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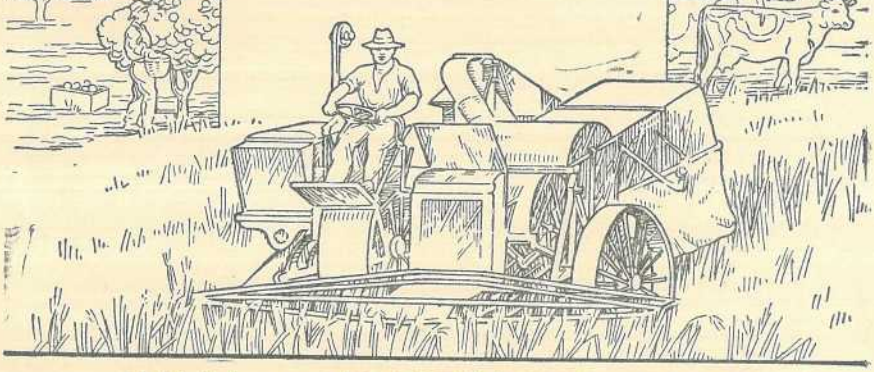

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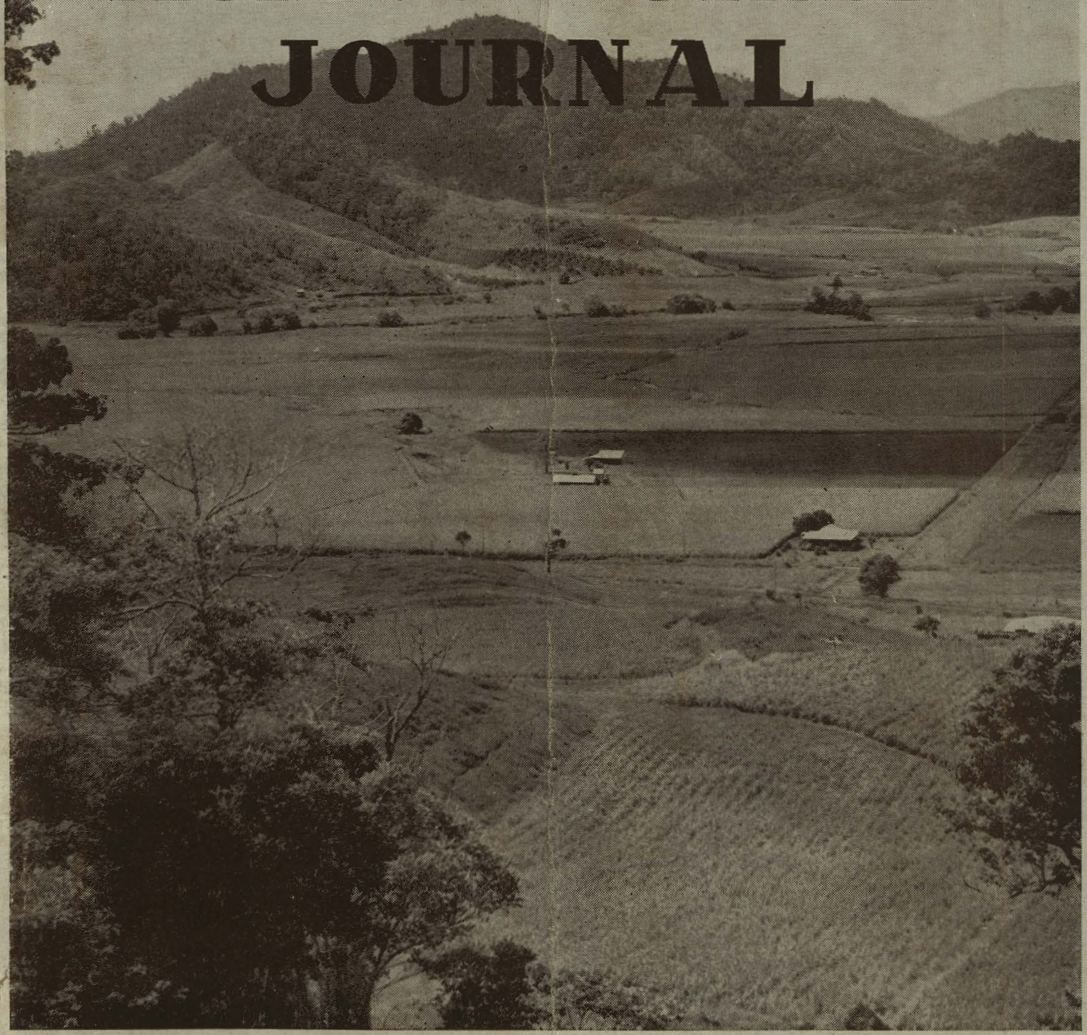
QUEENSLAND AGRICULTURAL JOURNAL



Sugar Cane Fields—Yungara Valley, Cairns District, North Queensland.

LEADING FEATURES

Edited by J. F. F. REID

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ANNUAL RATES OF SUBSCRIPTION.—Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling,** members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.

QUEENSLAND AGRICULTURAL JOURNAL

Vol. LIV. 1 JULY, 1940. Part 1.

Event and Comment

Farming a Key Industry.

FARM production is regarded as a key-industry in the present national emergency, even by recruiting staffs. Those outside the military service categories are urged to go on producing to their full capacity and maintain high-quality standards. It is now generally recognised that among our best efforts for the nation is the production of commodities essential for the feeding and clothing of our troops, the civil population, and the many thousands of homeless and destitute people who, by stress of war and invasion, have come under the protection of the British Commonwealth. Then, too, we have to consider the requirements of the position which will inevitably develop after the war. We have to prepare for the challenge to many of our primary industries, wool-growing particularly, by artificial substitutes. Incidentally, a tribute is due to the men and women of the land who are contributing so magnificently to the war effort, not only in respect of increased production, but of direct money subscriptions as well. Never has it been more impressively demonstrated that in war as well as in peace it is the country people who form the real foundation of a nation.

Planned Development and Post-war Stabilisation.

THE recent meeting at Canberra of the Australian Council of Agriculture, consisting of Ministerial representatives of Commonwealth and State Governments, was a notable event. Naturally, war-time needs

occupied most of the attention of the Ministers, all of whom recognise the fact that there is a vast land force throughout Australia capable of being mobilised in the national interest for the planned development and post-war stabilisation of our primary industries. Through a really national effort we can increase wartime production, while also planning and preparing for the aftermath of world-wide commercial disorganisation.

The war, it is acknowledged, has placed new responsibilities on farmers and graziers, all of whom have vital contributions to make as units in the army of production. As exporters in competitive markets we have, it is repeated, to prepare to face trade rivals with high-grade standardised products which will command preference on merit. Therefore, our watchwords at all times have to be quality, uniformity of quality, and continuity of supply. With an orderly plan of balanced output Australia will do her job in satisfying the needs of the Empire under war conditions, and of the world during the period of economic reconstruction which must follow.

A Worth-while War Effort.

MANY producers are of opinion that a policy of systematically levelling up the production of live stock during the war should be adopted. That would be regarded as a worth-while war effort which could be made a duty. To do this it would be necessary to conserve more fodder and sow more forage crops in districts suitable for their cultivation. Till now, fodder conservation has been regarded, more or less, as an insurance against serious drought; but we may yet have to provide for a more systematic supplementing of natural pastures during dry spells in order to level up production. To do this without touching our drought reserves means increasing the quantity of fodder stored and increasing the acreage of fodder crops sown in the course of normal practice. It is believed that if the steep rise and fall in Australia's exportable surplus of primary products could be kept at a more satisfactory level, it would help in the negotiation of war and post-war trade agreements. Not long before the war we had practically reached a limit on the British market and were confronted with both actual and prospective impositions of restrictive quotas in respect of some of our commodities. When the requirements of the Australian home market are considered, there is, apparently, less need to worry. The stimulation of the production of commodities which hitherto have figured on inward manifests, and in respect of which it is necessary to save exchange charges, will be welcomed by primary producers. Apart from growing crops to take the place of commodities normally imported, the fact that once more it has been demonstrated that the Australian market for primary produce is the most profitable should not be ignored and, therefore, we should do our best to look after it. It is reasonable to expect a big increase in population after the war—mostly because of large migrations from war-worn countries—and that will mean even a better home market. Every man, woman, and child who comes here shall have to be fed and clothed. With some products, it should not be necessary to wait until the war ends. Take wool, for instance. Look what it would mean to the pastoral industry if every woman could be induced to cease wearing synthetic fabrics and wear

good Australian wool! However, Australian producers are wideawake to the opportunities of national service, both in war and peace, which are now in their hands.

Producers' Problems.

FARMERS all over Australia are facing peculiar problems. With many farm products the war has assured a market for the duration and for a certain after period of readjustment, but that does not, however, absolve producers from the duty of maintaining their products at the highest possible standard of quality and from keeping an eagle-eye on the requirements of markets already established or likely to be developed. On producers rests the responsibility of studying war-caused marketing problems, and of deciding how best to serve Australia and the Empire. In many primary industries the output has to be kept as high as possible, and while that is being done, it will be necessary to plan for the future. Some markets held before the war may be lost to us after the war, and other markets may have to be found. One encouraging development is the growing use of farm products for the manufacture of plastic and other materials used in secondary industry. Farmers can take as big a share in the united national effort now being made as those engaged in any other industry, and Australia is fortunate in that the vast majority of her primary producers are men of vision and enterprise who are not likely to neglect the call for present economy and efficiency, and for careful long-range planning.

A Word for the "Waler" in War Time.

ACCORDING to General Sir Harry Chauvel, who commanded the Australian Light Horse and other cavalry divisions in the last war, if Australians are ever compelled to fight an enemy on their own soil, our difficulties will be greater if there is not available a large force of mounted troops, with adequate remount reserves.

In Palestine and during the South African war, the Australian Light Horse fought in the same way they would have to fight if war ever comes to Australia. In those campaigns, horses were called on for feats of endurance almost incredible. In the Sinai campaign, Australian "walers" for months lived on scanty rations, after surviving a long sea voyage, in a country which did not even grow grass and where water was very scarce. It was not unusual for them to carry heavy loads over soft sand for up to forty-eight hours on one watering. In some cases horses were known to go without water for eighty-four hours, covering long distances, and carry as much as 20 stone on their backs.

Unfortunately, the present generation of Australians is doing little to maintain that splendid breed of horses, but it is not too late to stop the decline and increase the rate of breeding.

Our job is to continue to produce that tough, robust "waler," with his tremendous powers of endurance and recuperation so much in evidence in the campaign of the Desert Mounted Corps. It will be many years before the motor will replace the horse completely. Many horses, it is true, have been replaced by mechanised traction, but nothing has yet been devised to take the place, under conditions which certainly exist in all parts of Australia, of the soldier who can fight mounted or on foot, meet quickly changing circumstances, and live on the country.

Pineapple Culture in Queensland.

H. K. LEWCOCK, M.Sc., B.Sc.Agr., Senior Research Officer.

(*Continued from page 277, March, 1940.*)

CHAPTER VI.—CLIMATIC INFLUENCES.

WHILE the pineapple is dependent on the soil for its supply of water and mineral nutrients, the extent to which these substances may be available, and the ability of the crop to utilise them, is determined largely by climatic influences. In a locality where climatic conditions depart from those most favourable for the development of the crop, particular care is necessary in the laying out and management of the plantation.

For its best development the pineapple requires warm, equable temperatures, moderate rainfall, and high atmospheric humidity. Such conditions are found normally only in tropical or sub-tropical latitudes, though latitude alone affords little indication of climate. Altitude, distance from the ocean, and the direction of the prevailing winds all exert considerable influence on the climate of a region, irrespective of its distance from the equator.

TEMPERATURE.

Of all the features which constitute climate, temperature is the one which chiefly limits the distribution of the pineapple as a field crop. Not only is the pineapple intolerant of frost, but its growth is almost entirely inhibited when the mean temperature falls below 60 degrees F. The mere existence of the crop cannot be regarded as evidence of suitable temperature conditions; low winter temperatures may reduce its yielding potentialities to the point where profit disappears though the plants remain. Apart from their influence on yield, however, low temperatures affect both the quality of the fruit and the time which they take to reach maturity. On the other hand, unduly high temperatures (90 degrees F. or more) may cause scalding of the succulent foliage of young plants and wastage of fruit through sunburn.

Other conditions being favourable, the pineapple thrives best in localities having a mean annual temperature between 70 and 80 degrees F., provided the seasonal range lies within the limits already indicated. It is for this reason that large-scale commercial production of pineapples is confined to regions enjoying an oceanic climate, viz., Hawaii, Malaya and Formosa. In fact, as far as this crop is concerned, it may be laid down as a guiding principle that the more equable the temperature the more suitable the climate.

In Queensland, temperature conditions limit the cultivation of the pineapple to the territory which lies between the eastern coastline and the mountain ranges which parallel it for the greater part of its length. From the New South Wales border to Cooktown, this extends over 1,100 miles and includes a range of latitude of nearly 15 degrees. For economic reasons, however, more than 90 per cent. of the existing production is obtained from districts which lie between the 26th and 28th parallels, that is, between Gympie in the north and Brisbane in the south, a distance of approximately 100 miles. (Plate 1.) The rise of the

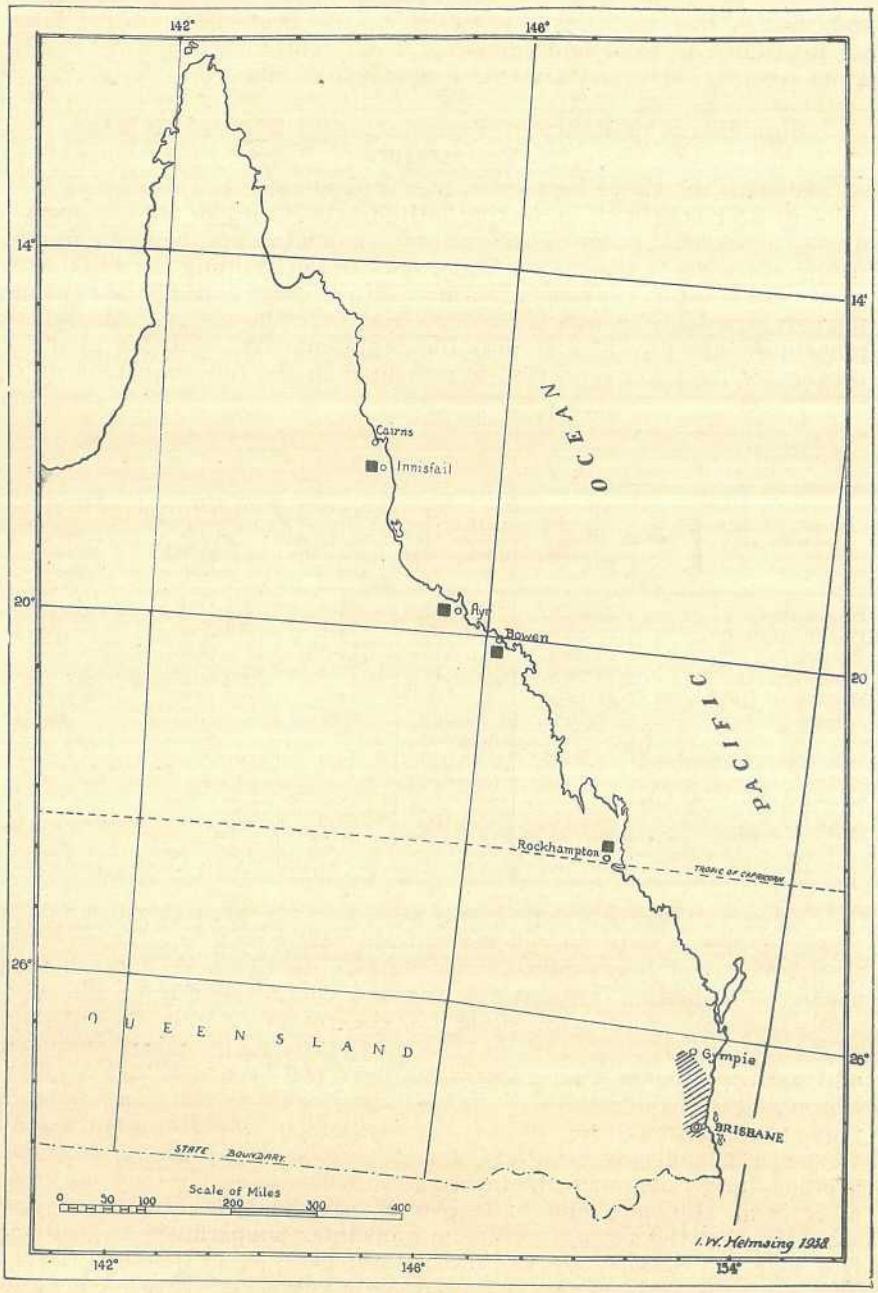

Plate 1.

PRINCIPAL PINEAPPLE-PRODUCING REGION IN QUEENSLAND.

OTHER CENTRES WHERE PINEAPPLES ARE GROWN COMMERCIALLY.

industry in this south-eastern portion of the State has resulted from its proximity to local and interstate fresh fruit markets which, until quite recently, absorbed a major proportion of the crop.

Significance of Range of Temperature as Opposed to Mean Temperature.

Because the range between winter and summer temperatures tends to be greater both with increasing latitude and altitude, even in coastal areas, the seasonal range of temperature—in contrast to the mean annual temperature—is of the utmost importance in determining the suitability of a locality for pineapple culture. In illustration of this point, temperature data for several localities along the Queensland coast where pineapples are grown, and also for representative localities in other pineapple-producing countries, is presented in the following table:—

TABLE I.

TEMPERATURE DATA FOR PINEAPPLE-PRODUCING LOCALITIES IN QUEENSLAND AND IN OTHER COUNTRIES.

Locality.	Latitude.	Height above Sea Level (feet).	Mean Temperature (Annual). Deg. F.	Mean Temperature (Hottest Month). Deg. F.	Mean Temperature (Coldest Month). Deg. F.
Brisbane, Q.	27.30'S.	137	68·9	77·1 (Jan.)	58·5 (July)
Rockhampton, Q. ..	23.26'S.	37	73·1	80·6 (Dec.)	62·5 (July)
Bowen, Q.	20·00'S.	16	74·9	81·5 (Jan.)	65·8 (July)
Cooktown, Q. ..	15.28'S.	17	76·5	82·5 (Dec.)	72·5 (July)
Honolulu (Hawaii) ..	21·18'N.	20	74·4	78·1 (Aug.)	70·5 (Jan.)
Johore (Malaya) ..	1.40'N.	10–200 (approx.)	80·0	..	..
Bukidnon (Philippines)	8.30'N.	2,000 (approx.)	74·0	..	..
Port Elizabeth (South Africa)	33.58'S.	50–100 (approx.)	63·6	..	..

Many of the cultural problems attending the profitable production of pineapples in southern Queensland are partly or wholly attributable to the effects of low winter temperatures. At Brisbane, for example, the mean minimum temperature for the coldest month of the year (July) is 48.5 degrees F. while for the coldest month at Honolulu (January) it is 65.5 degrees F. The range between the mean maximum and mean minimum temperatures at these two localities, and also for Bowen, Queensland, which is situated approximately the same distance from the equator as the southernmost island of the Hawaiian group, is shown graphically in Plate 2. It will be noted firstly, that the average daily range of temperature at Brisbane is nearly twice as great as it is at Honolulu and 3 degrees F. greater than at Bowen; and secondly, that the average minimum midwinter temperature at Brisbane is 8 degrees F. lower than at Bowen. Moreover, at no time of the year does the mean temperature at Bowen, or in any coastal area northwards from Rockhampton fall below 60 degrees F., unlike the conditions which obtain in south-eastern Queensland. In the latter region, vegetative growth of the pineapple is almost entirely arrested by the low temperature conditions which prevail during July and August, while optimum temperature conditions for growth persist only from the beginning of November until the end of April, i.e., during six months of the year. At Bowen, however, growth is never entirely inhibited and favourable

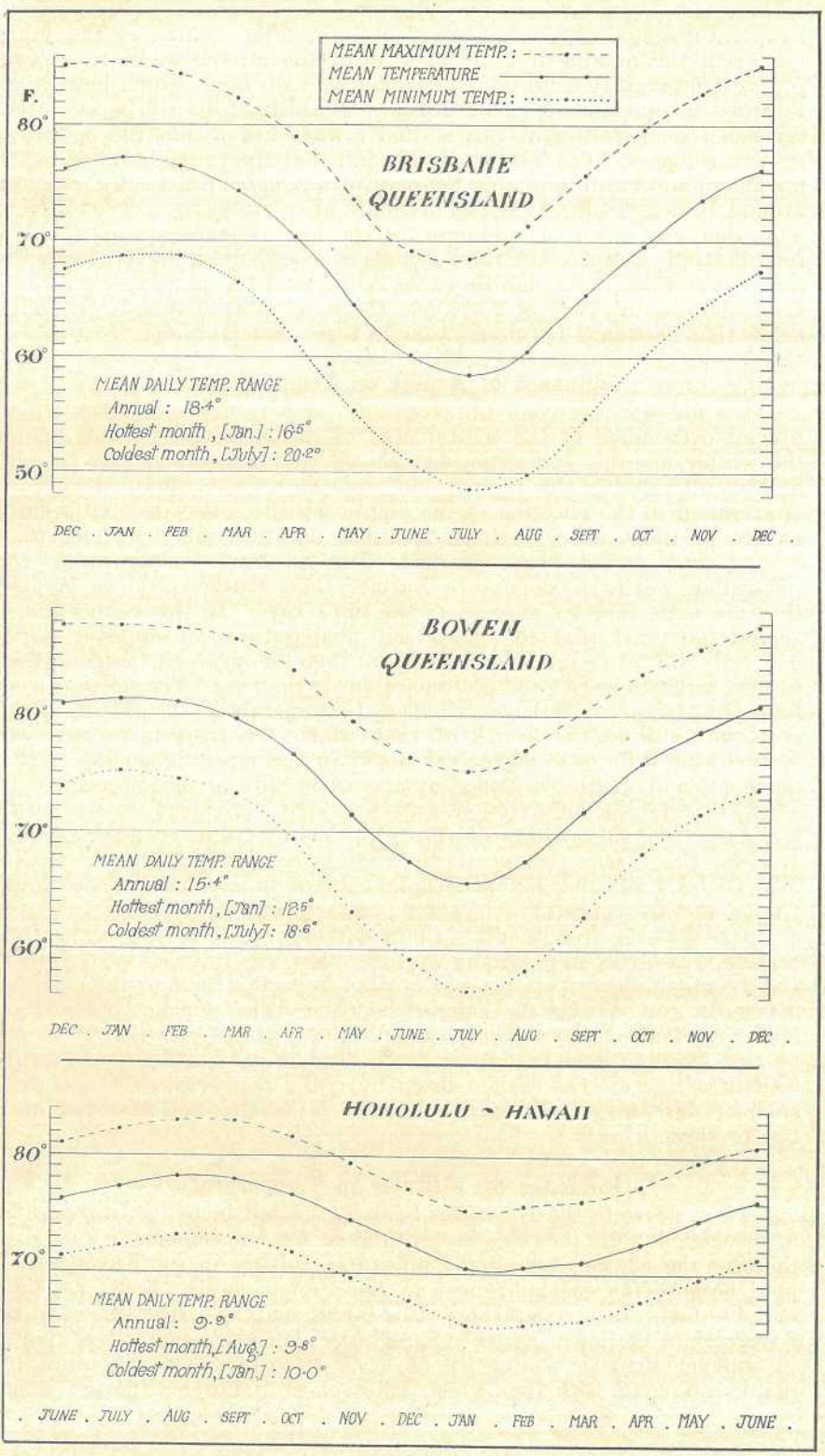
MEAN MAXIMUM TEMP.:
MEAN TEMPERATURE
MEAN MINIMUM TEMP.:
F.
80°
70°
60°
50°
BRISBANE
QUEENSLAND
MEAN DAILY TEMP. RANGE
Annual : 18·4°
Hottest month, [Jan.] : 16·5°
Coldest month, [July] : 20·2°
DEC . JAN . FEB . MAR . APR . MAY . JUNE . JULY . AUG . SEPT . OCT . NOV . DEC .
BOWEN
QUEENSLAND
80°
70°
60°
MEAN DAILY TEMP. RANGE
Annual : 15·4°
Hottest month, [Jan] : 12·5°
Coldest month, [July] : 18·6°
DEC . JAN . FEB . MAR . APR . MAY . JUNE . JULY . AUG . SEPT . OCT . NOV . DEC .
HONOLULU - HAWAII
80°
70°
MEAN DAILY TEMP. RANGE
Annual : 9·9°
Hottest month, [Aug.] : 9·8°
Coldest month, [Jan.] : 10·0°
. JUNE . JULY . AUG . SEPT . OCT . NOV . DEC . JAN . FEB . MAR . APR . MAY . JUNE .

