obtained by simply paying attention to the complete enclosure of the pigs.

4. Application of the tuberculin test to the entire dairy herd with slaughter of reactors is the surest method of eliminating tuberculosis in the pigs. If the per cent. infection is high, the herd should be tested again within six months and a third time within twelve months.

Testing of suspicious animals only will result in temporary relief from condemnations, but testing the whole herd is the only way to permanently eradicate the disease.

Occasionally the condemnation of carcases cannot be traced to the dairy cattle as the source of the tubercular infection. Under such circumstances the brood sows may be responsible, though actually such is rarely the case. When brood sows are solely responsible for condemnations, it is not difficult to diagnose due to the fact that the sow will exhibit rather marked symptoms. Chief of these are swellings in the head and neck region, sometimes discharging; marked digestive disturbances leading to emaciation; short dry cough later becoming distressed with difficult breathing; swollen joints which may discharge cheesy purulent masses.

The mere fact that although sows are often suspected and slaughtered they are usually found to be healthy, rather supports the belief that the milk from the dairy herd is not responsible for tuberculosis of the young pigs. Should the milk be solely responsible for all the condemnations of pigs for tuberculosis, surely it is obvious that breed sows in piggeries suffering condemnations would, despite greater resistance due to age and repeated light infections that had been overcome, also contract the infection, and within a year or two the majority of brood sows would be suffering from advanced tuberculosis leading to occasional deaths.

One additional source of infection worthy of mention is the poultry.

Pigs are susceptible to the strain of the tubercle bacillus causing the disease in poultry, and it should be remembered that tuberculous poultry excreting in pig pens are capable of transmitting the infection to pigs.

Fortunately avian tuberculosis, as far as can be determined, is of rare occurrence in Queensland. Hence, this source of infection is not so important as in other countries.

Summary.

1. The source of practically all tuberculosis in pigs in Queensland is the dairy cow.

2. Infection of pigs takes place chiefly—

(*a*) By ingestion of infective milk;

(*b*) By ingestion of material contaminated by infective droppings.

3. Infection by ingestion of material contaminated by infective dung is of greatest importance under conditions of pig-raising usually practised in this State.

4. Attention to health of the cattle, and complete enclosure of pigs preventing danger of ingestion of contaminated material will result in the elimination of persistent condemnation of tuberculous carcases.

Registered Hatcheries.

OBJECT OF REGISTRATION.

THE registration of hatcheries has for an object the distribution of healthy chickens, the progeny of parent stock of good type and production ability.

The following clauses of Regulation 29 of "*The Diseases in Poultry Acts,* 1923 *to* 1937," will indicate the obligations of owners of Registered Hatcheries:—

(iv.) He shall have all poultry at or upon or kept at or upon such hatchery tested for pullorum disease at the times and in the manner from time to time required by the Chief Poultry Expert. He shall pay to the Minister the cost of every such test.

(v.) He shall not place, permit, suffer, or allow to be placed in an incubator at such hatchery for the purpose of incubation, any egg which shall be less than 2 oz. in weight.

(vi.) He shall not sell or offer for sale any chickens other than chickens which are healthy and normal and shall not sell or offer for sale any chickens which are deformed or injured in any way, or which have weak navels.

(vii.) He shall at all reasonable times permit the Chief Poultry Expert, any Inspector, or any officer to enter into or upon such hatchery and inspect the same.

Following is a list, giving the name of the owner of the hatcheries, registered up to and including 30th June, 1938:—

Name and Address.	Name of Hatchery.	Breeds Kept.
G. Adler, Tinana	Nevertire ..	White Leghorns, Australorps, Rhode Island Reds, and White Wyandottes
F. J. Akers, Eight Mile Plains ..	Elmsdale ..	White Leghorns and Australorps
J. Cameron, Oxley Central ..	Cameron's ..	Australorps and White Leghorns
M. H. Campbell, Albany Creek, Aspley	Mahaca Poultry Farm and Hatchery	White Leghorns and Australorps
J. L. Carrick & Son, Manly road, Tingalpa	Craigard ..	White Leghorns
N. Cooper, Zillmere road, Zillmere	Graceville ..	White Leghorns
R. B. Corbett, Woombye ..	Labrena ..	White Leghorns and Australorps
T. G. Crawford, Stratford ..	Rho-Isled ..	Rhode Island Reds
Rev. E. Eckert, Head street, Laidley	Laidley ..	Australorps, White Leghorns and Langshans
Elks & Sudlow, Beerwah ..	Woodlands ..	Australorps and White Leghorns
W. H. Gibson, Manly road, Tingalpa	..	White Leghorns and Australorps
Gisler Bros., Wynnum	Gisler Bros. ..	White Leghorns
J. W. Grice, Loch Lomond ..	Quarrington ..	White Leghorns
C. & C. E. Gustafson, Tannymorel	Bellevue ..	Australorps and White Leghorns
F. J. Lambert, Acacia Vale, Townsville	Lamberts ..	Australorps and White Leghorns
J. McCulloch, Whites road, Manly	Hindes Stud Poultry Farm	White Leghorns, Australorps, and Brown Leghorns
A. Malvine, junr., The Gap, Ashgrove	Alva	White Leghorns and Australorps
H. L. Marshall, Kenmore ..	Stonehenge ..	White Leghorns and Australorps
W. J. Martin, Pullen Vale ..	Pennington ..	Australorps, White Leghorns, and Black Leghorns
J. A. Miller, Racecourse road, Charters Towers	Hillview ..	White Leghorns
F. S. Morrison, Kenmore ..	Dunglass ..	Australorps, Brown Leghorns, and White Leghorns
F. J. Mottram, Ibis avenue, Deagon	Kenwood Electric Hatcheries	White Leghorns
J. W. Moule, Kureen ..	Kureen ..	White Leghorns and Australorps
E. K. Pennefather, Oxley Central	..	Australorps and White Leghorns
G. Pitt, Box 132, Bundaberg ..	Pitt's Poultry Breeding Farm	White Leghorns, Australorps, Langshans, White Wyandottes, Sussex, Rhode Island Reds, and Brown Leghorns
C. L. Schlencker, Handford road, Zillmere	Windyridge ..	White Leghorns
E. E. Smith, Beerwah	Endcliffe ..	Australorps and White Leghorns
T. Smith, Isis Junction	Fairview ..	White Leghorns and Langshans
H. A. Springall, Progress street, Tingalpa	Springfield ..	White Leghorns
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkin's Poultry Farm	White Leghorns and Australorps
T. Westerman, Handford road, Zillmere	Zillmere ..	Australorps and White Leghorns
P. A. Wright, Laidley	Chillowdeane ..	Brown Leghorns, White Leghorns, and Australorps
R. H. Young, Box 18, P.O., Babinda	Reg Young's ..	White Leghorns, Brown Leghorns and Australorps

AUSTRALIAN PRODUCE AT MANCHESTER.

Australia had a lavish show of produce at the Manchester Grocers' Exhibition. Pride of place was given "to the excellent Australian butter and the well-known dried fruits which have won a richly deserved place in the trade by their high standard of quality."

Marketing Eggs and Poultry.

P. RUMBALL, Poultry Expert.

EFFICIENCY in egg and poultry producton is of little use, unless the same degree of effectiveness is extended to marketing. The quantity of eggs marketed at less than top values, because of lack of quality, definitely indicates that all the care that is necessary has not been extended to the marketing of the commodity. The loss sustained by the individual in the marketing of second-quality eggs is from 12 to 15 per cent. The loss incurred on poultry is more difficult to ascertain, but producers should realise, however, that the better the appearance of the birds, the better the demand, and the better the value.

On a commercial farm of approximately 1,000 birds there would be a little more than £600 worth of eggs sold per annum, and about £125 worth of live birds. These figures indicate that any reduction in receipts due to depreciation of egg quality and birds marketed could have a very serious effect upon the soundness of a poultry raising undertaking. The inferior quality of egg, as well as being unprofitable to those engaged in the business, has a depressing effect on local values, and has a tendency to reduce local consumption, consequently every effort should be directed to the maintenance of high-quality production.

Protecting Egg Quality.

As the loss due to deterioration in quality can be so great, it will readily be understood that every step should be taken to prevent this deterioration. To too many farmers, the egg is just an egg, and little thought is given to its quality. The producer should not lose sight of the fact that the hen provides a highly nutritious food in a convenient form, specially wrapped and sealed within a shell, although of a highly perishable nature.

A brief outline of the structure of the egg and the various causes of depreciation in quality it is hoped, will make for better care in handling and for the acceptance of recommendations made with the object of maintaining quality.

The yolk is the first part of the egg to develop. This takes place in the ovary where many hundreds of yolks are situated in various stages of development. Each yolk is enclosed in a sac, which, when the yolk is mature, ruptures along the non-vascular area, releasing the yolk into the oviduct. Occasionally this rupture extends beyond the non-vascular area, causing bleeding from one of the small blood vessels of the yolk sac, with the result that the yolk is released with a clot of blood. The presence of blood with the yolk renders the egg unmarketable on account of its appearance. When a producer is faced with a high percentage of such eggs, he should examine the system of feeding. Over stimulating foods are suggested as the probable cause, and if an examination of the total ration supplied indicates that the protein content is in excess of 15 per cent. the ration should be altered to reduce the crude protein content to that level; such alteration having as is object the reduction of the incidence of eggs with blood spots.

Plate 69.

THE MODERN PREMISES OF THE QUEENSLAND EGG BOARD, SHOWING ALSO PREMISES OF THE POULTRY FARMERS' CO-OPERATIVE SOCIETY.—For the year ending June, 1938, the average price paid to suppliers by the Board was 1s. 1.16d. per dozen, and a total to the industry of approximately a-quarter of a million pounds. The Board has distributed to producers £43,000 as profits on export since 1934, and it is anticipated that for this year approximately £8,000 will be disbursed.

The colour of the yolk is influenced by feeding, and may vary from that of a pale straw colour to a deep orange red. The colour most sought after is that of a good golden yellow, and breeders who are producing pale yolks may improve colour by feeding yellow maize and green feed.

As the yolk passes down the oviduct it gathers several layers of albumen. The first is a layer of dense albumen and the formation of what is termed the chalaza. The chalaza is that thickened, twisted mass of albumen that may be noticed when an egg is broken into a dish, extending from the yolk on opposite sides. The chalaza is intended to keep the yolk more or less centred in the egg. Passing further down the oviduct, the second layer of albumen is laid on; this is not so dense as the first. Then another layer of thinner albumen, followed by the two membranes, and then lastly the shell is added. The shell is not laid on in its solid form as seen, but by the accumulation of lime salts in more or less a semi-liquid form which becomes hardened before the egg is laid. Naturally there are minute pores between the particles in the shell-forming material. Nature, as a further protection, coats the egg with a gelatinous material before it is laid.

This coating is frequently referred to as the "bloom" of the egg, and if the egg could be carefully collected from the hen when laid, and allowed to dry, one would have then the best possible product to handle, and if given the correct subsequent treatment, there would be little cause for complaint as to quality. This, however, is not possible under commercial conditions, but it would be as well at the outset to realise that the less removal of the protective coating the better is the keeping quality of the egg, and therefore the producer should do all in his power to maintain the egg in its nearest approach to that as laid and realise that until some protective medium is found, which may be added to any fluid used for washing eggs, without detriment to the egg, that such washing renders the egg more susceptible to deterioration.

The poultry raiser has three principal factors to give consideration to in the protection of the egg quality—

(1) Fertile eggs;

(2) Soiled eggs;

(3) The effect upon the egg of heat.

There are other influences to which eggs may be exposed which affect quality, namely, the attack of moulds and bacteria. These influences, however, are not common where the best possible conditions for production have been followed.

The production of fertile eggs should be avoided as far as possible. Although incubators are operated at a temperature of 100 deg. Fahr., it does not need a similar temperature to commence the development of the germ, and in the height of summer it is almost impossible on many of our farms to keep eggs at a sufficiently low temperature to prevent some form of cell division taking place with fertile eggs, and once embryonic development has advanced to any degree and stops, decomposition soon follows.

Under these circumstances, males should not be allowed to run with the flock, excepting during the period when breeding practices are in operation.

Plate 70.

VIEW OF SECTION OF THE FLOOR ON WHICH EGGS ARE CANDLED.—Every egg received by the Board is submitted to this process. In this way, eggs are correctly graded for sale to retailers. During the peak period of 1937, no fewer than 73 girls were employed in the grading and packing of eggs.

The next condition to guard against is the soiling of eggs within the nests. Naturally, an ample supply of clean nests, sufficiently roomy for the bird should be provided. In these nests it is essential to have some form of material to make the nest comfortable and attractive to the bird, to protect the egg from being broken, and to protect the egg, as far as possible, from becoming soiled. Many egg producers use old butter boxes for nests. These, in size, are very suitable, and in planning any form of nests, the butter box could be used as a guide for size. The big factor is to construct nests so that they are readily cleaned, and of material that is free from odours as eggs, like milk, readily absorb taints.

Various forms of nesting materials are used, such as straw, shavings, sawdust, sand and shell grit. Shavings and sawdust are very absorbent, and not scratched out of the nest to the same extent as straw, and by reason of their fineness, are more absorbent, and have a greater cleansing effect upon the feet of the birds, thereby preventing, to some extent, the soiling of eggs. If sawdust or shavings are used, pine-wood residues should be chosen, as many of our hardwood sawdusts have a staining effect upon the shell of the egg. Shell grit is a reasonably good nesting material, naturally not so absorbent as sawdust, and too expensive in many districts for extensive use. Sand closely resembles shell grit, but many particles become attached to the moist gelatinous coating of the egg when it is laid, and they are most difficult to remove without washing.

It is not sufficient to provide suitable nests and nesting material. The frequency with which eggs are gathered has a very marked effect upon their cleanliness, and more than that, upon the labour entailed in preparing the eggs for market. Three gatherings per day is a practice that should be followed upon most farms, particularly during that period of the year when production is at its height, and several birds are visiting each nest daily. When production is slack, the gathering of eggs can be reduced to twice daily. Not only does the frequency with which eggs are gathered assist in keeping the eggs clean, it protects also against breakages, and the possible vice of egg-eating being developed.

The Effect of Heat.

The egg, when manufactured, is full. Upon cooling, there is a separation between the two membranes within the shell of the egg, which creates a small air cell. Heat hastens the evaporation of the moisture contained in the egg, enlarging that air cell. The albumen also becomes thinner, and the yolk more visible upon candling, and instead of being retained in a more or less central position of the egg becomes "sided," and at times attached to the shell. When this type of egg is broken for poaching or frying purposes the yolk is flatter, not standing up like a new laid egg, or an egg which has not been subjected to heat, and the albumen by being thin spreads—both conditions which the consumer does not appreciate.

It does not require a very high temperature to cause this breaking down, and it has been found that a temperature over 60 deg. Fahr. is conducive to rapid deterioration of quality. In fact, temperatures of 68 deg. Fahr. have been known to stimulate embryonic development; therefore the coolest position upon the farm should be sought for the storage of eggs pending shipment to markets. Further protection of the egg against excessive heat is given by frequent gatherings, as it prevents their being reheated by the visits of several other birds to the nests.

Eggs should be gathered in 2-gallon buckets with rigid sides. A bucket of this capacity will hold from 100 to 120 eggs, the bulk of which is conducive to the rapid loss of animal heat when placed in cool quarters. The nests should be erected in positions that are not exposed to the sun. For this reason nests extending in front of the poultry sheds are not recommended as most suitable for the preservation of quality. During transit to market cases of eggs should also receive some protection.

The storage of eggs on the farm pending shipment to market is most important. They should be held in a room which is as uniform in temperature as possible. One between 40 deg. and 60 deg. Fahr. would be ideal. It should be free from odours, and have good ventilation. If the air is too dry the humidity may be increased by setting pans of water about the room or sprinkling the floor. Excessive moisture, however, should be guarded against. This is indicated by condensation.

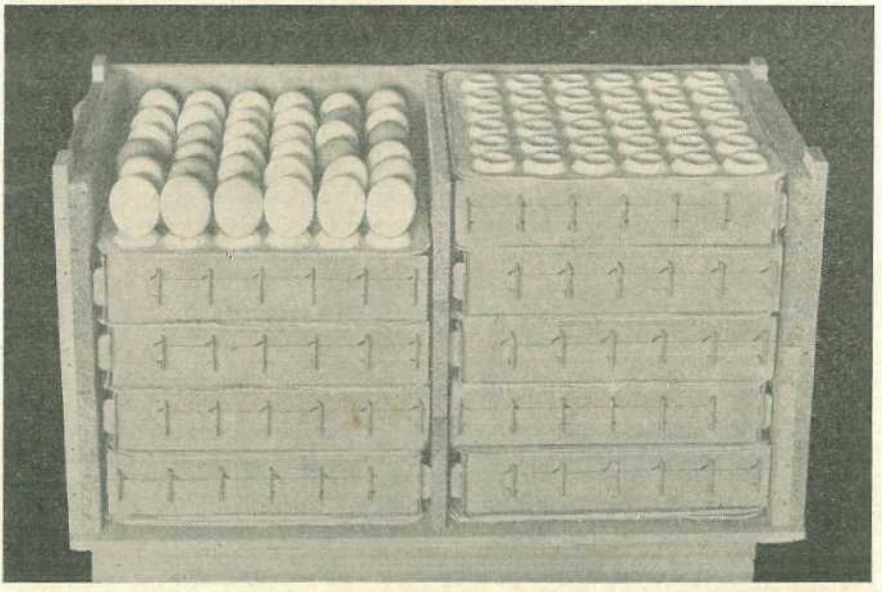


Plate 71.

Standard Egg Case Used by Suppliers to the Queensland Egg Board.—Note one filler removed and the eggs standing up in the flats. It will be seen that a leaking egg is not liable to cause the soiling of others. Observe also that there is no need for any further packing besides that supplied.

Moulds and Bacterial Infection.

Mould invasion of eggs is not uncommon in Queensland, particularly during the humid conditions that prevail in the early part of the year. Mould growths in several instances have been traced to the ordinary brown strawboard fillers frequently used, and on other occasions to nests in which mouldy grass or straw has been used for litter.

Humid conditions are conducive to the development of moulds, which enter the eggs through the pores of the shells, causing them rapidly to develop into what is known as black rots. Protection is afforded by the utilisation in the nests of only sweet and dry nesting

material, by keeping the cases and fillers used for packing as dry as possible, and by never packing eggs that have moisture adhering to the shell.

Bacterial invasion of the egg is not uncommon, and in every instance that has been investigated the infection has extended only to those eggs that have been submitted to a cleansing process by washing. As previously mentioned, washing removes that protective coating placed on by nature, and as it is the frequent practice to totally immerse soiled eggs in water which has been polluted by hundreds of others, it will readily be understood how easy it is to convey harmful bacteria from one egg to another.

As a protection against bacterial invasion of the egg as much of the dirt and filth adhering should be scraped off with a knife while the egg is dry, the water used for washing purposes replenished at frequent intervals, and any cloths used in cleaning kept clean by frequent rinsings, and if the cloth is to be used from time to time, sterilized by boiling. In any cleansing process it may be necessary to remove stains with an abrasive. When such is necessary, select some odourless material which is not of too coarse a nature.

Recently an experiment was conducted by the Missouri Experiment Station in the washing of eggs by adding to the washing water 1 per cent. of lye water as a protective against bacterial invasion. This experiment indicates that the problem of egg quality due to bacterial invasion is not only common to Queensland. The Missouri experiment appeared highly satisfactory, but in view of the caustic nature of the solution used it does not appear to be a practice that could be generally adopted, and it is only referred to to indicate the need for the exercise of the greatest care in production and the desirability of reducing the need for washing until some suitable protective agent is found.

Packing.

The practice of using chaff, &c., for packing material, fortunately, has largely disappeared, and the standard case and fillers adopted. Many producers, however, with the object of effecting greater protection to the egg, use chaff and material of a like nature in the bottom, and frequently the top of the cases. This is not recommended. As well as causing the eggs to become dusty in appearance the practice exposes the egg to infection by moulds. If it is at all necessary to use anything to take up the slack in the case crumpled paper is preferable.

The standard 30-dozen case, as now used by the Queensland Egg Board, is one that obviates the necessity for any further protection, and is definitely recommended to all producers as the best means of packing.

Adherence to the following rules will largely govern the production of quality eggs:—

(1) Breed only from birds that produce eggs of satisfactory size and shape and good-quality shell.