Plate 2.

temperatures are experienced over at least nine months of the year, i.e., from the middle of September until the middle of June. Comparing temperature conditions at Honolulu with those which have been recorded in pineapple-growing areas in Queensland, it will be seen that the mean temperature at this station always lies within the optimum growth range of 70 to 80 degrees F., and that the range between mean maximum and mean minimum temperatures remains practically constant around 10 degrees F. It is this attribute of equable climatic conditions, more than any other, that renders the Hawaiian Islands so well adapted for pineapple culture. In these islands as elsewhere, however, temperature is the chief factor limiting the use of land for pineapple-growing, since above an altitude of 2,000 feet the mean temperature is generally below that necessary for production on a commercial scale.

Influence of Aspect on Temperature.

Despite the relatively unfavourable temperature conditions which prevail over much of the coastal area of southern Queensland during the winter months, experience has shown that pineapples can be profitably cultivated in this region—and even high yields obtained—if care is exercised in the selection of the plantation site. Because of the hilly nature of the country, certain locations are noticeably warmer than others, since aspect has a marked effect on local temperatures. In particular, northern slopes are warmer than southern slopes because they are more directly exposed to the sun's rays. In this connection it should be noted that the mean soil temperatures of opposed slopes generally differ to a much greater extent than the mean air temperatures, because soil both warms and cools more slowly than air. The effect of such local temperature differences is reflected not merely in the growth of the crop, but also in the length of time which the fruit takes to reach maturity; a difference of several weeks in the ripening period on the northern and southern slopes of the same hill is not unusual. In effect, therefore, a difference in aspect may be equivalent to location in a climatic zone many miles northward or southward as the case may be. It is for this reason that northerly and north-easterly slopes are generally to be preferred for pineapple culture in southern Queensland. Under average conditions, however, westerly and south-westerly slopes are perhaps even less desirable than southerly ones because, while they receive very little more winter sunlight, they are fully exposed both to the drying influence of the cold spring westerlies, and to the burning afternoon sun during the summer months. The damage inflicted on maturing fruit by sunburn is always most acute on westerly slopes because the sun does not strike at its hardest until after the moisture content of the air has been reduced by rising temperatures; on a clear summer day the maximum temperature is usually not recorded until two or three o'clock in the afternoon.

Influence of Altitude on Temperature.

In contrast to the Hawaiian Islands, the fall in temperature which is associated with increase in altitude is not an important factor in limiting the choice of land for pineapple culture in southern Queensland because the coastal ranges in this region rarely exceed a height of 1,400 feet. In a general way, this corresponds to a decrease of about 3 degrees in the mean annual temperature, but since the fall is greater in summer than in winter its effect on the growth of the pineapple plant, compared with that which takes place at lower altitudes, is not

so pronounced as its effect on the length of time which the fruit takes to reach maturity. Along the Blackall Range, for example, the peak harvest period for both the winter and summer crops occurs several weeks later than it does in the neighbouring foothill districts of Woombye and Palmwoods. Delayed ripening of the crop, due to low temperatures, is usually associated with a smaller average fruit size and, consequently, a reduction in yield, but compensating this to some extent is the higher prices at which the product is marketed because of decreased supplies from other sources.

FROST.

Though retardation of growth occurs at temperatures far in excess of the freezing point, the geographic limits to the field culture of the pineapple are set by frost. While pineapples can be grown in localities which are subject to occasional light frosts, only special circumstances, such as proximity to markets, enable the crop to be profitably cultivated under such conditions. Areas in which damaging frosts are regularly experienced are entirely unsuitable for pineapple-growing, and this is the chief factor limiting the distribution of the crop in Queensland. In practically all of the recognised pineapple districts in the southern part of the State there are sites or locations which are susceptible to frost. Furthermore, in this region, an occasional frost may cause heavy losses over areas which are generally considered to be frost-free: consequently, in the selection of a site for pineapple culture special care must be taken to avoid locations which are subject even to sporadic frosting.

Influence of Topography on Frost Occurrence.

Frost may be caused either locally by radiation, in which case usually only a thin layer of air near the ground is chilled below freezing point, or heavy, cold air from outside may flow down into natural depressions, filling them to a much greater depth and so exerting a far greater effect than is usually the case with ground frosts.

It is this second type of frost which chiefly causes injury to pineapples and its occurrence is greatly influenced by local topography. This is why, in the coastal districts of southern Queensland, the susceptibility of a location to frost is determined more by its elevation in relation to that of the surrounding country than by its actual height above sea level. On clear, calm nights during winter and spring, the minimum temperatures experienced along the bottom of a valley may be from 6 to 10 degrees F. lower than those on the hilltops on either side of it, due to the fact that cold air always settles towards the lowest levels. For this reason, slight elevation frequently secures freedom from winter frosts, even on the sides of narrow valleys. However, the degree of frost protection which is secured by selecting a raised site depends not only on the amount of elevation, but also on the area of the ridge or slope from which the cold air drains in comparison with that of the valley or depression to which it settles. If the latter is restricted in area and has little or no outlet, while the slopes leading to it are extensive, relatively little downward movement of air can occur. In consequence, the frost line in a narrow enclosed gully generally extends to a much higher elevation than it does in a broad, open valley. Sometimes, however, a belt of trees or shrubs, which at other times serves admirably as a windbreak, may so obstruct the downward movement of cold air on calm nights that the frost protection which an elevated site would normally afford is not fully obtained.

Though frost occurrence in all of the pineapple-growing districts in southern Queensland is generally related to topographical influences, it is particularly so with respect to the foothills country which lies between the Blackall Range and the sea, and in which are located several of the oldest and most important producing centres, viz., Nambour, Woombye and Palmwoods. Along the eastern rim of the Blackall Range itself, however, frosts rarely if ever occur—although the altitude ranges from 1,200 to 1,400 feet—because of the moderating influence of the warm air currents which rise from the foothills below, or which blow in from the ocean. Similarly, the upper slopes of the Mary Valley, which lies about twenty miles inland, are still sufficiently affected by marine influences to be protected against frost, due to the fact that it is open to the warm northerly winds but is sheltered from the cold south westerlies and south easterlies. The floor and lower slopes of this valley, however, are subject to severe frosts because the protection which the surrounding hills afford against southerly influences also prevents the escape of the cold air which collects along the river flats. On the other hand, flat country which opens on to the coast is almost invariably frost-free, irrespective of its elevation, because of the moderating influence of the ocean breezes which sweep over it; the districts which lie between Caboolture and Landsborough, as well as Redland Bay and Manly, fall into this category. In fact, it is not too much to say that freedom from frost in southern Queensland is, in general, determined by marine influences, and it is for this reason that pineapple culture in this region is commercially practicable only along the coastal belt.

Protection against Frost.

The best method of ensuring against frost is discrimination in the selection of a plantation site. Over most of the coastal belt in southern Queensland a considerable latitude in choice is available, though in some places the line that divides desirable and undesirable locations is very finely drawn. However, in cases where immunity from frost is deliberately exchanged for other advantages, such as proximity to markets or a delayed ripening period, it should be clearly recognised that the exchange can be profitable only with respect to locations in which frosts are neither numerous nor severe.

In locations in which a frost hazard is known to exist, it will be necessary to employ some form of protection for the developing fruits if severe losses are to be avoided. Almost any form of covering may be used for this purpose, though perhaps the most convenient and satisfactory is that provided by brown paper bags or cylinders of a size such that they may be slipped readily over the tops of the maturing fruit. The paper from which the bags are made should be sufficiently thick and tough to stand up to the weather conditions which are likely to be experienced while the fruit is ripening. Dried grass may be used as a covering in place of paper bags, but it is seldom as satisfactory, partly because of the difficulty in arranging it so that it will afford complete protection to the fruit, and partly because it is apt to be dislodged by strong winds. Owing to the cost of the labour and materials involved, it is seldom either practicable or profitable to attempt to cover the plants themselves as a protection against frost injury. Dried grass is sometimes used for this purpose, but it is questionable whether the practice affords any additional benefit over that obtained from covering the fruit alone; in fact, it is more likely to cause injury because of the exclusion of light from the leaves which it entails. The use of smudge

fires to produce a screen of smoke as a protection against frost is not recommended in pineapple plantations because, as is explained later, one of the constituents of smoke has the effect of inducing premature blossoming in pineapple plants and the suckers arising from them. In any case, it has been demonstrated that smoke screens as such have little protective effect against frost.

RAINFALL.

Between very wide limits, total rainfall is of little significance in determining the climatic range of the pineapple. Apart from other considerations, however, regions or districts may vary widely in their suitability for pineapple production on a commercial scale because of differences in the seasonal distribution and intensity of the rainfall. In fact, where other conditions are favourable, distribution of the rainfall is the dominant factor in determining the profitable production of fruit. The importance of this factor has been emphasised already in discussing the water requirements of the pineapple (Chapter V.). In one locality, for example, the average rainfall may be considerably less than in some other, but the falls may be better distributed and less torrential, which would largely offset the difference in actual amounts. That portion of the total rainfall which runs off the surface of cultivated ground into watercourses or swamps is obviously lost to the crop, and the extent of this loss is chiefly determined by the intensity of the precipitation and the degree of slope; contributing factors are the type of soil and the methods employed in its cultivation. Because of these and other considerations—such as variation in the moisture-holding capacity of the soil, the effect of temperature on the moisture requirement of the crop and the rate of water loss by evaporation—it is not easy to define what deficiencies in rainfall constitute damaging droughts over any given area. In no part of Queensland in which temperature conditions are favourable for pineapple culture does the rainfall average less than 38 inches annually. That this is considerably above the minimum rainfall requirement of the pineapple has been demonstrated in Hawaii, where production is now carried out on an extensive scale without recourse to irrigation in areas receiving an average annual rainfall of as little as 15 to 20 inches. In semi-arid areas such as these, however, the water collected by the leaves of pineapple plants in the form of dew forms a very important supplementary source of moisture for this crop, and cultural methods have been devised whereby it may be utilized to the fullest possible extent.

Influence of Seasonal Distribution of Rainfall along the Queensland Coast.

Although lack of rainfall, or irregularity in its distribution, do not limit the distribution of the pineapple as a field crop in Queensland, these factors may have a very considerable influence on the yields which are obtained. In all districts the influence will be much more marked in some seasons than in others. The entire eastern seaboard of Queensland has a type of rainfall distribution characterised by a rainy summer and a dry winter. The annual total varies considerably in different districts, as also does its distribution within the broad limits already defined. At Ayr and Bowen almost three-quarters of the total rainfall is received between December and March, inclusive, while in the vicinity of Brisbane only slightly more than half the yearly total is normally recorded during this period. Moreover, at Brisbane the precipitation

for the driest month (September) is approximately four times that for the driest month at Ayr (August). These and other features of the rainfall at important pineapple-producing centres along the Queensland coast are summarised in the following table:—

TABLE II.

RAINFALL DATA FOR PINEAPPLE-PRODUCING LOCALITIES IN QUEENSLAND.

Locality.	Average Annual Rainfall.	Average Rainfall. Dec.-Mar. inclusive.	Percentage of Annual Total.	Wettest Month.	Average Rainfall.	Driest Month.	Average Rainfall.
Brisbane	45·27	23·33	51	Jan.	6·51	Sept.	2·00
Rockhampton ..	39·75	25·08	63	Feb.	7·89	Aug.	·85
Bowen	39·88	29·37	73	Jan.	10·37	Aug.	·66
Ayr	41·76	31·23	75	Jan.	11·50	Aug.	·58

It will be observed that there is a progressive decrease in summer rainfall from north to south, both as regards the proportion of the annual total as well as in actual amount; at the same time, there is a corresponding increase in the amount which falls during the winter months. This means that the districts in the southern part of the State enjoy a better rainfall distribution than those in the north. As far as pineapple-growing is concerned, however, the advantage is more apparent than real because, in southern Queensland, growth of this crop during the winter months is controlled, not by rainfall, but by temperature.

There is, for most plants, a critical period of growth during which weather conditions largely determine the amount of the final yield. In the case of the pineapple, this critical growth period occurs just prior to blossoming. Unfavourable growing conditions during this period will be reflected in a reduction in the number of florets making up the flower spike, which will result in a smaller average fruit size and a consequent decrease in yield. Under Queensland conditions, where there are two peak harvest periods during the year, there are also two critical growth periods, but owing to difference in temperature conditions these are not coincident in the northern and southern parts of the State. At Bowen, for example, they occur during November and May, while in the southern districts January and September are normally the critical months. In these latter districts, therefore, development of the flower buds for the summer crop occurs during the driest period of the year, while those for the winter crop develop in the rainy season. As a result, summer fruit in this region tend to be smaller in size than winter fruit, while, to a lesser extent, the reverse holds true for districts in the northern part of the State where moisture conditions in the soil are generally more favourable for plant growth in May than they are in November. In several northern areas, moreover, particularly the Burdekin delta, a deficiency of soil moisture during dry periods may readily be prevented by irrigation, a practice which can be employed in the southern districts only in isolated instances.

Harmful Effects of Excessive Rainfall.

In southern Queensland, however, heavier losses to the pineapple industry are caused by excessive rather than too little rainfall, particularly when heavy downpours occur during the late summer and autumn months. Apart from the damage resulting from erosion, heavy or poorly-drained soils which become soaked during this period remain in a semi-waterlogged condition until well into the winter, partly

because of the decreased rate of evaporation at this time of the year, and partly because the slowing up in the rate of growth which results from the lowering in temperature correspondingly reduces the water requirement of the crop. Soils which contain moisture in excess of their field capacities are, *ipso facto,* poorly aerated, and, as previously pointed out, such a condition, if prolonged, leads to death of roots from asphyxiation, and thus to the subsequent development of wilt symptoms in the leaves.

A definite relationship between rainfall and the incidence of pineapple wilt in southern Queensland would be difficult to establish because of the limited number of recording stations which are located in the pineapple-growing districts. Records reveal, however, that the first general outbreak of pineapple wilt in this region occurred in 1887, a year of excessively high rainfall, and that severe losses from the disease were again experienced in 1890 and 1893, both extremely wet years. This is illustrated by the following table, which shows the rainfall registrations at Brisbane for the years 1887 to 1894 inclusive, together with the average annual rainfall at this station:—

TABLE III.

RAINFALL AT BRISBANE, QUEENSLAND, 1887-94.

Year.	Rainfall. (Inches).
1887	81·54
1888	33·08
1889	49·36
1890	73·02
1891	41·68
1892	64·98
1893	88·26
1894	44·02
Annual average	45·27

Thus, in the years that pineapple wilt was prevalent in the Brisbane area during the period 1887-94, the rainfall was 36·27, 27·75, and 42·99 inches in excess of the average. Further evidence of the correlation which exists between abnormally high rainfall and the incidence of pineapple wilt is supplied by records from the Palmwoods-Woombye district from 1928 to 1933 (Table IV.). During 1928, and again in 1930-31, exceptionally wet conditions prevailed in this area and wilt became increasingly destructive. By 1931 there were few plantations which had not been affected by the disease. During the following year, however, which was exceptionally dry, further extension of the disease was arrested nor did it reappear in 1933—which was a year of approximately normal rainfall—even in plantations in which previously it had been making rapid headway.

TABLE IV.

RAINFALL AT PALMWOODS, QUEENSLAND, 1928-33.

Year.	Total Rainfall.	Rainfall, January to June (both inclusive).
	(Inches).	(Inches).
1928	92·40	83·68
1929	68·55	49·62
1930	84·43	70·25
1931	88·22	58·69
1932	36·01	21·81
1933	67·91	27·13
Annual average	65·92	45·36

While a relatively light rainfall, provided it is reliable in its incidence, is preferable to a heavy one for pineapple culture, it is not possible to lay down any hard and fast rule regarding the rainfall requirements for specific localities, since the amount of moisture required to maintain favourable moisture conditions in a soil varies considerably not only with the type of soil, but also with the rate at which water is being removed or lost from the zone of root penetration by transpiration and evaporation. Other things being equal, maximum yields can be obtained only when the moisture content of the soil is in excess of the wilting point—though not in excess of field capacity—throughout the whole period of growth. Such ideal moisture conditions are seldom realised in practice, but much can be done to increase the effectiveness of the rainfall which is received by the employment of cultural measures designed to prevent loss of moisture from the soil during dry periods while at the same time providing for the rapid removal of surplus water during wet ones. The practical aspects of moisture conservation and drainage are discussed in a subsequent chapter.

SUNSHINE.

In general, the period over which sunlight is recorded increases as rainfall decreases, though the varying length of day at different seasons of the year is an important factor in this connection, except in regions close to the equator. The amount of sunlight to which pineapple plants are exposed, especially during the ripening period, is often decisive in determining fruit quality, because sunlight is essential for the synthesis of sugar. In southern Queensland the sugar content of fruits which ripen between September and May is considerably higher than it is for the remainder of the year, and this is directly related to the very much shorter day period which obtains during the winter months. Fruits which ripen during prolonged wet or cloudy periods during March and April also tend to have a low sugar content, though this is frequently masked to the palate because of the low acid content which accompanies it. Dense ratoon fields in which desuckering has not been carried out produce fruits which are both small in size and relatively low in sugar because the area of leaf surface which is exposed to sunlight is greatly reduced, owing to the semi-vertical position into which the leaves are crowded. For a similar reason, wider spacing of plants is advocated in cloudy, wet localities than in dry ones. A belt of tall trees bordering on a pineapple plantation cuts down the amount of light available to plants which lie in the path of its shadow. The low productivity of pineapple plants when grown in proximity to citrus, papaw, or other trees is likewise due to shading.

In order that plants on both sides of a double row may receive approximately equivalent amounts of sunlight, it is desirable that the rows should run north and south. Except on level or very gently undulating country, however, the direction in which the rows are laid out is usually dictated by the direction of the slope, since it is more important to ensure adequate drainage than even illumination. Nevertheless, every grower will have observed that where the direction of the rows is east to west, the plants on the southern side are invariably backward in fruiting compared with those on the northern side.

In some countries, particularly in Florida, it was at one time considered that partial shading of pineapple plants was beneficial in that they were better able to withstand dry conditions and were less

susceptible to wilt. These views led to the introduction of methods for the cultivation of pineapples under lath houses—so-called "shed culture"—but these methods have since mostly been abandoned. The apparently superior growth which is sometimes made by plants growing in shade is due partly to their reduced moisture requirement—consequent on the slowing up in the transpiration rate under the lower temperature conditions which obtain in shade—and partly on their reduced nitrogen requirement. Provided the supply of moisture and nutrients is maintained at a favourable level, however, full exposure to sunlight can in no sense be considered deleterious to pineapple plants, though in midsummer serious burning of maturing fruit may result from the *heat* of the sun's rays which fall directly on them, particularly on westerly slopes. In southern Queensland, covering of fruit during December and early January for protection against sunburn is a precautionary measure which amply repays for the time and trouble involved. Sunburning of fruit, and measures for protecting against it, are further discussed in the chapter dealing with cultural methods.

WIND.

In pineapple culture, wind is important chiefly because of the conditions of temperature and humidity which accompany it; unless it attains hurricane force it has little effect of itself. Along the Queensland coast winds are moist or dry, according to whether they blow in from the ocean or out from the interior. Of the former, the most important are the moisture-bearing monsoons, because it is from these that the greater part of the summer rainfall is derived. The effect of these monsoonal winds on the rainfall of the coastal districts depends very largely on the height of the nearest mountain ranges and on their distance inland. The wettest part of the Queensland coast is that which lies between Cardwell and Cairns, where the highest mountains in the State are located within a few miles of the sea. South of Cardwell, however, the ranges are both lower in height and further inland, so that there is a correspondingly sharp decrease in the coastal rainfall. This is most marked between Townsville and Bowen; in the latter district, for example, the rainfall is less than 30 per cent. of that at Innisfail, which is located at the foot of the highest part of the coastal range. In southern Queensland, also, the effect of the monsoons on rainfall is greatly influenced by the height and location of the coastal ranges. Palmwoods, at the foot of the Blackall Range, has an average rainfall of 65·92 inches, while Brisbane, in less mountainous country 60 miles to the south, receives an average of only 45·27 inches.

Though the effect of moisture-laden winds in relation to rainfall is naturally more marked on mountain ranges than on small ridges and spurs, localised differences in rainfall arising from differences in aspect may have quite an appreciable influence on the character of native vegetation. In southern Queensland, for example, the occurrence of tropical rain-forest (scrub) is restricted very largely to slopes having a northerly or north-easterly aspect; it does not occur on gently undulating or flat country, such as that between Landsborough and Brisbane, because of the drier conditions which obtain therein owing to the absence of continuous land masses which would intercept the monsoons.

While the monsoons are typically summer winds, those that blow from the interior are most prevalent during late winter and spring.

Consequently, their influence is felt during the coldest and driest period of the year and their net effect is to render still more unfavourable the difficult growing conditions which then obtain. In Queensland, westerly winds are always dry winds, and pineapple plantations which are fully exposed to their influence quickly exhibit symptoms of acute moisture deficiency during dry periods. Moreover, losses from the physiological disease of pineapple fruits known as "black heart" are invariably heavier in locations lacking shelter from westerly winds. In fact, fluctuations in the incidence of this disease in all localities in southern Queensland during late winter and spring are closely correlated with the periodicity of the westerlies.

Care in the selection of the plantation site is the best precautionary measure which can be taken against the damaging effect of westerly winds. In flat, exposed areas, the planting of belts of low-growing trees or shrubs will afford valuable wind protection, but it should be remembered that such breakwinds not only compete with nearby crop plants for soil moisture and nutrients, but that, if unduly high, they may exert a harmful shading effect on an appreciable proportion of the crop, particularly during the winter months. Of the great number of trees and shrubs which may be planted for breakwinds, two of the most satisfactory for southern Queensland conditions are the Portuguese cypress (*Cupressus lusitanica*) and the native coastal cypress (*Callitris arinosa*). Neither of these trees grows to a height of much more than 20 feet and, in addition to being robust in constitution, they are relatively quick-growing and bushy in habit throughout their life.

DEW.

When moist air in contact with the ground is chilled below the point at which it can hold all its moisture in the form of vapour, the surplus moisture is deposited on plants and other objects in the form of dew; or, if the temperature falls below freezing point, in the form of frost. Conditions which favour the formation of heavy dews are, therefore, warm day temperatures, cold nights, and proximity to large bodies of water, so that as the air warms up in the daytime it may be able to take up large quantities of moisture in a gaseous form. In addition, clear skies are necessary for dew formation since clouds reflect back the heat of the earth and thus prevent the ground air from chilling to the temperature necessary for condensation of its moisture. Along the Queensland coast, conditions are most favourable for dew formation during late winter and spring, a period characterised by warm, sunny days and clear cold nights. At Brisbane, for example, the mean maximum temperature from July to September is 72 degrees F., the mean minimum temperature 52 degrees F., and the mean relative humidity 69 per cent. Because of the proximity of the ocean, a relatively high atmospheric humidity is maintained throughout the coastal districts at this time of the year, despite the lack of ground moisture. The fact that conditions are so favourable for dew formation in southern Queensland at a time when the supply of available soil moisture is apt to be deficient is of special significance in relation to pineapple culture in this region, because, as has already been pointed out, the water collected by the leaves of the pineapple plant in the form of dew is of considerable value in maintaining its growth during dry periods.