(2) Provide only wholesome food, including shell grit, and fresh water. Remember that yolk colour is improved by the feeding of green feed and yellow maize.

(3) Produce infertile eggs for market, thereby preventing them from decay due to partial embryonic development.

(4) Provide at least one nest and clean nesting material for each five layers. Keep the nests dry and protected from the sun.

(5) Do not allow broody hens to occupy nests. They heat up the eggs.

(6) Gather eggs thrice daily in summer and twice in winter, in a clean bucket, and stand in a cool place until animal heat is lost before packing.

(7) Do not wash eggs unless absolutely necessary to make them thoroughly clean. Aim at keeping them clean by good management.

(8) Keep eggs until marketed in a cool, clean room free from odours.

(9) Market eggs at least twice weekly, protecting them from the sun during transit.

(10) Use only standard cases and fillers for packing.

MARKETING TABLE POULTRY.

The basis of the poultry industry in Queensland is egg production, for which breeds such as leghorns and australorps are bred, the former predominating. Under these conditions the class of bird which forms the bulk of poultry sold for table purposes are young cockerels of both light and heavy breeds and hens culled on account of their age or for other reasons which have rendered them unprofitable as egg producers.

Present System of Sale.

The birds are received by the selling agents by rail or direct from the producer in crates of all types, shapes, and sizes. They are then dumped on the saleroom floor, little effort being made by either the producer or agent in the direction of classification, and sold to the highest bidder.

Undoubtedly, at times, even under these conditions, the birds tendered for sale realise payable prices, but, again, at other periods they are sold considerably under their value. The low values are, no doubt, influenced by the supply and demand, but at the same time, if the birds were classified and displayed to advantage, values would be materially increased.

Classification of Poultry.

A *prime roaster* is a cockerel that has made the maximum development without reaching full maturity. This is indicated by his plumage being just short of adult, his comb not fully developed, and there is no evidence of spur development. Again, he has shown little evidence of sexual activity. If a bird is retained beyond this stage he is referred to as a stag. Most of our dual-purpose birds are best as prime roasters.

Small Roaster.—This term is used for a bird of about three and one-half to four months of age. Many of our early-maturing breeds, notably Leghorns and some strains of Australorps, are very plump at this age, and show the maximum development for the quantity of food consumed. It frequently happens that birds kept over this age develop considerable frame for a time, and appear poorly fleshed.

Grillers.—Young chickens 1½ to 2½ lb. in weight. They must be grown quickly to be plump and marketable, and it is only during the early portion of the season that reasonable values are obtainable.

Culled Hens.—Old hens that have finished their lay or hens culled as being poor producers. Old hens that are to be disposed of on account of age should not be retained until the moult is well advanced. It is frequently more remunerative to sacrifice the few eggs they will produce than to retain them until they are a mass of pin feathers. The following of this practice would make a greater spread of the supplies and be more in keeping with the demand.

A *stag* may be any old cock bird or a cockerel with adult plumage showing evidence of spur development. The flesh upon such birds is tough, and in cooking the same treatment is necessary as in the preparation of an old hen.

The following table indicates the approximate weights which can be expected at different ages of leghorn and australorp cockerels, and also the feed consumed:—

Age.	Leghorns.		Australorps.	
	Feed Consumed.	Weight of Birds.	Feed Consumed.	Weight of Birds.
	Lb.	Lb.	Lb.	Lb.
10 weeks	5¼	1⅜	6⅛	2⅛
12 weeks	7¼	2⅛	9	3
16 weeks	11¼	3	14	4¾
18 weeks	13½	3¼	17½	5¼
20 weeks	..	..	21	5¾

At the age of sixteen weeks leghorns commence to show great sexual activity, and their rate of development slows up. It is questionable if it is economically sound to retain them for a longer period. The same conditions do not apply to australorps until they are eighteen weeks old. Many other dual-purpose breeds are slower in sex maturity, and can be retained longer without loss of flesh quality.

Transport of Poultry.

The conditions under which table poultry are sold undoubtedly leave room for improvement, both from a humane and a commercial point of view. From the humane point of view, the crates used for forwarding birds to market should have sufficient head room and floor space for the number and variety consigned. They should be well ventilated and provided with water receptacles, the latter being firmly attached to each corner of the crate. The crates for fowls and ducks should be at least 18 inches high, and those for turkeys and geese 30 inches. This permits of the birds crated being able to stand erect without injury. The actual dimensions or area required for an individual bird naturally varies according to the numbers and variety to be marketed at one time. Crates 4 feet long by 2 feet 6 inches wide, with a partition in the middle, will comfortably hold sixteen to twenty birds, according to their size and to the prevailing climatic conditions. The object of the partition is to prevent crowding to one end and consequent

losses in the event of the crate becoming tilted in transit. A little thought on the part of the producers for the birds' comfort in transit would prevent overcrowding of crates. If the crates are well made they will last for some time, as well as ensure the comfort of the birds both in transit and while awaiting sale. Good crates are worth being returned from markets, which obviates the necessity of constantly constructing makeshift crates.

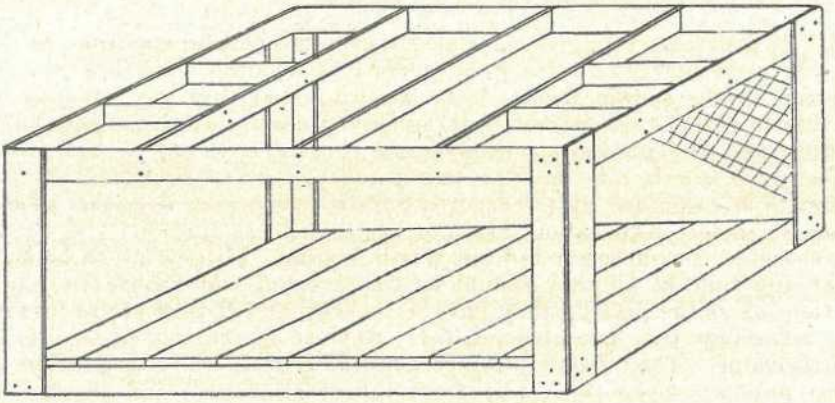


Plate 72.

A Consignment Crate for Poultry.—The sketch illustrates a crate of simple design, the measurements being 4 feet long, 2 feet 6 inches wide, and 18 inches high. It is made entirely of pine, the frame being 3 inches by ¾ inch, and the bottom 6 inches by ⅝ inch. Doors are provided in the top, and the whole structure covered with 1½-inch mesh netting. If larger netting is used, it is desirable to place a piece of timber around the frame at least 2 inches higher than the floor to prevent the birds' legs protruding and becoming injured.

There is a right time for marketing stock, whether they are young or old. Every day they are kept on the farm after reaching sale condition adds to farm costs. The crates can, with a little care, be so constructed as to permit of the birds being seen to advantage by the buyers. Under the present conditions of selling it is a few minutes' work for the assistant to burst open a crate and pass a bird or two round for inspection. Doors placed on the top of the crate would facilitate this work, allowing buyers greater time for examination.

The individual producer has to consider such questions as the time of marketing, condition of stock, grading, and crating.

Cockerels constitute, possibly, most of the birds that a producer has yearly for sale, and present greater difficulties by reason of the fact that they have to be disposed of during a relatively short period. They may be sold at various ages, each age having its special advantage. Although most buyers prefer young stock for table purposes, they will not pay high prices for small, half-grown birds when larger hens are available, which would proportionately be much cheaper. Having this in view, it is not a desirable practice for the producer to send half-grown cockerels to the market and expect to receive good prices for them during the time when the great majority of our old hens are being disposed of on account of age. This period varies, but usually extends from some time in January until April. Young, half-grown birds will find a ready sale from August until the Christmas season.

After that period young stock should be well grown to command good prices, but not kept until they become staggy, which is indicated by spur growth.

Although cockerels with slight spur development may at times bring remunerative values, it will be noticed that such values are only obtainable at that period of the year when there is a shortage of supplies, and that during the period when prime cockerels are available those carrying spur development are not sought by buyers.

It is necessary to give some attention to the general condition of the birds to be marketed. No good is done by sending stock low in condition to the selling floor. It is not suggested that any attempt be made to fatten this class of bird, as they generally are constitutionally unfit, and the producer's ends would be better served if they were destroyed, for it may happen that these particular birds will be the first to be examined by prospective buyers. Cockerels, however, should receive some consideration, and not be treated—as they too frequently are—as an encumbrance and not worth feeding. If they are to be kept for any time at all they should be well treated and receive the same attention as the pullets; they have to be kept, and if they are to be sold to advantage they must be well fed. Rubbish in the way of food is of little value. They require, for economical growth, the same ration as the pullets. Keep them free from intestinal worms, and dispose of them as early as possible.

In the raising of cockerels for table purposes, particularly heavy-breed cockerels, it is advisable occasionally to examine the breasts for defects. In quick-growing heavy-breed cockerels, blisters upon the breasts are not uncommon. These blisters eventually callus up, and, at times, are responsible for the complete condemnation of the carcase. The perching of heavy-breed cockerels on wire-netting and on rough perches appears to be conducive to this disorder, and if the condition is noticed upon examination some action should be taken to prevent the trouble from becoming general. When such a condition is found it is suggested that the cockerels be given straw to sleep upon if they are being raised upon wire-netting; should they be perching, that the perches be smoothed off and, if narrow, wider ones—say, 3 inches in width substituted. The wider perch may also have the effect of reducing the number of crooked breasts—a feature that also depreciates values.

Crating should receive the attention previously suggested, and a good layer of straw or grass placed on the floor to ensure the stock being in a clean condition on reaching the market. The birds crated together should be alike as possible as regards age, size, and condition, and of the one variety.

WOMEN FARM WORKERS IN BRITAIN.

The number of women employed in agriculture in Britain is increasing to a remarkable extent. This is attributed to the fact that women in the country districts of the Old Land during the past year have been attracted to farming because it is now included among the insurable industries under the National Insurance Scheme. On the other hand, there is a shortage of men for farming work, even at wages well above the fixed rate for farm labour. The revival of the heavy industries as a result of the rearmament policy is probably the reason for this.

Suitable Cotton Varieties for the 1938-39 Planting.

THE bulk of the requirements of the Australian spinners for the coming season will be for cottons of 15/16th to 1-1/16th inch in length. This will necessitate a greater growth of varieties producing these staple lengths than has been the custom in the past. The following recommendations are therefore made to assist farmers who have not grown such cottons before to select the most suitable variety of this type for their soils.

The best variety producing the shorter cottons on the alluvial soils of fair to good fertility in the Southern district and the South and Central Burnett districts appears to be the Half-and-Half, which has yielded very well in these areas during the last two seasons. It has not done well in trials in the Callide Valley, and cannot be recommended for that area. It has a medium-sized boll, which picks well when the variety is grown under favourable conditions, yields cotton around 15/16th inch in length, and has a lint percentage of approximately 40. It should be grown on soils of low moisture-retaining ability, for adverse conditions markedly reduce the size of the bolls and the quality of the lint.

The Lone Star variety appears to be the outstanding cotton for most of the clay loam soils of the lower slopes originally covered with ironbark and box trees of the forest series, and brigalow, brigalow-wilga, and brigalow-belah of the scrub series. For several seasons this variety has yielded satisfactory returns on such soils in the Maranoa, the South, Central, and Upper Burnett, and the Callide Valley districts. It is rather a vigorous grower on fertile loamy soil, however, and should, therefore, not be planted on alluvial loams in districts likely to experience heavy mid-seasonal rains. It has large, well-opened, easily picked bolls, produces fibre from 15/16th to 1-1/16th inch in length, according to soil and climatic conditions, and yields around 36 per cent. lint for the bulk stocks, and up to 38 in some of the newer developed strains.

It is undoubtedly a variety well suited for many of the districts, and should be grown wherever possible, as the lint is in great demand by the spinners.

Another big-bolled cotton that should be grown to the fullest extent is the Miller variety, which has given excellent results on the clay loam soils of the lower forest and scrub slopes, as well as on the alluvial clays of moderate fertility in the Wowan, Callide Valley, Upper Burnett, South Burnett, and Southern districts. It is earlier fruiting than Lone Star and can, therefore, be planted on more fertile soil, but requires greater moisture than does the latter variety, thus making it a better cotton for the heavier soils of the slopes in the coastal areas. The bolls are very large, and are exceptionally easily picked, particularly on cultivations following grassland; the fibre is the fullest bodied of any cotton grown here, and averages around an inch in length, with a 35 lint percentage. As a rule, rather high grades of lint are obtained with Miller, for the fibres clean up well in the ginning operations.

Cliett is a big-bolled variety that competes with Lone Star and Miller under certain specialised conditions, but is not recommended for distribution except where carefully conducted tests have indicated its superiority.

Mebane is a nice type of big-boll cotton that produces excellent fibre on sandy soils overlying clay in the drier districts and on the harder clay melon-hole soil types of the brigalow scrub, where it gives very satisfactory results. It is not suited to the better soil types, however, owing to a tendency to make rank growth on such soils under good rainfall. Under suitable conditions it is a good picker, with a 38 lint percentage, and produces fibre ranging from 1 to 1-1/16th inch in length.

The most promising of the shorter stapled cottons for the fertile alluvial loams are Half-and-Half and New Boykin in the Upper Burnett district, and New Boykin and Ferguson in the Callide and Wowan districts. Ferguson is a quick-maturing type that under favourable conditions produces 15/16th inch to 1 inch cotton of good quality, has a 37 lint percentage and a boll of medium size which opens and picks well. When it is grown on droughty soils under adverse conditions the variety reacts severely, the lint percentage dropping to 35 with the fibres tending to be soft. Care should be exercised, therefore, in selecting suitable soil for this variety. New Boykin has proved itself a very uniform cotton, yielding well in a normal season. The staple length varies from $\frac{7}{8}$ inch to 1 inch, and it has a lint percentage of about 37.

It will also be necessary to produce a reasonable amount of $1\frac{1}{8}$-inch cotton, and farmers who have obtained satisfactory yields of high-grade cotton with Indio Acala should continue to grow this variety. It is advised, however, that there is little demand for the softer or yellow-spotted grades of these longer cottons, and where growers have received mostly yellow-spotted grades they should resort to the Miller or New Boykin varieties, for apparently their conditions are not suitable for the longer cottons.

It is stressed, though, that there is a bigger factor of safety for obtaining satisfactory yields of cotton of good quality from all varieties during the first three or four seasons following the breaking-up of grassland. After that, the changes in the chemical and physical condition of

the soil that occur with further cotton cultivation make it necessary that the varieties be very carefully selected to suit the soil and climatic conditions.

It is strongly recommended that when in doubt as to the best variety, the farmer should apply for advice either to the field officer of the cotton section of the Department of Agriculture stationed in his district, or direct to the Department of Agriculture and Stock, Brisbane, for a large amount of evidence has been collected as to the merits of the different varieties which would be of assistance in determining the best variety, if the soil type is described.

Cotton Seed Distribution.

THE distribution of cotton seed for the coming planting season is now in progress. For the benefit of farmers intending to order seed who are not acquainted with the details, it is advised that the recommended rate of seeding is 12 lb. per acre for planting in the newly-burned scrub; 15 lb. delinted and 20 lb. fuzzy seed per acre in the cultivations. The cost of seed, including freight to the grower's nearest railway station, is 1d. per lb. for fuzzy and 1¼d. for delinted. Applications for seed, accompanied by a remittance at the specified rates, should be sent to the general manager of the Cotton Board, Whinstanes. A description of the soil type should also accompany the order to assist in selecting the most suitable variety for the conditions.

Judged by the ratio of delinted to fuzzy seed issued to date, it would appear that many growers are not fully aware of the advantages of planting delinted seed. Carefully conducted tests at the Cotton Research Station have indicated that, except where planting in the dry soil is practised, the use of delinted seed has marked advantages over the fuzzy seed. The removal of the fuzz allows the seed to absorb soil moisture more quickly, thus speeding up germination and enabling a strike to be obtained on a light storm. This is a decided asset, for frequently a grower may have a well prepared seed-bed with an ample supply of moisture below the surface and yet may not dare to plant fuzzy seed following a light storm, as germination would be so slow that the effect of the storm would be lost before a full stand could be obtained. By using delinted seed a gain in germination of fully forty-eight hours would be effected, which would be ample to give the seedlings the benefit of most of the surface moisture, and thus allow them to penetrate into the good supply of moisture stored up in the lower layers of the soil from earlier rains.

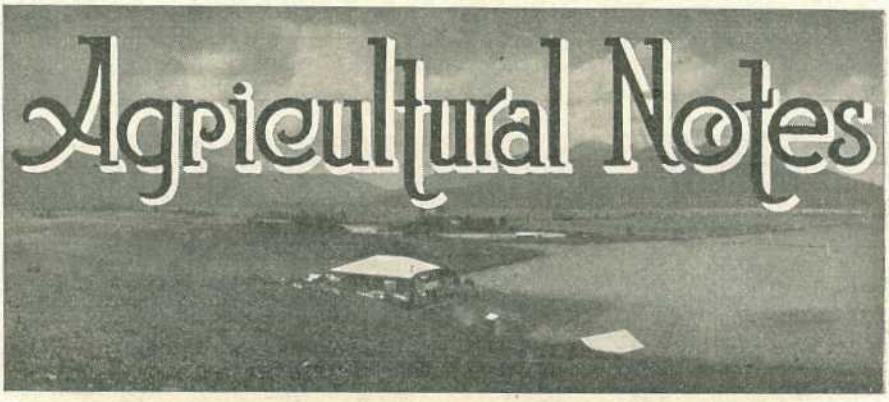
The removal of the fuzz is also of value in the planting operations, in that the seed is more uniformly spaced than is the case with the fuzzy seed. Fuzzy seed tends to cling together and come through the planter in bunches, and it is necessary to plant more seed than is actually required in order to obtain a full stand. By using delinted seed a

lighter rate of sowing—12 to 15 as compared to 18 to 20 lb. per acre—is sufficient to produce a good stand, and, in addition, reduces the competition for moisture between the seedlings, because of the more uniform spacing, which enables them to withstand adverse conditions to much better advantage. Likewise, the lighter and better spaced stand obtained with delinted seed is of value to the farmer where thinning has to be delayed unavoidably, for the plants will be able to develop reasonably well past the correct stage for thinning.

Another advantage of delinted seed is that it can be sown with the ordinary maize planter equipped with the usual six-hole seed plate, having holes three-eighths of an inch in diameter with only slight adjustments to the machine, whereas the fuzzy seed requires special cotton seed attachments for the planter. Full details of such adjustments may be obtained by writing to the Department of Agriculture and Stock.

Growers planting in the newly-burned scrub areas immediately after planting rains should also use delinted seed, for it is suitable for the walking-stick hand planters, without any of the treatments that are required to paste down the fuzz of the undelinted seed. Sufficient evidence has not been collected yet as to the merits of the delinted seed for planting in the dry ash, as is often done by growers of large acreages of cotton in the newly-burned scrub areas. It is possible that treating the fuzzy seed in a manner to paste the fuzz down so that the seed will run freely through the planter may be the best system for dry planting, as considerable rain is required to wet up the ash sufficiently to enable a strike to be maintained. The delinted seed might germinate on light rains, whereas the treated seed would require greater rainfall, which would ensure better conditions for the resultant seedlings.

Where planting in the dry soil of the cultivations is intended, it is better to use fuzzy seed, for it does not germinate if light showers of around 20 points of rain are experienced after the seed is in the dry soil. Planting in the dry soil has merits where a large acreage is to be sown, but also has definite drawbacks, especially on old cultivations, where the physical condition of the soil may be such that the surface sets badly following heavy rain. In such cases it is very difficult to obtain a good strike from dry planting, and growers have to replant their whole acreage in some seasons. It is recommended, therefore, that only the portion of the acreage that cannot be planted within three days after the planting rain be dry planted. Under such a system, the grower has a good chance of obtaining a satisfactory strike over all his area with the first good planting rain, without running the hazard of having to replant the whole of his acreage in the event of a heavy cold rain rotting all the dry planted seed. If such a rain does occur, under the recommended system, a good strike should be obtained from the area planted after the rain, thus leaving only the dry planted portion to be replanted following the next rain.



Poona Pea as a Green Manure Crop.