[TO BE CONTINUED.]

Codling Moth Control.

Report on 1938-39 Investigations.

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FOR a number of years past, codling moth research has aimed, firstly, at limiting the use of lead arsenate in the spray programme in order to minimise both foliage injury and arsenical residue on the fruit; and secondly, at timing cover sprays so that the maximum control will be effected by each application. Since 1936, investigations at Stanthorpe have sought primarily to test the value of white oil and white oil plus nicotine sulphate in various combinations as codling moth cover sprays, and simultaneously to find a suitable basis for the systematic timing of sprays.

The question of timing codling moth sprays is of particular interest, and in recent years has become one of major importance to apple and pear growers. Very effective control has been obtained in Victoria from spray applications timed according to moth activity as indicated by lure traps (Anon., 1938; Pescott and Miller, 1937). Attacking the insect just after the activity of adult moths has reached a peak seems to be the most logical method of rendering ovicidal and larvicidal cover sprays fully effective, for a maximum number of eggs have then been deposited and are about to hatch.

Accordingly, in the Stanthorpe investigations much attention has been focussed on the timing aspect of the control problem. It has now become apparent that the flight of adult moths is usually an indication of egglaying activity, and it has been repeatedly demonstrated that the flight and abundance of moths can be accurately gauged from continuous records of the numbers of moths caught in lure traps. An abundance of moths on the wing, however, is not necessarily followed by an immediate heavy deposition of eggs, because reproduction and other activities are influenced by weather conditions, particularly by temperature. For this reason, the timing of codling moth sprays cannot be reduced to a simple formula, but must be guided to some extent by a consideration of climatic conditions operating at and shortly after a peak of moth activity.

In 1938-39, the main experimental aims were, firstly, to determine the relative value of various combinations of white oil and nicotine sulphate when employed as cover sprays, and to compare them with the commonly used cover sprays, white oil and lead arsenate; secondly, to study the control value of the different sprays when applied according to three different timing schedules; and thirdly, to study adult moth activity at a number of centres in the district. The work was essentially a continuation of that carried out in the preceding season and which has already been reported (Ward and Ross, 1938).

ORCHARD SPRAY TRIAL.

The orchard spray trial was designed to provide, in the one block of trees, a comparison between different spray mixtures and between different spray timing schedules. The trial was laid down at The

Summit on the block of nineteen-year-old Granny Smith trees used in 1937-38. In general, the experimental methods employed were similar to those of the previous year, but information gained in the past led to an improvement in the design of the experiment, a factorial design in which six spray mixtures were applied under three different timing schedules being used. There were, therefore, eighteen treatments and each of them was replicated six times on two-tree plots arranged in six randomised blocks. Three unsprayed plots were left in each block so that the severity of the infestation could be gauged and the controlling effects of the sprays demonstrated. The experiment involved the treatment of 252 trees during a period extending from mid-October, 1938, to late February, 1939.

During the 1938-39 season, codling moth was unusually active in the Stanthorpe district and gave rise to severe infestation in the majority of apple orchards. In the experimental block there were eighteen unsprayed plots in which the activities of the insect were entirely unchecked, and a further thirty-six plots, those sprayed at five-week intervals, in which control was poor. The presence of these plots kept the moth population in the block at a high level and in consequence the various spray treatments were tested under very severe conditions of infestation.

Spray Treatments.

Since the primary object of the spraying experiment was to study cover sprays, all of the experimental trees, controls excepted, first received a calyx spray consisting of 2½ lb. of lead arsenate powder and ¾ lb. casein spreader in 80 gallons of water. Subsequently the cover spray treatments were as follows, the quantities given being made up to 80 gallons with water:—

(A) White oil, 1½ gallons.
(B) White oil, 1 gallon, plus nicotine sulphate, ¼ pint.
(C) White oil, ½ gallon, plus nicotine sulphate, ½ pint.
(D) White oil, ¼ gallon, plus nicotine sulphate, 1 pint.
(E) White oil, 1½ gallons, plus nicotine sulphate, 1 pint.
(F) Lead arsenate powder, 2½ lb., plus casein spreader, ¾ lb.

The sprays were applied under the following three timing schedules:—

I. According to moth activity as shown by lure traps.
II. At intervals of three weeks as from date of calyx spray.
III. At intervals of five weeks as from date of calyx spray.

Weather conditions prevented a rigid adherence to these schedules and the actual dates of spray application were as follows:—

Calyx spray—14th October.

Sprays timed according to moth activity—31st October, 14th November, 5th January, 18th January, 25th January, 20th February.

Three-weekly sprays—4th November, 28th November, 16th December, 6th January, 25th January, 20th February.

Five-weekly sprays—14th November, 19th December, 25th January, 20th February.

The final spray on 20th February was required by schedules I. and II. but was also applied to schedule III. and control plots in order to obviate further losses to the grower. Differences in final yields of sound fruit are, therefore, attributable to cover spray treatments prior to 20th February. Harvesting began on 14th February and was completed on 20th March.

Assessment of Results.

The fruit harvested from the experimental trees was classified into three groups—namely (i.), sound, i.e., uninfested; (ii.), infested—calyx entrance; and (iii.), infested—side entrance; fruit which showed slight surface injury (i.e., "stung" fruit) without having actually been entered by a larva was classified as "infested." Thus, in classifying the fruit, export standards were adopted with respect to codling moth injury, which meant that "stung" fruit was rejected although it may have been suitable for local markets. Similarly, classified records were obtained of all windfall fruit.

A total of 184,000 apples, including windfalls, was examined, and of these, 168,000 apples or approximately 1,120 cases, were harvested from the experimental trees. When the data obtained in this experiment were statistically analysed it was found that exactly the same significant differences between treatments showed up when the analyses were based on the total fruit, i.e., harvested fruit plus windfalls, as when based on the harvested fruit only. For this reason the tabulated results which are presented below refer only to the harvested fruit.

Relative Efficiency of the Sprays.

The relative efficiency of the different sprays in controlling codling moth is summarised in Table I., where differences between treatments are not significant unless they equal or exceed 4·3.

The first point of importance which arises from the figures is that five of the six spray mixtures exerted a comparable controlling effect on the insect—i.e., differences in yield of sound fruit given by treatments A, B, C, D, and F were not statistically significant. From this it follows that reductions in the strength of the white oil from 1⅓ gallons to ¾ gallon in 80 gallons, accompanied by increases in the quantity of nicotine sulphate in the mixtures, did not cause any loss of efficiency to the spray. The figures also show that all of the while oil-nicotine sulphate combinations and white oil alone were at least as effective as lead arsenate used alone throughout the season. The 1937-38 spray trial had indicated that a white oil-nicotine sulphate spray, in which the quantity of white oil had been reduced to ¼ gallon and combined with 1 pint of nicotine sulphate, was as effective as the other sprays tested. The 1938-39 experiment confirmed this observation, for this spray (treatment D) again proved as efficient as the other sprays tested, with the exception of the full-strength white oil-nicotine sulphate mixture (treatment E) which in 1938-39 gave definitely better results than any other spray. Trees sprayed with this full-strength mixture yielded an average of 10 per cent. more sound fruit than those receiving other treatments. This increase can be attributed to the presence of the nicotine sulphate in the mixture, since treatment A, in which white oil was used alone at a strength of 1⅓ gallons in 80, was definitely inferior to treatment E.

TABLE I.

RELATIVE EFFICIENCY OF SIX COVER SPRAY TREATMENTS. BASED ON THE MEANS FOR ALL TIMING SCHEDULES.

Treatment.	Mean per cent. Sound Harvested Fruit.
(A) White oil (1½ gallon-80 gallons)	73·2
(B) White oil, plus nicotine sulphate (1 gallon-¼ pint-80 gallons) ..	74·3
(C) White oil, plus nicotine sulphate (½ gallon-½ pint-80 gallons) ..	70·7
(D) White oil, plus nicotine sulphate (¾ gallon-1 pint-80 gallons) ..	72·8
(E) White oil, plus nicotine sulphate (1½ gallon-1 pint-80 gallons) ..	83·0
(F) Lead arsenate powder (2½ lb.-80 gallons, plus ¾ lb. casein spreader)	74·8
Unsprayed plots	41·5

Standard Error = 1·53 = 2·05 per cent. of General Mean
Significant Difference = 4·3
F value = 7·74, which is highly significant.

More detailed figures showing the effectiveness of the six different cover sprays under each of the three timing schedules are presented in Table II. The main differences between spray treatments show up in all timing schedules and are similar to those in Table I.—viz. (*a*), treatment E was outstanding, and (*b*), other white oil-nicotine sulphate sprays have much the same insecticidal value as lead arsenate in codling moth control. The low yield of sound fruit in treatment C under schedule I. is clearly an anomaly of no real significance; otherwise, comparable yields would have been apparent with the same spray in other timing schedules. Since the white oil spray and the white oil-nicotine sulphate combinations were as effective as lead arsenate in all three timing schedules, it would appear either that lead arsenate was not effective for a longer period than the other sprays, because of its removal by foliage rubbing, growth of fruit, &c., or that greater egg and/or larval mortality immediately following the application of the non-arsenical sprays compensated for any greater durability in the toxic action of the lead arsenate.

One of the principal points which emerges from the results presented in Tables I. and II. is that the white oil and white oil-nicotine sulphate sprays compare favourably with lead arsenate, and the experiment has, therefore, demonstrated once again that these sprays form reliable substitutes for lead arsenate in cover sprays used against codling moth.

Effect of Timing Spray Applications.

In timing schedules I. and II. six cover sprays were applied, and in schedule III. the trees received four such sprays. The relationship between codling moth activity and the dates of application of the sprays under each schedule is shown in Plate 3, A.

Data which indicate the efficiency of the sprays under the three timing schedules are given in Table II., and a summary of them appears in Table III. No significant difference is apparent between schedules

I. and II., but with schedule III. results were definitely inferior to those obtained under the other two schedules. Obviously, under this latter schedule the sprays gave a markedly inferior control of the insect. A comparison of the percentage sound fruit from timing schedules I. and II. would seem to indicate that sprays applied according to moth activity had no advantage over those applied regularly at three-week intervals. However, four of the six cover sprays which were applied at three-week intervals fell due shortly after peaks of moth activity (Plate 3, A) and

TABLE II.

SUMMARY OF RESULTS GIVEN BY THE SIX SPRAY TREATMENTS UNDER THREE DIFFERENT TIMING SCHEDULES.

Spray Treatments.	Mean Per Cent. of Sound Fruit.		
	Timing Schedules.		
	I.	II.	III.
A	79·7	73·2	66·6
B	80·9	77·9	64·0
C	71·5	74·4	66·2
D	76·8	74·4	67·5
E	88·7	85·3	75·0
F	81·4	77·3	65·7

Unsprayed plots = 41·5.

Standard Error = 2·65.

Significant Difference = 7·47.

TABLE III.

MEAN PERCENTAGES OF SOUND FRUIT OBTAINED UNDER THREE TIMING SCHEDULES. BASED ON MEANS FROM THIRTY-SIX PLOTS.

Timing Schedule.	Mean Per cent. Sound Fruit.
(I) according to moth activity	79·8
(II) at three weekly intervals	77·1
(III) at five weekly intervals	67·5

Standard Error = 1·08.

Significant Difference = 3·05.

F value = 35·50, which is highly significant.

would, therefore, be as effective as the corresponding sprays timed by lures. This unusual circumstance would, undoubtedly, mask even considerable differences in the efficiency of these two schedules such as might otherwise have occurred.

Although statistical significance was not obtained, it will be gathered (Table II.) that spray treatments applied under timing

schedule I. showed a general tendency to give better control than the same sprays applied in accordance with schedule II., and this tendency is opposed only in the case of treatment C. A detailed examination of the experimental data showed that if treatment C were omitted from the analysis a significance between the two schedules could be proved, but such a procedure is not admissible on statistical grounds. Though the experiment has not proved conclusively that timed sprays give more satisfactory control of codling moth than sprays applied at three-week intervals, it does suggest, however, that under circumstances in which three-week sprays did not happen so often to fall at appropriate times, the better results obtained under the lure-timed schedule would be clearly marked.

Calyx Infestation.

The amount of calyx infestation in plots which received lead arsenate cover sprays was significantly less than that which occurred in plots sprayed with white oil or white oil and nicotine sulphate (Table IV.). It would appear, therefore, that lead arsenate is more effective than the other materials in preventing calyx entrances, but may be less effective in preventing side entrances. Another significant difference is that white oil alone (treatment A) was less effective in controlling calyx infestation than two of the white oil-nicotine sulphate mixtures (treatments D and E). In general, these results further show that approximately 20 per cent. of the infestation took place through the calyx of the fruit. In the control plots, which received no calyx spray, 40 per cent. of the infestation took place through the calyx. This point clearly demonstrates the value of the calyx spray.

Arsenical Spray Injury.

All plots that received lead arsenate in both calyx and cover sprays showed extensive foliage injury, which took the form of dark-brown,

TABLE IV.

INFLUENCE OF VARIOUS SPRAY TREATMENTS ON CALYX INFESTATION.

Treatment.	Mean Per Cent. Calyx Entrances in Infested Fruit.	Mean Per cent. Side Entrances in Infested Fruit.
A	22·0	78·0
B	20·5	79·5
C	20·4	79·6
D	18·1	81·9
E	18·9	81·1
F	14·5	85·5
Control plots	40·2	59·8

Standard Error = 1·07 = 5·59 per cent. of General Mean.
Significant Difference = 3·0.
F value = 6·00, which is highly significant.

irregular, dead blotches on the leaves, and of marginal scorching. Plots that had received lead arsenate only in the calyx spray showed some injurious effects, but these were confined to older foliage, such as that which occurs towards the basal part of current season's shoots. These plots carried a relatively high proportion of normal foliage, and they therefore demonstrated that a marked reduction in leaf blotch and leaf scorch occurred when lead arsenate was not employed in cover sprays. The best foliage was produced on the control trees, which had not received any lead arsenate sprays.

SPRAY TESTS AGAINST CODLING MOTH EGGS.

Tests against codling moth eggs were made with the object of determining the ovicidal value of sprays employed in the 1938-39 field experiment, and of other sprays which are used in orchard practice or which have been suggested as being suitable for use against codling moth. Twelve spray mixtures were tested.

Experimental Technique.

To secure large stocks of eggs for the tests, numerous adult moths were induced to deposit eggs on apple twigs placed in oviposition cages. About fifty moths taken from stocks of the insect which had overwintered in the larval stage were maintained in each cage. About 800 eggs were required for each series of tests, and as soon as sufficient twigs bearing this number became available they were grouped in thirteen batches, each containing an approximately equal number of eggs; twelve different spray treatments were then applied, one treatment to each batch, and one batch being left unsprayed. The age of the eggs at the time of treatment was not less than two days and not more than six, and none of them had reached the "black spot" stage, i.e., the stage immediately preceding hatching. The number of eggs not hatching under each treatment was determined by making periodical examinations under a binocular microscope. Each series of tests was repeated eight times between October and early December, the same procedure being adopted on all occasions.

Results.

A summary of the tests is presented in Table V. Of the materials used, white oil was the only insecticide that possessed marked toxic properties against the eggs of the insect. A reduction in the strength of the oil sprays tended to result in a slightly lower mortality (cf. treatments 3 and 4 with 1, 2, 5, and 6), but this decrease in mortality was not significant. The combination of nicotine sulphate with white oil was no more effective than white oil alone, although nicotine sulphate itself is shown to possess weak ovicidal properties (cf. treatment 7 with control 13).

With the exception of lead arsenate, which, of course, was entirely ineffective, the remaining sprays failed to destroy more than a low percentage of the eggs. The test, therefore, has demonstrated that these spray mixtures are of little or no practical value as ovicides against codling moth. The colloidal sulphur plus nicotine sulphate and the potash soap sprays have failed to control codling moth in earlier field experiments, and as they are only very weak ovicides it would seem that these two sprays are unable to act effectively against any stage of the insect.

TABLE V.

EFFECTS OF SPRAY MIXTURES AGAINST CODLING MOTH EGGS. MEANS OF EIGHT SEPARATE TESTS.

Treatment.	No. of Eggs Treated.	Per Cent. of Eggs not Hatching.	Significantly Exceeds.
(1) White oil (1½ gallons in 80 gallons)	378	95·0	7, 8, 9, 10, 11, 12, 13
(2) White oil-nicotine sulphate (1 gallon-¼ pint-80 gallons)	396	94·0	7, 8, 9, 10, 11, 12, 13
(3) White oil-nicotine sulphate (½ gallon-½ pint-80 gallons)	463	92·4	7, 8, 9, 10, 11, 12, 13
(4) White oil-nicotine sulphate (¼ gallon-1 pint-80 gallons)	384	90·2	7, 8, 9, 10, 11, 12, 13
(5) White oil-nicotine sulphate (1⅓ gallon-1 pint-80 gallons)	460	97·0	7, 8, 9, 10, 11, 12, 13
(6) White oil-nicotine sulphate (1 gallon-1 pint-80 gallons)	497	98·1	7, 8, 9, 10, 11, 12, 13
(7) Nicotine sulphate (1 pint-80 gallons)	452	39·1	11, 12, 13
(8) Lime sulphur-nicotine sulphate (1 gallon-1 pint-80 gallons)	406	36·1	11, 12, 13
(9) Colloidal sulphur-nicotine sulphate (2½ lb. -1 pint-80 gallons)	477	32·9	12, 13
(10) Potash soap (20 lb.-80 gallons)	576	41·7	11, 12, 13
(11) Potash soap-nicotine sulphate (5 lb.-1 pint-80 gallons)	700	24·6	12, 13
(12) Lead arsenate (2½ lb.-80 gallons)	397	5·0	
(13) Control (untreated)	501	4·7	

S.E. (of square roots of mortality percentages) = 0·35 = 4·81 per cent. of G.M.
F value for treatments = 66·2, which is highly significant.

In the 1938-39 orchard experiment a spray consisting of one pint of nicotine sulphate and 1⅓ gallons of white oil in 80 gallons of water, (treatment E, Table I.) gave definitely better control than a spray consisting of white oil only used at a strength of 1⅓ gallons in 80 (treatment A, Table I.). In view of the fact that, in the ovicide tests, nicotine sulphate did not increase the egg-killing value of the white oil, it would appear that the nicotine sulphate used in the field experiment acted on some stage of the insect other than the egg. There are four potential modes of action of nicotine sulphate in the field—

(*a*) The destruction of adult moths present in the trees at the time of spraying;

(*b*) The prevention of oviposition, perhaps during a brief period only, by a repellant action of the spray;

(*c*) The destruction of newly-hatched larvæ which might be exposed on the trees at the time of spraying, or which might hatch soon after spraying; and

(*d*) The destruction of eggs which are about to hatch when the sprays are applied.

Any one or more of these modes of action may be operative. Hough (1938) has shown that free nicotine compounds, such as nicotine sulphate, kill adult moths in the orchard, but there is little experimental evidence suggesting any prolonged repellant action in nicotine sprays.

In Victoria, however, nicotine sulphate used alone or combined with white oil has proved very effective in killing newly-hatched codling moth larvæ (Pescott, 1939). Finally, in America, nicotine sulphate alone killed a high percentage of those eggs which were due to hatch within twenty-four hours of being sprayed, but its effectiveness rapidly decreased when the eggs were more than one day from their normal time of hatching when sprayed (Hough, 1938). This American observation is in agreement with the results recorded above. A considerable amount of evidence has accumulated, therefore, to show that although nicotine sulphate is not of great practical value as an ovicide against codling moth eggs, it has a more toxic effect upon some other stages of the insect.

CODLING MOTH ACTIVITY DURING 1938-39.

Method of Study.

The activity of adult moths throughout the season was observed at the site of the orchard spraying experiment and at four other widely-separated centres in the Stanthorpe district—namely, Broadwater, Bapaume, Eukey, and Glen Aplin. In an apple orchard at each centre twenty glass lure traps containing one part of light wine in nine parts of water were examined twice each week. The number of moths collected was then recorded. The traps were recharged with fresh lure material at fortnightly intervals, and water was added on alternate weeks to offset evaporation. Daily minimum and maximum temperature records were kept by the orchardists on whose property the traps were located.

Moth Activity at The Summit.

In the 1938-39 season the moths began to appear early in October, and the main activity of the spring brood occurred between mid-October and early November (Plate 3, A). Thereafter, until late December, the moths were much less abundant. At the end of December, the activity of the summer brood—the progeny of those moths which were active in the October-November period—had commenced. In the ensuing two months this activity was marked by the occurrence of a number of distinct peaks in the graph record, and after the end of February the moths became very scarce.

A striking and unusual feature of the moths' behaviour is reflected in the occurrence of well-defined twin peaks of activity in October, January, and February. The October peaks occurred during the mass emergence of the spring brood. The first of the two peaks was reached on 24th October, and was at once followed by a rapid decline. Temperature records for the six days preceding 24th October show that conditions were then favourable for emergence, the weather being warm, with daily maxima reaching 82 deg. F., but the next few days were relatively cold, with maxima ranging from 60 deg. to 70 deg. F., and also rainy, 1 inch of rain having fallen. During this period temperatures, at dusk, when flight and egg-laying are usually at a maximum, ranged from 55 deg. to 60 deg. F. These conditions were unfavourable for the activity of those moths which had already emerged and probably delayed the emergence of further moths. Under the influence of rising temperatures a few days later the moths again became active, and trap collections showed a sharp rise to form the second of the twin peaks on 31st October. In the experimental spray plots, two timed cover sprays were required to cope with each of the twin peaks (Plate 3, A).

During a period extending from mid-November to early January, no timed cover sprays were applied, but under the three-week timing schedule the experimental trees involved received two cover sprays in this period (Plate 3, A). The small peak in late December and the twin peaks in January were dealt with in timed sprays applied on 5th, 18th, and 25th January. In February, two more peaks developed, and under the circumstances a single-timed spray was considered adequate to control the insect at this stage. By 15th February harvesting was in progress, and on 20th February a final cover spray was applied to all the plots to check further infestation of fruit still unpicked.

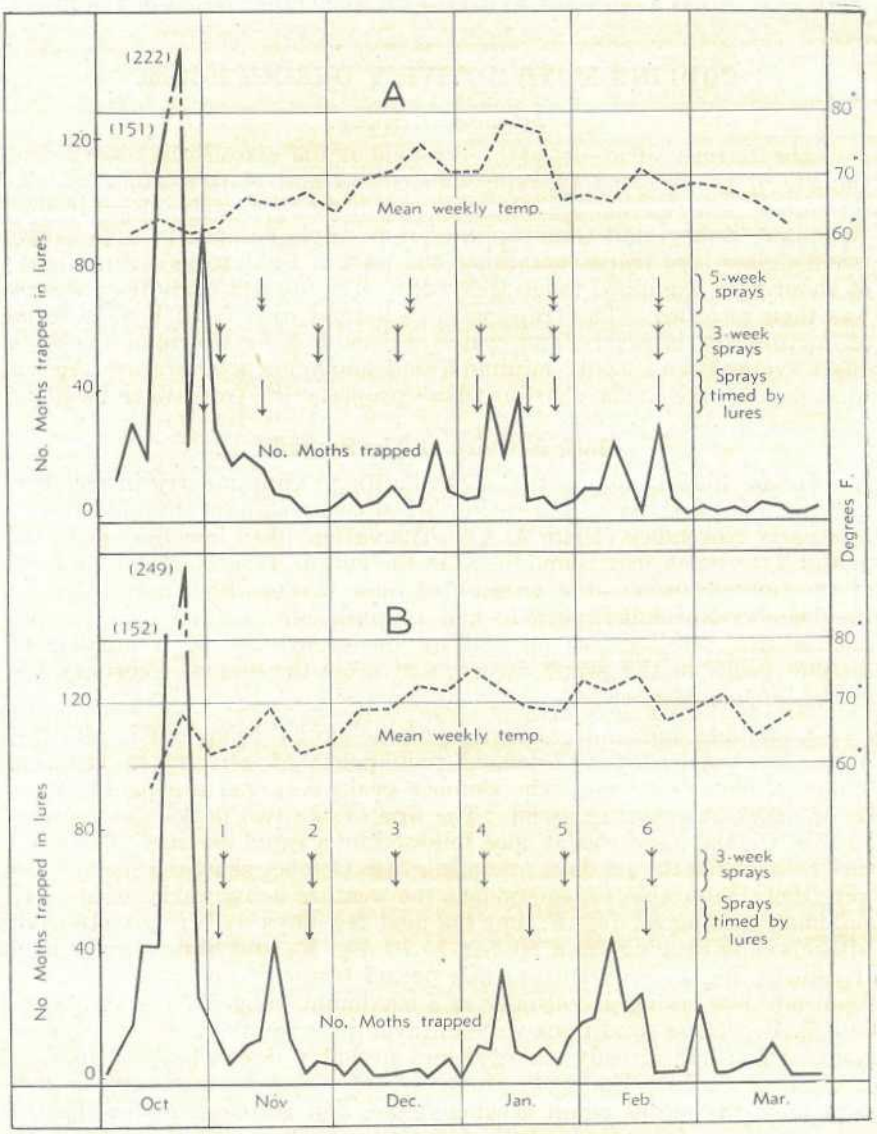

Plate 3.

SHOWING CODLING MOTH ACTIVITY AND MEAN WEEKLY TEMPERATURE AT THE SUMMIT: A—IN 1938-39; B—IN 1937-38.

Spraying requirements in lure-timed and three-week schedules at The Summit in 1937-38 and 1938-39 indicate one of the more obvious advantages of timing cover sprays according to trap records (Plate 3, cf. A and B). In 1938-39, four of the six three-week sprays were applied within periods when timed cover sprays were also due. If the same two systems of timing had been employed in the previous season, three of the three-week sprays (the 1st, 2nd, and 6th) would have fallen on about the same dates as timed sprays, but two of the former sprays (3rd and 4th) would have been applied unnecessarily in view of the relative inactivity of the moth at that time, and one of them (the 5th) would have been applied too late to act effectively against the peak which occurred in January. Further, in 1937-38, only four lure-timed cover sprays were required to control the pest on late varieties of apples, whereas six sprays were required by a three-week schedule.

These graphs also show that codling moth activity in the two seasons differed considerably, and the control problem was therefore different in each season. In 1938-39, control was complicated by the occurrence of double peaks of activity three times during the season, and this necessitated a greater number of cover sprays than in the previous season. The times of application of the sprays in the two seasons also differed in a marked degree.

The optimum times for applying codling moth sprays in any particular year thus bear little or no relation to the times of spraying in other years. Beneficial results from the timing of cover sprays should be most noticeable in a season when the insect is unusually abundant and difficult to control.

It follows from the above evidence that by studying moth activity during the season it is possible, on the one hand, to dispense with unnecessary sprays, and, on the other, to intensify control measures when circumstances so demand.

Moth Activity at Other Centres in the District.

Moth activity at all observation stations is summarised in Plate 4. The curves of moth activity show that the major peaks in October and January occurred on the same dates at all stations, Glen Aplin partly excepted, and in each case double peaks developed simultaneously. This point demonstrates a general similarity in the behaviour of the moths at five centres, and at the same time shows the sensitiveness of the lures. The graphs differ, however, with respect to minor peaks. At The Summit and Bapaume the moths showed little activity between mid-November and January, and no cover sprays were required at the two centres during that time. At Eukey, Broadwater, and Glen Aplin, however, there were, between the same dates, sufficient moths present to warrant the application of one or two precautionary sprays. The Glen Aplin graph shows some rather abnormal features. At that centre the spring mass emergence of moths was not as clearly marked as at others, and no prolonged period of relative inactivity occurred between the emergence of first and second brood moths, and second brood peaks were not very distinct. The double January peaks were less marked at Glen Aplin than they were at the other centres. In seasons and localities where the Glen Aplin type of moth behaviour is recorded the timing of some of the cover sprays may be difficult, and, therefore, it may be as satisfactory to apply later cover

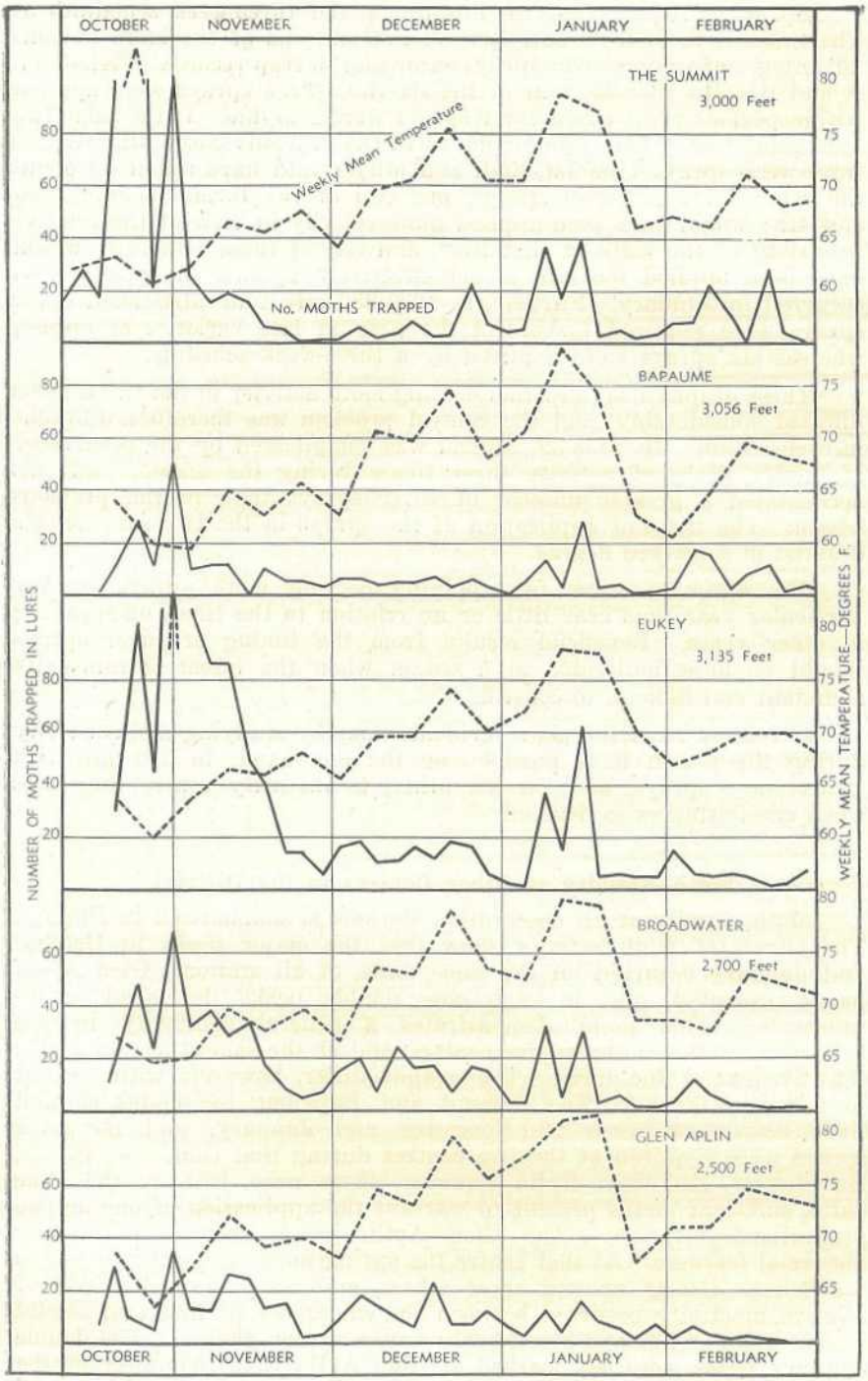

Plate 4.

CODLING MOTH ACTIVITY AND WEEKLY MEAN TEMPERATURES AT VARIOUS CENTRES IN THE STANTHORPE DISTRICT DURING 1938-39.

sprays at, say, three-week intervals as to time them by lure-traps records; but the early cover sprays to control the spring brood could, no doubt, be timed according to moth activity.

Similar temperature changes occurred simultaneously throughout the district, and, in general, these changes influenced codling moth activity in much the same way. Thus, a temporary drop in temperature in October was responsible for an interruption in moth activity at all centres, whilst hot weather in January appears to have caused another temporary setback in activity; in both cases the temperature change was marked by the development of twin peaks. Between 11th January and 17th January temperature maxima ranged from 98 deg. F. at Bapaume to 103 deg. at Glen Aplin, and the Stanthorpe maximum record was broken at 102 deg. These high temperatures merely interrupted moth activity, as trap collections increased again immediately afterwards. It seems probable that egg-laying was also greatly reduced, as excessively high temperatures are known to prevent reproduction (Isley, 1938). This latter fact may account, in part, at least for the virtual cessation of moth activity after February (trap collections continued until the end of March).

Whilst the graphs show that, in general, temperature changes occurred simultaneously throughout the district, it is also apparent that some centres consistently recorded higher temperature than others. Relative differences in temperature at the different centres are indicated by the following average maximum and minimum temperatures based on daily records for the October-March period, 1939:—The Summit, 85 deg. and 52 deg. F.; Bapaume, 82 deg. and 54 deg. F.; Eukey, 85 deg. and 54 deg. F.; Broadwater, 89 deg. and 55 deg. F.; Glen Aplin, 93 deg. and 52 deg. F.

From the above observations, the general conclusion can be drawn that, although codling moth activity at various centres is comparable during spring and summer bursts of activity, the moths may be relatively more abundant in some localities than in others between the peaks arising from the spring and summer broods (cf. The Summit and Bapaume graphs with those of Broadwater and Glen Aplin). This difference in moth behaviour, whilst not strikingly marked, may sometimes necessitate the adoption of slightly modified spray programmes in some localities. Hence, if district-wide recommendations on the timing of cover sprays are based on lure trap records taken at one or two observing stations only, better control is likely to be obtained in some parts of the district than in others. It seems, therefore, that such recommendations must be based on observations made in several localities, and especially in localities which tend to differ from each other topographically and climatically. Obviously, cover sprays could be most successfully timed if observations on moth activity within individual orchards or within a group of orchards in the same locality were available.

LIFE HISTORY OBSERVATIONS.

General observations on the life history of the codling moth were made in the Stanthorpe insectary during 1937-38 and 1938-39, when the insect was reared by the usual methods, and records were kept of the life cycle of a number of individuals. In 1938-39, the observations were based on a single generation reared between October and January.

The data gathered during the two seasons mentioned can be summarised as follows:—

	Days.
Preoviposition period	4·4
Oviposition period	11
Total egg stage	9
Larval feeding stage	22
Cocooning to pupation	8
Pupation to emergence	15
Total cocoon period	23
Egg to adult	54

These figures represent the time required for the majority of the insects in the spring brood to pass through each stage, but there are always some individuals which take a shorter or longer period than that shown above. Thus, the time which elapsed between the emergence of female moths and the commencement of egg-laying varied from one to seven days; the length of time the larva was in an apple varied from fourteen to twenty-five days; and the cocoon stage ranged from twelve to twenty-nine days. The periods given above are liable to vary, also, during the season, being a little longer in spring, when development is slightly retarded, and a little shorter in the summer months, when it is slightly hastened.

SOME ASPECTS OF CODLING MOTH RESEARCH ELSEWHERE.

The search for suitable substitutes for lead arsenate in the codling moth spray programme has been rendered necessary by three important factors:—

(*a*) The foliage injury which arises so frequently on trees sprayed with lead arsenate;

(*b*) The difficulty of complying with legislation which requires that fruit for human consumption must not contain more than $\frac{1}{100}$ grain of arsenic trioxide equivalent per pound; and

(*c*) The desirability of obtaining an improvement in control over that usually given by lead arsenate.

Research on these questions in various parts of the world has covered a very wide field. The investigation of other stomach poisons, such as calcium, zinc and manganese arsenates, has not so far led to the finding of a substitute which has conclusively been shown to be more satisfactory than lead arsenate. Efforts to render the lead compound itself more effective by improving the spreading and sticking qualities of the spray mixture has resulted in a tendency for lime-casein spreaders to be replaced by other materials which allow less run-off and thus enable a thicker film of poison to be deposited. In this connection, the use of a small quantity of white oil in lead arsenate sprays has become a common practice in many apple areas. Experiments in Victoria in 1936-37 indicated that better control resulted when one pint of white oil was incorporated as a spreader or sticker in lead arsenate sprays than when 1 lb. of calcium caseinate was used (Pescott and Miller, 1937).

Attempts have also been made to discover whether any relationship existed between the size of the poison particles in lead arsenate and its toxic value. Work of this nature has been undertaken because it was thought that possibly commercial lead arsenates contained too high a

proportion of large-size particles and, on this account, minute newly-hatched codling moth larvæ might be unable to ingest a sufficiently large dose of the poison. This theory, however, seems to have received no support from experimental evidence. Thus, American laboratory tests have shown that medium-grained fractions of lead arsenate, somewhat coarser than those which normally exist in the commercial material, tended to be slightly more effective than fine fractions, though particles too large to be ingested were obviously of no value (Siegler and Goodhue, 1939). In a Victorian orchard spraying trial, in which colloidal lead arsenate was compared with ordinary lead arsenate paste, the colloidal material gave a markedly inferior control (Pescott, 1936, 1938). It seems therefore that experimental work in this particular direction offers little prospect of an improvement in lead arsenate sprays.

Attempts to discover effective non-arsenical cover sprays for use in the codling moth programme have, on the other hand, met with a considerable amount of success. The insect could often be controlled by sprays which acted primarily against the egg stage, and in this connection white oil emulsions assumed an important rôle. In America, where conditions of infestation necessitate heavy and frequent spray applications, white oil with a high viscosity caused foliage and fruit injury, but this defect could be largely overcome by using oils with a lower viscosity and limiting the amount of oil in the spray mixture (Driggers, 1937). In a large-scale experiment in New Jersey, white oil was applied to apple trees for a period of five years without injuring the trees (Driggers, 1937). White oil has also been used in Australia for a number of years without injuring the foliage and fruit of most commercial varieties of apples.

In recent years much attention has been given to the question of combination sprays for use against codling moth, and white oil has again taken a prominent part. The well-known combination of lead arsenate and white oil has led to a definite improvement in control, but if the mixture is employed in cover sprays, particularly late cover sprays, a heavy arsenical residue remains on the fruit at harvest. A means of obviating this difficulty promised to become available when the value of nicotine as a constituent in codling moth sprays was discovered. Numerous experiments have shown that certain nicotine compounds, when combined with white oil, are satisfactory substitutes for lead arsenate.

A combination spray containing white oil and nicotine sulphate was reported as reliable and efficient (Driggers and Pepper, 1934; Harman and Moore, 1938), and proved more effective than one in which white oil was used alone (Harman and Moore, 1938; Hutson *et al.*, 1938). The addition of nicotine sulphate to both lead arsenate and lead arsenate plus oil sprays has also led to a marked improvement in control (Driggers and O'Neill, 1939). Nicotine compounds have, in American experiments, given good control when combined with bentonite or bentonite sulphur, which "fix" the nicotine so that greater quantities of it are retained on the foliage, and remain active for a greater length of time than ordinary nicotine sulphate (Driggers, 1936). Mixtures of bentonite and nicotine sulphate prepared in the spray tank, i.e., tank-mixed, although giving good control of codling moth, cannot be used in practice because of a heavy and persistent residue which such sprays leave on the fruit (Hutson *et al.*, 1938; Jarvis, 1937). The addition of an oil to the above mixture renders the residue less persistent and easier to remove; a satisfactory spray formula contained nicotine sulphate, bentonite sulphur,

soya bean oil, and sodium lauryl sulphate (Steiner and Sazama, 1938). Steiner and Sazama's experiments also indicated that the nicotine-bentonite mixture remained effective after heavy rain, and that the use of white oil-nicotine sulphate after earlier nicotine-bentonite sprays minimised the bentonite deposit without causing any loss in efficiency. A proprietary nicotine-bentonite mixture has received attention in a number of experiments in America. The material possesses larvicidal properties, and gives a degree of control which is comparable with that given by lead arsenate. It leaves only a slight, easily removable deposit on the fruit, and is more effective when combined with white oil or with white oil plus nicotine sulphate than when used alone (Harman and Moore, 1938).

The combination sprays which have been discussed are double- and triple-acting mixtures; each of the component spray materials acts mainly against a different stage of the insect. Sometimes one of the components may act against more than one stage. Lead arsenate is a larvicide and acts as a stomach poison; white oil is primarily an ovicide; nicotine sulphate and bentonite-nicotine affect adult moths, eggs about to hatch, and newly-hatched larvæ, but the latter spray is much the more effective against newly-hatched larvæ.

Another important aspect of control is concerned with the correct timing of spray applications. For many years it has been recognised that distinct broods of codling moth occur during the season, that a peak or peaks of emergence and egg-laying activity occur during the active period of each brood, and that this activity is influenced in a marked degree by climatic conditions. Studies on the behaviour of the insect under different climatic influences have provided information which permits the adjustment of spray treatments to insect activity. Several methods of timing sprays have been investigated in America and elsewhere. The emergence of adult moths in cages placed in apple orchards has supplied data on the length of the emergence period and the dates on which peaks occur (Bieberdorf, 1937). A second method requires the use of the "thermal constant" which expresses the relationship existing between the rate of development of the insect and temperature conditions (Headlee, 1931). Either of these two methods when used alone appears to be unsatisfactory, and as a result of extended investigations in America a more refined method has been devised which combines (i.) the summation of effective degree days* of temperature, (ii.) observations on the emergence of moths in field cages, (iii.) the collection of moths caught in lure traps in commercial orchards (Headlee, 1936). The method is designed, primarily, to enable the date of maximum emergence of moths to be predicted. Australian experience has shown that effective control of codling moth can be achieved by timing sprays according to moth activity as indicated only by lure trap records (Anon., 1938; Pescott and Miller, 1937).

The relation of temperature to egg-laying activities of codling moth has been investigated by Isley (1938) in America. A rise in temperature causes an increase in the number of eggs deposited daily and abnormally rapid egg-laying shortens the life of the moths. Excessively

* The total number of degree days for a given stage of development of an insect is arrived at by taking each day from the commencement to the termination of the stage concerned, and by computing the number of degrees by which each day's mean temperature exceeds that of the threshold of development, and then summing the number of degrees so obtained for the whole period under consideration. (Imms, Recent Advances in Entomology.)

high temperatures, 90 deg. F. and above, repress egg-laying, and may produce sterility in the eggs deposited. Heat waves, even of short duration, tend to prevent newly emerged moths from ever depositing eggs. Short periods of high temperature, however, may not have noticeable effects in the field. Low temperatures, on the other hand, retard egg-laying but prolong the life of the moth, and may cause intermittent egg-laying. The most favourable temperature, for oviposition, is about 80 deg. F., at which the moth may deposit an average of nineteen eggs each day. Under favourable conditions a moth may deposit 146 eggs during its lifetime.

GENERAL DISCUSSION.

Codling moth research at Stanthorpe has now almost entirely achieved its immediate objects. The spraying trials have indicated that lead arsenate can be replaced in cover sprays by other spray mixtures without loss of efficiency in the control programme, and that adult moth activity forms a reliable basis for the effective timing of cover sprays.

Whilst it may still be possible to discover new spray materials which are more toxic to codling moth larvæ than those now available, better control of the insect can unquestionably be obtained in the Stanthorpe district by the thorough application of existing sprays, provided these are properly timed. The theoretical basis for the timing of cover spray applications appears to be sound. If continuous records are kept of the number of moths caught in lure traps, fluctuations in adult moth activity can be determined. These records indicate flying and egg-laying activities of the moths, but are not necessarily records of emergence, for moth activity after emergence may be modified by climatic conditions. Lure traps are sensitive to changes in moth activity brought about either by alterations in the population or by the occurrence of unfavourable weather. A large catch of moths is, in general, indicative of a heavy egg deposition. When the catches increase markedly to a maximum and then quickly decline to relatively low numbers a "peak of activity" can be said to have occurred. If the date of the maximum catch is taken as the starting point, it is possible, by making due allowance for the rate of development of the insect and for weather conditions, to ascertain the period during which the greatest number of unhatched eggs will be present on the trees. The time during which a spray could be most effectively applied is determined in this way.

Experimental evidence gives considerable support to these theoretical considerations. It has shown that—(i.) definite peaks of activity occur; (ii.) moth activity is influenced by weather conditions, and this is an important factor in determining appropriate spraying dates; (iii.) lure traps are sensitive to changes in activity; (iv.) orchard sprays applied strictly in accordance with lure trap records are at least as effective as sprays applied every three weeks, and probably more effective. Direct evidence that a large trap collection of moths is correlated with an ensuing heavy egg deposition is not available, but the indirect evidence is substantial and is supported by the good control obtained in orchards where the timing principle is applied.

The interpretation of lure trap records is not always straightforward, because moth activity is greatly influenced by weather and to a less extent by other variable factors. The timing of sprays by moth activity cannot be carried out with mathematical accuracy, and, therefore, the best time to spray must sometimes be determined by experience

of moth behaviour and the conditions under which a spray is required, but a precise knowledge of moth activity and weather conditions is indispensable to the success of the method. In practice, two difficulties may arise. In the first place, it may sometimes be doubtful whether the number of moths trapped at a peak of activity has been sufficiently high to justify a spray application. Under such conditions, the decision to spray or not to spray must rest largely on experience. In past experimental work, cover sprays have usually been applied when the catch at a peak averaged at least one moth per trap. This standard is, of course, purely arbitrary and subject to change as the result of further experience, or of experimental work bearing on this point. The second difficulty arises from the fact that a rather long period of relative inactivity usually occurs between November and January, i.e., between spring and summer brood activity. During this time, which is of six to eight weeks' duration, the moth population is low and slightly fluctuating, though seldom rising at any one time to numbers which call for a spray. According to the lures, a spray might not appear to be required. However, during a period such as this, the cumulative effects of slight moth activity may damage more fruit than is desirable should at least one precautionary spray not be applied.

The replacement of lead arsenate in cover sprays by other spray materials is partly necessitated by the extent of the foliage scorch which develops on apple trees sprayed with lead arsenate. From the experimental evidence there can be little doubt that the widespread leaf scorch noted in recent years is directly attributable to lead arsenate sprays, though it may at times be confused with and accentuated by scorch arising from mineral deficiencies in the soil. The injury causes a considerable reduction in the effective leaf area on the tree, and this must lead to loss of vigour and interference with fruiting capacity. The use of white oil in cover sprays, with or without nicotine sulphate, has greatly reduced the amount of scorch in all experimental plots in recent years and has maintained control of the pest.

The fact that a spray mixture containing ¼ gallon of white oil, 1 pint of nicotine sulphate, and 80 gallons of water has controlled the insect in experimental plots, indicates that the cost of the cover spray can be kept within reasonable bounds. Although this spray is effective against codling moth, it is not likely to control scale insects and red mites satisfactorily, and, therefore, if these latter pests require attention the amount of oil in the mixture should be increased in one or more of the codling moth sprays.

Although the application of efficient sprays at appropriate times is the main factor in the control of codling moth, there are other factors of considerable importance. First among these is the method of application of the sprays. There is very often a tendency on the part of growers to use too little spray material on each tree, or to make the application too hurriedly, and consequently the fruit and foliage on which the eggs are deposited are not adequately covered by the spray. Obviously, no spray can be fully effective unless all parts of the tree are completely covered; the inside of the tree must, therefore, be sprayed as thoroughly as the outside. The efficient application of sprays to trees in foliage can best be obtained by the use of a nozzle and a spray pump pressure which will give a rather coarse driving spray. Another important factor in codling moth control is orchard hygiene which is concerned with tree banding and measures aimed at the destruction of

larvæ in fruit cases and packing sheds. Supplementary measures such as these play an important part in preventing the building up of a large moth population, and they must, therefore, be regarded as an essential part of the codling moth control programme.