THE Poona pea belongs to that class of legumes commonly known as "cowpeas" and more particularly to the *catjang* or Indian cowpea group. The origin of the name "Poona" is obscure; this is not used overseas, but it appears probable that the introduction was made from Poona in India and that the term was used to describe this particular variety of cowpea. It was introduced into Queensland a good many years ago and in later years has enjoyed a remarkable rise to favour as a green manure crop in North Queensland. At the present time in the far north it is probably planted to a greater area than the combined areas of all other green manure crops. The reasons for this expansion are—(1) the small cost of seed, one bushel costing approximately 15s. being ample for the broadcast seeding of 3-4 acres; (2) quick and certain germination; (3) ability to produce a heavy crop on poorer lands.

Although the Poona pea may take longer to attain maturity than, say, the Groit bean or the black cowpea, nevertheless it must be regarded as a quick maturing crop and may usually be ploughed in some 10-12 weeks after planting. It is a prolific seeder and for that reason must be ploughed in when the seeds are in the milk stage, otherwise some trouble may be experienced later.

The Poona pea is rich in protein and makes an excellent stock food either cut and fed green or when stored as hay; it is widely used by dairy farmers in Southern Queensland. We have not had much experience of the ratooning of this crop but have observed several instances of excellent ratoons being produced; for this purpose it would appear necessary to cut the crop early, before the first seed has set. In some instances the plant crop has been used for fodder and the ratoon crop ploughed in for green manure purposes. (See Plate 73.)

Unfortunately this otherwise excellent plant is rather susceptible to a wilt disease which attacks it in wet weather. The stem of affected plants starts to discolour and wilt a few inches above ground level; the infection then extends down to the roots and the plant eventually dies. This wilt spreads very rapidly in the wet season and a whole planting may be destroyed in a short time. Although it generally commences

in the wettest portions of fields its spread appears to be mainly dependent upon continued wet weather and it has been observed on every type of soil, including well drained hillsides. In areas where this wilt persistently occurs it would be advisable to plant the Groit bean or the giant, black, or victor cowpea.

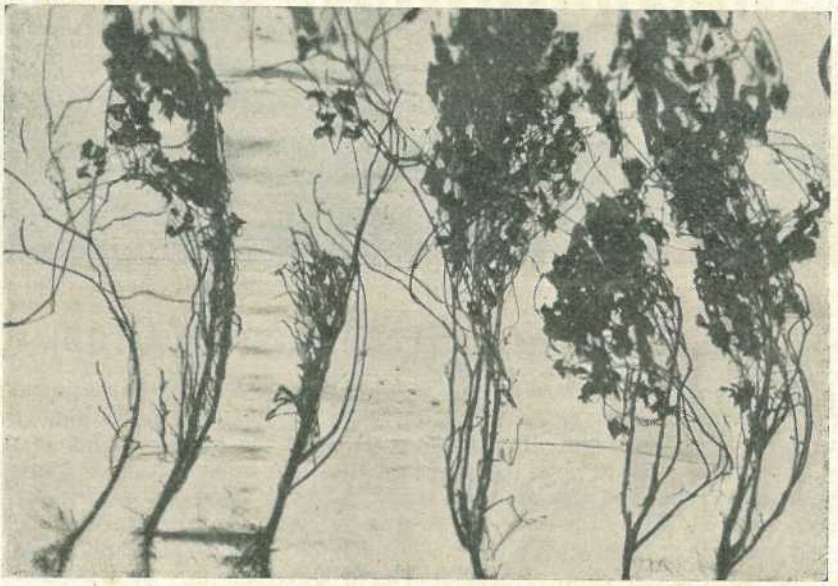


Plate 73.

Poona pea grown on the farm of F. J. E. Holt, The Cedars, Mackay. The three plants on the left represent the plant crop, and the three on the right the ratoon crop from portion of this plant crop. The older plant crop plants have naturally become woody and defoliated, but it will be seen that the ratoon plants have grown better even with the shorter growth period.

As in the case with all legumes, Poona pea has the faculty of working in association with nitrogen-fixing bacteria and obtaining its supplies of nitrogen from the air and not from the soil. Consequently when such a crop is ploughed in the nitrogen content of the soil is considerably enriched. These nitrogen-fixing bacteria carry out their work in small nodules attached to the roots of the growing plant. It should be pointed out that these bacteria will not carry on with nitrogen fixation if there is plenty of nitrate available in the soil and thus no additional stocks of nitrogen will be accumulated. From this point of view therefore it is desirable to plant the green manure soon after harvesting and ploughing out, when the nitrate supplies of the field are low. By the same token it should be borne in mind that if nitrates are plentiful it is possible to grow an excellent crop of Poona pea without the formation of a single nodule—but in such a case all the nitrogen will have come from the soil and not from the air.

Particular strains of these nitrogen-fixing bacteria are specific to particular groups of plants while, in addition, one strain may be much more efficient than another strain which works in the same plant. Consequently, in order to ensure that efficient strains will be present in the soil, modern agricultural practice aims at the planting of suitably inoculated seeds of legumes. In Plate 74 will be seen the advantage gained from

the inoculation of Poona pea with a highly efficient strain of bacteria as compared with a less efficient strain. Cultures of this efficient strain are maintained in our Pathology Laboratory in Brisbane and can be made available to cane growers at a nominal charge. Application, accompanied by a postal note or stamps to the value of 1s., should be made

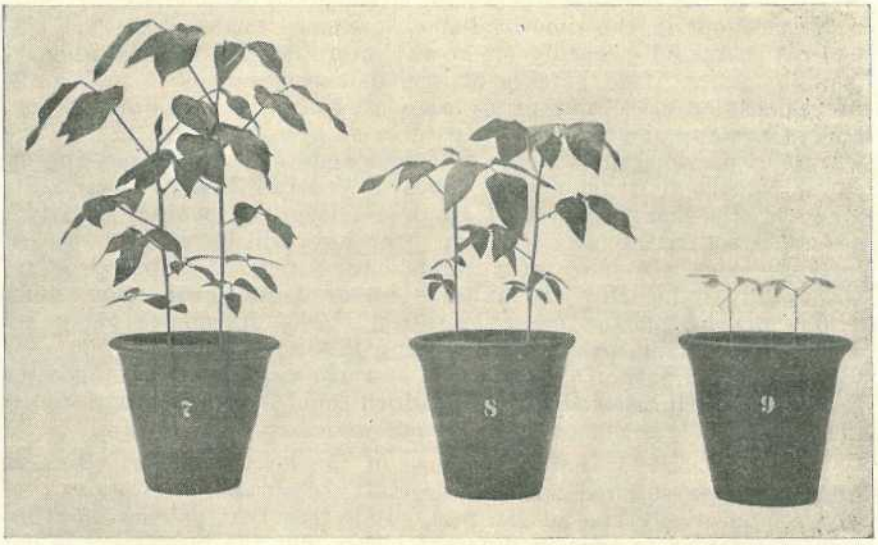


Plate 74.

Poona pea plants grown in sterilized sand. No. 7 inoculated with a good strain of nitrogen-fixing bacteria. No. 8 medium strain, No. 9 not inoculated.

to the Director, Bureau of Sugar Experiment Stations, Brisbane, at least three weeks before the proposed planting; in making such applications the weight of seed to be planted should be furnished. The process of seed inoculation is very simple and rapid, and full instructions will be issued with each culture.

—A. F. B. and G. B. in The Cane Growers' Quarterly Bulletin.

FERTILIZER "BURN."

A severe case of fertilizer burn has been brought to our notice in the Mulgrave area, where a field of D.1135 failed to germinate and had to be ploughed out and replanted. The damage can be attributed directly to the method of application rather than to the type of fertilizer used. In planting, a combined driller, planter, and fertilizer machine was used, the fertilizer being dropped immediately on top of the plant. The result was that the young, tender roots were burnt and the set failed to grow.

The Bureau has always recommended placing fertilizer in the drill with the plants, but at the same time advises this to be put in the bottom of the drill and under the plant.

It is not suggested that applying fertilizer on top of the plant will always cause trouble, but nevertheless it has been proved that under certain conditions a complete failure in germination may result. In the case under review only 4 cwt. of fertilizer per acre was applied, and while soil moisture was ideal at the time of planting, dry conditions followed. The rows without fertilizer gave almost 100 per cent. "strike."

—G. B., in The Cane Growers' Quarterly Bulletin.

Cane Grub Control in the Isis District.*

R. W. MUNGOMERY.

WHILST investigating the progress of the Giant American Toad in the Isis district in the early part of the present year, attention was paid to the cane grub pest and, although no detailed survey could be carried out in the time available, it seemed evident that the pest had not increased markedly (if at all), over the general infestation of previous years. Odd patches of grub-damaged cane were to be seen in various localities, and grubs were even bad in paspalum pasture land where they had killed out patches of grass, but this has been a feature of previous infestations too; the standover crops do not appear, as yet, to have given the pest any great impetus to increase abnormally. However, the standing over of crops and longer ratooning, and their general effect on the increase of the grub pest, will have to be watched carefully over a number of years to ensure that these practices are not unduly influencing the building up of denser grub populations. Where grubby patches occur in ratoon blocks of cane, growers are warned against the practice of allowing this cane to stand over, since the combined influence of both grubs and dry weather often reduce the final yield much below the tonnage which could have been harvested if the block had been cut as a normal one-year crop.

It is pleasing to note that some of the larger estates, which in previous years suffered such heavy and widespread infestations, are now comparatively free of the pest. It is true that patches of grubs occur from time to time in different blocks, but the infestation is not on such a huge scale as previously. This changed status of the grub pest appears to be due to the system of using the high-speed rotary hoe and eliminating spring planting. When blocks are being prepared for planting they are given two high-speed rotary-hoeings during summer months, when the majority of the grubs are located in the upper soil levels. To get the maximum benefit from these operations it is best to carry out this work when the soil is reasonably moist. These two operations should also be spaced at an interval of six weeks to two months in order to ensure that any grubs which are below the depth to which the implement works on the first occasion, will almost assuredly lie within its range at the second working, when they move up near to the surface. Dry soil conditions tend to make the grubs retire deeper in the soil, hence the undesirability of carrying out this work when the soil is in that state. After the first rotary-hoeing a grubber can sometimes be worked through the block with advantage, as this allows the hoes of the implement to cut more deeply during the second operation.

These operations account for a large percentage of grubs and, when planted to cane in February or thereabouts, the block then starts off with a very low grub population and, in typical grub-infested areas, it can usually be expected to remain reasonably free of the pest until the second ratoon crop.

Such a system of grub control, involving the use of expensive tractor equipment, was necessarily limited in previous years to those large plantations which could afford such heavy overhead expenses as this equipment involves. However, we understand that a high-powered unit now operates in the Isis district on contract work and although we have not had the opportunity of checking the grub mortality behind this machine, reports indicate that it is much in advance of the ordinary type rotary hoe commonly used by growers.

* Reprinted from *The Cane Growers' Quarterly Bulletin* (Bureau of Sugar Experiment Stations, Department of Agriculture and Stock) for July, 1938.

The more widespread adoption of this form of grub control seems to be a definite forward move and it has much to commend it over the more tedious, costly, and less efficient method of single furrow ploughing and hand-picking.

THE CULTIVATION OF GRAIN SORGHUMS.

The production of grain sorghum as an alternative to maize in the drier farming areas is well worth consideration when planning cropping programmes. There is no doubt that suitable varieties of grain sorghums will yield profitably under seasonal conditions which are usually unsuitable for maize grain production.

Friable medium heavy loams will produce the heaviest yields, but satisfactory crops can be grown on average wheat lands throughout the Darling Downs, Maranoa, and the agricultural districts of Central Queensland. The best results are obtained from thoroughly cultivated winter-fallowed land.

Grain sorghums may be sown through standard grain drills, either in rows 3 feet to 4 feet apart, permitting of inter-row cultivation, or through every grain run or every second grain run of wheat drills. When sown in the wide-spaced rows, 4 to 5 lb. of seed per acre are usually necessary, although satisfactory stands have been obtained with a seeding rate as low as 3 lb. per acre.

Of the tall-growing varieties, Feterita and Standard Milo have given the best results, Blackhull Kafir and White Milo also being satisfactory types.

For large-scale production of such varieties it is usually necessary to harvest with a maize binder prior to curing, carting, and threshing.

Small areas can be headed with a cane knife and carted direct to the barn, subsequently passing the heads through a thresher or corn sheller suitably adjusted for the purpose.

The dwarf-growing varieties, however, offer the greatest opportunity for economical production within the wheat areas, as harvesting can be successfully undertaken with header-harvesters, reaper-threshers, or autoheaders.

During the 1936-37 season, when maize crops on the Downs failed generally, small areas of Wheatland Milo, Brown Yolo, Kalo, Day Milo, and Dwarf Pink produced marketable grain, the yields varying from approximately 6 to 50 bushels per acre, according to seasonal conditions in the district concerned, three growers harvesting with standard grain-harvesting machinery. As grain sorghums can be relied on to produce heavier yields than maize during any season, the fact that machine harvesting is now possible should greatly enhance their popularity.

In some districts bird pests are very troublesome, but with increased areas these probably would prove less serious.

Regarding food value, the grain sorghums are little inferior to maize. Feeding tests carried out in the United States of America have indicated that grain sorghums had approximately 90 to 95 per cent. of the feeding value of maize for fattening cattle, pigs, and lambs. The protein content of grain sorghums is generally higher than that of maize.

—H. W. Ball.

Grub Control in the Burdekin District, 1937-38.*

H. G. KNUST.

THE following notes on cane grub control in the Lower Burdekin have been compiled from observations made during visits to this district in 1937-38:—

The repeated heavy waterings of cane lands in the Burdekin District does not appear to have any definite effect on the time of emergence of the greyback beetles, as is instanced by the fact that beetles did not emerge until after the copious rains which occurred at the end of last November. Following these rains large emergences occurred in various parts of the district where grub infestation had been great and destruction considerable earlier in the year; emergence occurred from the cultivated lands, and it was not until later rains occurred, in late January and early February, that beetles emerged from the grassed and timbered lands.

Collection of beetles under the Burdekin conditions would, in my opinion, be a very unsatisfactory method of control; feeding trees (Black Palm, Bloodwood, Moreton Bay Ash, and Ti-tree) occur throughout the district and are numerous in the large areas of forest lands within and adjoining the cultivated lands. Under these conditions only a small percentage of the beetles could be collected, and a sufficient number would be left to cause considerable damage. Destruction of any small areas of feeding trees within the cane areas should reduce the grub population adjacent to these areas, but destruction of the larger areas is, I consider, a very big undertaking and may not be beneficial.

Apparently, continued favourable weather conditions have been responsible for a low mortality of grubs and beetles, and this year we find that grub populations per infested acre are high, ranging from an average of 3 to 14 grubs per stool. Fumigation has been practised this year, and the results accruing therefrom should be beneficial.

When fumigating careful supervision has to be maintained for the following reasons:—

1. Some soils appear to hold the moisture longer than others and cracking of the soil occurs, quite soon after rain, in some situations. When cracking occurs water has to be applied to make the soil suitable for fumigation.

2. The water furrows between the rows of cane, and the application of water to these furrows does not force an early concentration of grubs at the base of the stool but rather tends to keep the grubs scattered for a longer period, and the grubs appear to favour the root growth in these furrows.

3. Where grubs concentrate at the base of the stool they feed from 4 to 10 inches below the surface, due to the necessity for heaping soil against the stool to create water furrows and the consequent burying of the stools.

* Paper contributed at a Conference of Cane Pests Destruction Boards, held at Meringa, on 25th May, 1938.

It is my opinion that, with the assistance of the weather conditions peculiar to the Burdekin District, fumigation will considerably reduce the grub-infested areas, but small areas of cane lands immediately adjoining the large areas of forest lands will have to be continually watched and fumigated if necessary.

SUMMER FODDER CROPS IN THE MARANOA.

The possibilities of summer hay and fodder crops for early spring planting, if the weather is favourable, are now engaging the attention of farmers in the Maranoa district. Land for such crops should, of course, be prepared now. Ploughing may be impracticable until it rains, but there are many paddocks already prepared for wheat which could not be sown during the dry weather. When replanting these areas it would be advantageous to reserve at least a portion of the area for summer fodder crops.

Pre-eminent among the fodders suited to the district is Sudan grass. The risk of prussic acid poisoning associated with this crop can be reduced by purchasing seed from a reliable source to ensure freedom from contamination by the more toxic sorghums. Careful grazing is also necessary. Stock should not be fed on young crops, or crops which have been checked in any way during growth. It is also inadvisable to turn hungry cattle into a Sudan grass paddock.

Good-quality hay can be made from Sudan grass in the Maranoa, and it constitutes a valuable standby for all stockowners during winter or other dry periods. Fine-stemmed plants are preferred by stock, and facilitate both harvesting and curing the hay. For this reason, wide drills which strain the cutting mechanism of a mower or binder and tend to develop coarse plants should be avoided. Planting with the wheat drill, at the usual spacing for wheat, gives excellent results if the seed is sown at the rate of 7 lb. per acre.

As a quick-growing crop Japanese millet is coming into wider cultivation on the better loams of the eastern portion of the district. The crop may be grazed when quite young, and in feeding off there is no risk of stock poisoning. For best results, however, it is wise to allow growth up to 9 to 12 inches. The hay is good, although yields are not so heavy as Sudan grass; 10 to 12 lb. per acre is the usual sowing.

West of the Darling Downs cowpeas are not in general use for fodder or hay, although they do well enough on the lighter soil types, and form a very useful supplement to other fodders. Stock often show a dislike to the fresh green growth when they are not used to it, but eat it readily when cut. The value of this legume in supplying a protein supplement when fed with native pasture, and its capacity to enrich the soil through the action of nitrogen-fixing bacteria in the nodules of the roots should not be overlooked—particularly in sandy soils where native legumes are of little consequence.

Broadcast sowings of half a bushel are usually made with small-seeded peas such as Poona. In rows, 8-10 lb. of seed is sufficient.

—C. H. Defries.

French's Cane Beetle.*

J. H. BUZACOTT.

AT the end of last year some consideration was given to fumigation as a means for controlling grubs of the cane beetle *Lepidiota frenchi*. Observational plots were established on a neighbouring farm in order to determine whether economic results might be obtained by the use of the following fumigants:—Carbon disulphide, carbon disulphide + para-dichlorbenzene (1 : 1 mixture), and carbon disulphide + ortho-dichlorbenzene (2 : 1 mixture).

At the time of fumigation the grubs had already caused severe damage in patches throughout the block of cane. Rows were selected where the cane was wilted but not dead. The standard dose of 4·6 ccs. was used, and four injections were made at each stool placed approximately 6 inches deep in the soil, which was very dry at the time.

Fumigation was carried out on the 22nd November. On 1st December considerable wilting of heart leaves had occurred in stools treated with ortho-dichlor and para-dichlor mixtures, whilst there was no apparent difference between controls and stools treated with carbon disulphide alone. Later inspections showed that the stalks of the orginal stools died out when fumigated with the mixtures, whereas no damage occurred by using carbon disulphide on its own. The stools damaged by the mixtures grew new shoots—that is, they virtually ratooned—but, of course, their growth did not attain that of the undamaged stools in the control and carbon disulphide-fumigated plots.

When examined during April, 1938, it was apparent that no advantage had been gained by the fumigation; the rows fumigated with disulphide looked no better than those which were left as controls, and those fumigated with the mixture were still comparatively stunted. Considering the dryness of the season surprising growth had been made by the grub-damaged cane and, except where the stools had actually been killed by the grubs, they had made an excellent recovery.

Considered from every point of view, fumigation would not appear to be a practicable method for dealing with frenchi grubs. In the first place, it would be necessary to dig the fields before damage commenced to show, in order to determine which portions to fumigate. This would involve digging to a great depth, and even were this done the erratic manner in which frenchi grubs come up from the deeper layers of soil in order to recommence feeding would render fumigation a doubtful proposition. Particularly is this so in a dry year, and it must be borne in mind that it is in dry years that frenchi grubs cause more severe damage. In years with a well-distributed rainfall the cane is able to make roots sufficiently rapidly to withstand the attacks of the grub.

At present the best recommendation seems to be to pay attention to thorough cultivation and not ratoon too long, as ratooning allows the pest to build up large populations.

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* Paper contributed at a Conference of Cane Pests Destruction Boards, held at Meringa, on 25th May, 1938.

SEED POTATO SELECTION.

The problem of obtaining suitable seed potatoes for the early crop confronts most growers every year. This seed must necessarily come from southern sources, and, although the regulations demand that the bags must clearly bear the name of the variety, attention is called to the risk of buying seed of inferior quality. On most farms it is a common practice to grade out all undersized tubers and sell them as seed. This means that the weakest and least prolific strains of the variety are included and the risk of a poor return is obvious. Much can be said in favour of purchasing larger potatoes and cutting them into sets, as this largely eliminates the danger of rubbish being planted.

It is false economy to cut the sets too small, as they serve as a reserve food supply for the plant during the early stages of its growth. Small sets soon become exhausted and the growing plant fails to receive the necessary assistance. This check hinders normal growth and handicaps the plants in the formation of tubers. Sets should not be allowed to dry out more than can be helped before planting.

For the late crop, round seed is recommended and most growers manage to reserve their own requirements. The practice of selecting this seed at the time of harvesting from the most prolific plants is well worth the extra trouble.

THE HEMP PLANT—INFORMATION SOUGHT.

Considerable press publicity has been given recently to the supposed occurrence in Queensland of the Hemp plant (*Cannabis sativa*), and statements have been made that it occurs in various parts of the coast, both in North Queensland and in the South-Eastern districts.

The Department is very anxious to confirm, or otherwise, these accounts, and to enable people in the country to recognise it, the following description is offered:—

Cannabis sativa is an upright plant, 3-10 feet in height. It is rather stout in growth, and holds its branches nearly upright. The inner bark is fibrous and very tough and strong. The whole plant is rough-hairy, and is strongly scented. The leaves are compound, and are composed of 5-7 slender leaflets, radiating out like fingers from a common base. The individual leaflets vary from 3-6 inches in length, and from ¼ to 1 inch wide. They are pointed at both ends, and are sharply toothed. The male and female flowers are borne on distinct plants. The males are formed in large compound panicles. The female or fertile flowers are borne in small spikes in the leaf axils. They bear a number of small seed-like nuts, about ⅛ inch long. It contains a powerful drug, which is used in medicine, and in parts of Asia and Africa to produce narcotic effects somewhat similar to opium. The plant has been grown in an experimental way on account of its fibre in Queensland at odd times, but the Department has no record of its occurring wild. It occurs wild, or semi-wild, to a limited extent in parts of New South Wales. Anybody who sees a plant they take for Hemp is asked to forward specimens for identity to the Department of Agriculture and Stock. The specimens may be sent, either to the Under Secretary, or to the Government Botanist.

Spraying Recommendations for the Control of Citrus Diseases.

F. W. BLACKFORD, B.Sc.Agr., Assistant to Research Officer.

DURING the citrus season just closing, surveys have shown that many growers are suffering losses from diseases which may be checked by the application of suitable sprays in the early part of the season. The most important of such diseases are black spot, melanose, scab, and brown spot of the Emperor of Canton mandarin. Each of these diseases causes serious blemishes on the rind, thus detracting from the appearance of the fruit with a consequent lowering in value. The presence of either black spot or brown spot may also result in direct loss due to premature fruit fall.

Observations show that there is a varietal resistance to certain of these diseases. Brown spot is restricted to the Emperor of Canton mandarin. Melanose, on the other hand, affects nearly all varieties of citrus. Scab is particularly severe on lemons and, to a less extent, on mandarins, while the orange is immune. Late Valencia oranges and lemons are most seriously affected by black spot. Common oranges, mandarins and grapefruit mature early and may be picked before this disease develops. If allowed to hang on the trees late in the season infection may be severe.

Experiments have shown that in all the diseases mentioned, infection takes place from the time the fruit and leaf tissues are very young. The fruit may remain susceptible to black spot for three or perhaps four months after setting. In the case of melanose and scab this period is a little shorter. Brown spot, however, is capable of infecting the fruit throughout the season. In many cases, the infection may remain dormant for a considerable period, and the symptoms appear only as the fruit approaches maturity.

Based on the foregoing observations effective spray schedules for the control of these diseases have been developed. The latest recommendations for use under Queensland conditions are given below. It is necessary to stress the importance of spraying early at the correct time. Late spraying is usually ineffective.

Black Spot.

Spray with Bordeaux mixture (3-2-40) to which 1 per cent. (approximately ½ gallon in 40 gallons) spraying oil, well emulsified in its own volume of water, has been added as a spreader, at the following times:—

(1) When half to three-quarters of the blossom has fallen.
(2) About two months later.

Melanose.

Spray with Bordeaux mixture (3-2-40) plus 1 per cent. spraying oil immediately all the blossom has fallen. This spray may be applied earlier if it is desired to control black spot or scab as well, but should not be later than the time mentioned.

Scab.

Spray with Bordeaux mixture (3-2-40) plus 1 per cent. spraying oil when half to three-quarters of the blossom has fallen.

Brown Spot of the Emperor of Canton Mandarin.

Spray with home-made colloidal copper (3 gallons of stock in 40 gallons of water) at the following times:—

(1) When half to three-quarters of the blossom has fallen.
(2) Two months later.
(3) In late February.

As the use of Bordeaux mixture, under certain circumstances may lead to an increase in the infestation of scale insects, special steps may have to be taken for their control when this spray is used. Colloidal copper does not appear to possess this disadvantage to the same extent, and although the efficiency of this spray has not been demonstrated except in the case of brown spot, there is reason to believe that, where desired, it may be substituted for Bordeaux mixture in all the schedules.

From a consideration of the above schedules, the following fungicide programme is suggested for use in Queensland citrus orchards. One, two or three applications will be required according to the varieties grown and the diseases concerned.

The first spray may be applied to all varieties in the orchard and is necessary for the control of all four diseases. It should consist of Bordeaux mixture (3-2-40) plus 1 per cent. oil or home-made colloidal copper (3 in 40) and be applied when half to three-quarters of the blossom has fallen.

The second spray is necessary for the control of black spot and brown spot and should be applied to late Valencias and lemons and, where brown spot is prevalent, to Emperor mandarins. Early oranges, grapefruit and mandarins may be included also where black spot has proved severe. This spray, consisting of Bordeaux mixture (3-2-40) plus 1 per cent. oil or home-made colloidal copper (3 in 40), should be applied two months after the first spray.

The third spray is required only in those districts where the Emperor mandarin is affected with brown spot. It should consist of home-made colloidal copper (3 in 40) and should be applied in late February.

In the drier inland citrus districts it may be possible to effect control of black spot with the blossom spray only.

Selection and Care of Scions for Grafting Deciduous Fruit Trees.

H. COLLARD, Instructor in Fruit Culture.

TOO much care cannot be bestowed on the selection of scions to be used for grafting. Just as the grower expects to receive good trees from the nursery, so should he, in proposing to rework trees, take care to see that his scions are the best procurable, for the life of a reworked tree should be, if the job is done properly, just as long or even longer than if it had not been regrafted.

The scions should be obtained for preference when the wood is quite dormant, and, since "like begets like," they should be taken from selected trees that are healthy in all respects and, if possible, proved good croppers, or they may be taken from reworked trees the scions of which had been in their turn carefully selected.

Scion wood can be taken from anywhere in the tree, but it should be but one year old—that is, of the previous season's growth and with apples and pears free from flower buds. With stone fruit, this is not always possible, because, in addition to the simple wood buds, they usually have multiple buds—i.e., both flower and a wood bud at the one location; this does not matter, because the outside flower buds will fall off, leaving the dormant wood bud in the middle.

Medium-sized wood is the best. Overgrown, coarse growth with long internodes should be avoided. Small thin growth also is undesirable.

As the grower usually has plenty of wood to select from, he can easily see that he has only the right material. If he has not, then he should get it from a neighbour, rather than attempt to use unsuitable material. The grower should see that he has plenty of scions and he will find it advisable to allow for only one scion out of each wood stick. Assuming the wood sticks are about 18 inches long, the grower will usually find that with the bottom 4 inches the buds are poorly developed. The top 6 inches are too thin and the buds immature, leaving but 8 inches of the most suitable wood in the middle of the stick, out of which it is often hard to cut more than one scion. This applies to scion wood other than the peach or nectarine, which is an exception, because in grafting these fruits it is desirable, if the top portion of the scion is of sufficient thickness, to leave the terminal intact.

In grafting, the principle is to graft a dormant scion on to an active stock and then when the sap flows from the active stock into the dormant scion, it brings the dormant buds of the scion into life and growth commences immediately.

Some growers experience difficulty in keeping their scions dormant, but they will have no trouble if they go about it the right way.

The scions kept should not be merely an armful of prunings of the required variety buried in a trench in an orchard, some times without even a stick to mark the site, which often means hunting for hidden treasure when the day for grafting arrives. They should first be tied into neat bundles of from forty to fifty scions to a bundle, labelled correctly as to variety and then buried, so that from a third to a quarter

of the scion is in the ground and two-thirds to three-quarters above ground.

Choose for the site a place where they have a reasonable amount of moisture, but as little sun as possible, because it is the warmth of the soil that starts them into life. The south or south-westerly side of a building is a good site.

If the grower experiences difficulty in keeping the scions back because of his having a lot of grafting to do, and so that the period has to be prolonged, then he should dig them up one evening, leave them out all night, and replace them in the soil in the morning. This will act as a check without harming them in any way.

With scions of stone fruit, should the flower buds commence to swell or even come into blossom, the grower should not jump to the conclusion that they are too forward, because, on examination, it will usually be found that the wood bud which is situated in between the flower buds is still dormant. It is when the wood bud commences to shoot that they are too forward. Should the scions show signs of withering through insufficient moisture, they should be buried entirely in a moist place for some days. On no account soak them because this will cause the buds to absorb a large quantity of water, which soon dries out again and there is a grave risk of the buds falling out.

When the time for grafting comes and the scions are dug up it will usually be found that callus formation has started at the bottom—this is a normal provision of nature. Should some of the scions have failed to form this callus, however, they should be discarded, because usually there is something wrong with them.

Some growers are inclined to start grafting too soon. This is inadvisable. It is much harder to perform the operation if the sap in the stock is not running freely. In the Stanthorpe district it will be found that the best time to start is in the last week in August or the first week in September for stone fruits, and for apples and pears a month later. The period can be extended to so long as the scions remain dormant.

With grafting there are three essentials:—(1) Healthy trees; (2) good scions; (3) good workmanship. If any one of these three is lacking, then the result must be a failure.

Officers of the Department of Agriculture are in Stanthorpe to assist growers, and should anyone be in any doubt as to whether his trees are suitable for grafting, he should get in touch with the officer in charge who will advise him as to their suitability or otherwise, and the best grafting methods to adopt according to the circumstances.

Further, should a grower be in any doubt as to his own capabilities as a grafter of trees, then the Departmental officers will be pleased to give him the necessary instruction. It is at times hard to understand how some growers, who have but a very hazy idea of grafting, have so little compunction in cutting down perfectly good trees and, through ignorance, spoiling them for all time when an hour or two's tuition would enable them to do the work correctly and without doubts as to its success.

A pamphlet, "Propagation of Fruit Trees," dealing with this and many other points in orchard practice, is available on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

WATER MELON GROWING.

C. N. MORGAN, Fruit Branch.

THREE essential requirements for successful water melon production are a warm climate, a reasonably fertile soil, and abundant water. Owing to the latter necessity, commercial production is practically limited to coastal districts, although inland, good crops can be grown where irrigation is available. The most suitable soils are those of a sandy loamy nature, to which has been added a fair amount of organic matter, preferably animal manures where these are available.

An application of artificial fertilizer worked into the soil a week or so before planting also is desirable, and the following is recommended per acre:—

1½ to 2 cwt. sulphate of ammonia.

3 to 4 cwt. superphosphate.

1½ cwt. sulphate of potash.

The land should be deeply ploughed during the winter, and properly broken down ready for planting in the spring. In the southern part of the State, August and September are the best months to plant, though seed sowing may be carried on until December. Futher north, planting may commence in July.

Seed may be planted singly about 1 inch deep and 2 feet apart in rows about 4 feet 6 inches apart, or three or four seeds may be planted together in "hills" made about 6 feet apart each way. Two pounds of seed are required to plant an acre.

Rotation of crops must be practised with melons, which should not occupy the same ground for at least two years in succession.

When the main runners are 4 to 6 feet in length, or when the first flower drops and the fruit starts to set, the tips may be cut off to induce the vines to branch. In no case, however, should the pruning be done closer than two or three joints from the nearest flower or setting fruit. Whilst the vines and fruit are growing, they must be kept well watered, and if the weather is excessively hot it is advisable to cover each melon with a handful of straw. When the fruit begins to ripen, the water supply may be cut off.

Water melons take three to four months from seed sowing to maturity.

Difficulty is often experienced by new growers in determining when a melon is ripe and ready to pick. Some experts can tell by giving the fruit a slight crushing, when the creaking of the breaking flesh inside will indicate ripeness. Apart from this, there are two sure ways of testing for ripeness. When the little tendril on the vine near where the fruit breaks away begins to wither, it indicates that the fruit is ripening; but when the tendril at the next joint of the vine also dies, the melon is ripe.

Another test is to turn the melon over and examine the skin which has been in contact with the ground. At first that part is white, but as the melon ripens it turns a darker colour.

Some good varieties are—

Early Yates.—Extra early maturing, medium size, good cropper, light mottled green colour.

Kleckley Sweet.—Long dark green, medium to large size, excellent flavour.

Tom Watson.—Large dark green, good carrier.

Cuban Queen.—Very large long melon, good carrier.

CODLING MOTH CONTROL EXPERIMENTS.

During the 1937-38 season, experiments were carried out in the Stanthorpe district to determine the relative efficiency of certain spray schedules for the control of codling moth and to provide information on the seasonal activity of the pest. The results are summarised below.

In an orchard spraying trial at the Summit, three spray schedules proved as effective as one in which lead arsenate was used for both calyx and the several cover sprays. These schedules are:—

1. A lead arsenate calyx spray (2½ lb. powder to 50 galls. of water with an appropriate spreader) followed by white oil cover sprays (1⅓ gal. white oil to 80 galls. water);

2. White oil—nicotine sulphate (1⅓ gal. white oil, 1 pt. nicotine sulphate and 80 galls. water) applied in both calyx and cover sprays;

3. Nicotine sulphate with sufficient white oil to facilitate spreading (1 pt. nicotine sulphate, 1 qt. white oil, 80 galls. water) applied in both calyx and cover sprays.

Schedules 2 and 3 excluded lead arsenate altogether but there are clear indications that, had lead arsenate been used in the calyx spray and the alternative sprays restricted to cover treatments, the results would have been even better. Lead arsenate should therefore always be applied as a calyx spray no matter what sprays may be used later in the season. Either white oil or white oil plus nicotine sulphate are satisfactory cover sprays which should eliminate the lead arsenate deposit risk incidental to complete reliance on lead arsenate for the control of codling moth.

Schedule 3 is based on a new spray formula, the value of which must be confirmed in further tests before its usage can be recommended.

Potash soft soap, employed in the experiment for calyx and cover sprays at a strength of 10 lb. in 80 galls. of water, gave little or no protection against codling moth.

Lure traps showed that moths appeared in the orchard in a series of waves of varying intensity. The number of eggs laid is consequently greater at some times than at others, and marked improvements in codling moth control can be expected if cover sprays are timed in relation to these peaks in moth activity. Growers should therefore maintain a series of approximately 15 lure traps in the orchard, recording the number of codling moths caught at regular intervals twice a week. Cover sprays can usually then be applied to the trees between the fifth and twelfth days after recorded peaks of moth activity as determined by the lure traps. Vinegar and water (1-12) or molasses and water (1-12) are good lures. Growers should however make contact with Departmental officers at Stanthorpe if detailed information concerning methods of trapping or the timing of cover sprays is required.

For the coming season apple and pear growers at Stanthorpe should therefore use lead arsenate as a calyx spray and either white oil (1⅓ gal.-80 galls.) or white oil—nicotine sulphate (1⅓ gal., 1 pt., 80 galls.) as cover sprays, timing the latter with the assistance of lure trap data when and where possible.

—*K. M. Ward.*

WHITE ANTS AS PESTS OF FRUIT TREES.

Although usually associated with injury to structural timbers, white ants are a source of considerable worry to fruit growers, particularly in dry inland districts where irrigation facilities are available. In established orchards, these insects excavate tunnels within the trunk of the tree or the stem of the vine as the case may be, the tissue destruction ultimately causing irregular bearing and frequently the death of the plant. Young trees or vines may also be attacked, but the insects then work more or less superficially on the stem just below ground level, the runways being built over the bark.

Losses in citrus and grape vines, commonly grown in inland areas, are frequently of economic importance and the injury is not normally detected until the ill effects are visibly apparent in the yellowing of the foliage and the lack of vigorous new growth.

Control measures can be grouped into two categories, preventive and remedial:—

(*a*) Preventive.—White ants subsist for the most part on wood or similar vegetative materials. When land is first cleared for an orchard stumps should be removed and roots run to their extremity. Otherwise, the white ant population in the soil will persist until such time as the residual roots are completely disintegrated and any plants grown may be attacked. The removal of trees, stumps and roots on the site of proposed new orchards is desirable therefore, not only for cultural reasons, but also to minimise the risk of future white ant attacks.

(*b*) Remedial.—In established trees, obviously infested with the pest, ¼-inch or ⅜-inch auger holes which penetrate to the white ant tunnels should be made in the trunk at various heights above ground. A small quantity of Paris-green—an arsenical dust—is then blown through the openings by means of a bulb blower with a suitably narrow outlet, and the holes are subsequently plugged with grafting or paraffin wax. The worker insects acquire a toxic dose of the poison when feeding and the bulk of the colony, sometimes the whole colony, is wiped out. Treatment is practicable on plants with a stem diameter of 2 inches or more, on which an auger can be used, the size of the auger depending of course on the dimensions of the tree.

In young trees, the soil should be removed from the base of the plant to a depth of two or three inches. After destroying the runways by hand, a little Paris-green is blown in the vicinity so that any runway linkages with the parent nest are impregnated. The base of the plant should be left open to the air to facilitate natural callousing of the wounds and to minimise the risk of contamination with disease organisms.

With herbaceous plants, Paris-green cannot be used effectively and fumigation may be practised. For this purpose, paradichlorobenzene is the most suitable soil fumigant, crystals being placed in ½ oz. doses at depths of 4 inches in the soil, dosages being at least 1 foot from the plant and 18 inches from each other. Plants are liable to injury if excessive dosages are applied and the spacing must therefore be varied with the susceptibility of the plants requiring protection.

These methods of coping with white ants in orchards presuppose care and thoroughness, but, judiciously used, they help considerably in safeguarding valuable crops to which a great deal of time and attention have been given.

—*J. Harold Smith.*

CHECKING SOIL WASHING ON HILLSIDE BANANA LAND.

Cavendish and Mons Marie varieties of bananas are usually grown on hillsides and mostly in soils of a free, fine, shaley nature, which tend to wash very freely. Much of this soil can be saved by placing logs at intervals athwart the slope. On most clearings many logs remain unburnt and can be put to good use in this way.

All the straight lengths of timber up to, say, 8 inches in diameter will be found very useful in checking the downhill rust of water during heavy rains.

After they have been levered or rolled across the hillsides they should be "anchored" in position against stumps or by stakes and, possibly, large stones. It is not always possible to place them directly across the slope, because of the unevenness of the land, but they will prevent loss of surface soil, even if placed somewhat at an angle.

Where the land is carrying large "floaters," the stones also can be used to advantage by placing them in half circles below the banana stools and filling in the intervening hollow with soil.

When the plantation is in its second year and stripping of the lower leaves or desuckering is done, the material also can be placed with advantage along the logs to aid in preventing erosion.

—*E. F. Duffy.*

WIND BREAKS FOR BANANAS.

During the recnt cold snap, the desirability of retaining suitable wind breaks around banana plantations has been indicated by the number of plantations which have been frosted.

As growers are now falling scrub to plant fresh areas, the necessity of retaining a belt of scrub about 2 chains wide around new areas cannot be too strongly stressed. Where the ground is definitely liable to frosting, it is a good plan to make the track through the scrub or forest into the plantation on a zigzag formation. In areas not liable to frosting, a wind break will greatly assist in keeping out cold winds which chill the plants and thus retard their growth.

Where plantations are already established, growers should give attention to the planting of wind breaks, of which two types are easily made. Lady's Finger or Sugar bananas planted in close formation round the plantation will produce a thicket, and so afford protection. Several border rows of Jarva cane will also give some protection against frost and wind.