SPRAY RECOMMENDATIONS.

Substitutes for lead arsenate in cover sprays can now be used with confidence, since, under Stanthorpe conditions, several of the non-arsenical sprays tested will control codling moth at least as well as, and in some cases better than, lead arsenate. The correct application of the most efficient of these sprays implies accurate timing now that extensive observations have shown that cover sprays applied according to moth activity are more advantageous than the application of the same sprays on any other basis.

The following recommendations can therefore be made. The quantities of spray materials given are to be mixed with 80 gallons of water:—

Calyx spray—Lead arsenate, 2½ lb. powder (or 5 lb. paste), plus ¼ gallon of white oil as a spreader.

This spray must be applied before the calyces of the blossoms have closed, as it is primarily designed to cover the walls of the calyx cup with poison and thus to prevent larvæ from gaining entrance to the fruit at this point.

Cover sprays—

(1) White oil, 1⅓ gallons, plus nicotine sulphate, 1 pint, *or*
(2) White oil, ¼ gallon, plus nicotine sulphate, 1 pint, *or*
(3) White oil, 1⅓ gallons.

Of the three alternative cover sprays, the first is the most expensive, but it gives more effective control of codling moth than the other sprays tested, and is also of definite value in checking woolly aphis, red mites, apple leafhoppers, and various scale insects. The second spray is less expensive and is as effective as lead arsenate against codling moth, but will not give as good control of other insects as the first spray. The third mixture is as effective as lead arsenate in suppressing codling moth and will also act against red mites and scale insects.

The desirability of timing cover sprays has already been emphasised. Growers who wish to observe codling moth activity in their own orchards and thereby time cover sprays with the greatest accuracy would find that the maintenance of fifteen or twenty lure traps in two acres of apple trees consumes very little time and is very simply carried out. Provided that conditions are favourable for egg-laying when a peak of activity occurs, cover sprays should be applied not earlier than the *fifth* and seldom later than the *twelfth* day after the recorded peak. Any difficulties experienced in interpreting records obtained from lure traps should be referred to officers of the Department of Agriculture and Stock at Stanthorpe, where general information concerning moth activity and appropriate dates for applying cover sprays will also be available.

SUMMARY.

Codling moth investigations were continued at Stanthorpe in 1938-39, and aimed primarily at testing white oil and nicotine sulphate

in cover sprays, at determining the value of timing cover sprays according to the abundance of adult moths, and at examining the possibility of timing sprays on a district-wide basis.

In a replicated factorial orchard experiment, six spray mixtures were compared under three different timing schedules. The results showed that white oil alone, 1½ gallons–80 gallons, and three combinations of white oil and nicotine sulphate, namely, (i.) 1 gallon–¼ pint –80 gallons, (ii.) ½ gallon–½ pint–80 gallons, and (iii.) ¼ gallon –1 pint–80 gallons, gave as effective control as lead arsenate plus spreader. A fourth combination, 1½ gallons–1 pint–80 gallons, gave better control than any of the other treatments. The results, generally, supported previous observations and demonstrated that white oil and white oil-nicotine sulphate combinations are safe substitutes for lead arsenate in cover sprays. The non-arsenical cover sprays greatly reduced foliage injury and left no objectional residues on the fruit.

Sprays timed according to moth abundance as indicated by lure traps tended to give better control than those applied every three weeks, though the difference was not statistically significant. Sprays applied every five weeks gave poor control. Four of the six three-week sprays fell due shortly after peaks of moth activity, and would therefore be as efficient as those timed by lure traps. There can be little doubt that had spray dates in these timing schedules been more widely divergent, lure trap timed sprays would have shown up to greater advantage.

Tests of various spray mixtures against codling moth eggs showed that white oil is an excellent ovicide, but nicotine sulphate, lime-sulphur plus nicotine sulphate, potash soap, and other materials are far from efficient for this purpose.

Studies of moth behaviour in the field confirmed the previous observation that well-defined peaks of activity, which are associated with moth abundance, occur during the season. Spray applications can therefore be timed according to insect activity, thus avoiding the unnecessary application of sprays and enabling the intensification of spray measures whenever required. It is shown that dates of spray applications in one year do not necessarily bear any relation to those in any other year.

These studies further showed that major peaks of moth abundance develop simultaneously in all parts of the district, but in some localities the moths were sufficiently abundant in between the major spring and summer peaks to warrant the application of precautionary sprays. Temperature changes tended to occur simultaneously throughout the district, but some centres were consistently warmer than others. It is concluded from this work that a district-wide advisory service on the timing of codling moth sprays is practicable, but would need to be based on observations made at several localities in the district.

Studies on insectary-reared moths supplied data on the rate of development of the different stages of the insect at Stanthorpe.

A review of some recent literature indicates the trend of codling moth work elsewhere, and in general shows that the principal insecticides employed in the control of this insect are lead arsenate, white oil, nicotine sulphate, and nicotine-bentonite preparations.

Spray recommendations are given, and if the sprays are well timed and thoroughly applied they will give satisfactory control of the insect.

ACKNOWLEDGMENTS.

A site for the orchard experiment and facilities for applying the sprays were provided by Mr. B. R. Middleton, of The Summit. A number of growers co-operated with the Department to secure lure trap and temperature records. The Deciduous Sectional Group Committee assisted financially and arranged a field day at the site of the orchard spray trial.

The writers are indebted to the foregoing, and wish to take this opportunity to express thanks for the ready assistance given by them.

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Producer Gas Units.

(Supplied by the Sub-Department of Forestry, Queensland.)

THE Commonwealth Government has recently examined a number of producers with a view to recommending certain types to the public.

In making their recommendations, the Commonwealth advisors approved only those units manufactured by firms of known experience and efficiency. It is quite possible that other lower-priced units may have satisfactory efficiency. Such manufacturers have been invited to submit their units for official test. Upon satisfactory completion of such tests by Government technicians, their names will be added to the approved list.

The manufacturers in the various States whose units have been approved are given in the list below:—

	£	s.	d.	
(1) Powell Gas Producer Ltd. ..	62	10	0,	f.o.b. Sydney, plus £10 fitting.
(2) Crewe (W. Aust.)	58	16	0,	plus £5 17s. 9d. fitting.
(3) Malcom Moore (Vic., Tas.)	73	0	0,	plus fitting.
(4) Wishart and Co. (Vic.) ..	85	6	3,	plus £4 19s. 6d. fitting.
(5) Fleet Forge (S.A.)	67	12	5,	plus £14 14s. fitting.
(6) Carbo-Gen Gas Co. (N.S.W.)	60	4	9,	plus £3 19s. fitting.

Prices shown are for a limited number of units suitable for trucks with engines of 30 h.p. R.A.C. rating. Most of the firms also manufacture units suitable for tractors and cars, but the prices for these variations would have to be determined by enquiry to the firms concerned.

Of the above firms, Messrs. Powell, Messrs. Wishart, and Messrs. Fleet Forge have Queensland agents—Olympian Auto Services, Adelaide street, Brisbane; Buzacotts Ltd., Petrie Bight, Brisbane; Eagers Pty. Ltd., Adelaide street, Brisbane, respectively.

Other Queensland manufacturers whose units are now available include:—

(1) W. Telford, care of Toowoomba Electric Light and Power Co. Ltd., King street, Warwick (Telford Producer).
(2) Campbell Bros., Bowen Hills. (Gohin-Poulenc Producer).
(3) S. F. Manfred, 732 Ann street, Brisbane (Sheldon-Reddie Producer).
(4) Pollards Ltd., corner Margaret and Albert streets, Brisbane (National Emergency Producer).

Neither the Commonwealth nor any of the State Departments has prepared plans and specifications for an approved type of producer. There are available to the public plans and specifications of several types of producers, but these have not been examined closely by any Government Departments. The public are warned that they should exercise caution before proceeding to manufacture and instal such units.

With any of the approved units it will be found that the charcoal consumption will be such that 13 to 16 lb. of charcoal will be approximately equivalent to 1 gallon of petrol.

CHARCOAL.

(a) Market.

The present market is not extensive. Apart from blacksmiths, foundries, and poultry farmers, the only regular demand comes from small power houses, or from firms requiring power to drive machinery —butter factories, joinery works, &c. On account of its relatively large bulk, it is not profitable to transport charcoal any distance (e.g., 50 miles), so that, in any area, the charcoal demand would be governed largely by local conditions.

There is a great deal of interest at the moment in charcoal as a possible substitute for petrol in trucks, cars, and tractors. In Western Australia there are over 700 units in operation, but in Queensland there would be probably not more than 100.

(b) Timbers Suitable for Charcoal.

We have manufactured charcoal from twenty-six different species, and have found that most species produce satisfactory charcoals, but that there is a considerable variation in density, heavy woods producing denser charcoals, which are generally more acceptable because more fuel is available for the volume occupied. There are a few species which have not given satisfactory results in portable producers, however, and it is recommended that those intending to burn charcoal advise us of the species proposed, so that we may advise as to the most satisfactory types. Unless the burning operation is properly carried out the product from even the best timber may be unsatisfactory.

(c) Manufacture of Charcoal.

(i.) Perhaps the simplest method is to use a pit. Several pit methods are used, and a simple scheme which will give satisfactory charcoal is outlined here.

A pit, roughly 3 ft. deep by 3 ft. wide by 15 ft. long, is dug in suitable soil, allowing a little batter on the walls if desired. In the bottom are laid twigs and branches to a depth of 12 in. This is thoroughly ignited and then the main billets, up to 8 and 10 in. in diameter, are thrown in carefully lengthwise until the pit is filled to a height of 2 ft. to 3 ft. above ground level. After several hours the pit should have burnt down level with the ground line. At this stage, billets should again be piled on, again to a height of 2 ft. to 3 ft. above the ground line. As this pile burns, holes which burn out are filled with small timber until the pile again burns to the ground line, then the pit is completely sealed with sheet iron and earth, and every effort made to prevent air from getting into the pit. Wherever smoke is seen coming through the seal, further earth should be shovelled on. In operating these pits, dry timber burns more quickly, and is easier to handle than wet.

After about forty-eight to seventy-two hours, the pit may be opened and the charcoal bagged, but careful watch must be kept to detect any hot spots from which a fire might ultimately generate. If a hot spot is detected, the charcoal should be moved carefully with a shovel and quenched. If the charcoal is still too hot and tends to fire in several places, then the pit must be sealed again to allow further cooling.

From such a pit about twenty to thirty bags of charcoal—i.e., about 10 to 15 cwt.—are obtained. The chief disadvantage of the pit method is that portion of the charcoal so produced is likely to be contaminated with earthy matter.

Many burners line the pits with iron to prevent this contamination, but where suitable lining material is not available, then the "floating" method should be quite satisfactory to remove dirt from all doubtful bags. It has been found that "floating" *cold* charcoal on water separates all the earthy matter, and adhering moisture can be dried from the charcoal by spreading out and exposing to the air for a few hours.

(ii.) Charcoal may also be made in portable retorts. Such retorts cost between £30 and £100, depending on the design and size. Such retorts produce charcoal free from dirt and are much favoured where a clean charcoal is desired. However, unless a number of retorts are operated simultaneously the cost of operation is unprofitable.

(d) Price.

Price paid by consumer varies considerably. In country districts relatively good quality lump charcoal can be bought for about 1s. 6d. per bag (of about 55 lb. each), i.e., 60s. per ton.

If the charcoal is screened and graded the price may be twice as much.

City prices would show an increase of 20 per cent. or more; at the moment, charcoal of fairly good quality is being retailed at 1s. 6d. per bag.

(e) General.

Charcoal for portable generators should be entirely free from any earth and sand contamination, should be well burnt, i.e., completely carbonised so that tarry substances will not tend to reach the engine, and free of dust.

It is also important that the wood used has comparatively low ash content—a timber with a silicon ash is unsatisfactory.

The size of charcoal used is largely dependent upon the type of producer used, and various makers have different recommendations. In general, small charcoal gives greater flexibility.

CONSUMPTION OF CHARCOAL, OIL, AND KEROSENE IN TRACTORS.

The most authentic record of fuel consumption on farm tractors is that of Mr. E. C. Powell, Agricultural Instructor of the New South Wales Department of Agriculture, reported in the September, 1939, issue of New South Wales Agricultural Gazette.

The records of fifteen owners of producer gas plants are given. A summary of these records is given below:—

Conditions of Working.	Average Fuel and Oil Consumption per Ten-hour Day.			
	Producer Gas.		Kerosene.	
	Charcoal.	Lubricating Oil.	Kerosene.	Lubricating Oil.
	Bags.	*s. d.*	Gallons.	*s. d.*
Full load	5	1 7	20	4 0
Light load	4	1 7	18	4 0

The range of oil hours with producer gas varied from 60 to 200 hours, while with kerosene the oil life was from thirty to sixty hours, but the figures of 100 and 40 have been taken as the average oil life for producer gas and kerosene respectively.

A table showing the estimated schedule of cost of operating tractors has been compiled by this Department. From this table, costs for any individual case can be readily interpolated.

SCHEDULE OF COSTS OF GAS PRODUCER OPERATION ON TRACTORS.

Item.	Cost per Week, According to Number of Days Worked per Week Each of Ten Hours.			
	1	2	3	4
	s. d.	*s. d.*	*s. d.*	*s. d.*
With Charcoal—				
Fixed cost, interest, and redemption on plant, and fixing for life of five years on capital cost of £125	9 10	9 10	9 10	9 10
Maintenance of generator scrubbers, &c., ½ hour per day	1 0	2 0	3 0	4 0
Charcoal fuel, 4 bags per day (light load)—				
At 1s. 3d.	5 0	10 0	15 0	20 0
At 2s.	8 0	16 0	24 0	32 0
Lubricating oil cost 1s. 7d. per day (life 100 hours), 3 gallons per fill	1 7	3 2	4 9	6 4
Petrol (½ gallon per day) ..	1 0	2 0	3 0	4 0
Total cost per week ..	18 5 21 5	27 0 33 0	35 7 44 7	44 2 56 2
With Kerosene—				
Kerosene, 18 gallons per hour, at 1s. 3d.	22 6	45 0	67 6	90 0
Lubricating oil, 4s. 4d. per day (40 hour life—3 gallons per fill) ..	4 4	8 8	13 0	17 4
Total	26 10	53 8	80 6	117 4
Savings per week using charcoal	8 5 5 5	26 8 20 8	44 11 35 11	73 2 61 2

Similar analysis with regard to road vehicles is a little more difficult, inasmuch as pay load is reduced and operating conditions vary vastly. As a rough guide, however, it may be taken that a 30-cwt. truck operating on reasonably long hauls—not less than 20 miles—would have to cover a minimum of 200 miles per week before real savings were effected.

The above analyses are based solely on economic factors. In the event of liquid fuel rationing or shortage, the advantages of charcoal as a fuel would be increased—in fact, the use of producer gas would probably become essential for national welfare.

Termites or "White Ants."

By J. H. BUZACOTT.*

THE small insects commonly known to farmers as "white ants" prove destructive at times both to sugar cane and to farm buildings. The term "white ant," however, is a distinct misnomer, for although these insects, or *termites* to give them their correct name, are social in habit, they are not ants and are entirely different from true ants, both in their behaviour and their biology.

Termites may be classified in two main groups—viz., wood-dwelling species and earth-dwelling species. The first group may be further divided into drywood forms and dampwood forms, whereas the main bulk of the second group is made up of subterranean termites. It is this last group which contains the various species of chief interest to the farmer.

Subterranean termites have their nests in the ground and may or may not build a surface mound. Some of the species which attack cane have mounds of a distinctive type which may be readily recognised, whereas others, notably the *Giant termite* (*Mastotermes Darwiniensis*), build no mound and their nests are correspondingly difficult to locate.

The principal food of termites is cellulose in some form or other, and this is obtained by the insects from timber, trees, sugar cane, and other substances of which the chief constituent is cellulose. In search of food materials the termites will travel a considerable distance from their nests through specially constructed tunnels, for, with the exception of winged individuals during the swarming period, the other castes are light-shunning. It has been recorded that some species will travel several hundred yards from the nest and still maintain communication with it.

Most species of termites require to live in an atmosphere practically saturated with water vapour. In the coastal areas of tropical and sub-tropical Queensland this condition is easily realisable in the soil and, generally speaking, moisture could not be regarded as a limiting factor in the distribution of species which affect cane. The most destructive species to sugar cane, however, the giant termite, is exceedingly restricted in range through the sugar belt as it only attacks cane in a comparatively small area in the Burdekin district. The particular coastal area frequented by Mastotermes occurs in the driest portion of the tropical coast and it is probable that this pest requires either specific conditions of rainfall or soil temperature for its survival.

The giant termite not only destroys the older mature sticks standing in the field, but it also eats into the newly planted sett underground and destroys the young shoots before they have time to become established. One feature of its attack on standing cane is the fact that the presence of the insect is not apparent until the cane is destroyed as Mastotermes eats the cane from the ground upward leaving a complete shell and it is not until the termites reach and destroy the growing point that the cane shows distress. The presence of this termite in standing cane is manifest by the appearance of "dead hearts" similar to those caused by the moth borer.

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* In *The Cane Growers' Quarterly Bulletin* for April, 1940.

Generally speaking, Mastotermes causes its most severe damage during dry seasons, for the insect probably visits cane more freely under these conditions in order to use it as an easy source of maintaining the necessary moisture content in the nests. It has been found by some farmers that frequent watering of affected patches will result in a cessation of damage.

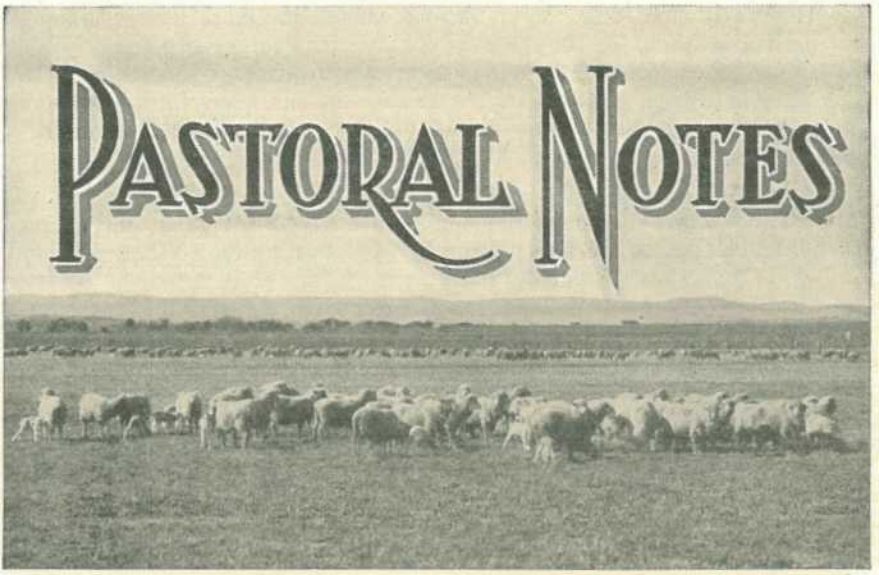
A general method of control is to clean up, as far as possible, all fallen and useless timber in the neighbourhood of the farm and to pay particular attention to the poisoning of fence posts. When infested timber or fence posts are reasonably dry, by far the best way to destroy the termites is to blow Paris green powder with a dust blower through a small hole made into the tunnels in which the insects are operating, and sealing the hole with mud after the operation. The value of this poison lies in the fact that the insects traverse treated tunnels and become covered with the Paris green dust. By the process of grooming one another, granules of the poison are distributed among others of the colony and widespread death results. Thus the treatment of a fence post may result in the destructon not only of the termites within the post, but also of numbers in the main nest which may be situated a considerable distance away. If the hole be not sealed after treatment the termites will cease to use the treated tunnel, thus rendering useless the effort made to destroy the pest.

Paris green used as above is also particularly suitable for the destruction of termites in farm buildings. Naturally in new buildings it is better to use concrete foundations or posts and timber impregnated with a repellent such as creosote in order to prevent the entry of the pests in the first place.

Several other species of termites besides *Mastotermes Darwiniensis* attack sugar cane but it is only on rare occasions that they destroy standing cane. More frequently they confine their attentions to stools or setts, and in the latter case, are the cause of poor strikes. Usually infestation from these species results from wood debris in the canefield, or from infested fence posts and timber near by. Frequently in the region of a damaged sett the remains of an old stump may be located under the ground. Such debris should be removed and destroyed, likewise any extraneous timber adjoining canefields. Fence posts should be examined carefully and where evidence of the attack is noticed they should be treated with Paris green as indicated above for Mastotermes.

In regions where termite damage is prevalent, steel or concrete fence posts are worthy of consideration by the farmer. Paris green is also the most efficient poison for the treatment of small species of termites in farm buildings. This should be used in a manner similar to that described previously, care always being taken to see that the tunnels are adequately sealed after the treatment with the poison.

Care should be taken in the use of Paris green as it is a deadly poison and should be kept out of reach of children and animals.



The Fat Lamb Scheme.

JAS. CAREW, Senior Instructor in Sheep and Wool.

Following is a summary of lamb sales during the season 1939-40:—

IN all, 5,934 lambs came under review in making out the respective averages. Dorset Horn and Border Leicester crosses were among the greatest number of sales. The rise and fall of values at the respective sales has a big influence over the average for the respective breed, as, for instance, the Romney Marsh cross which was only included in one sale which happened to be on a good market.

DETAILS.

	£	s.	d.
Lambs from Border Leicester rams included in sixteen sales—			
From merino ewes—1,057 lambs averaged	0	16	9
From Corriedale ewes—77 lambs averaged	1	0	0
From Romney March cross—66 lambs averaged ..	0	18	3
From Border Leicester cross—175 lambs averaged ..	0	18	6
From crossbred cross—54 lambs averaged	0	19	0
From comeback cross—417 lambs averaged	0	17	0
From all ewes cross—1,846 lambs averaged	0	17	5
Lambs from Southdown rams included in ten sales—			
From merino ewes—206 lambs averaged	0	16	8
From Border Leicester cross ewes—126 lambs averaged	0	18	11
From Romney Marsh cross ewes—66 lambs averaged ..	0	18	3
From crossbred ewes—71 lambs averaged	0	18	11
From comeback ewes—55 lambs averaged	0	17	3
From all ewes—524 lambs averaged	0	17	10

Lambs from Dorset Horn rams included in twenty-nine sales—			
From merino ewes—1,548 lambs averaged	0	17	2
From Border Leicester cross ewes—514 lambs averaged	0	18	4
From crossbred ewes—318 lambs averaged	0	17	6
From English Leicester cross ewes—622 lambs averaged	0	16	6
From comeback ewes—73 lambs averaged	1	0	4
From all ewes—3,075 lambs averaged	0	17	4
Lambs from Corriedale rams included in four sales—			
From merino ewes—70 lambs averaged	0	13	10
From crossbred ewes—82 lambs averaged	0	17	6
From all ewes—152 lambs averaged	0	16	0
Lambs from Romney Marsh rams in one sale—			
From merino ewes—258 lambs averaged	0	18	3
From comeback ewes—79 lambs averaged	1	1	3
From all ewes—337 lambs averaged	0	19	0

All lambs over the season averaged 17s. 5d.

The outstanding feature of the season's sales was the advantage and importance of the crossbred ewe, no matter what breed or ram was in use.

CLASSING THE EWE FLOCK.

Many grazing properties in Queensland are now stocked well up to their carrying capacity, and, with the coming crop of lambs to be provided for, some reduction in numbers may be necessary. It is better to own a flock of good ewes than a flock containing a mixture of good and bad stock. Besides being more profitable, it should give the owner far more satisfaction to have a flock as near as possible to uniformity in type and which will cut a heavy fleece of good quality wool.

On most large holdings, classing the ewe flock forms part of the station routine, and there is no reason why smaller flocks should not be classed in the same way.

Just before shearing is the most suitable time to do the classing and, usually, the flock can be classed in three groups to advantage. The tops should consist of all the large-framed deep-bodied ewes carrying a covering of even type, well grown, and showing the character and colour typical of the breed. Ewes selected for the main flock should be as free from fault as possible, but need not be so even or up to the standard of the tops. The third class will be the culls, including light cutters, ewes producing inferior wools in quality or colour, and ewes rejected for defective frames, weak constitution, or objectionable folds or wrinkles. The rams to be mated with them should be classed in the same way, the best being selected for the top line. All culled ewes should be fattened, and sold as soon as possible; likewise those cast for age.

PREPARATION FOR SHEARING.

Before the shearing season starts, graziers would be well advised to give that necessary attention to the shed, plant, and yards.

Starting is often delayed, because everything has been left to the last minute. The shed itself should be clean, and all pen gates and hinges seen to to ensure convenient working. Grating floors, also, should be attended to where necessary.

The down shoots should be carefully repaired, if necessary, thus ensuring that shorn sheep are not ripped by outjutting nails, splinters, or other projections. Counting-out pens nearly always need repairing. The branding race and the gates at both ends should be in good working order.

Inside the shed, all machinery should be overhauled, belts examined, handpieces attended to, and oil cans ready.

The wool bins may need a nail or two, new rungs may be required in the wool-rolling, piece-picking, and classing tables.

The wool press should be overhauled thoroughly and the ropes examined, for if new ropes are necessary, rigging them is a long job.

Have wool packs placed conveniently near the press, and all tools used in pressing in their places. Scales should be tested and every other detail attended to. If this work is neglected until the commencement of shearing, delays and frayed tempers are inevitable.

A MAINTENANCE RATION.

All livestock rations are divisible into two parts—the part used for maintaining the body in a healthy condition and the part used for production, whether it be for hair, wool, fat, meat, milk, or progeny. Under severe winter or drought conditions the livestock owner is more concerned with a maintenance standard of feeding, and it becomes important to know where economies may most effectively be introduced.

A short consideration of an animal's reactions to starvation will supply the answer. Take the dairy cow in full lactation: the first defence which nature attempts is a conservation of material and the milk yield falls rapidly. Supplies to the body covering are restricted, and a dull, shaggy, lustreless coat develops. The body reserves of fat are called on and the animal becomes thinner. Horns and hooves become brittle. As starvation advances, some encroachment is made on the last defences—the muscles and vital organs. At this stage, the animal weakens rapidly and collapse followed by death results. It is, therefore, clear that the last defences of the body—i.e., the muscles and vital organs—must be protected. For this purpose, the animal must be supplied with protein. In other words, drought feeding should centre round protein-rich foods. Where the stock are close to the source of such foods, the relative merits of each should determine which is to be fed, but on distant properties where freight charges are high it becomes important to buy the most concentrated and most digestible preparations.

Producers often remark that nature gave the sheep a commodious intestinal tract which must be filled, and they usually buy roughage of only moderate protein content. The argument is fallacious when the

question is one of maintenance for limited periods only. It is surprising how well sheep can keep their condition on as little as 2 oz. of cotton seed meal and 4 oz. of maize daily.

The mineral requirements of stock should be provided for, but the excessive quantity of salt in many licks is unnecessary. Animals are capable of retaining enough salt for normal body functions from a very restricted intake, but lime and phosphate are continuously excreted and must be supplied in greater quantities. More than 30 per cent. of salt in a lick is rarely necessary, and in most cases it could well be less. Lime and phosphate are supplied in a number of forms, but on current prices well-prepared sterilized bone meal containing about 20 per cent. protein is, apparently, the best.

WATER ON THE GRAZING FARM.

It is not every grazing farmer who is fortunate enough to have surface water on his property. Consequently, provision has to be made for water supply by bore, drain delving, well-sinking, or tank-making.

Much money may be wasted in attempted provision of surface water. It is a common experience to see as many as three or four tanks, ranging in capacity from 1,000 up to 1,500 cubic yards on a single property. These earth tanks provide water in good seasons, but may be quite empty when water is most wanted in a dry time. If the whole of the money invested in "pot holes" had been expended on one large tank, the supply would probably be adequate and permanent, more or less.

A mistake is often made by fencing a paddock and then trying to water it adequately. If first a large tank is excavated at a central site, and country then subdivided for convenient watering, money would be saved, security obtained, and value added to the property.

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 may be obtained from the Department of Agriculture and Stock, Brisbane.

FLOCK MANAGEMENT.

A tendency at times to leave sheep too long in the one paddock has been observed. It is no rare thing, for example, to see sheep shorn, driven to a particular paddock, and left there until the next shearing.

Sheep respond quickly to change of pasture, and the change is noticeable both in the health and condition.

Sheep will often benefit, even if placed in a comparatively worse paddock than that on which they have been running for a brief period. On a breeding property, provision should be made for the ewes and lambs by spelling a paddock well before lambing time. Should rain fall while the paddock intended for the ewes and lambs is spelling, it is all to the good, for the succulent new growth so much to be desired for ewes and lambs will be available. At weaning time there is again a necessity for fresh feed, for it should be fully realised that as a weaner a sheep is going through its most tender period. Grass seed country should not be considered where weaners are concerned.

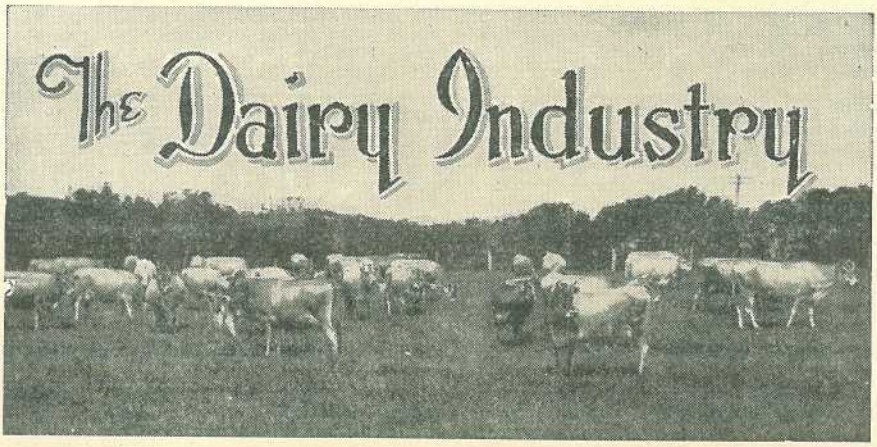
CATTLE LICE.

A heavy lice infestation of all classes of cattle, particularly dairy cows, has become a serious matter to stockowners in parts of Central Queensland. The lice—the long-nosed sucking louse and the short-nosed sucking louse—usually make their appearance on cattle in the winter months, becoming most active in the spring when the warm weather sets in.

The presence of lice on cattle is indicated by ceaseless skin irritation. In their efforts to ease this irritation, the cattle rub themselves against fences, stumps, and trees, and soon become almost denuded of hair on the neck, dewlap, and rump. Whole patches of skin become raw from rubbing; other parts of the animal also become affected.

The ordinary arsenic and soda dip is ineffective against the lice, but if three-quarters of a gallon of crude cresylic acid is added to every 400 gallons of dipping fluid, good results will be obtained. For the treatment of dairy cattle and stud bulls by spraying a solution of one ounce—two tablespoonsful—of nicotine sulphate solution (40 per cent. or thereabouts) in six gallons of water has proved effective. In either case, the treatment must be repeated in fourteen days in order to destroy the pest. The reason for this is that the first treatment only kills the lice actually alive on the cattle at the time, and will not destroy the small eggs which are attached to the hair of the animals. Within fourteen days all these eggs will have hatched, and the young lice will soon be capable of laying eggs, and so continuing the cycle. For treatment to be effective it is, therefore, most important that a second dipping or spraying should be done not later than fourteen days after the first treatment.

Cattlemen who are at present troubled with lice in their cattle will be well repaid if treatment on these lines is carried out as soon as practicable.



Variations in Milk Tests.

VARIATIONS in the fat test of milk which occur from time to time often cause misunderstanding among dairy farmers, particularly cheese factory suppliers. Actually, such variations are bound to happen and are conditioned by a number of factors, which may be conveniently divided into:—

(*a*) Natural or inherent causes.

(*b*) Other causes.

There are two main factors which cause natural variations in fat tests—breed and individuality. Breed is the more important factor influencing the percentage of fat in milk, as it is well known that cows of certain breeds are noted for high fat contents. For instance, Jersey and Guernsey milks are usually richer than Australian Illawarra Shorthorn and Ayrshire milks, which, in turn, are richer than Friesian milk. Within any breed, however, certain families give milk above average quality for the breed, while others give below the average, because of fat content being an hereditary characteristic. An increase in the butter fat percentage in the milk of a herd can be brought about by introducing a bull from a high-production and high fat-testing family.

Apart from the inherent or natural causes of differences in fat tests, the chief factors are:—

1. Stage of lactation.
2. Season of year, temperature and weather conditions.
3. Interval between milkings.
4. Health.
5. Efficiency of milking.
6. Excitement and oestrum, or "heat."
7. Age.
8. Exercise.
9. Feeding and condition of animal.

The stage of lactation exerts a marked effect on fat tests in this State, because most cows calve in the one season of the year—spring. It is generally found that soon after calving the tests are slightly above normal, followed by a gradual reduction until the lowest level is reached about the time of maximum milk yield—that is, three to four months after calving. Tests then remain fairly stationary for some time, but a higher figure will be again recorded when the end of the lactation period is approaching and the milk yield is declining to its minimum.

As to the influence of season of year and temperature, fat tests are lower in summer and higher in winter. In Queensland, the period of minimum fat content in the lactation cycle coincides with the hottest months and as high temperatures also depress the fat content, it should be easily understood why tests are lowest at that time of the year. Butterfat test records at many cheese factories have revealed the difference between January and June tests to be about 0·3 per cent. It is difficult to estimate the effect of sudden changes in weather, as other accompanying factors—food supply, water, &c.—often disturb the fat content and especially the total yield of milk. For instance, it is usual to change cows from green, succulent feed to dry paddocks during rainy weather and it has been observed that there is often a diminution in milk yield and a sudden appreciable rise in fat content. At one factory visited 6,272 gallons of milk of an average test of 3·6 per cent. were received in a week before rain, while in the week in which rain fell the milk supply dropped to 5,762 gallons and the mean test rose to 4·1. Drought also tends to slightly reduce the fat content and to greatly decrease yields.

The interval between milkings constitutes the most important factor causing differences to occur in the fat content of the milk of an individual cow. It is usual for the morning's milk, produced after the long night interval, to be of greater quantity and lower fat tests than the evening's milk, and the magnitude of this divergence may be as great as 1 to 2 per cent. if the periods between milkings are very irregular. It should thus be obvious to anyone sending samples to a laboratory, or any other place, for check testing, that care should be taken not to select just morning or night milk as a check against the factory test. At factories, a representative sample of the mixed night and morning milk is taken and it also is essential for the farmer to obtain a true sample of the mixed milk, if he is to avoid dissatisfaction because the results obtained on a sample taken by him are at variance with the factory tests. Likewise, some farmers in order to obtain butter for household use habitually skim some cream from the evening's milk before sending it to the factory next morning. The effect of this practice in decreasing tests also should be borne in mind if a sample of unskimmed milk is forwarded for check purposes.

The fat content is subject to alterations if an animal is indisposed, if recently calved, if the udder receives a chill, or if any other abnormal condition arises. Some samples of mastitis milk recently analysed contained as low as 1·5 per cent. of butterfat.

Incomplete stripping of a herd may result in a diminished fat content and a decreased yield and, if continued, causes cows to dry off more rapidly than if thoroughly stripped at each milking.

Excitement, oestrum or "heat," age, and exercise, although responsible for disturbances in the fat content of the milk of a single cow, are

unlikely to exert any bearing on the fat content of the bulked milk of a herd.

Contrary to the opinion of many farmers, the conclusions reached from numerous investigations in various countries are that in herds of cows receiving an adequate and balanced ration, changes in feeding can, at most, cause only a slight and temporary change in fat content and a permanent alteration cannot be induced by this means. It is usually conceded that a cow, if well nourished and fit at calving time, will give a better yield in the ensuing lactation period than if she calves in poor condition, and overseas investigations also have shown that a slightly higher fat test will be maintained.

COWS CALVING AT SHOW TIME.

Competitors in dairy classes arrange usually for the calving of individual cows about show time, so that they may be brought before the judge with all their characteristics of production strongly in evidence.

Should calving be delayed until the show is in full progress, the noise and consequent excitement may cause the continuance of labour pains, although weakly, for many hours, thus exhausting the cow and, perhaps, endangering the life of a valuable calf. In these cases, it is advisable to seclude the cow in a quiet part of the building, where there is no traffic, where curious visitors may be excluded, and where any attention required may be given only by her regular attendant. In these surroundings the cow soons settles down, the pains become strong and effective, and the calf is born without any trouble.

Immediately the calf is dropped, it is advisable to tie the navel string, close to the belly, with strong thread or silk, which has previously been soaked in a suitable disinfectant, and to paint the part with strong tincture of iodine. Neglect of this precaution may allow the entrance of infection leading to fatal disease.

The calf should receive for the first few days all it will drink of its mother's milk, as the colostrum it contains acts as a laxative, removing offensive material from the bowels, and is essential to the future well-being of the calf.

If the cow has been subjected to great excitement through travel and strange surroundings, the first milk she yields should be discarded, for such milk may cause digestive disorder leading on to fatal diarrhœa. It is safe to feed the second and subsequent milkings to the calf.

SCUMMY CREAM.

It often happens that when cream is being put through the strainer into the vat at a factory, a quantity of thick greasy substance is retained by the strainer. In most cases, this is due to the inclusion of the thick scum from the interior of the separator bowl with the cream. This is a practice which cannot be condemned too severely and results frequently in the cream being graded down.

REJECTION OF THE FIRST-DRAWN MILK.

The first thing to do to ensure clean and, therefore, profitable milking is the washing of the cow's udder and teats to remove dust and dung particles and loose hairs, which, if they fall into the milk, carry with them enormous numbers of bacteria. The second is the removal of the first-drawn or "foremilk," which is a less commonly recognised source of troublesome organisms. The small quantity of milk left after milking within the narrow canal leading from the udder to the outlet of each teat forms a good breeding ground, where nourishment, moisture, and a suitable temperature are available for growth.

Because of their minute size, bacteria can penetrate past the "sphincter" muscle, which closes the teat when milk is not being drawn, and, especially in the case of older cows, where this muscle has become slack, large numbers may enter and become established in the teat canal between milkings. Thus it is advisable, before milking is begun, to remove into a separate vessel—a small pail or billycan is suitable, but *not* a milking bucket—the first two or three streams from each teat. This will wash the teat canal free or almost free from contaminating organisms.

Experiments have shown that the foremilk, compared with the middle milk and strippings from the same cow, contains by far the largest proportion of the total bacteria, and, when it is considered that most of these may be from pasture, dung, soil, or contaminated stagnant water, which contain particularly obnoxious types, the value of rejecting the first-drawn milk can be better realised. It has been found to be an important contributory factor in lengthening the life of milk, whether it is intended for human consumption, cheese-making, or separation of cream for butter-making, and in avoiding bacterial taints and troubles, such as ropiness and sweet curdling.

A far more important reason, however, why every farmer should make a practice of removing the foremilk regularly at each milking is that it enables him to notice anything abnormal in the appearance of the milk. Early indications of mastitis usually show up in the form of tiny clots or strings in the first drawn milk, which if observed may mean the detection of animals having one or more affected quarters, before the disease becomes serious. Special care may then be taken to milk the infected cows last; their milk is then isolated from the rest, and the spread of the disease to other cows in the herd prevented.

In no circumstances should the foremilk be withdrawn on to the floor of the milking bail, for this is one of the surest ways of spreading any infection that may be present. Apart from this, decomposition will occur with accompanying bad smells and attraction of flies.

It is well known that the highest percentage of butterfat in milk is contained in the strippings and that the first-drawn milk is the poorest portion, so that discarding it will involve only a small loss in quantity, which is more than offset by the improvement in keeping quality.

In large herds, where the quantity of foremilk is considerable, it can be pasteurised or boiled and used for calf, pig, or poultry feeding, unless definitely known to be infected. If it contains milk from diseased quarters, it should be disposed of by adding some disinfectant and emptying well away from cowbails and water supply.

Name and Address.	Name of Hatchery.	Breeds Kept.
G. Adler, Tinana	Nevertire ..	White Leghorns, Australorps, Rhode Island Reds, and Langshans
F. J. Akers, Eight Mile Plains ..	Elmsdale ..	Australorps
E. J. Blake, Rosewood	Sunnyville ..	White Leghorns, Australorps, White Wyandottes, and Rhode Island Reds
W. Brown, Waterworks road, Ashgrove	Strathleven ..	White Leghorns
A. F. Buchler, Milman	Pincrow ..	White Leghorns
J. Cameron, Oxley Central ..	Cameron's ..	White Leghorns and Australorps
M. H. Campbell, Albany Creek, Aspley	Mahaca ..	White Leghorns and Australorps
J. E. Caspaney, Kalamia Estate, Ayr	Evlington ..	White Leghorns
J. L. Carrick and Son, Manly road, Tingalpa	Craigard ..	White Leghorns and Australorps
N. Cooper, Zillmere road, Zillmere	Graceville ..	White Leghorns
R. B. Corbett, Woombye ..	Labrena ..	White Leghorns and Australorps
T. G. Crawford, Stratford, via Cairns	Rho-Isled ..	Rhode Island Reds
B. Cross, Apple Tree Creek, Childers	Spring Hill ..	White Leghorns, Australorps, and Langshans
Dr. W. Crosse, Musgrave road, Sunnybank	Brundholme ..	Australorps, White Leghorns, and Rhode Island Reds
O. M. Dart, Upper Brookfield ..	Woodville ..	Australorps, White Leghorns, Langshans, and Rhode Island Reds
Dixon Bros., Wondecla ..	Dixon Bros. ..	White Leghorns
W. Easson, Formosa road, Tingalpa	Grassdale ..	White Leghorns and Anconas
E. O. F. Eckert, Laidley ..	Laidley ..	Australorps, White Leghorns, and Langshans
F. G. Ellis, Old Stanthorpe road, Warwick	Sunny Corner ..	Australorps
Elks and Sudlow, Beerwah ..	Woodlands ..	White Leghorns and Australorps
B. E. W. Frederich, Oxley road, Corinda	Glen Albyn ..	Australorps
W. H. Gibson, Manly road, Tingalpa	Gibson's ..	Australorps and White Leghorns
Gisler Bros., Wynnum ..	Gisler Bros. ..	White Leghorns

Name and Address.	Name of Hatchery.	Breeds Kept.
G. Grice, Loch Lomond, via Warwick	Kiama ..	White Leghorns
J. W. Grice, Loch Lomond, via Warwick	Quarrington ..	White Leghorns
Mrs. M. Grillmeier, Mount View, Milman	Mountain View	Australorps, Minorcas, and Rhode Island Reds
C. and C. E. Gustafson, Tannymorel	Bellevue ..	Australorps, White Leghorns, and Rhode Island Reds
P. Haseman, Stanley terrace, Taringa	Black and White	Australorps and White Leghorns
C. Hodges, Kuraby	Kuraby ..	White Leghorns and Anconas
H. Hufschmid, Ellison road, Geebung	Meadowbank ..	White Leghorns, Brown Leghorns, Minorcas, Australorps, and Rhode Island Reds
S. W. Kay, Cemetery road, Mackay	Kay's	White Wyandottes, Light Sussex, Rhode Island Reds, Australorps, White and Brown Leghorns
F. W. R. Longwill, Birkdale ..	Nuventure ..	Australorps and White Leghorns
J. McCulloch, Whites road, Manly	Hindes Stud Poultry Farm	White Leghorns, Brown Leghorns, and Australorps
W. S. MacDonald, Box 208, Babinda	Redbird ..	Rhode Island Reds and Anconas
F. McNamara, Vogel road, Brassall, Ipswich	Frammara ..	White Leghorns and Australorps
A. Malvine, junr., The Gap, Ashgrove	Alva	Australorps and White Leghorns
H. L. Marshall, Kenmore ..	Stonehenge ..	Australorps and White Leghorns
W. J. Martin, Pullenvale ..	Pennington ..	Australorps, White Leghorns, and Langshans
C. Mengel, New Lindum road, Wynnum West	Mengels ..	Australorps
J. A. Miller. Racecourse road, Charters Towers	Hillview ..	White Leghorns
F. S. Morrison, Kenmore ..	Dunglass ..	Australorps, White Leghorns, and Brown Leghorns
Mrs. H. I. Mottram, Ibis avenue, Deagon	Kenwood Electric	White Leghorns
J. W. Moule, Kureen	Kureen ..	Australorps and White Leghorns
D. J. Murphy, Marmor ..	Ferndale ..	White Leghorns, Brown Leghorns, Australorps, Light Sussex, and Silver Campines
S. V. Norup, Beaudesert rd., Cooper's Plains	Norups ..	White Leghorns and Australorps
H. W. and C. E. E. Olsen, Marmor	Squaredeal ..	White Leghorns, Black Leghorns, Australorps, Brown Leghorns, and Anconas
A. C. Pearce, Marlborough ..	Marlborough Stud Poultry Farm	Australorps, Langshans, Rhode Island Reds, Light Sussex, White Wyandottes, Khaki Campbell Ducks, Indian Runner Ducks, and Bronze Turkeys
E. K. Pennefather, Douglas street, Oxley Central ..	Pennefathers ..	White Leghorns and Australorps
G. Pitt, Box 132, Bundaberg ..	Pitt's Poultry Breeding Farm	White Leghorns, Brown Leghorns, Australorps, Langshans, White Wyandottes, Rhode Island Reds
G. R. Rawson, Mains road, Sunnybank	Rawson's ..	Australorps
J. Richards, Atherton	Mount View ..	White Leghorns and Australorps
H. K. Roach, Wyandra ..	Lum Burra ..	Australorps and White Leghorns
C. L. Schlencker, Handford road, Zillmere	Windyridge ..	White Leghorns
S. E. Searle, New Cleveland road, Tingalpa	Tingalpa ..	White Leghorns and Australorps

Name and Address.	Name of Hatchery.	Breeds Kept.
A. Smith, Beerwah	Endcliffe ..	White Leghorns and Australorps
A. T. Smith, Waterworks road, Ashgrove	Smith's ..	Australorps and White Leghorns
T. Smith, Isis Junction	Fairview ..	White Leghorns and Langshans
H. A. Springall, Progress street, Tingalpa	Springfield ..	White Leghorns
J. Steckelbruck, The Gap, Ashgrove	Cosy Nook ..	White Leghorns and Australorps
A. G. Teitzel, West street, Aitkenvale, Townsville	Crescent ..	White Leghorns
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkin's ..	White Leghorns and Australorps
P. and K. Walsh, Cleveland ..	Pinklands ..	White Leghorns
W. A. Watson, Box 365 P.O., Cairns	Hillview ..	White Leghorns
G. A. C. Weaver, Atherton ..	Weaver's ..	Australorps, White Leghorns, Buff Leghorns, Wyandottes, Anconas, Indian Game, Rhode Island Reds, Barred Rocks, Buff and Black Orpingtons
H. M. Witty, Kuraby ..	..	White Leghorns and Australorps
P. A. Wright, Laidley ..	Chillowdeane ..	White Leghorns, Brown Leghorns, and Australorps
R. H. Young, Box 18, Babinda	Reg. Young's ..	White Leghorns, Australorps, and Brown Leghorns

EGG PRODUCTION.