Growers should remember that too much hard work is put into falling scrub, burning off, logging up, and planting areas to excuse the neglect of reasonable precautions against the possible damage to bananas from frost or cold winds, for one severe frosting followed by a warm day will render their plantations worthless.

—*W. E. Hamley.*

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

DISTINCT signs are now showing that the market for fruit is emerging from the depressed period experienced during the last few weeks. The unusual cold dull weather has been the depressing factor, and with a return of warm sunny days the consumption of fruit should rise considerably, relieving the market of its over-supplies of various fruits.

Another factor which is not given sufficient consideration is the actual distribution of fruit to the public. Dr. Ross, of America, who recently paid a visit to Southern Queensland, was scathing in his criticism of the lack of fruit supplied on the tables of the hotels where he stayed during his visit, which extended as far north as Bundaberg. Pointing out that we had the best fruits in the world at our disposal, he remarked that at most hotels fruit could only be had by the visitor as an extra or not at all. When travelling one can appreciate the truth of his observations. When it is realised that the months from May to October are the period when Queensland's tourist traffic is at its peak, one wonders whether a golden opportunity is not being missed for creating an outlet for the disposal of that extra portion of fruit over market requirements which is at present creating an over-supply, with consequent low prices. An organised "fruit on the table" campaign throughout the hotels and boarding-houses should bring beneficial results.

The damp weather has had a detrimental effect on the keeping qualities of citrus, and growers are urged to use every care in handling their citrus fruits in order to avoid skin damage.

Complaints are still being received about green papaws being sent to Southern markets. Growers must realise that this trade is only being developed, and that it is necessary for only good types of fruit to be sent South. For example, close examination of the types of papaws obtained from different trees will enable a grower to select the best. Further, a careful selection of only good types for seed when planting should assist a grower to eventually evolve a satisfactory type of fruit for long-distance transport.

Winter tomato growing locally has proved much more difficult this season than during the dry winter of last year. This has reduced supplies, enabling firmer rates to be maintained.

Avocados have sold well throughout the season, which is now drawing to a close.

Custard apples have remained firm since the early season period of over-supply. This fruit has never before been seen to greater perfection, the quality and packing being excellent.

Pineapples have been in good supply, and at times hard to move.

Because of the wet weather good-quality strawberries were hard to get at the start of the season, but supplies now are of excellent quality.

Market prices for the various fruits at the end of July were:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: Nines, 16s.; eights, 9s. to 16s.; sevens, 9s. to 15s.; sixes, 4s. to 11s. 3d.

Sydney.—Cavendish: Nines and eights, 14s. to 16s.; sevens, 11s. to 14s.; sixes, 10s. to 12s.

Melbourne.—Cavendish: Nines and eights, 13s. to 16s.; sevens, 10s. to 14s.; sixes, 9s. to 11s.

Well filled Queensland fruit in demand.

Lady's Finger, 1½d. to 7½d. per dozen.

Pineapples.

Brisbane.—Smoothleaf: 4s. to 5s. 6d. case; loose, 1s. to 5s. per dozen. Ripley: 3s. 6d. to 4s. 6d. case; 6d. to 3s. per dozen.

Sydney.—7s. to 9s. per tropical case.

Melbourne.—8s. to 10s. per case.

Papaws.

Brisbane.—Yarwun, 3s. to 7s. tropical case; Gunalda, 3s. to 5s. bushel; Locals, 2s. to 3s. 6d.

Melbourne.—10s. to 16s. tropical case.

Green fruit unsaleable.

Custard Apples.

Brisbane.—2s. 6d. to 4s. half bushel.

Avocados.

Brisbane.—10s. to 12s. half bushel.

Granadillas.

7s. to 10s. per dozen.

CITRUS FRUITS.

Oranges.

Brisbane.—Navels, 6s. to 8s. per case; Commons, 4s. to 6s.

Small counts unsaleable.

Mandarins.

Brisbane.—Emperor, 5s. to 8s. case; small sizes, 3s. to 4s.; Scarlets, 4s. to 10s. case; Glens, 8s. to 12s.

Small sizes hard to dispose of.

Grape Fruit.

Brisbane.—4s. to 5s. per bushel case; Gayndah, 8s. to 12s. per bushel case.

Lemons.

Brisbane.—Gayndah, 6s. to 9s. per bushel case; Locals, 4s. to 6s. per bushel case.

Inferior grades lower and hard of sale.

DECIDUOUS FRUITS.

Apples.

Brisbane.—Jonathan, Victorian, 6s. to 9s.; Granny Smith, Imported, 8s. to 11s.; Stanthorpe, 10s. to 12s.; Delicious, 9s. to 11s.; Cleopatra, 7s. to 8s.; Scarlets, 5s. to 7s.; Sturmer, 5s. to 6s. 6d.; French Crab, 6s. to 7s.

Pears.

Brisbane.—Tasmanian and Victorian Winter Cole, 10s. to 14s.; Winter Nelis, 6s. to 11s.; Josephine, 7s. to 13s.

OTHER FRUITS.

Tomatoes.

Brisbane.—Ripe, 2s. to 6s. half bushel; green, 3s. to 5s.; choice coloured, 6s. to 7s.

Melbourne.—Green, 5s. to 6s.; coloured and firm, 6s. to 8s.

Strawberries.

4s. 6d. to 7s. per dozen; choice packs, 8s. to 11s. per dozen.

Passion Fruit.

Brisbane.—First grade, 8s. to 9s.; seconds, 6s. to 7s.

Cape Gooseberries.

5d. per lb.

MISCELLANEOUS VEGETABLES, &c.

Cucumbers.

Brisbane.—Bowen cucumbers, 8s. to 10s. per case.

Melbourne.—9s. to 11s.

Pumpkins.—5s. to 7s. per bag.

Marrows.—2s. 6d. to 6s. per dozen.

Lettuce.—6d. to 2s. per dozen.

Cabbages.—2s. to 6s. per dozen.

Beans.

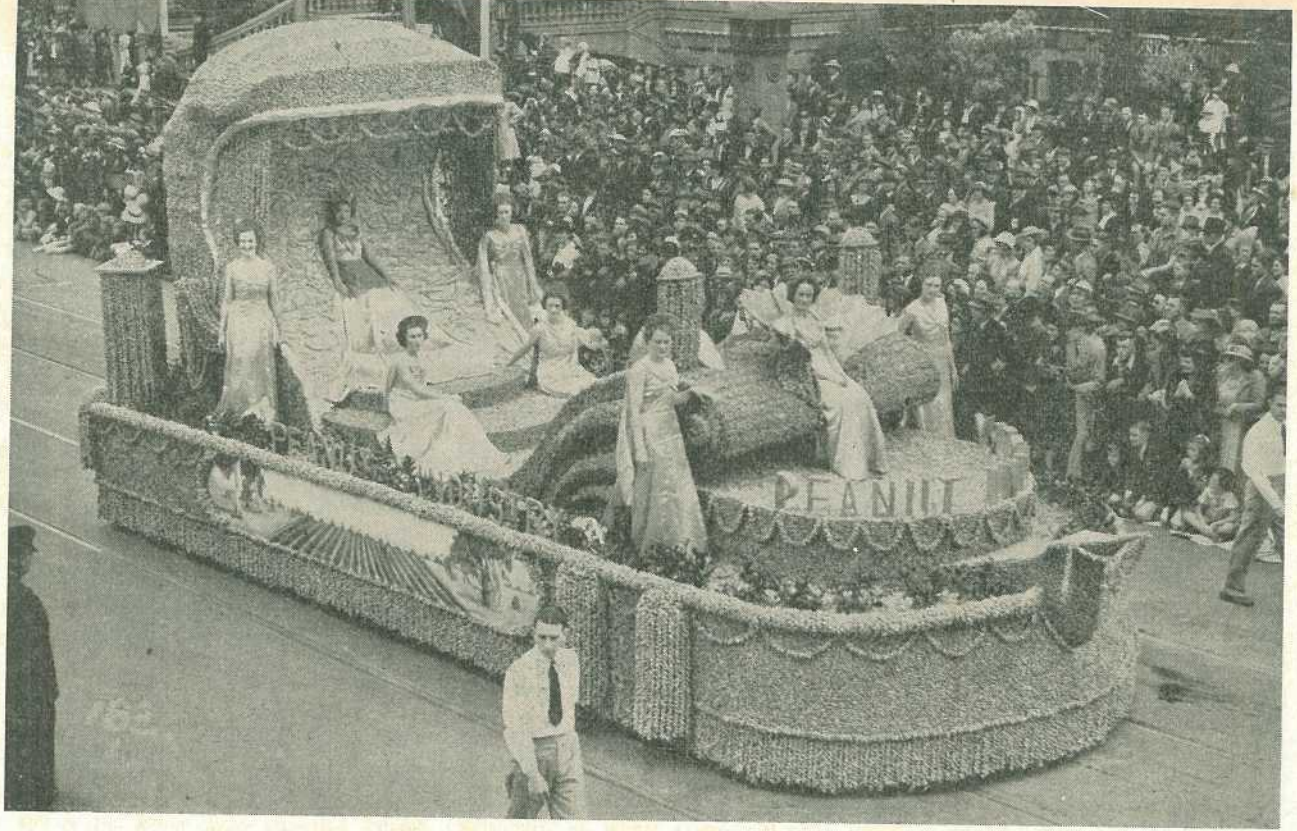
Brisbane.—10s. to 13s. sugar bag.

Melbourne.—4d. to 8d. per lb.

Peas.—5s. to 7s. sugar bag.

Chokos.—6d. to 1s. 3d.

Cauliflowers.—2s. to 8s. per dozen.



[Photo. by Hall and Co., Hunter street, Sydney, and supplied by courtesy of the Queensland Peanut Board.

Plate 75.

This strikingly beautiful float, one of the most colourful and outstanding features of the Sydney Sesquicentenary Pageant, was representative of every phase of the peanut industry. It also served to typify the spirit of Australian youth, as represented by the galaxy of charming young womanhood.

Peanuts used in the display were supplied largely from Kingaroy, Queensland's chief peanut-growing centre.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the advanced register of the herd books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, the Ayrshire Cattle Society, production charts for which were compiled during the month of June, 1938 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE (STANDARD 350 LB.)				
Sunnyview Ruby	N. Bidstrup, Warra	11,795·23	404·064	Lovely's Commodore of Burradale
Rhodesview Primrose	W. Gierke & Son, Helidon	10,138·5	368·015	Blacklands Prospector
SENIOR, 4 YEARS (STANDARD 330 LB.)				
College Doreen	Queensland Agricultural High School and College, Lawes	9,131·31	343·497	Premier 2nd of Hillview
SENIOR, 3 YEARS (STANDARD 290 LB.)				
College Buttercup 3rd	Queensland Agricultural High School and College, Lawes	9,573·55	389·783	College Robin
JUNIOR, 3 YEARS (STANDARD 270 LB.)				
Trevor Hill Polly	Geo. Gwynne, Umbiram	8,488·76	358·982	North Glen Emblem
SENIOR, 2 YEARS (STANDARD 250 LB.)				
Trevor Hill Nectar	G. Gwynne, Umbiram	8,413·33	334·479	North Glen Emblem
JUNIOR, 2 YEARS (STANDARD 230 LB.)				
Chelmer Blossom	E. O. Jeynes, Raceview	11,064·67	430·316	Mountain Home Renown
Trevor Hill Aster	G. Gwynne, Umbiram	8,613·53	373·517	North Glen Emblem
Trevor Hill Fussy	G. Gwynne, Umbiram	7,634·43	308·083	North Glen Emblem
Ehlma Park Millie	N. Bidstrup, Warra	7,069·86	290·66	Mount Blow Monarch
Trevor Hill Crystal	G. Gwynne, Umbiram	8,185·5	289·066	North Glen Emblem
College Buttercup 5th	Queensland Agricultural High School and College, Lawes	6,590·49	285·562	Trevlac General
Jamberoo Modesty III.	N. Bidstrup, Warra	6,779·46	270·944	Brooklyn Terrace Banker
Ehlma Park Podge (256 days)	N. Bidstrup, Warra	6,992·39	251·18	Mount Blow Monarch
College Buttercup 6th	Queensland Agricultural High School and College, Lawes	5,782·91	240·959	Trevlac General

JERSEY.

MATURE COW (STANDARD 350 LB.)

Majesty's Belle of Brooklands	N. Webb, Beaudesert	11,753·4	587·826	His Majesty of Dalebank
Glenview Mavourneen	G. Harley, Childers	7,343·41	384·92	His Majesty of Dalebank

SENIOR, 3 YEARS (STANDARD 290 LB.)

Glenview Hawthorn	F. P. Fowler & Son, Glenview, Coalstoun Lakes	8,682·2	461·196	Trinity Governor's Hope
Glenview Hopeful	F. P. Fowler & Son, Glenview, Coalstoun Lakes	8,231·4	437·307	Trinity Governor's Hope
Carnation Princess Marina	W. Spresser & Son, Redbank	4,769·08	294·507	Vinchelez Golden Victory

JUNIOR, 3 YEARS (STANDARD 270 LB.)

Hillsdale Centenary	F. W. Hohmann, Gowrie Junction	8,227·25	368·367	Pussey's Chief of Wyreene
Hillsdale Melba	F. W. Hohmann, Gowrie Junction	5,920·7	306·333	K. C. of Rosedale

JUNIOR, 2 YEARS (STANDARD 230 LB.)

Calton Morel	E. Burton & Sons, Wanora	7,973·11	422·995	Larwood of Calton
Glenview Sultane's Jubilee	F. P. Fowler & Son, Glenview, Coalstoun Lakes	7,418·7	370·431	Trinity Governor's Hope
College Starbright 4th	Queensland Agricultural High School and College, Lawes	7,191·1	339·947	Belgonia Peggy 9th's Duke
Kathleen of Hillsdale	F. W. Hohmann, Hillsdale, Gowrie Junction	6,327·05	333·927	Pussy's Chief of Wyreene
College Pearl 2nd	Queensland Agricultural High School and College, Lawes	6,500·93	326·074	Belgonia Peggy 9th's Duke
Glenview Meadowsweet	F. P. Fowler & Sons, Glenview, Coalstoun Lakes	6,039·00	316·594	Trinity Governor's Hope
Jubilee Gift of Woodbine	G. W. Champney, Wooroolin	4,844·75	310·197	Brookland Royal Gift
College Florette 4th	Queensland Agricultural High School and College, Lawes	5,640·22	268·153	Belgonia's Peggy 9th's Duke
Hillsdale Jose	F. W. Hohmann, Gowrie Junction	5,289·95	250·479	Pussy's Chief of Wyreene

AYRSHIRE.

JUNIOR, 3 YEARS (STANDARD 270 LB.)

Aucher Eden Beauty	J. N. Scott, Camp Mountain	6,243·22	322·671	Fairhill Cameron

The Tropics and Man

The Health that is in Us.

DOUGLAS H. K. LEE, Profesor of Physiology.

Security versus Accomplishment.

"One crowded hour of glorious life is worth an age without a name."
—*Scott.*

THIS quotation is familiar enough, but the problem behind it is far more than a personal one. To maintain security or to risk existence in an attempt at achievement has been a matter of tremendous moment throughout the realm of Nature since the world began, but more especially so since life began. What a noble example of solidity is a rock; with what massive calm it faces the buffets of nature—but what does it achieve? Many daring philosophers have described the logical consequences of an evolution along different lines from that now in progress, but none, as far as I know, has dared to suppose any effectual evolution with non-living matter as its main stream. As complex and progressive a world as that about us could never have eventuated but for the origin of living matter. In that one act Nature relinquished stability and security for the chance of accomplishment. The whole course of evolution since that time has been marked—nay, directed—by a fight to maintain security and flexibility in the best proportions for the situation then existing. When the proper balance has not been obtained, or when the situation has changed, the species has been doomed, and some better-adapted form has taken the lead. For size and thickness of hide nothing could rival those monster reptiles, Brontosaurus and his playmates; but this security proved their undoing. They soon got to the size when mobility became impossible. If you increase an animal's size ten times you increase his weight 1,000 times, and to support this his bones would have to be, not ten times as thick, but more than thirty times as thick. The situation eventually became absurd, and, to use a popular phrase, the small, fleet animals could "put it all over" these lumbering giants.

Man, the Masterpiece of Compromise.

After æons of trial and error, Nature has produced her masterpiece of compromise—Man. Throughout the general animal kingdom Nature has relied upon nine methods of defence—concealment, camouflage, association with stronger animals, natural weapons, inedibility, armour, flight, cunning, adaptation. Man, the king of all, has practically abandoned most of these, the more passive methods of protection, as they literally "cramped his style." It is upon the last two—cunning and adaptation—that he depends for security.

Man's enemies, however, are not all animals like himself. There are many other forces working for his destruction—bacteria, poisons, temperature changes, and the host of those resulting from his own ingenuity—ships that sink, motor cars that crash, aeroplanes that fail. These call for very much more resource than the relatively simple manoeuvres of a beast of prey.

Let us examine some of the extremely delicate mechanisms that make up this masterpiece in action.

Protection against Infection.

Here is an army of septic bacteria, Staphylococcus by name. They are leading a harmless, peaceful existence for the moment on a dirty piece of linen. A child decides—for a reason known only to children and psychologists—that this dirty piece of linen is a favoured toy, and bestows its affection upon it. The "Staphs," to speak familiarly, are transferred to the child's skin. This is much more to their liking; so they wax fat and multiply. The healthy skin, however, although no longer of armour-plate quality, still retains its biological protective power. Although it allowed the "Staphs" to live comfortably, it entirely prevents their passage into the body. But suppose the skin is not healthy, suppose the hair roots have been irritated by the accumulation of sweat and grease, unremoved by adequate washing. What happens? The barrier is weak, the accumulated dirt is an excellent growing medium, the bacterial forces increase and penetrate the skin—the body's first line of defence. The hair roots become inflamed and the beginnings of a boil or a carbuncle are formed. If the body generally is healthy sufficient scavenging cells and anti-bodies are brought by the blood-stream to prevent any further spread of the trouble—a sort of chemical warfare is waged which, in the first place, stops the organisms from spreading and, in the end, exterminates those which have gained a local footing.

But again, suppose the body is not healthy. Suppose, for instance, the vitamin intake in the food has been only just sufficient for body needs. A demand is now made upon them and there are no reserves. The chemical troops are deprived of certain essential materials. Or suppose the body is already engaged upon another front—for example, the tonsils—and things are not going too well. In either case it is highly probable that the local resistance will be too weak to prevent the "Staphs" from spreading. A large boil or a nasty carbuncle is the least that can result. In such a case the body's reserves will be mobilised upon a much larger scale, and very probably win the day. In a war, however, there are no victors. Although the body may win the local battle, its reserves are depleted, its efficiency reduced—as you very well know if you have ever had a carbuncle. For some time afterwards the body is more open to a successful attack by one of its many enemies—it is in a run-down condition, to use every-day language. But this is only the least of the possible trouble. The invading "Staphs" may meet with practically no resistance and break into the blood-stream. Now the life of the whole body is in danger. There is no limit to the spread of the infection—it can go to all parts of the body and set up abscesses everywhere. Some of these may be in vital organs, such as the brain, but apart from this you cannot expect the body to stand up to poisons produced in mass all over the body. Blood-poisoning, even by these mildly toxic organisms, is very often fatal.

Thus we have a chain of events—soiled linen, irritated skin, poor chemical defence, invasion of blood stream, widespread abscesses, death—all because of what? You will say, "Soiled linen." Logically, you will be right, but practically I should prefer to say, "Lowered resistance." While one should keep dirty articles away from children,

it is an impossible task, and Staphylocci are always with us. It is much more efficient and much more practicable to maintain the resistance of the body at, not a high level, but the *highest* level. Use the powers the body possesses to their utmost. This can be done only by attending to all the many items which go to make up health—cleanliness, exercise, balanced meals, avoidance of excesses.

Protection against Overwork.

Now let us turn our attention to a different case. Here we have a man doing heavy work. We know very well that if he works too long he will get fatigued, perhaps so fatigued that he will be fit for little next day; or if he tries to do too much at once he will "strain himself." What stops the average man from exceeding either of these limits—beyond, perhaps, a natural disinclination to do too much? Or, on the other hand, if there is a natural check, why do we sometimes overstep it and suffer the consequences? Again, what part does training play?

The answer to some of these questions comes when you examine a muscle at work. It consists of a number of elastic fibres side by side, and fixed at one end, which, when told to do so by their nerve, contract. If the weight they are asked to lift is too heavy they simply cannot contract, or, if the stimulus is very great, may actually tear themselves off their attachments. The more practice they get at lifting, the larger and stronger they become, and the firmer become their attachments. This is *one* reason why training is so important. Generally speaking, the brain quickly becomes aware of the fact when too great a strain is being put on the muscles and the attempt is abandoned, but the warning messages from the muscles are sometimes ignored in the excitement of the moment—hence the "tennis elbow." Sometimes, of course, the opposite is the case; the brain decides the job is impossible although the muscles are quite capable of carrying it out—this is labelled "lead-swinging."

For continuous work, the muscles must have a good blood supply, and a good blood supply means a good heart, capable of great increases in work, and good blood-vessels. Work in cramped positions, or work beyond the point at which the heart and blood vessels can keep up a proper supply, leads to the accumulation of waste products in the muscles. These stimulate nerve endings in the muscle and give rise to that familiar sensation of muscle pain or fatigue. This warning bell is rung before the muscles get into a dangerous condition, and it is a warning very difficult to ignore.

So again in muscular work you see body safeguards at work, but a different system of safeguards—a warning system informing the brain, which is the directing influence in work. This system is generally an efficient one, but may be overcome if the muscles are weakened by disease or malnourishment, if strenuous exercise is forced upon muscles which have not been adapted to it by intelligent training, or if sudden strains are thrown upon muscles unprepared or ill-adapted for the purpose. Even an inherently "fool-proof" system like the muscles may be beaten by the exercise of unintelligent will-power.

To some, perhaps, the term "overwork" calls to mind the guttering candle, the wet towel on the brow, and the clock ticking remorselessly on to the examination hour. Here again the body has its automatic protective devices. When you find yourself coming to the bottom of

the page for the third time, without the remotest idea of what is on it, then, most certainly, have you reached the limit. You may be able to drive yourself still further under the stress of emotion, but only with danger and certainly without efficiency. The mechanism which deals with judgment is being thrown out of circuit, as you would switch an overheated iron out of circuit; to put it in again is to court disaster. There is only one thing to do—go to bed and let the overheated iron cool off.

The Chink in the Armour.

This brings us to the crucial point of this talk. That extraordinary organ—man's brain—developed through geological ages from the undifferentiated nerve-net of the lowly Cœlenterate, is at once man's proud heritage and his betrayer. As I mentioned before, a great deal has been sacrificed in the course of evolution to the brain, and a great deal of power has been given to it. While automatic machanisms exist it is necessary that the brain should be able, if the necessity arises, to override them and determine the issue to the advantage of the body as a whole, as distinct from the immediate interest of the part in question. An automatic mechanism provides that you should pull your hand away when a bee stings you, but I wonder what your brain would decide to do if the said hand were supporting you from a branch hanging over a precipice. The brain was intended to be the benevolent dictator, for whom most of us have at times longed—provided the Dictator had our ideas, of course. The idea is a good one—as long as the Dictator is sufficiently informed, infallible, and strictly benevolent. Alas for Man, no one of these things is perpetually true! For one reason or another—an emotional interlude, a set belief, an uncritical judgment, or perhaps the mere strength of a trained automatic response—the brain often fails to discharge the duties for which it was designed, and the good of the whole body fails.

Some of these mistakes are beyond control, but many—far too many—are avoidable. We deliberately ignore the warning Nature has developed for us, think it is unmanly to take care, feel it is the thing to "crack hardy." No doubt many of these ideas had very good foundation under the circumstances of their creation, but they have long since been lifted into the realm of logic-defying creeds. We have the creed of the muscles, the creed of records, the creed of sun-tan, the creed of no-breakfast, and the creed of slimness—each containing a certain germ of truth, but practised to an extent that is usually ludicrous, often positively harmful. No one who has the slightest knowledge of the body's working or appreciation of its delicate mechanism could advocate starvation diets or herculean tasks as a regimen for any except a very few for very special reasons. But these are understandable human foibles. It is a matter for much greater concern that there should be abroad so much ignorance and apathy about health. Governments can legislate, and advisers pour out their wisdom, but it counts for very little if the people are not interested. What greater tragedy can there be than to have the most wonderful and delicate machine ever fashioned ruined and despoiled, not by genuine though misdirected enthusiasm, not by legitimate though awkward experiment, but by sheer carelessness, ignorance, and apathy!

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Red Head or Milky Cotton Bush.

R.B. (Maleny)—

The specimen is *Asclepius curassavica*, red head or milky cotton bush, a native of tropical America, but now naturalised in most tropical and sub-tropical countries. It is a very common weed in Queensland and New South Wales. It is poisonous, producing gastro-enteritis in stock. It is very distasteful to them, and so is not generally eaten in sufficient quantities to cause death. In spite of the fact that the plant contains a very poisonous principle, feeding tests with it are rather conflicting. Most of the trouble that has been reported to us has been with poddy calves or young stock.

Oriental Mustard. Pepper Cress.

V.L.L. (Brigalow)—

The larger specimen is *Sisymbrium orientale*, the oriental mustard. This is a native of Europe, and is now a common weed in most temperate countries. It is fairly common as a farm weed in Queensland, but is not known to possess any poisonous or harmful properties. Like other members of the turnip family, it taints the milk of cows. "Mustard Weed" is the common name generally applied to it, although this local name is also given to other weeds of the same family.

The smaller plant is *Lepidium ruderale*, the pepper cress, a plant very widely spread over the temperate regions of the world. It is very common in Queensland as a weed both of cultivation and of the pasture. It is quite good fodder, but taints milk and cream badly. It is in fact, one of the worst offenders in this respect. It belongs to the same genus *Lepidium*, as the cultivated garden cress. Water cress belongs to an allied genus.

Both plants you send are members of the family *Cruciferae*, which contains the turnip, radish, cabbage, and many other cultivated plants.

A Useful Grass.

U.B.W. (Yandina)—

The grass is *Eulalia argentea*, a fairly common grass in some parts of coastal Queensland, particularly along the North Coast line between Landsborough and Gympie. We have not heard a common name applied to it, and do not think, usually speaking, it is regarded as a very good forage. It has a value, however, in that it grows on second class country inclined to be swampy where other grasses will not thrive.

Coast Button Grass.

M.C. (Mackay)—

The specimen is coast button grass, *Dactyloctenium aegyptium*, a native grass fairly common in coastal Queensland from Rockhampton northwards. It is generally regarded as quite a good forage and frequently grows in sandy land almost on to the sea beach. It is an annual, but may last more than a year. During the summer it is at its best, and generally speaking, tends to die off about May or June, though sometimes may last, green, into July or August according to the season.

Wild Sage.

A.M.R. (Toowoomba)—

The specimen is wild sage *Salvia verbenaca*, a common English and European plant now naturalised in most temperate countries. In Queensland it is confined more or less to the Darling Downs. So far as we have observed, it is not a particularly aggressive weed here. Although sometimes fairly abundant, and calls for no special method of eradication. It is sometimes called "Cleary" (Clear Eye) in England and was used by herbalists for eye complaints. The seeds, when placed in water, yield a mucilage which, when placed in the eyelid for a few minutes, envelops any particle of dust which may be causing trouble in the eye. The plant is not known to possess any poisonous or harmful properties.

General Notes

Staff Changes and Appointments.

The appointment of Mr. R. Letters as an inspector under the Diseases in Plants Acts, Brisbane, has been confirmed as from the 1st December, 1937.

Mr. C. L. Mudd, Inspector of Stock, Dairying and Slaughterhouses, Brisbane, has been transferred to Killarney.

Sergeant A. T. Hogan, of Boonah, and Constable R. L. Gannon, of Kajabbi, have been appointed also inspectors of slaughterhouses.

Mr. John Richters (Durong, via Tingoora), Mr. C. A. Cocks (Burke street, Ayr), and Mr. E. H. Hewett (Burke street, Ayr) have been appointed honorary protectors under the Fauna Protection Act.

Mr. A. F. Crees has been appointed an inspector of stock, dairies, and slaughterhouses.

The following members of the Police Force have been appointed also inspectors of slaughterhouses: Sergeant 2/C J. H. Cooke (Home Hill), Constable N. F. Gee, (Coomera), Constable I. L. Eggins (Tewantin), Constable H. W. Ambrose (Peranga), Constable W. C. J. Powell (Stonehenge), Constable G. W. Mouatt (Oaks), and Constable W. E. Hogbin (Ewan).

The following members of the Pioneer Mill Suppliers' Committee, Ayr, have been appointed honorary protectors under the Fauna Protection Act: Messrs. L. W. J. Hoey, J. H. Hawkins, M. T. Norris, P. Sayers, and L. F. Laun.

Mr. E. B. Rice, dairy technologist, has been transferred from Brisbane to Toowoomba.

The appointment of Miss M. A. Lyle as assistant cane tester at Inkerman Sugar Mill has been cancelled, and Miss Lyle has been appointed to the position of cane tester at the Invicta Mill, in place of Mr. L. C. Home, resigned.

The appointments of Messrs. G. R. Kronk, E. J. Delaney and V. W. Keating as assistant cane testers have been cancelled, and the following have been appointed Assistant Cane Testers for the current season:—Messrs. B. McMaugh and S. Wilson at the Maryborough and Marian Mills, and Misses K. M. O'Brien and W. Page at the Fairymead and Inkerman Mills, respectively.

Constable J. Bennett (Marburg) and Constable J. H. Lewis (Mungallala) have been appointed also slaughtering inspectors.

Mr. H. D. Grimes, inspector, Diseases in Plants Acts, Stanthorpe, has been appointed agent under the Banana Industry Protection Acts and inspector under the Diseases in Plants Acts, and attached to Nambour.

Mr. J. Byron, temporary grader, Cotton Section, has been appointed grader, Cotton Section, Department of Agriculture and Stock.

Mr. T. W. Murray, head teacher, State School, Elliott, has been appointed inspector under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock.

Mr. L. G. Walker, Inspector of Stock, Slaughtering, and Dairies, has been transferred from Cunnamulla to Brisbane.

Mr. E. J. Taylor, Stock, Slaughtering, and Dairy Inspector, has been transferred from Brisbane to Toowoomba.

Mr. E. B. Rice, Dairy Technologist, Department of Agriculture and Stock, Toowoomba, has been appointed also an inspecter under the Dairy Produce Acts.

Constables N. R. J. Carolan (Birdsville) and A. W. Dargusch (Mungana) have been appointed also inspectors under the Slaughtering Act.

The following members of the Wangaratta Shire Council, Bowen, have been appointed honorary protectors under the Fauna Protection Act:—

Messrs. A. H. W. Cunningham, Strathmore, via Collinsville; A. Pott, Burnfoot, Bowen; J. Maltby, Firsby Farm, Bowen; G. Pott, Newstead Farm, Bowen; A. E. Beak, Salisbury Plains, Willmington; V. A. Toms, Moss Vale, Bowen; F. S. Isbell, Havilah, Collinsville; P. N. Lumsden, Mount Coolon; W. G. Preston, Mount Coolon; H. T. Bridson, Chesterfield, via Clermont; R. M. Henderson, Collinsville; R. J. Bowes, Collinsville; and D. S. Malcolm, Collinsville.

Mr. G. Chinn, Kairi, has been appointed also an honorary protector under the Fauna Protection Act.

The following transfers of District Inspectors of Stock have been approved:—

Mr. F. R. Dunn, District Inspector of Stock, Cloncurry, has been transferred to the position of District Inspector of Stock, Brisbane.

Mr. W. Dixon, at present Inspector of Stock, Goondiwindi, and recently appointed a District Inspector of Stock, will be attached to Cloncurry.

Mr. D. Hardy, District Inspector of Stock, Emerald, has been transferred to the position of District Inspector of Stock, Rockhampton.

Mr. P. P. Comiskey, at present Inspector of Stock, Boonah, and recently appointed a District Inspector of Stock, will be attached to Emerald.

The following transfers of Inspectors of Stock have been approved:—

Name.	From	To
Mr. T. Douglas	Rockhampton	Goondiwindi
Mr. J. W. Mackay	Wowan	Rockhampton
Mr. R. J. O'Sullivan	Killarney	Wowan
Mr. S. J. Monaghan	Brisbane	Boonah
Mr. S. C. C. Jessop	Toowoomba	Brisbane
Mr. W. R. Burnett	Brisbane	Toowoomba
Mr. N. C. Copeman	Wandoan	Crow's Nest
Mr. S. M. Seamer	Julia Creek	Wandoan

Fauna Sanctuary at Durong.

An Order in Council has been issued under the Fauna Protection Act declaring the property of Mr. C. Park-Smith, at Durong, via Tingoora, to be a sanctuary under the Act. The property is described as portion 100, parish of Burraburri, County of Auburn, with an area of 1,125 acres 1 rood.

Local Sugar Cane Prices Boards.

The Regulations under the Regulation of Sugar Cane Prices Acts provide that Local Sugar Cane Prices Boards shall meet not later than fourteen days after the appointment of members of such Boards. An amendment issued to-day deletes the provision that Local Boards shall meet within such period of fourteen days.

Removal of Dead Wood from Orchards.

A Regulation has been issued under the Diseases in Plants Acts which provides that an occupier or owner of an orchard shall destroy, by burning, dead fruit trees or prunings which are liable to disseminate disease.

Cane Pests Boards—Voting Powers.

Regulation 47 under the Sugar Experiment Stations Acts, which provides that no member of a cane pests board shall vote in respect of any matter in which he has, directly or indirectly, any pecuniary interest, has been amended.

The amendment makes provision that a member of a cane pests board shall not be debarred from voting on any matter affecting the purchase of pest control materials or the subsidising of fumigant purchases, or, with the prior approval of the Minister, on the matter of remuneration to be paid for attendance at meetings.

Stallion Board Appointments.

East Moreton.—J. C. J. Maunder, B.V.Sc. (Chairman), D. Jackson, and R. J. F. O'Bryen.

West Moreton.—A. F. S. Ohman, M.V.Sc. (Chairman), D. Jackson, and R. J. F. O'Bryen.

Central Coast.—M. R. Irving, B.V.Sc. (Chairman), G. Elliot, and J. H. Wall.

Northern Coast.—M. H Irving, B.V.Sc (Chairman), W. C. Jeffery, and H. S. Handley.

Northern.—A. L. Clay, B.V.Sc. (Chairman), T. Turkington, and W. Frood.

Important Point for Motorists.

Users of closed cars are reminded of the danger of driving for any length of time with all the windows closed.

Cars are prolific generators of the deadly carbon-monoxide gas, which is tasteless, odourless, and colourless, and can cause death very quickly when inhaled in any closed space. It is produced in the combustion chamber of the engine, and is carried off by way of the exhaust, but where there is a leak in the exhaust pipe or the muffler, the gas is likely to enter the interior of a car—more especially the older models—through cracks in the floorboards.

Any driver suffering headaches while at the wheel of a closed car should suspect the presence of carbon-monoxide and ensure immediately an ample supply of fresh air.

Banana Levy.

An Order in Council has been issued under "*The Banana Industry Protection Acts, 1929 to 1937,*" providing for a levy on banana growers to be used for the maintenance of the Banana Industry Protection Board.

The levy is at the rate of 1½d. per one and a-half bushel case of bananas, and 2d. in the £ sterling on bananas marketed in the bunch. The levy is the same as that which has been operating for some years past.

Pineapple Levy.

Executive Council approval has been given to the extension of the Pineapple Levy Regulation for a further period of twelve months from 28th August. This levy is made under the Fruit Marketing Organisation Acts and is administered by the Committee of Direction of Fruit Marketing.

Imperial Fruit Show.

The Department of Commerce has received class schedules and entry forms for the Imperial Fruit Show and Canners' Exhibition, which this year is to be held at Bristol, England, from 28th October to 5th November.

The Australian products which may be entered for competition include honey, citrus fruits, apples, canned produce, and fruit juices.

The pure fruit beverages section which was added to the Show last year is being continued, and the citrus and grape juice classes are open to competition for Australian exhibitors.

Last year there were seventy entries from Australia, which constituted a record for this country, and considerable success attended many of the entrants.

It is hoped that the Imperial Fruit Show will be supported equally well this year by Australian firms, for it provides an excellent opportunity to demonstrate the high quality of the Australian product in competition with that of other Empire countries.

Entry forms and full particulars are obtainable from the Department of Commerce, Commonwealth Offices, Brisbane, and entry forms must be lodged with that Department not later than 22nd August, 1938.

Game Restrictions.

An Order in Council has been issued under "*The Fauna Protection Act of 1937*" prescribing the following as the maximum numbers of birds which any one person may take or kill in any one day during an open season:—20 wild ducks, 25 quail, and 2 scrub turkeys.

Canary Seed Board.

The election of two growers' representatives on the Canary Seed Board resulted as follows:—

	Votes.
Ernest Ambrose Thomas, Roma	113
William Alexander Ross, Macalister	107
Garrett Denis O'Neill, Table Top, Allora	70

Messrs. Thomas and Ross will be appointed for a term of one year. Mr. Ross has displaced Mr. G. D. O'Neill, the present member of the Board.

Value of Sown Pastures.

The Editor of *The Farmer* (Maritzburg, Natal, South Africa) writing in appreciation of a series of articles in the *Queensland Agricultural Journal* by C. W. Winders, Assistant Research Officer, says:—"Sown pastures are growing in popularity in this country, and I feel that Mr. Winder's review of the various types would be most valuable to our readers. A well-known Natal farmer, Major P. F. Wall, estimates that unimproved veld worth, say, £5 per acre, can be raised in value to between £100-£200 by planting suitable grasses in favourable localities."

Citrus Levy.

The citrus levy regulation which came into force in April, 1936, and was extended last March, has been further extended for a period of twelve months from 1st March, 1938.

An amendment has been made in the regulation which provides that the minimum levy shall be 1d. a bushel case and ½d. a half-bushel case. At present, the minimum levy is 1d. a case.

Sugar Experiment Stations Advisory Board.

The Regulations under the Sugar Experiment Stations Acts relating to meetings of the Sugar Experiment Stations Advisory Board have been amended.

A new Regulation 20A provides that at any meeting of the Board the Secretary of the Queensland Cane Growers' Council may act as deputy for an absent growers' representative, and the Secretary of the Australian Sugar Producers' Association Ltd., may act as deputy for an absent manufacturers' representative.

A member of the Board who travels to or from a meeting other than by rail may be paid an amount not in excess of one first class rail fare in respect of each such journey.

If within fourteen days of the expiration of the term of office of the Board the sugar organisations entitled to nominate representatives of growers or manufacturers for appointment as members of the Board have failed to make any such nomination, the Minister is empowered to nominate sufficient representatives to complete the membership of the Board.

The Minister is given similar powers with regard to any vacancies on the Board which may occur during its term of office, where within fourteen days of the vacancy occurring the organisations entitled to nominate a successor have failed to do so.

Poultry Sales.

A new Regulation issued under the Diseases in Poultry Acts, provides that no agent shall be entitled to receive as commission, fees, charges, reward or other remuneration for or in respect of services or transactions carried out by him in respect to the sale of poultry, any amount in excess of 7½ per centum of the gross amount received for the sale of such poultry.

Wool Draft Allowance Abolition Act.

A Proclamation has been issued under "*The Wool Draft Allowance Abolition Act of* 1936" which will bring that measure into force in Queensland as from the 1st July, 1938.

Cattle Creek Mill Levy.

Regulations have been issued under the Primary Producers' Organisation and Marketing Acts empowering the Cattle Creek Mill Suppliers' Committee to make a further levy for administrative purposes at the rate of one penny three farthings per ton of sugar-cane supplied by growers to the Cattle Creek Sugar Mill.

Declaration of Swine Dysentery as a Disease under Diseases in Stock Acts.

An Order in Council has been issued to-day under the Diseases in Stock Acts declaring swine dysentery to be a disease under and for the purposes of such Acts.

Poultry Registration Amended.

An amendment of Regulations under the Diseases in Poultry Acts has been approved. This provides that the owner of introduced poultry or day-old chickens on arrival from another State shall deliver to an inspector at the place of introduction a declaration that such poultry or day-old chickens are free from pullorum or other diseases. The declaration shall be further endorsed by an inspector of the Department of Agriculture and Stock from which the poultry are being introduced to the effect that a test of such poultry for disease has given negative results.

Wild Life Preservation.