In breeding poultry, the farmer should exercise the utmost care in order to establish and maintain a high quality flock. Considerable progress has already been made in the improvement of breeding practice. Egg production has been increased from about 60 eggs to over 200 eggs per bird per annum, many individual pullets laying over 300 eggs in a year.

In dealing with the egg production in a flock of birds consisting of an equal number of pullets and hens, many authorities quote twelve dozen as a fair average annual production. It is doubtful, however, whether there are many poultry farmers in Queensland who obtain an average production per bird of less than thirteen dozen eggs yearly. In some experiments conducted at the Animal Health Station, using White Leghorns purchased from a poultry farmer as day-old chickens, the average production over the two years was 181 eggs per bird, the variations being—pullet year, from 194 to 209 eggs; second year, from 155 to 162 eggs. In these experiments, 116 pullets were used, and the average of the two years was over fifteen dozen eggs, and even these birds in their second year laid over thirteen dozen. The birds were kept under poultry farm conditions.

The poultry farmer should be able to obtain an average production at least equal to those figures. A constant high average production is only obtainable by good breeding, in conjunction with good management and feeding.

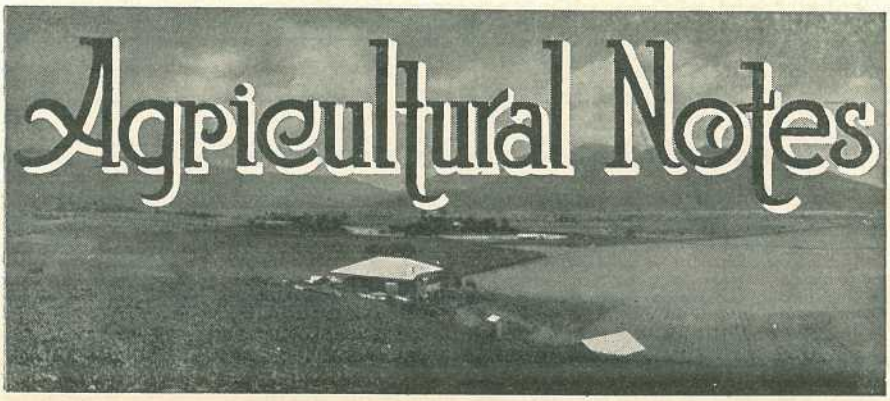
The chief considerations in establishing standards of good breeding are:—Type, constitutional vigour, action, and laying characteristics.

Having selected birds reasonably true to type, care must be taken to see that they are of strong constitutional vigour. This is indicated by the vitality, stamina, health, brightness, and alertness of the bird, and is of equal importance to the knowledge of the actual number of eggs laid. As an example, some years ago the first three birds in a laying test laid 302, 296, and 294 eggs, respectively. An examination of these birds at the conclusion of the test showed that the first and second birds were weak in constitution, whereas the third bird was very strong. All these birds were used as breeders, but while the progeny of the first and second hens were disappointing layers, the descendants of the third bird have performed very well in laying tests every year since. That example should emphasise very clearly the necessity for rejecting birds that are weak constitutionally.

Admittedly, it takes courage not to breed from a 300-egg bird. If such a bird produced the eggs without a heavy drain on her body she would be constitutionally strong. If, however, the bird rapidly loses condition during the year, she is obviously weak in constitution and, consequently, would probably be an indifferent breeder. Any bird that is unable to stand up to a heavy season's laying without losing condition cannot be expected to give high-laying progeny and should be discarded, irrespective of other characteristics.

Plate 5.
IN THE WHEAT LANDS OF THE DARLING DOWNS.

"Oh, I am the grass that has conquered man
I am the King that is Bread:
Your Armies and Fleets are but fragile things
That await a nod of my head."



Winter Preparation of Land for Maize.

TO get the best results, maize requires a good soil in which a plentiful supply of plant food is available—a condition which can only be brought about by an early and thorough preparation of the land before planting, attention to the cultivation of the crop itself, and to the eradication of young weeds during its early growth.

The land should be ploughed to a depth of at least 9 inches during winter and allowed to lie in the rough until early spring. The action of frost and rain will improve the texture of the soil and will leave it in a mellow condition. In early spring, the land should receive a second ploughing which, if possible, should be a cross ploughing. This should not be so deep as the first ploughing, and should be followed immediately by a harrowing and cross harrowing to work the surface soil into a fine tilth.

If a crop of weeds is turned under during the second ploughing, planting should not be carried out for at least a few weeks to allow the weeds to rot. On land which is not too heavy and moist, rolling is desirable as it consolidates the soil and helps to make a good firm seedbed. Rolling should always be followed by a light harrowing.

Preparation of Seedbeds.—The preparation of the seedbed is one of the most important points in the production of maize. No amount of after cultivation will undo the damage caused by planting in a badly prepared piece of land One has only to see the difference, not only in the growth, but also in the colour of the foliage between a crop grown on thoroughly prepared and another on hastily prepared land, to realise how great the effect is.

Give the young crop a chance to become well established in a well prepared seedbed—in which the young plants will not have to battle with a host of weeds—and the increased return will more than compensate for the extra time and labour spent.

Time to plant.—The best time to plant will naturally vary in different districts. In districts which have a long growing season and a comparatively regular rainfall, planting can be done whenever weather conditions are suitable, from August to late December.

Two very important points are—firstly, to choose a variety which is suitable for the district; and, secondly, to plan to have the crops tasselling, if possible, during periods in which rain can usually be expected. Maize must have moist conditions when tasselling, and if hot, dry winds occur during this period, the pollen is shed too early and fertilization cannot take place.

Seed should be sown in drills spaced 3 feet 6 inches to 4 feet apart. The wider spacing is essential for the tall-growing, late-maturing varieties. As a general rule, single spacing in the rows gives the best results, the grains being dropped singly, with a distance of approximately 12 inches between the grains for the quick maturing varieties, and from 15 to 18 inches for the late maturing varieties.

From 9 lb. to 12 lb. of seed is sufficient to plant an acre, when sown in this way.

The seed drill is the best implement for sowing maize, as it ensures a good even spacing and no loss of moisture occurs during planting, as is often the case where furrows have to be opened up for hand planting.

WINTER-GROWING RHODES GRASS RISKS.

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.

DO NOT WASTE FODDER.

Having experienced very favourable conditions during the last few months, most farmers are in the position of having a plentiful supply of grass for stock both for present needs and for winter.

In the circumstances, there is a tendency to underrate the importance of standing crops of summer fodder, and there is apt to be considerable waste. This is accentuated by the fact that crops such as Sudan grass, which have grown luxuriantly, and appear very difficult to handle, have been badly discoloured by rust and stain resulting from the humid conditions. The unattractive appearance of these crops should not be considered a good reason for waste or just turning the

cows in to pick up what they can. Stained Sudan is not palatable, and stock are just as likely to graze the grass on the headlands as eat the crop.

Silage or hay is the only method of turning this excess mature fodder into good account, and if the crop is stained it should be made into silage rather than hay. Sink a pit or build a silo stack immediately before the fodder becomes too dry. Later on when the next dry spell comes stock will turn to good and profitable account every scrap of surplus fodder whether it be grass or crop, rusted or clean, on every property in the Maranoa. But it should be made into hay or silage.

SWAMP LANDS.

Throughout a considerable stretch of the northern coastal country are many swampy areas of lesser or greater extent, particularly in the wetter regions where dairying is now being developed. These lands, to a large extent lying idle, could, at no great cost, be brought into production by planting them with para grass. This grass is easy to establish, because of its habit of rooting freely at the nodes. It is a rather coarse, vigorous grower, but has succulent stems and leaves and gives a large quantity of green material per acre. Under favourable conditions, yields of over 30 tons per acre have been obtained in one year. It is easily cut back by frost, and is, therefore, most suitable for the warmer localities.

This grass grows well in swampy localities, the runners going out even into deep water. Once established, it holds its own with any other grass. It has a further advantage in that it is credited with completely drying out marsh lands.

Para grass is usually propagated by runners, which root readily. These runners can be easily planted in furrows about 3 feet apart and about the same distance between the rows.

NOTICE TO READERS.

Because of the present necessity for strict economy in the use of paper, readers are requested to renew their subscriptions promptly. If renewals are unduly delayed, it may be impossible to supply back numbers of the Journal.

Address all renewals and other correspondence to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Planting the Queensland Nut.

WHERE it is proposed to plant an area of the Queensland Nut on open or forest ground, the land should now be got ready for planting time in August. Thorough deep ploughing of the area will be necessary to give the young trees a sufficient depth of a free soil in which to make a good root system. Subsoiling, if practicable, is also desirable.

When planting the young trees, a good hole, at least 2 feet across and 18 inches in depth, should be dug so that the tap root—which is comparatively long—can be properly set vertically into the ground, and the secondary roots distributed evenly around the plant.

In digging the trees from a seed-bed, care must be taken to remove them as carefully as possible, and to get a good length of the tap root with the plant. If the tap root is injured during digging, care should be taken to cleanly prune off the injured portion above the point of mutilation. If the tap root is too long, it can be pruned back about 8 inches.

It is advisable to soak the bed thoroughly the day before lifting the young trees, as this will make it easier to extract them from the ground without breaking the roots. Loosening the soil by making a trench, 15 to 18 inches deep alongside the rows, will simplify digging.

The trees should be planted in the ground at the same level as they were in the nursery bed, or perhaps a little deeper. Excessively deep planting should, however, be avoided.

The young trees should be well watered at the time of planting and also subsequently should the weather be dry.

On open land, shade should be provided by driving sufficient stakes into the ground around them to support a light hessian or bag cover.

Very often the main stem of the tree is allowed to grow too high before the top is pruned off. This will result in an ungainly, lanky tree.

With the Queensland Nut, as with fruit trees, pruning should aim at producing a sturdy-set tree, well-balanced and fairly open.

The young trees should not be allowed to grow beyond 2 feet in height on a single stem before the top is pruned back. Three side shoots nicely placed are later trained to make the framework of the tree.

Many young trees do not come away well on a single stem, this failure being due to a variety of causes, and a cluster of base shoots may arise as a consequence. It will then become necessary to select the strongest and best-situated shoot to form the tree, the others being cleanly cut away.

No matter whether the trees be planted amongst bananas, pine-apples, or other fruits, or in the open, a good stake should be driven alongside each tree, both to protect and support it. Many young trees are destroyed or permanently misshapen by injuries caused during cultural operations, and some protection is clearly necessary.

Where young trees have grown very densely through too many low shoots having been permitted to grow, a certain amount of thinning out of surplus main branches, or of the secondary growths, will be necessary to open up the trees to light and air.

CULTIVATING NEW BANANA LAND.

The benefit to be derived from a thorough breaking-up of the soil in new land should not be overlooked, especially as so much forest country is now being used for banana growing. If possible, breaking-up should be done before planting, but, with new land, time may not permit of this being done between burning-off and planting. Therefore, growers are advised to do this work during the first winter at the very latest, otherwise much damage may be done to the rooting system of the banana plants. Mattocks or fork hoes are the implements best suited for this work.

The land should be dug up to depth of not less than 8 inches. A great improvement in the physical and mechanical condition of the soil will be observed soon afterwards. Increased root development, making possible the drawing of plant food from a much greater area, will result in vigorous plant growth and the production of larger bunches and fruit of higher grade.

On many farms, small crops, such as peas and beans, are planted between the rows of young bananas and the thorough breaking-up of the soil will also benefit these crops, inducing quicker growth and greater bearing capacity.

The need of improving the humus content of the soil, particularly our forest soils, should be recognised. Humus can be added to the soil by burying the pea and bean plants after the pods have been picked. Shallow trenches should be dug across the slope of the land at convenient intervals, and the crop residues buried in the trenches under a covering of at least 2 inches of soil. The formation of these trenches across the slopes assists in preventing surface soil erosion.

Legumes such as beans and peas extract nitrogen from the air, and some of this nitrogen is returned to the soil in a readily available form

when the roots and vines of these plants are turned under. The soil is thus enriched with this valuable plant-food. In addition, the humus content, fertility, and moisture-retaining capacity—a very important factor in successful banana-growing—of the soil is increased, or at least, maintained.

Where the soil has been well dug, less chipping is required, because the rapid growth of the banana plant soon controls weed growth; besides, mechanical condition of the soil is improved, making chipping easier and thus reducing cultivation and production costs.

THE SUGAR BANANA.

The sugar banana has been grown profitably for all the "bunch" trade markets in Queensland. Small, sweet, and delicately flavoured, this fruit claims many staunch supporters.

For the production of this banana deep, warm alluvial flats, favoured with a generous rainfall or watered by irrigation, are most suitable. As with other varieties, good drainage is essential. As the sugar banana possesses a slender stem, damage by wind must be guarded against, and where there is no permanent windbreak it is worth while establishing one at the time of planting. For this purpose double border rows of lady fingers or sugar banana plants may be planted 7 feet apart in the row and 7 feet between the rows. The spacings in the inner row should actually lie between the spacings in the outside row—i.e., planted according to the septuple system. These two rows close quickly in towards each other and rapidly form an effective windbreak. Of course, the planting of a permanent windbreak of suitable trees would be far more valuable on account of their permanency, provided the cultivated area is reconditioned from time to time.

Prior to planting, the soil should be worked to a depth of at least 12 inches and reduced to as fine a tilth as possible. The holes for the young plants in the plantation area should be 14 feet apart, 15 inches deep, and 18 inches square. The rows should be lined out as straight as possible each way, thus allowing the greatest convenience in working horsedrawn cultivating implements.

Opinions differ somewhat in the matter of selection of planting material, but generally a vigorous young sucker about 4 feet high dug from a matured stool is most favoured. The top portion of the sucker should be removed, leaving a plant of 3 feet in height to place in the hole. The plant is placed in position within the hole and sufficient surface soil placed in around it to fill approximately two-thirds of the actual cavity. The rest of the cavity is filled in gradually as the ground is cultivated during the ensuing year. According to the quality of the soil, one or two followers are allowed to come away, and, normally, the first bunches will be harvested seventeen or eighteen months after planting.

Farmyard manure applied judiciously to sugar banana plantations will repay the grower handsomely. Light horsedrawn implements are satisfactory for cultivating, and green crops, such as Poona and field peas, are excellent soil invigorators, provided they can be turned back into the soil at the correct time—i.e., when still very soft and succulent.

As the sugar banana is usually marketed in the bunch and the fruit possesses a thin, delicate skin, special care in handling is necessary in order to obtain the best market returns.

PACKING SHEDS AND EQUIPMENT.

In many deciduous fruit districts marketing activities are now at a minimum, and it is now possible to overhaul, repair, replace, and add to the existing packing shed equipment. Many growers carry on, season after season, with make-shift equipment, when, for a little time and a small expenditure of money, a properly-equipped packing shed could be furnished.

Packing stands, nailing-down presses and benches, sizing machines, hammers, stencils, and other equipment should all be gone over and restored to a high state of efficiency. Simple designs for packing stands, nailing-down presses, and case-making benches can be procured, and are not hard to follow by anyone who is useful with a hammer and saw. Simple forms of sizing machines can also be made at home, while those growers who have commercial machines should overhaul them thoroughly, tightening up all screws and bearings, and, if necessary, renewing the padding in the bins and feed channels. Broken parts should be replaced and power plants overhauled. Broken handles in working tools should be renewed. Scrapers and packing needles should be sharpened and greased and packed away until required next season.

Complete sets of new stencils can be cut. A sheet of thin zinc, a small chisel, round, and flat fine-grain files, a hammer, and a piece of end-grain hard wood are the necessary tools. The designs of the letters to be cut can easily be made by obtaining stencils, and copying them on to the zinc in the design wanted. The stencilled letters are then cut out of the sheet of zinc with hammer and chisel, and, in that way, an excellent stencil is made. Stencils are easily obtained, and there is no need to use blue crayon for marking cases.

When the overhauling of plant has been completed, growers should turn their attention to the cleanliness of the packing shed. Old cases and packing-boxes should be repaired or burned, a close inspection of the cracks and crevices being made for pupating insects, such as codling moths. Any shed-stored fruit, which has rotted in the cases, should be removed and destroyed and the cases thoroughly sterilised by completely immersing them in a 5 per cent. solution of formalin for at least one minute. Floors and other parts of the building affected by juice from rotted fruit should also be treated.

Close attention to these details will enable growers to make a clear start at the next harvesting period.

TALL-GROWING VARIETIES OF BANANAS.

The standard commercial banana is the Cavendish, a relatively low-growing form.

Although some of the tall-growing types—such as the Gros Michel, Williams' Hybrid, Vernon, and Mons Marie—have been in cultivation in small areas for a long period, the demand for suckers of these varieties has only recently become of any consequence. In certain favoured localities, they may yet become as popular as the shorter-growing Cavendish.

The fruit of some tall-growing varieties compares favourably with the Cavendish in both size and quality, while their carrying capacity is frequently superior.

Under ordinary conditions, cultural methods applicable to the Cavendish banana can be used for all varieties. They respond to approved desuckering systems used for the Cavendish, and, generally speaking, yield a greater weight of fruit per acre. The returns per acre from tall varieties are thus sometimes better than those received from the more widely grown Cavendish.

PARSNIP-GROWING

Although the parsnip is a native of England and must therefore be classed as a temperate climate vegetable, it may be grown with reasonable success in the tropics during the winter season.

Soil for growing this vegetable should be deep, rich, and free. A good sandy loam gives excellent results. The soil should be prepared some months previously by trenching or cultivating deeply, and incorporating a heavy dressing of stable manure. Organic manures should never be applied in considerable quantities immediately before planting this crop, as they frequently induce forking of the roots. At the end of the wet season the ground should be thoroughly worked up and reduced to a very fine tilth. The seed is then sown thinly and very lightly raked over, after which the soil should be rolled or well packed down with the back of a spade along the drills. The packing is necessary to ensure close contact between the seeds and the soil. A light covering of old horse manure well crumbled or old sawdust will assist germination by preventing the caking of the surface soil.

As soon as the seedlings are well up, thin them out where they are over-crowded, and when about 4 to 6 inches high thin out finally to about 8 inches apart.

Parsnip seed is usually of rather poor germinating capacity, and is practically useless unless quite fresh.

WIND BREAKS FOR BANANAS.

As growers will soon be clearing land to plant fresh areas, the necessity of retaining a belt of scrub about 2 chains wide around new fallings 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, wind breaks 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 Java 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.

The Fruit Market.

J. H. GREGORY, Instructor in Fruit Packing.

WITH cold seasonal conditions prevailing, fruit sales have had a tendency to slow up at lower price levels.

Following on the warning given growers in last month's notes, attention is again called to the widespread practice of sending immature fruit to Southern markets. Pineapples, papaws, and bananas often drop in price at this period of the year because of this practice. Queensland growers have almost a monopoly in tropical fruit supplies to Southern markets, so the unwisdom of spoiling a grand opportunity for obtaining the best from the markets is obvious. Competition is said to be the keynote of business, and, probably, Queensland producers of tropical fruits would be more easily persuaded to do the correct thing if there were more competition to meet. In all our fruit production we have always been able to hold our own without trouble in the competitive field, so why not in the commercial sphere?

Ruling market prices during the last week of June, 1940—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: Small, 11s. to 16s.; Sixes, 14s. to 16s.; Sevens, 14s. to 21s.; Eights and Nines, 18s. to 22s.

Sydney.—Cavendish: Sixes, 14s. to 19s.; Sevens, 18s. to 21s.; Eights and Nines, 20s. to 27s.

Melbourne.—Cavendish: Sixes, 18s. to 21s.; Sevens, 20s. to 23s.; Eights and Nines, 23s. to 25s.

Lady's Finger.—3d. to 9½d. dozen.

Pineapples.

Brisbane.—Smoothleaf, 4s. to 8s. case; loose, 1s. 6d. to 5s. dozen; Ripley, 4s. to 6s. case; 1s. to 3s. 6d. dozen.

Sydney.—Smoothleaf, 8s. to 13s. case.

Melbourne.—Smoothleaf, 8s. to 12s. case; specials higher.

Papaws.

Brisbane.—Yarwun, 5s. to 7s. tropical case; Locals, 2s. 6d. to 3s. bushel.

Sydney.—8s. to 10s. per tropical case.

Melbourne.—8s. to 12s. per tropical case.

Custard Apples.

Brisbane.—2s. 6d. to 3s. half-bushel.

Monstera Deliciosa.

Brisbane.—2s. 6d. to 4s. dozen.

Strawberries.

Brisbane.—4s. to 10s. dozen cartons.

Sydney.—Trays, 4s. to 9s.; Boxes, 8s. to 16s. dozen.

Avocados.

Brisbane.—6s, to 9s. half-bushel.

Sydney.—8s. to 10s. half-bushel.

Passion Fruit.

Brisbane.—First grade. 7s. to 8s. half-bushel; second, 5s. to 7s. half-bushel.

Melbourne.—9s. to 11s. half-bushel.

OTHER TROPICAL FRUITS.

Cape Gooseberries.—6d. to 7d. lb.

CITRUS FRUITS.

Oranges.

Brisbane.—Navels, 6s. to 9s. bushel case; Commons, 4s. to 6s. bushel case.

Mandarins.

Brisbane.—Emperor, 4s. to 7s.; Glens, 7s. to 11s.; Scarlets, 4s. to 7s.

Sydney.—Emperor, 6s. to 9s.; Glens, 8s. to 13s.; Scarlets, 6s. to 10s.

Melbourne.—Emperor, 8s. to 10s.; Glens, 10s. to 12s.

Grape Fruit.

Brisbane.—6s. to 9s. per bushel.

Lemons.

Brisbane.—5s. to 10s. bushel.

Sydney.—6s. to 10s. bushel.

DECIDUOUS FRUITS.

Apples.

Brisbane.—Jonathan, 6s. to 12s.; Granny Smith, 6s. to 11s.; Delicious, 6s. to 12s.; French Crab, 5s. to 9s.; Democrat, 6s. to 9s.; Cleopatra, 6s. to 10s.; Sturmer, 6s. to 8s.

Pears.

Brisbane.—Packham's, 6s. to 7s.; Winter Cole, 9s. to 11s.; Glean Morceau, 8s. to 11s.; Winter Nelis, 8s. to 11s.

Tomatoes.

Brisbane.—Ripe, 4s. to 6s.; Green, 2s. to 3s.

MISCELLANEOUS VEGETABLES.

Cucumbers.—10s. to 12s. bushel.

Pumpkins.—4s. to 5s. bag.

Marrows.—1s. to 4s. dozen.

Lettuce.—3d. to 1s. 6d. dozen.

Cabbages.—2s. to 3s. dozen.

Cauliflowers.—4s. to 7s. dozen.

Beans.—*Brisbane,* 4s. to 7s. sugar-bag; *Sydney,* 4s. to 8s. case; *Melbourne,* 4d. to 6d. lb.

Peas.—5s. to 9s. sugar-bag.

Beetroot.—3d. to 9d. bundle.

Parsnips.—9d. to 1s. 6d. bundle.

Carrots.—3d. to 9d. bundle.

Rhubarb.—1s. to 1s. 6d. bundle.

Celery, Local.—1s. to 2s. bundle.

SOUTHERN.

South Australian Celery.—10s. to 15s. crate.

MILK IN THE HOME—A CORRECTION.

In the article "Problems of Keeping Milk in the Home," by Dr. O. Kudelka, page 553, in the June issue of this Journal, an inadvertent transposition of figures occurred (see page 554, Q.A.J., June, 1940).

Following are the corrected tables:—

Figures for Pasteurised Milk.

	Time Examined.	Atmospheric Temperature. Degrees F.	Bacteria Count.
1	9.0 a.m.	70·3	4,300
2	11.0 a.m.	76·3	7,300
3	1.0 p.m.	77·0	19,000
4	3.0 p.m.	75·9	22,000
5	5.0 p.m.	73·8	122,400
		Refrigerator Temperature. Degrees F.	
6	5.0 p.m.	56·0	2,900

Figures for Raw Milk.