Orders in Council have been issued to-day under the Fauna Protection Act declaring Eurominda, Pelican—the property of Mr. H. K. Nevell—and Currawong and Gyranda Grazing Selections in the Taroom District—properties of Messrs. F. W. Horn, Ravenscraig, Camboon, and Joyce and Joyce, Eidsvold—to be sanctuaries for the protection of fauna. Messrs. F. W. Horn and R. F. Joyce have been appointed honorary protectors.

Southwick West, in the Charters Towers district, the property of Mrs. V. O. A. Allingham, Ingham, has been declared a sanctuary for the protection of wild life under "*The Fauna Protection Act of* 1937."

An Order in Council has been issued under "*The Fauna Protection Act of* 1937," declaring Settlement Pocket, Alice River, near Barcaldine, to be a sanctuary for the protection of fauna. Mr. J. E. McHugh, of Barcaldine, has been appointed an honorary protector in connection with such sanctuary.

"Mundoolun," Broomfleet, the property of Mr. D. M. Fraser, has been declared a sanctuary under "*The Fauna Protection Act of* 1937." Mr. Fraser has been appointed an honorary protector in respect of the sanctuary.

Mr. G. Shave, Barcaldine, has been appointed an honorary protector under the Fauna Protection Act.

Rural Topics

Crops for Winter and Spring Feed—A Correction.

In the June issue of this Journal, under the heading "Crops for Winter and Spring Feed," page 658, a departure from the original manuscript occurred, conveying the impression that field pea and vetch seeds should be ploughed in. The third paragraph should have read, "In the absence of seed drills, broadcasting is usually adopted, sowing the legume first, and discing or cultivating in, following with cereals which are broadcast and harrowed in." Similarly, the sixth paragraph should read, "Rape may be sown from March to May, drilling in 4-5 lb. of seed per acre."

The Current Cane Crushing.

An all-time record is in sight for the current cane harvest. The present estimate is 5,460,000 tons of cane. Making some allowance for a standover crop in some of the southern areas, it is probable that at least 5,200,000 tons will fall to the knife, and from that crop a yield of 750,000 tons of raw sugar is anticipated. Early crushings are returning a high sugar content and the millings will probably equal—if not surpass—the aggregates of the past two seasons. That means that the "excess" sugar problem will remain as acute as ever.

The reduction in the sugar export quota, although slight, indicates the necessity of continuing a tight control on Australian sugar production. In the circumstances, growers may have to turn their attention to other farming enterprises, either as alternatives to or in combination with cane-farming. Results of recent trials at Mackay point to fat lamb raising as, at least, one possible payable sideline.

A Policy for the Pig Industry.

The Australian Meat Board has investigated the position of the export trade of pig meats to the United Kingdom and now states that there is provision for a steady expansion of this trade.

In an endeavour to set a policy for the Australian pig industry the Board has, after thorough investigation, made recommendations—firstly to the effect that the baconer trade should be fostered rather than the porker trade; and secondly, that the carcase specifications as published by British authorities should be adopted by Australian producers.

Subject matter relevant to these recommendations has been published in booklet form by the Australian Meat Board, and copies are available free of charge from the Department of Agriculture and Stock, Brisbane.

Value of Eucalypts—The "National Tree" of Palestine.

When the Australian Light Horsemen were campaigning in Palestine during the great war, they realised to the full the meaning of nostalgia—the dictionary term for homesickness—as the smell of burning gum leaves scented the air while camped near groves of eucalypts which had been introduced from Australia.

Here is what Dr. B. Shein, a recent visitor to Brisbane, had to say of a valuable Australian native:—

"The Australian eucalyptus has become almost the national tree of Palestine, for it has almost rid the country of its former scourge of malaria."

Thanks to the eucalyptus, added Dr. Shein, who left Jerusalem in May, the young people of Palestine were growing up in perfect condition.

Dr. Shein is on a world lecturing tour to tell of the position of the Jewish people in all countries, particularly of those in Palestine. The Zionist organisation, he said, concentrated on the building up of Palestine. Since the war 400,000 Jews had settled in Palestine, and agricultural as well as industrial enterprise on a large scale had been developed. It was intended that as many Jews as the country could absorb should settle there and form a national home.

The Jewish people were thankful to Australia for what had been accomplished by the eucalyptus tree, which had been planted in great numbers in the last forty years. The trees, which absorbed much water, had together with a draining system, dried up much of the marsh lands which had caused an incidence of malaria in some villages of up to 80 per cent. of the population.

Butter in the Bible.

For butter it can be truly claimed that it possesses a tradition that goes back to the earliest period of civilisation. According to the Bible, Abraham took butter and milk and the calf which he had prepared and set them before his visitors. Butter formed a part of the greatest and holiest sacrifices of many of the ancient peoples. The Greeks and Romans used it as a remedy for injuries to the skin, and the soot of burned butter was regarded as a specific remedy for sore eyes. The maidens of old Alexandria annointed themselves with "milk oil," and it is recorded that in many cold regions people used butter in their baths. Until comparatively recent times butter was used as oil for lamps, and historians relate that, as late as the seventeenth century, the medicine shops of Spain labelled butter "for external use only."

Fined for Undercutting Butter Prices.

At Dublin (Eire) recently, two fines of £15 were imposed on a provision merchant for having sold butter at less than the price fixed by the Department of Agriculture.

Living Standard in England.

In Britain the general standard of living is high. It is estimated that 1⅞ acre is required to produce the diet enjoyed by the average Englishman. At the present standard Britain produces enough food to satisfy only 18,000,000 of the population. Every effort is therefore being made to increase the area of cultivated land.

Treatment of Cows with Sore Teats.

Wire cuts and wounds on cows' teats are among the disagreeable experiences of dairying. Milking irritates the wound and aften causes bleeding, besides being painful. In such cases, absorbent cotton wool placed over the wound so as to make a soft pad between the milker's hands and the teat will give relief and arrest bleeding. After milking, an antiseptic ointment should be applied.

Points in Calf Rearing.

For success in calf rearing it is essential to observe these rules:—

Always handle calves quietly and patiently.

Feed at regular intervals every day.

Feed only on perfectly clean sweet milk.

Feed with milk at body temperature (about 100 degrees, Fahrenheit.)

Always cleanse feeding buckets as scrupulously as you would all other dairy utensils.

Provide shade in summer and shelter from winter weather.

Effect of Tillage.

To grow crops, tillage is a necessity. What effect does tillage produce? Tillage loosens the soil temporarily and produces what is called a "good tilth." Continual tillage, however, packs the soil and diminishes water movement and aeration. Experience on farm and experiment station the world over demonstrates that the most feasible way of maintaining soil structure is by combining ordinary farming with grassland farming. This form of crop rotation should not be left until the farming land has been worked to the point of exhaustion. Queensland cotton growers, for instance, are finding cultivated crop and grass rotation a very profitable practice from every point of view.

The Quality of Australian Butter.

That Australian "Kangaroo" brand butter is, on the average, better than any butter going to the London market, including Danish, is the belief of the Commonwealth Supervisor of Dairy Exports (Mr. F. Wigan). He has expressed a doubt whether the butter of any other country has as high a keeping quality as Australian, which is also of high texture. This rise in the quality of Australian butter is attributed largely to the grading standards and the work of the graders. This quality can only be improved—or, at least maintained—by a continuance of complete co-operation between the farmers and the factory managers.

The Value of Refrigeration.

Professor Young of the Melbourne University, speaking of the influence of refrigeration on Australian economy said that the value of produce exported yearly under refrigeration from Australia and New Zealand is £75,000,000.

Orchard Notes

SEPTEMBER.

THE COASTAL DISTRICTS.

In the North Coast and Gayndah districts the bulk of the citrus crops have been harvested with, perhaps, the exception of Valencia Lates. Orchard activities should be directed towards pruning, cultivation, fertilizing, and spraying. As a result of seasonal conditions some trees are showing signs of impaired vigor, and these will require a severe pruning both in thinning and shortening back, removing superfluous growths and diseased and weakly woods. Healthy and vigorous orange trees will require little attention beyond the removal of crowded lateral growths.

Mandarins will need special treatment, particularly Glen Retreats and Scarlets. These varieties usually produce a profusion of branches, and as the trees mature the growths harden and the fruit-bearing shoots make short, weakly growths, which generally result in an overproduction of small fruits and a weakening of the trees. This is particularly noticeable in the case of the former variety. Here the annual pruning should consist of a heavy thinning and shortening back. Mature mandarin trees require attention towards assisting them to produce new and vigorous fruit-bearing growths.

Unprofitable trees should receive attention and be prepared for top-working. They may be headed back to three or four main arms radiating from the stem and whitewashed to prevent bark scald. Such trees may be grafted or later budded when suitable growths have matured.

Prior to working up the soil, fertilizing should receive attention. The spring application should carry a high percentage of nitrogen.

In the warmer districts which are free from frosts plantings of young trees may be made. Serious consideration should be given to the selection of commercial varieties only, and, having due regard for local conditions, selections may be made from the following varieties:—Washington, Navel, Joppa, Siletta, Valencia Late, Beauty of Glen Retreat, Emperor, Scarlet, Solid Scarlet, Marsh Seedless or Thompson grapefruit, and Villa Franca, Lisbon, and Genoa lemons.

Where melanose and black spot are present in orchards preparations for control measures should be made, and Bordeaux sprays applied at the correct times.

The majority of citrus trees would be considerably benefited by the application of a strong lime-sulphur wash, 1-18.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

Black aphis should be fought wherever it makes its appearance by spraying with a tobacco wash, such as black-leaf forty, as if these very destructive insects are kept well in hand the young growth of flowers, leaves, wood, and fruit will have a chance to develop.

The working over of undesirable varieties of fruit trees can be continued. The pruning of grape vines should be done during the month, delaying the work as long as it is safe to do so, as the later the vines are pruned the less chance there is of their young growth being killed by late frosts. Keep the orchards well worked and free from weeds of all kinds, as the latter not only deplete the soil of moisture, but also act as a harbourage for many serious pests, such as the Rutherglen bug.

New vineyards can be set out, and, in order to destroy any fungus spores that may be attached to the cuttings, it is a good plan to dip them in Bordeaux mixture before planting. The land for vines should be well and deeply worked, and the cutting should be planted with one eye only out of the ground and one eye at or near the surface of the ground.

In the warmer parts which are suitable for the growth of citrus fruits, the land must be kept well cultivated, and if the trees need irrigating they should be given a good soaking, to be followed by cultivation as soon as the land will carry a horse without packing.

Fruit fly should be systematically fought, as it will probably make its appearance in late citrus fruits and loquats; and if this swarm of flies is destroyed, there will be every chance of the early crops of plums, peaches, and apricots escaping without much loss.

Farm Notes

SEPTEMBER.

With the coming of warmer weather, weeds of all kinds will be making their appearance on cultivated land, and among row crops, but in the latter instance, they can be effectively dealt with by inter row cultivation, and where necessary, by the use of the hoe.

Where crops are sown on thoroughly fallowed land, the greater freedom from weed infestation is at once apparent when compared with adjacent paddocks which have merely received a hurried preparation, so that any effort to sow clean seed on clean land is amply rewarded in the resultant clean crops, and higher returns.

Potatoes planted during July and August will now be making growth, and should be sprayed with Bordeaux mixture as a preventive of blight, particularly if cool, moist weather is experienced. Bordeaux and Burgundy mixtures are not regarded as a cure for blight, but the spray forms a satisfactory protective covering, which, if applied at intervals during growth, will effectively prevent the disease. Where land has received adequate preparation, forming a satisfactory seed bed, and has a sufficiency of subsurface moisture to induce germination, early sowings of maize, sorghum, Sudan grass, millets, cowpeas, pumpkins, etc., and the planting of sweet potato cuttings can be proceeded with, the farmers' chief concern being to provide a sufficiency of summer growing fodder and grain crops, both for current needs, and for storage as seasonal reserves.

The spring maize crop is usually considered an uncertain proposition for grain, as the warm, moist conditions desired during the tasselling period do not always eventuate, but as excellent crops are sometimes obtained, the risk is well worth while, especially as the fodder provided can always be put to good use in the event of a failure for grain.

Early maturing Yellow Dent varieties, such as "Funks 90 Day" will be found the best for early sowing, as they have the ability to make the best use of available moisture.

The market prices obtainable are also a consideration, as although early sown maize is usually intended for farm use, any surplus can be disposed of at prices in excess of those obtainable for the main crop at a later date.

Sweet potato cuttings will now be obtainable, and attention is directed to this valuable crop, which will thrive over a much greater range of climatic and soil conditions than will the English potato.

There is scarcely a farm throughout the State that would not benefit from a patch of sweet potatoes, to be utilised for culinary and stock feeding purposes. They are not always profitable as a market proposition, but considerable improvement in this direction is possible if well graded tubers of suitable cooking varieties only are marketed.

THE GREATNESS OF THE FARMER.

The farmer is a great man, but does not know it. He never claims to be an authority, even in his own business, and that is one of the reasons why so many officious people presume to give him advice. In every walk of life it is the fellow who cannot do things who sets himself up as a critic of those who can, and do a big, worth-while job.

The farmer seldom defends himself from his critics; he is too busy fighting nature—whether in the form of drought or a grasshopper plague, or the hundred and one other difficulties that beset the land industries.

The farmer is a student of soils, of the life of seeds and plants and animals. The secrets of nature can only be learned by careful thought and observation, and any man who has succeeded as a farmer has more knowledge of real life and more courage to face its emergencies than most men of the city.

The farmer has worked hard enough and has learned enough from the very beginning of time to feed, clothe, and shelter mankind. Who could do better?

Our Babies.

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

CARE OF THE PREMATURE BABY.

OUR ante-natal work aims at keeping the expectant mother well and enabling her to carry her child to full term.

Many babies are born prematurely, and the mortality amongst them is high. In order to have a reasonable chance of surviving the premature infant needs special care. His weight is generally less than 5 lb., but infants weighing 2 lb. may survive when properly cared for. Any baby born weighing less than 5 lb. should be treated as premature. Infants six weeks or more premature are usually weak, unable to suck, have a feeble cry or are unable to cry at all.

In order to help her the mother should secure the services of a child welfare trained nurse if possible.

The points to keep in mind are:—

1. Prevention of chilling.
2. Careful feeding with mother's milk.
3. Avoidance of unnecessary handling.
4. Avoidance of exposure to infection.

In order to prevent chilling the baby is not bathed, but is smeared over quickly with a piece of cotton wool dipped in warm olive oil and wrapped in cotton wool or soft flannel. In order to hold the cotton wool in position it is covered with butter muslin. A bonnet and jacket may be made by lining the cotton wool inside and out with butter muslin.

If a prepared cradle is not ready to hand half a dress basket makes a very suitable one. This is lined inside (sides and bottom) with brown

paper or newspaper to prevent escape of heat. Inside this the basket is lined with a piece of old blanket or flannel or a woollen scarf. This is fixed in position by stretching it round the sides of the basket outside so that it reaches from the top edge to the bottom. Fasten the strip of material used by means of a string tied all the way round immediately below the edge, or by sewing through the material and basket at intervals. Now take the bottom border of the material, turn it over the top edge into the basket, and press it against the sides all round. Throw a single blanket over the basket so that it reaches to within about 8 inches of its head. Place a thin, firm pillow in the bottom of the basket and a soft one over it to form a mattress. A pillow stuffed with oaten chaff makes an excellent mattress into which the child sinks. Premature babies chill so easily that it is necessary to warm the cradle. This is done by means of hot water bags. If these are not available stone bottles may be used. In cold weather three are required—one at the foot of the cradle under the upper pillow forming the mattress, the others between the mattress and the side of the cradle, not against the baby's body. The bag at the foot is filled with two cups of boiling water and one cup of cold water, the bags at the sides with one and a-half cups of boiling water and one and a-half cups of cold water. Into this warmed cradle baby is placed wrapped in his cotton wool jacket and covered loosely with a light shawl. One side of the blanket which passes under the mattress is carried across the baby's body to the other side of the cradle, where it is tucked in firmly under the mattress so as to include the hot water bag. Now the other side of the blanket is taken, carried across the baby's body, and tucked in similarly on the opposite side. In cold weather these bags require to be refilled in rotation, one every hour.

Providing his bed is kept at a temperature between 90 deg. and 95 deg. Fahr., which is taken by means of a dairy thermometer placed under the blanket midway between the child and the bottle at one side, the premature infant should be kept in a properly ventilated room. Guard against overheating in the hot weather and against sudden changes in the atmospheric temperature.

Do not put him into a bath until he weighs 5 lb. or more and is able to cry lustily. Begin by sponging one part at a time until his whole body is sponged, and later place him in a bath.

Feeding is Important.

Though the baby may live and thrive on an artificial food he is much more likely to do so if he is fed on breast milk. Usually the baby is unable to suck the breast until he weighs nearly 5 lb., and then he is able to do so for short periods only. The milk will require to be expressed from the mother's breast at first. In the case of very premature and feeble infants feeding will require to be carried out by means of a pipette or eye-dropper, and later by a pipette with a teat attached. In such cases only one or two teaspoonfuls of fluid may be taken at each feed, and twenty to thirty minutes may be occupied in giving this, a few drops at a time. Much patience and care must be exercised, and the swallowing movements observed before a drop or two more is expressed into the lower side of the child's mouth as his head is turned to one side. When he is able to swallow such a small amount he may require to be fed every hour for the first twenty-four or forty-eight hours.

Begin by giving warm boiled water as much as he will take without being fatigued, perhaps one teaspoon every hour. For a bady weighing 2½ lb. about 3 oz. of boiled water may be given during the first twenty-four hours. If there is delay in the secretion of breast milk whey may be given temporarily. When the baby is able to take two teaspoons in twenty to thirty minutes comfortably, feed him one and one-half hourly for a day or two, then two hourly, giving him sixteen, then twelve feeds in twenty-four hours. When expressed breast milk is available feed with equal parts breast milk and boiled water or boiled whey. As he takes his food more readily gradually increase the quantity of his mixture so that at the end of a week or ten days he may be taking 4½ to 6 oz. in twenty-four hours, that is three to four teaspoons two hourly. When he is taking his allowance well, give him boiled water in addition so that the total amount of fluid he receives is equivalent to 3 oz. for every 1 lb. of body weight. He may be kept on two hourly feeds until he has gained 1 lb. in weight, when he may receive ten feeds instead of twelve in twenty-four hours, namely two hourly, 6 a.m. to 6 p.m., three hourly, 9 p.m. to 3 a.m. When he is about three weeks old he may be taking 7½ oz. of his mixture composed of equal parts of breast milk and whey and 1¾ to 2 oz. boiled water during the twenty-four hours. At one month he may be taking 9 oz. of his mixture and 3 oz. of water. Be guided by his capacity to take the mixture and by his weight. He may gain scarcely any weight during the first week, during the second he may gain 2 to 3 oz., and by the time he is one month old he may have gained 9 to 10 oz. on this mixture. Be content while he is gaining strength and weight. Do not exceed his tolerance for food. There is a real risk of an upset which may prove serious.

Do not remove him from his cot to feed or oil him. Handle the premature infant as little and as gently as possible while attending to him. Turn him from one side to the other every four hours.

Allow as few visitors as possible to see him, particularly keep away anyone suffering from a cold or other infection. If the mother herself happens to be suffering from a cold it is wise for her to tie two layers of gauze over her nose and mouth when attending to the baby.

BOTANY FOR QUEENSLAND FARMERS.

Mr. David G. Stead, President of the Naturalists' Society of New South Wales, writes—

Reference, C. T. White's Principles of Botany.—Please allow me to congratulate you on the issue of this splendid work,* which is quite unique among such publications. Mr. White has performed a most meritorious service, not only for Queensland, but for the whole of Australia, in writing this fine book, while the Queensland Government is to be thanked for its great discernment of the value of a really useful publication in issuing it in such a fine, permanent format, so well got up in the matter of printing and illustrations.

This book will prove of lasting use and benefit as a contribution to a practical understanding by farmers and by other citizens of Australia of the basic principles of Nature that are to be studied if they are to be successful in dealing with the primary products of the land. At the same time, the fund of useful information about our trees and many native shrubs, is of the greatest practical utility to every student.

One should add here that the issuing of the work at such a low price is also an evidence of the liberal foresight of the Queensland Government in its recognition of the fine practical usefulness of the book.

**Principles of Botany for Queensland Farmers.* By C. T. White, Government Botanist; issued by the Department of Agriculture and Stock. Price, 2s.

IN THE FARM KITCHEN.

VARIATIONS IN STEWS.

Stewed Veal Chops.

Take 6 tender veal chops, 1 large tomato, 1 onion, 2½ gills white stock, 1 teaspoonful grated orange-rind, 1 stalk celery, 4 tablespoonfuls butter or bacon fat, 1 blade mace, 2½ tablespoonfuls flour, 1 carrot, pepper and salt to taste.

Beat and trim chops. Season with pepper. Melt one and a half tablespoonfuls butter in a deep frying pan. Brown chops on each side for three minutes. Season to taste with salt. Cook another three minutes on each side. Add minced carrot, celery, and onion, and chopped and peeled tomato. Cover with two gills of the boiling stock, then cover pan. Simmer ten minutes. Melt remainder of butter in another frying pan. Stir in orange rind and mace. Cook for five minutes. Add flour and remainder of stock. Bring to the boil. Pour over the chops and vegetables. Cover and cook ten minutes. Uncover. Remove mace. Serve on a hot dish.

Stewed Knuckle of Veal.

Take 1 lb. knuckle veal, 1 small onion, 1 oz. flour, 1 oz. butter, seasoning.

Wipe the meat. Melt the butter and fry onion, cut in thin slices. Add half a pint of water and boil. Place the veal in and stew gently for three hours. When tender, lift out the meat and place it on a hot dish. Thicken the sauce with the blended flour and pour over the meat. Garnish with watercress and serve with salad.

Stewed Kidney and Rice.

Take 4 sheep's kidneys, 1 medium onion, ½ pint stock, 6 oz. rice, 2 tablespoonfuls dripping, 4 oz. grated cheese, 1½ tablespoonfuls flour, 1½ tablespoonfuls lemon juice, 1½ teaspoonfuls French mustard, pepper and salt, parsley to garnish.

Wash, skin, and core kidneys, then cut into dice. Melt fat in a saucepan. Dip kidney in flour and salt and pepper to taste, and fry until brown, then remove to a plate. Peel and slice onion, and fry slowly until golden, adding more fat if required, then remove to plate, and brown remainder of flour. Stir in stock and bring to the boil. Boil until smooth, stirring constantly, then add kidney, onion, and mustard. Cover and simmer for one hour or until kidney is tender, then add lemon juice. About half an hour before kidney is ready, place a pan half-filled with salted water on to boil. When boiling, wash and add the rice. Boil quickly uncovered until soft, then strain through a colander and return to pan. Add grated cheese and stir over a slow heat till melted. Arrange in a ring on a hot dish and pour the stewed kidney into the centre. Decorate with sprigs of parsley.

Stewed Lamb and Green Peas.

Take 1½ lb. middle neck of lamb, 1 pint water, 1 pint green peas, 1 onion, 1 oz. flour, 1 oz. dripping or bacon fat, salt and pepper to taste.

Melt the fat in a saucepan. When smoking hot, add the peeled and chopped onion and fry till brown and crisp. Remove the onion. Add the meat divided into suitable pieces for serving. Brown on both sides. Remove to a dish and drain off any remaining fat in the pan. Mix the flour to a paste with a little water. Turn into a saucepan. Stir in the remainder of the liquor. Keep stirring till boiling. Add the meat and onion and simmer for two and a half hours. Add drained tinned peas and bring again to the boil. If you use fresh peas, add them about twenty-five or thirty minutes before the stew is ready. If liked, a sliced carrot, one or two pieces of turnip, and one or two small onions can be added after the meat is cooked for one hour.

Stewed Breast of Lamb.

Take 1 breast of lamb, 1 oz. butter, ¾ oz. flour, white stock, 1½ pints peas, 1 blade mace, ¼ teaspoonful white pepper, potato balls, salt, gravy.

Remove skin from lamb, then cut meat into pieces. Place meat in a stewpan with mace and sprinkle with salt and pepper. Add enough stock to cover. Cover pan and simmer gently for three-quarters of an hour. Skim well and remove mace. Add two-third of the peas and simmer again for half an hour. Mix butter and flour together. Stir into gravy in small pieces, so that all dissolves. Simmer for ten minutes. Remove meat carefully and arrange on a dish. Pour sauce over. Garnish with potato balls and remainder of peas, plainly boiled.

Stewed Tripe with Tomato Sauce.

Take 2 lb. tripe, 3 tablespoofuls fat, tomato sauce, 2 tablespoonfuls flour, 1 chopped onion, boiling water.

Wash, dry, and cut tripe into small strips. Melt fat in a frying pan till smoking hot. Add onion and cook until brown. Stir in flour. When flour is brown stir in tripe and enough boiling water to cover—about one and a-half cupfuls. Turn into a casserole. Cover and simmer slowly for one or two hours, or until tender. Serve with tomato sauce.

Tomato Sauce.

Take ½ cupful water, 2 tablespoonfuls flour, salt and pepper, 2 tablespoonfuls margarine, ½ teaspoonful minced onion, 1 gill sieved tomato.

Melt butter in a saucepan. Remove pan from gas and stir in the flour. Add water. Stir well. Add tomato puree, minced onion, and seasoning to taste.

Stewed Mushrooms.

Take ½ lb. mushrooms, 1 pint stock, 1 oz. butter, juice ½ lemon, seasoning.

Peel the mushrooms and cut each into four (or they may be left whole). Stew gently for five minutes with one ounce of butter. Add seasoning, a little flour, and one pint of stock. Cook for ten minutes. Serve on toast. Sauce may be served separately. Add lemon juice before serving.

Stewed Brisket of Beef.

Take 2 lb. brisket, 2 tablespoonfuls dripping, ½ pint bean liquid, 1 pint butter beans, 2 tablespoonfuls flour, salt and peper to taste.

Sprinkle the meat with salt and pepper and stand for one and a half hours. Cover the beans with cold water and soak overnight. Drain the beans. Turn into a saucepan. Cover with fresh water. Bring slowly to simmering point, then add the meat, well browned in the dripping. Cover and simmer until meat and beans are tender. Re-heat the dripping in the frying pan. Stir in the flour, and when frothy gradually stir in half a pint of liquid from the stew. Pour the sauce into the saucepan. Cover and cook slowly for a moment or two; then serve the stew with well-mashed potatoes.

UNUSUAL FISH DISHES.

Fillets of Fish with Sausage-meat.

Take 1 lb. fish fillets, ½ lb. sausage-meat, 2 eggs, ½ pint to ¾ pint milk, salt and pepper to taste.

Wash and trim the fillets. Roll up each fillet with some of the sausage-meat inside; and arrange neatly in a glass fireproof dish, casserole, or pie-dish. Season well. Now pour over a custard made with the eggs and milk. Place in a moderate oven for about three-quarters of an hour. On no account cook too fast, or the custard will curdle. Serve immediately.

Spanish Hot Pot.

Place a layer of cooked, mashed potatoes in the bottom of a well-greased pie-dish. Cover alternately with layers of fried onion, raw sliced tomatoes, and pieces of uncooked fish dipped in flour. Sprinkle with knobs of dripping. Repeat the layers till the pie-dish is full, finishing with potatoes, dripping, and grated cheese. Bake till the fish is cooked, about half to three-quarters of an hour, and serve.

Quenelles of Whiting.

Take 1 large whiting (cooked and sieved), 1 gill milk, 3 oz. breadcrumbs, 1 oz. butter, 2 egg-yolks, 1 egg-white, anchovy essence, seasoning.

Soak the crumbs in milk, then squeeze them dry in a cloth. Melt the butter, add the crumbs, and leave over a gentle heat until the butter is absorbed. Add the sieved whiting, seasoning, and the egg, well beaten. Mix all well together. Shape into quenelles with two tablespoons. Butter a sauce-pan and lay on the quenelles. Pour over boiling water and poach gently for about ten minutes. Drain and serve coated with sauce. Serve en couronne, and fill up the space with green peas or French beans.

Russian Fish Pie.

Take ½ lb. fish (cooked or raw), 1 teaspoonful parsley, 1 oz. melted butter, 1 hard-boiled egg, 2 tablespoonfuls white sauce, grated lemon rind, seasoning, flaky pastry.

Free the fish from bones and flake very finely. Add seasoning, parsley, butter, sauce, and lemon rind. Grate the egg and mix all well together. Roll out the pastry into a square. Place mixture in the centre of pastry and fold up the four corners to the centre. Brush with egg and decorate with pastry-leaves. Bake in a hot oven and serve very hot.

Sole a la Creme.

Take 1 sole, 1 tablespoonful cream, seasoning, bay-leaf and mace, ¾ pint milk, lemon juice, 1 oz. butter, 1 oz. flour.

Skin and fillet the sole. Roll up the fillets after seasoning well. Sprinkle each with lemon juice. Heat the milk with the bay-leaf, mace, and seasoning. Strain and cook the fillets gently for a quarter of an hour in the liquid. Melt the butter and add the flour and half a pint of the liquid strained from the fish. Boil and add cream and extra seasoning. Pour the sauce over the fish and garnish with parsley and lemon.

Sole a l'Orly.

Take 1 sole, 1 small onion, 1 oz. grated cheese, 3 tomatoes, 1 teaspoonful chopped parsley, 1 teaspoonful anchovy essence, 1½ oz. butter.

Chop the onion and mix with the parsley and cheese. Melt the butter and add. Add anchovy essence. Skin the black side of the sole, and raise the two fillets. Stuff with the mixture. Place on a buttered dish, and cover with slices of tomatoes. Sprinkle a little grated cheese on the top and bake for twenty-five minutes. Serve very hot.

Flounder and Spinach Pie.

Take 1 lb. of fillet flounder, 1½ cupfuls white sauce, ½ gill water, 1 cupful cooked spinach, ½ gill milk, 1½ teaspoonfuls Parmesan cheese, 3 tablespoonfuls grated cheese, salt and pepper to taste.

Butter a shallow fireproof dish. Fold fillets in two. Place in dish side by side. Season with salt and pepper to taste. Add milk and water. Cover with a buttered paper. Cook in a moderate oven for fifteen minutes, or till milky white all through. Drain well. Butter another shallow fireproof dish. Line with the spinach. Lift fillets carefully from other dish and arrange side by side on top of the spinach. Stir cheese into sauce. Stir in a dash of made mustard, if liked. Pour over fish, sprinkle with grated Parmesan. Bake in the top of a hot oven or brown under the grill.

Skate Steaks with Tomato Puree.

Take 2 or 3 skate steaks, 1 inch thick, 2 teaspoonfuls butter, small piece onion, salt, cayenne pepper, 2 tomatoes, ½ pint fish stock, 2 teaspoonfuls flour, blade of mace, lemon juice.

Dry the fish with a cloth, sprinkle with salt and pepper, and lemon juice on the under side. Lay it on a buttered plate with another plate on top, and set it on a saucepan of boiling water for half an hour till the fish leaves the bone. Lift it on to a cloth to drain, then lay on a hot meat dish. Warm the butter and fry the tomatoes and onions sliced, add flour, mace, and seasonings, and fish liquid, and cook twenty minutes. Rub through a sieve. Return to saucepan to heat, then pour over fish. Sprinkle with chopped parsley.

FOR BIRD LOVERS.

Bird-lovers will find that an attractive and inexpensive bath can be made for their feathered pets in the following way:—

Take a tile sewer pipe about 3 feet long, push it will into the ground for several inches, keeping the tile upright. Tie a weight to the lid of a discarded rubbish tin by the handle. Invert the lid on top of the pipe, allow the weight to swing inside, thus holding the lid in position. Finally paint the whole with two coats of any paint considered most suitable, and you will be delighted with the result.—E.E.S. in the *"Sydney Morning Herald."*

RAINFALL IN THE AGRICULTURAL DISTRICTS.

Table showing the Average Rainfall for the Month of June, in the Agricultural Districts, together with Total Rainfall during 1938 and 1937, for Comparison.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	June.	No. of years' records.	June, 1938.	June, 1937.		June.	No. of years' records.	June, 1938.	June, 1937.
North Coast.	In.		In.	In.	*Central Highlands.*	In.		In.	In.
Atherton	1·65	37	1·40	0·25	Clermont ..	1·68	67	1·69	1·70
Cairns	2·85	56	2·25	0·30	Gindie	1·43	39	..	0·84
Cardwell	2·02	66	2·23	0·83	Springsure ..	1·76	69	2·52	0·92
Cooktown ..	1·99	62	2·01	0·03					
Herberton ..	1·15	52	0·75	0 07					
Ingham	2·39	46	4·15	1·51					
Innisfail	7·20	57	7·41	3·19					
Mossman Mill ..	2·46	25	1·67	0·70	*Darling Downs.*				
Townsville ..	1·37	67	0·68	0·75					
Central Coast.					Dalby	1·66	68	0·90	1·04
					Emu Vale ..	1·48	42	0·50	0·78
Ayr	1·48	51	0·25	0·48	Hermitage ..	1·71	32	..	0·51
Bowen	1·65	67	0·49	1·54	Jimbour ..	1·63	50	0·58	0·79
Charters Towers ..	1·33	56	0·28	1·90	Miles	1·75	53	0·74	0·68
Mackay	2·73	67	2·40	1·88	Stanthorpe ..	1·90	65	0·47	1·38
Proserpine ..	3·36	35	1·57	1·56	Toowoomba ..	2·36	66	0·88	1·19
St. Lawrence ..	2·50	67	0·95	1·40	Warwick ..	1·73	73	0·42	0·68
South Coast.									
					Maranoa.				
Biggenden ..	2·22	39	1·49	0·92					
Bundaberg ..	2·85	55	2·48	1·26	Roma	1·55	64	0·80	0·50
Brisbane	2·68	86	0·86	0·73					
Caboolture ..	2·65	51	1·07	1·14					
Childers	2·45	43	1·50	0·79					
Crohamhurst ..	4·42	45	2·88	1·74					
Esk	2·20	51	0·33	1·16					
Gayndah	1·82	67	0·98	0·72					
Gympie	2·66	68	1·35	1·21	*State Farms, &c.*				
Kilkivan	2·11	59	0·88	1·16					
Maryborough ..	3 00	67	2·18	1·63	Bungeworgorai ..	1·26	24	..	0·32
Nambour	3·71	42	3·52	1·94	Gatton College ..	1·80	39	..	0·82
Nanango	1·97	56	0·75	1·29	Kairi	..	..	..	..
Rockhampton ..	2·57	67	1·27	1·60	Mackay Sugar Experiment Station	2·47	41	..	1·57
Woodford ..	2·86	51	0·69	1·51					

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—JUNE, 1938.

Compiled from Telegraphic Reports.

Districts and Stations.	Mean Atmospheric Pressure, at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·94	80	71	84	7	67	15	201	13
					28				
Herberton	..	71	56	82	7	47	19	75	7
Rockhampton	30·11	72	56	79	9	45	21	127	6
Brisbane	30·17	69	52	77		41	28	86	8
Darling Downs.									
Dalby	30·18	67	42	76	7, 8	28	21	90	6
Stanthorpe	..	59	35	69	9	21	28	47	4
Toowoomba	..	62	42	72	7, 8, 9	31	28	88	5
Mid-Interior.									
Georgetown	29·98	84	59	89	28, 29	44	28	32	2
Longreach	30·10	75	50	85	9	40	2	134	6
Mitchell	30·17	65	43	77	7	29	21	115	5
Western.									
Burketown	29·99	84	62	89	20	55	27	..	..
Boulia	30·07	74	50	85	8	40	27	24	2
Thargomindah	30·10	65	48	74	6	39	5, 6	106	4

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	August. 1938.		Sept. 1938.		Aug., 1938.	Sept. 1938.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	6·35	5·21	6·7	5·37	9·42	10·21
2	6·34	5·22	6·6	5·37	10·20	11·11
						p.m.
3	6·33	5·23	6·5	5·38	11·0	12·1
4	6·33	5·24	6·4	5·38	11·42	12·49
					p.m.	
5	6·32	5·25	6·3	5·39	12·26	1·40
6	6·31	5·25	6·2	5·39	1·14	2·33
7	6·31	5·26	6·1	5·40	2·2	3·26
8	6·30	5·26	5·58	5·40	2·55	4·17
9	6·29	5·27	5·57	5·41	3·47	5·12
10	6·28	5·27	5·56	5·41	4·37	6·6
11	6·28	5·28	5·55	5·42	5·32	7·2
12	6·27	5·28	5·53	5·42	6·25	7·59
13	6·26	5·29	5·52	5·43	7·18	8·57
14	6·25	5·29	5·51	5·43	8·10	9·57
15	6·24	5·30	5·50	5·44	9·7	10·57
16	6·23	5·30	5·49	5·44	10·4	11·58
17	6·22	5·31	5·48	5·45	11·5	..
						a.m.
18	6·21	5·31	5·47	5·45	..	12 56
					a.m.	
19	6·20	5·32	5·45	5·45	12·3	1·49
20	6·19	5·32	5·44	5·46	1·5	2·39
21	6·18	5·33	5·43	5·46	2·5	3·25
22	6·18	5·33	5·42	5·47	3·4	4·6
23	6·17	5 33	5·41	5·47	3·55	4·48
24	6·16	5·34	5·40	5·47	4·45	5·30
25	6·15	5·34	5·39	5·48	5·32	6·9
26	6·14	5·35	5·38	5·48	6·15	6·48
27	6 13	5·35	5·37	5·49	6·53	7·32
28	6·12	5·36	5·36	5·49	7·35	8·19
29	6·11	5·36	5·35	5·50	8·15	9·2
30	6·10	5·37	5·34	5·50	8·57	9·50
31	6·9	5·37			9·39	

Phases of the Moon, Occultations, &c.

3rd Aug.,	☽	First Quarter	12 0 p.m.
11th ,,	○	Full Moon	3 57 p.m.
99th ,,	☾	Last Quarter	6 30 a.m.
25th ,,	●	New Moon	9 17 p.m.

Apogee, 8th August, at 1.0 p.m.
Perigee, 23rd August, at 3.0 a.m.

Among the stars of the far distant Zodiacal Constellations, through which the planets pursue their course, we can trace their movements, though in the case of Jupiter and Saturn, amongst inconspicuous stars, not to the best advantage at present.

Mercury will reach its stationary point on the 13th, after which it will rapidly decline in altitude until on the 28th it will be lost in the Sun's rays and disappear from the evening sky.

About the middle of the month, when Jupiter, in Aquarius, has arisen Mercury will be low down in the west and Venus, in Virgo, above it.

On the last day of the month Venus will pass the first magnitude star Spien close to the ecliptic.

Mercury rises at 7.57 a.m., 2 hr. 6 min. after the Sun, and sets at 7.23 p.m., 1 hr. 22 min. after it, on the 1st; on the 15th it rises at 7.13 a.m., 49 min. after the Sun, and sets at 7.7 p.m., 1 hr. 37 min. after it.

Venus rises 8.49 a.m., 2 hr. 14 min. after the Sun, and sets at 8.33 p.m., 3 hr. 11 min. after it, on the 1st; on the 15th it rises at 8.32 a.m., 2 hr. 8 min after the Sun, and sets at 8.52 a.m., 3 hr. 22 min. after it.

Mars rises at 6.30 a.m. and sets at 5.10 p.m. on the 1st; on the 15th it rises at 6.4 a.m. and sets at 4.58 p.m.

Jupiter rises at 6.52 p.m. and sets at 7.52 a.m. on the 1st; on the 15th it rises at 5.50 p.m. and sets at 6.58 a.m.

Saturn rises at 10.34 p.m. and sets at 10.18 a.m. on the 1st; on the 15th it rises at 9.37 a.m. and sets at 9.25 p.m.

At about 9 o'clock at the beginning of the month and two hours earlier at the end the Milky Way from south-west to north-east will be most luminous near the Southern Cross and at the zenith near Scorpio and Sagittarius North-eastward it can be traced through Aquila, the Eagle (with the bright star Altair and a smaller one on each side of it) and to the horizon through Cygnus, the Swan. The latter constellation contains the figure of a Cross (The Northern Cross) inverted in our Hemisphere. The head of Cygnus is a small star between Altair and the brilliant white star Vega in Lyra, its wings stretch out beyond the Milky Way; the largest star, Deneb, nearest the horizon marks its tail.

2nd Sept.	☽	First Quarter	3 28 a.m.
10th ,,	○	Full Moon	6 8 a.m.
17th ,,	☾	Last Quarter	1 12 p.m.
24th ,,	●	New Moon	6 34 a.m.

Perigee, 20th September, at 10.0 p.m.
Apogee, 5th September, at 3.0 a.m.

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 somewhat 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.

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