No.	Time Examined.	Atmospheric Temperature. Degrees F.	Bacteria Count.
1	8.30 a.m.	67·9	12,000
2	10.30 a.m.	70·2	164,000
3	12.30 p.m.	71·0	920,000
4	2.30 p.m.	70·7	1,200,000
5	4.30 p.m.	69·0	2,960,000
		Refrigerator Temperature. Degrees F.	
6	4.30 p.m.	56·0	14,000

Sugar Levies.

(Abbreviated Notice.)

1940 SEASON.

Regulations under "*The Primary Producers' Organisation and Marketing Acts*, 1926 *to* 1938," have been approved, providing for levies on suppliers of cane to sugar-mills at the following rates for the season 1940 [the figures for 1938 and 1939 are given for comparison purposes]—

Name of Mill.	General Levy by Queensland Canegrowers' Council.	Administrative Levy by District Executive.	Administrative Levy by Mill Suppliers' Committee.	Special Levy by Mill Suppliers' Committee.	Total Levies for 1940.	Total Levies for 1939 given for comparison.	Total Levies for 1938 given for comparison.
	d.	d.	d.	d.	d.	d.	d.
Mossman Central	¾	1½	..	..	2¼	2½	2
Hambledon	¾	¼	¼	..	1¼	1	1¼
Babinda Central	¾	¼	⅛	..	1⅛	⅞	1 1/16
Mulgrave Central	¾	¼	..	.	1	¾	1
South Johnstone Central	¾	1½	⅛	.	2⅜	2	2¼
Goondi	¾	1½	..	.	2¼	2	2¼
Mourilyan	¾	1½	..	.	2¼	2	2¼
Tully River Central	¾	1½	..	..	2⅛	2¼	2⅛
Macknade	¾	¾	¾	..	2¼	1½	1⅝
Victoria	¾	¾	¾	..	2¼	1½	1⅝
Kalamia	¾	..	1	¼	2	2	1⅝
Pioneer	¾	..	1	½	2¼	2¼	2¼
Inkerman	¾	..	¾	..	1½	1	1½
Invicta	¾	..	1	..	1¾	2	2¼
Proserpine Central	¾	1	..	..	1¾	1½	1¾
Cattle Creek Central	¾	¾	¼	..	1⅝	1½	1½
Plane Creek Central	¾	¾	¼	..	1⅝	1⅝	1⅝
Marian Central	¾	¾	¼	..	1⅝	1½	1½
North Eton Central	¾	¾	½	..	1⅝	1	1¼
Pleystowe	¾	¾	1	½	2⅝	1¾	2
Racecourse Central	¾	¾	½	..	1⅝	1½	1¾
Farleigh	¾	¾	¼	..	1⅝	1½	1¾
Qunaba	¾	½	¼	..	1½	2¼	2¾
Bingera	¾	½	½	..	1¾	2¼	2¾
Fairymead	¾	½	½	..	1¾	2½	3
Gin Gin Central	¾	½	¾	..	2	2½	3
Millaquin	¾	½	¼	..	1½	2	2½
Isis Central	¾	½	..	..	1¼	1	1¼
Maryborough	¾	½	½	½	2¼	1¼	1½
Mount Bauple Central	¾	½	¼	..	1½	1½	1½
Moreton Central	¾	..	1	½	2¼	2¼	2¾
Rocky Point	¾	..	¾	..	1½	1½	1¾
Eagleby	¾	..	..	..	¾	1½	1

No poll will be taken in respect of the General Levy of ¾d. per ton (first column) for the Queensland Cane Growers' Council, or for the administrative levies by District Executives or Mill Suppliers Committees (second and third columns).

In the fourth column, the levies on cane supplied to the Kalamia, Pioneer, Pleystowe, Maryborough, and Moreton Central Mills will be used in defraying the costs of employing farmers' representatives at those mills for the current season. In the case of these levies, growers may

petition for a poll, and the petition must be signed by at least 100 or 50 per cent. (whichever shall be the less) of the growers who are suppliers of cane to the five mills concerned.

In addition to the foregoing levies, the undermentioned Mill Suppliers' Committees are empowered to make particular levies on growers within each of the following districts, at the following rates:—

Name of Mill Suppliers' Committee and Mill to which Cane is Supplied.	Description of District upon the Growers wherein Levies will be made and description of Cane upon the Growers whereof Levies will be made.	Amount of Levy per ton of Cane Supplied.	Purposes of Levy.
		d.	
Isis Central ..	All cane consigned on the railway by Government trucks from Booyal, Junien, and Marule Sidings on the Dallarnil railway.	¼	To be used for administrative purposes by Booyal Branch of Isis Central Mill Suppliers' Committee.
Mount Bauple Central	Yerra-Mungar district within the boundaries of the parishes of Gungaloon, Denison, Doongul, Woocoo, and Young	¼	To be used for administrative purposes by Yerra-Mungar District Branch of Mount Bauple Mill Suppliers' Committee.
Maryborough ..	That part of the Pialba district within the boundaries of the parishes of Urangan, Vernon, and Bingham, county March	1	To be used for administrative purposes by the Pialba District Branch of Maryborough Mill Suppliers' Committee.
Maryborough ..	Maryborough district within the boundaries of the parishes of Tinana, Maryborough, Bidwell, Elliott, Young, and Walliebum, county March	¼	To be used for administrative purposes by Maryborough District Branch of Maryborough Mill Suppliers' Committee.
Racecourse Central	All cane hauled over the Silent Grove tramline	2	To defray the costs of employing a farmers' representative of the section of growers concerned at the Racecourse Mill for the current season.
Marian Central ..	All cane loaded at Dow's Creek and Langdon Sidings	½	To be used for insurance and weighbridge maintenance by the Dow's Creek and Langdon Branch of the Marian Central Mill Suppliers' Committee.
Gin Gin Central ..	All cane delivered at Morganville Railway Station by growers in the Goodnight district	½	To defray the cost of maintaining a loading derrick at Morganville Railway Station by the section of growers concerned.

Growers are given the opportunity of petitioning for a poll to decide whether or not the above levies shall be made. The petition must be signed by at least 100 or 50 per cent. (whichever shall be the less) of the growers who are cane suppliers within any of the areas concerned.

All petitions must reach the Secretary for Agriculture and Stock, Department of Agriculture and Stock, Brisbane, on or before the 15th July, 1940.

Full particulars of these Regulations appear in the *Government Gazette* of the 13th June, 1940, or may be obtained on application to the managers of the various sugar-mills in Queensland or to the undersigned—

R. P. M. SHORT, Under Secretary,
Department of Agriculture and Stock,
Brisbane.

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, and the Ayrshire Cattle Society, production charts for which were compiled during the month of May, 1940 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
Mature Cow (Standard, 350 lb.).				
Nellie 4th of Alfa Vale (365 days)	W. H. Thompson, Alfa Vale, Nanango	23,889·3	889·754	Reward of Fairfield
Alfa Vale Laura	W. H. Thompson, Alfa Vale, Nanango	19,752·65	718·55	Reward of Fairfield
Applegarth Jill	J. A. Heading, Highfields, Murgon	14,339·2	459·385	Hillcrest Duke
Glengarry Gem	G. Waugh, Glengarry, Peeramon	10,969·4	428·236	Jean 7th's Prince of Blacklands
Senior 4 Years (Standard 330 lb.)				
Blacklands Jennie 9th	T. Ryan, Allora	10,272·5	353·749	Hillview Daphne's Reform
Junior, 4 Years (Standard, 310 lb.).				
Highfields Princess 4th	J. A Heading, Highfields, Murgon	9,981·35	384·644	Headlands Hero
Senior, 3 Years (Standard, 290 lb.).				
Navillus Vera 7th	Con. O'Sullivan, Navillus, Ascot, Greenmount	11,267·2	415·41	Alfa Vale Re Nell
Braemar Merry Maid	W. Henschell, Yarranvale, Pittsworth	9,119·76	393·888	Jamberoo Banker 15th
Springleigh Red Rose 5th (229 days)	H. F. Moller, Boonah	9,313·00	390·652	Burradale Roland
Springleigh Red Rose 4th	H. Moller, Springleigh, Boonah	8,411·00	328·26	Greyleigh Governor
Arolla Gentle	J. Crookey, Allora	7,404·4	318·398	Navillus Rosebud Sheik
Junior, 3 Years (Standard, 270 lb.).				
Sunnyview Bess 6th	J. Phillips and Sons, Sunnyview, Wondai	9,772·5	362·184	Sunnyview Commodore
Claredale Duchess	W. Henschell, Yarranvale, Pittsworth	9,451·86	351·126	Wilga Vale Royal Lad
Claredale Lovely	W. Henschell, Yarranvale, Pittsworth	9,477·56	321·847	Wilga Vale Royal Lad
Penrhos Elva 6th	Alex. Sandilands, junr., Penrhos, Wildash	6,540·16	306·796	Penrhos Blossom Prince
Pilton View Olga 4th	P. D. Fiechtner, Ascot, Greenmount	6,346·1	284·253	Navillus Venie's Sheik
Claredale June II. (223 days)	W. Henschell, Yarranvale, Pittsworth	8,231·69	279·828	Wilga Vale Royal Lad
Rosehill Stella 2nd	W. Flesser, Boyland	7,541·6	271·981	Dnalwon Count

JERSEY.

MATURE COW (STANDARD, 350 LB.).

Cream Lass of Calton	L. J. Comiskey, Warra	10,209·8	605·907	Retford Meteor
Trecarne Chimes 2nd	T. A. Petherick, Lockyer	8,773·95	518·188	Trecarne Golden King
Glenview Hawthorn	F. P. Fowler and Son, Glenview, Coalstoun Lakes	10,514·95	469·276	Trinity Governor's Hope
Trinity Lady Victoria	J. Sinnamon and Sons, Moggill	8,446·36	381·614	Some Hope
Trinity Dreaming Darling	J. Sinnamon and Sons, Moggill	7,599·61	374·477	Trinity Dreaming Pioneer
Trinity Joyful Lady	J. Sinnamon and Sons, Moggill	7,718·16	374·257	Some Hope
Trinity Gallant Lady	J. Sinnamon and Sons, Moggill	7,288·28	365·303	Some Hope
Glenview Tinkle Bell	F. P. Fowler and Son, Glenview, Coalstoun Lakes	7,552·15	356·026	Trinity Governor's Hope

SENIOR, 4 YEARS (STANDARD 330 LB.).

Westbrook Tulip 63rd	Farm Home for Boys Westbrook	8,921·55	414·613	Trinity Ginger Boy
Trinity Lady Gleam	J. Sinnamon and Sons, Moggill	8,505·67	362·542	Some Hope
Ladybird of Hopeview (240 days)	H. T. C. Gibson, Kingaroy	6.167·05	340·859	Lady's Reminder of Hopeview

JUNIOR, 4 YEARS (STANDARD, 310 LB.).

Brooklands Royal Chimes	N. C. Webb, Beaudesert	8,450·65	479·315	Retford Earl Victor
Westbrook Sweet Suey 2nd	Farm Home for Boys, Westbrook	8,785·00	421·638	Oxford Golden Dreamer
Westbrook Tulip 68th	Farm Home for Boys, Westbrook	6,994·2	367·261	Oxford Gem's Ambassador

SENIOR, 3 YEARS (STANDARD, 290 LB.).

Trecarne Dairy Maid	T. A. Petherick, Lockyer	8,718·5	495·957	Trinity Some Officer
Brooklands Royal Babette	N. C. Webb, Beaudesert	8,718·75	452·313	Retford Earl Victor
Hopeview Duchess	H. T. C. Gibson, Kingaroy	7,115·08	401·404	Reminder of Calton
Glenview Rosalyn	F. P. Fowler and Son, Glenview, Coalstoun Lakes	7,497·4	382·652	Trinity Governor's Hope
Glenview Sweet Sultane	F. P. Fowler and Son, Glenview, Coalstoun Lakes	7,047·15	371·937	Trinity Governor's Hope

JUNIOR, 3 YEARS (STANDARD, 270 LB.).

Cooceall Belle	E. G. Rothery, Ringarooma, Archer	7,404·7	413·122	Booser of Cooceall
Trinity Noble Hazelette	J. Sinnamon and Sons, Moggill	7,804·39	403·941	Trinity Nobly Born
Trinity Mountain Fern	J. Sinnamon and Sons, Moggill	5,639·73	287·594	Trinity Royal Sovereign

General Notes

Staff Changes and Appointments.

The undermentioned inspectors under *The Diseases in Stock Acts, The Slaughtering Act,* and *The Dairy Produce Acts,* Department of Agriculture and Stock, have been appointed also inspectors under *The Brands Acts,* as from the 15th June:—G. K. L. Clark, V. Kleinschmidt, D. S. Robertson, W. F. Snewin, A. H. Strohfeldt, E. J. Taylor.

Constable T. H. Widt, of Lowood, has been appointed also an inspector under *The Brands Acts.*

A. Carpenter, S. J. Claydon, J. N. Sutton, B. G. Weber, and G. Frankham, relieving officers of the Stock Branch, Department of Agriculture, New South Wales, have been appointed also inspectors under *The Diseases in Plants Acts.*

The appointment of Mr. S. O. D. Arthur, Yelarbon, as honorary protector under *The Fauna Protection Act,* has been cancelled.

Mr. A. F. Moodie, dairy inspector, at present attached to Mackay, is to be attached to Hughenden.

Mr. R. W. Bambrick, inspector of stock, at present attached to Hughenden, is to be attached to Gayndah.

Mr. C. R. Tummon, slaughtering inspector, at present attached to Oxley Bacon Factory, is to be attached to Mackay.

Mr. S. M. Seamer, inspector of stock, at present attached to Wandoan, is to be attached to Boondooma.

Mr. E. C. Dunn, inspector of stock, at present attached to Boondooma, is to be attached to Wandoan.

Mr. T. J. Donohue has been appointed an assistant cane tester at Babinda.

Mr. J. G. Auld, of Maryvale, Warwick, has been appointed an honorary ranger under *The Native Plants Protection Act* and honorary protector under *The Fauna Protection Act.*

Protection of Native Plants.

An Order in Council has been issued under "*The Native Plants Protection Act of* 1930," declaring that all species of the native plants helichrysum and helipterum (everlastings) shall be protected under the abovementioned Act throughout the whole State of Queensland for an unlimited period.

Mill Suppliers' Committees and District Executives.

The regulations in force under the Primary Producers' Organisation and Marketing Acts relating to the election of mill suppliers' committees and district canegrowers' executives have been revised, and the regulations in their amended form will provide for optional preferential voting in respect of future elections of these committees and executives.

Gumming Disease of Sugar Cane.

A Proclamation has been issued under "*The Sugar Experiment Stations Acts,* 1900 *to* 1938," declaring portion of the Hambledon mill area to be a quarantine area in respect of gumming disease of sugar-cane. The nature of the quarantine shall be the prohibition of the removal from such area of any sugar-cane (except for milling purposes at the Hambledon mill) unless written permission has been granted by the Minister or an inspector.

Grant to Wheat Growers.

An Order in Council has been issued under "*The Wheat Stabilisation Act of* 1938," determining that the basis on which the moneys granted to the State by the Commonwealth Government by way of financial assistance shall be distributed shall be a payment to each wheatgrower (in addition to payments already made) of 74/75ths of a penny per bushel of wheat harvested on or after the 1st October, 1938, which has been sold or delivered for sale during the year ended 30th December, 1939.

Orders in Council issued in May and November last provided for payments of 2d. and 1 9/16d. per bushel, respectively.

Answers to Correspondents

Starr Burr—A Bad Weed Pest.

H.P. (El Arish)—

The specimen is Starr Burr (*Acanthospermum hispidum*), a native of tropical America, now naturalised in North Queensland, and one of our worst weed pests. In some parts of North Queensland it is called Bindy-eye, but the use of this name is wrong, as it belongs more correctly to a different plant altogether, a native of Western Queensland. So far as we know, the plant has not been declared a noxious weed within your Shire, and if you desire to have it so declared you should make a request to your local shire office. It has been gazetted in a number of northern shires. We have seen the plant as far south as Brisbane, but it does not seem to gain a hold here as it does in the northern parts of the State.

The plant should succumb fairly readily to spraying with weak arsenical solutions, but these are poisonous to stock.

Jaragua Grass.

G.B.B. (Rockhampton)—

We were very pleased to receive the specimens of Jaragua grass. They represent *Hyparrhenia rufa*, a native of tropical Africa and introduced into Brazil. The Index Kewensis gives its distribution as tropical Africa and South America, but we think most authorities agree now that the plant is an introduction into the latter country, in spite of the fact that it is so common there, and the outstanding grass in Southern Brazil and Paraguay. It has been introduced into Queensland at odd times both from South America and from Africa. Of course, it is very hard to judge from appearances, but we should hardly think the grass as good as some of our native sorts, such as the Forest Blue Grass (*Bothriochloa intermedia*), which it resembles somewhat in growth.

White Spear Grass.

A.V.B. (Brookstead)—

The specimen is the white spear grass (*Aristida leptopoda*), a grass with a very wide distribution in Queensland on the black soil flats, and a menace in many localities. The grass belongs to the genus *Aristida*, represented by a number of species in Australia, mostly in Queensland, and of very poor fodder quality. The present one is perhaps the best of a bad group and has a certain amount of fodder value in its young stages. Probably the only means of controlling it would be cultivating the ground and sowing with a better species, such as Rhodes Grass.

We hesitate to recommend winter grasses under Queensland conditions, but think you might try *Urochloa panicoides*, with and without ploughing. This grass has become very abundant on the Downs during the last few years, and has gained some reputation as a control of mint weed. Seed is not stocked by nurserymen.

A Poisonous Plant—Cestrum Parqui.

H. (Wilston)—

Your specimen is Green Cestrum, *Cestrum Parqui*, a native of Chile and the Argentine, now a common naturalised weed in Queensland. It is abundant in vacant allotments in Brisbane. It is very poisonous to stock, and we have had several cases of dairy cows having been killed by it. It has been gazetted a noxious weed throughout the State.

Hairy Indigo.

H.S.B. (Mundubbera)—

The specimen is Hairy Indigo (*Indigofera hirsuta*), a native of Eastern Australia, but with a very wide distribution in tropical Asia and Africa. In Queensland it is commonly seen as a weed of old cultivation areas, but is not confined to such places. It is very common in the central district, particularly about Rockhampton, but we have had reports from there that stock, especially horses, are quite fond of it. Some of the indigos are useful herbs in the mixed native pasture in Northern Queensland, but we are rather doubtful about the value of the present one.

Rural Topics

Drought Feeding of Sheep.

Here is the experience of a Queensland grazier who has had a lot to do with feeding sheep in dry times. He favours the automatic system of feeding instead of the old "feeding the fowls" maize method. In the last prolonged dry spell in his district he saved his sheep and marked 100 per cent. of lambs as a result of "automatic" feeding, plus, of course, sound and careful management. He fed his sheep from log troughs at the rate of 2½ oz. a day on a variety of mixtures, and under the guidance of a stock nutritional adviser. Amongst the ingredients of the mixtures used were cottonseed meal, calphos bone meal, salt, molasses, barley meal, wheat meal, and meat meal.

His belief in self-feeding by sheep in a dry time is based on these reasons—

No mustering (you don't knock your sheep about and run their energy off); lower labour cost; less cost for material feed; and greater improvement in the condition of the sheep.

How Fruit Growers Save Soil and Water.

Contour planting is just as effective in the orchard as in the paddock as a means of conserving soil moisture and preventing erosion. Experiments in hilly country in parts of Queensland and of New South Wales have given abundant proof of this fact.

Orchardists have quickly realised the benefits to be derived by following the system. Until a few years ago orchards, irrespective of location, slope of the land, and other features, have been planted on the square, or on some similar method. This had the effect of quickening the run-off of rain water and consequent loss of soil. If land is to retain its productivity, the soil must be maintained—especially that thin layer of top soil.

Contour planting definitely prevents—or at least minimises—loss of soil by erosion and ensures the retention of moisture in both soil and subsoil. In New South Wales, contour-planted orchards are the rule in all the main tableland fruit-growing regions. Apart from new orchards planted on the contour, many growers have established contour banks in old orchards, realising that the conservation of soil is of paramount importance. As time goes on, the results from contour planting and contour banking will be reflected in improved health, productivity, and life of the fruit tree.

More Salt for Horses.

One occasionally hears farmers complain that their animals chew rags, sticks, old car batteries, and other material that may be lying around. One farmer tried to sue the Canadian Government because his heifer died from licking a freshly-painted surface. The Government officials replied that he would not have lost his heifer if he had kept her supplied with a mixture of salt and sterilised bonemeal. In all these cases, the animals are trying to supply their systems with some mineral substances which have not been supplied by their owners.

It would seem that in view of the great value, low cost and ease with which salt can be obtained, regular and sufficient supplies for live stock should always be made available. However, the fact remains that a correct and regular ration of salt is often forgotten, and, unfortunately, live stock have no way of expressing their desires other than by manifesting some symptoms like licking freshly-painted fences, chewing bones, or swallowing metal odds and ends—or by decreased efficiency in production.

During hot summer weather, working horses are frequently subject to very trying conditions. One of the most frequent causes of lowness in condition and undue fatigue in horses is due, primarily, to a lack of recognition of needed salt requirements. Horses should be allowed access to salt at all times. A very satisfactory idea is to keep a salt block under cover in the paddock, and, in addition, it is a good thing to provide, say, a block of salt in each manger. Otherwise, a tablespoon full of salt may be added to the horse's feed. Few farm animals will eat too much salt if given free access to it. Only a salt-starved animal will eat more than it should. Often, a finicky feeder and shy drinker will show increased appetite when allowed free and regular access to salt.

Farm Notes

AUGUST.

AUGUST is normally a dry month throughout the State, but where good soil moisture exists the coming of warmer weather will cause an increase in weed growth, necessitating the use of cultivators in growing crops and the land being prepared for maize, cotton, sorghums, and other crops.

Well-worked land having reserves of subsoil moisture is essential for satisfactory subsequent growth, as spring-sown crops often have to withstand moderately dry conditions until the occurrence of early summer storms.

In coastal districts where frost is not liable to occur, early sowings of maize, sorghums, millets, sudan grass, pumpkins, and melons may be made. Arrowroot, artichokes, and sweet potatoes also may be planted, but unless ample soil moisture is present, there is little to be gained by very early sowings before the soil is sufficiently warm, as later-established areas will often make rapid growth, equalling or excelling that of earlier sowings.

Potato planting will be commencing in the Downs, South Burnett, and other areas away from the coast, where July plantings are likely to be affected by frost, the bulk of the spring crop being established during July and August.

Potatoes thrive in thoroughly prepared virgin soils, more especially deep, friable well-drained alluvial loams and scrub soils, which indicates that the maintenance of a supply of humus in the soil is essential for profitable yields.

Seed potatoes for this crop are usually obtained from the Southern States, where certified seed true to varietal type is now available, but, to prevent seed-borne disease, all seed should be treated either by the hot formalin or corrosive sublimate methods, full particulars of which are obtainable from the Department. Whole sets are preferable, but cut sets may be used for the spring planting, dusting the cut surfaces with wood ashes or slaked lime shortly after cutting.

Dairy farmers in many districts will now be utilising early sown winter fodder crops to maintain production, and where crops are grazed, temporary subdivision will prove valuable in conserving growth and providing fresh pastures at frequent intervals.

On the Downs the grazing of wheat areas, intended ultimately for grain, should have ceased by late July, otherwise probable yields are likely to be considerably reduced.

QUEENSLAND SHOW DATES FOR 1940.

The Queensland Chamber of Agricultural Societies has issued the following list of show dates for 1940:—

JULY.

Ayr	12th and 13th
Rosewood	12th and 13th
Cleveland	12th and 13th
Townsville	16th to 18th
Maleny	18th and 19th
Charters Towers	29th to 31st
Gatton	23rd to 25th
Innisfail	25th, 26th, and 27th
Caboolture	26th and 27th
Atherton Show	30th and 31st
Crow's Nest	31st and 1st August
Maleny Show	abandoned for 1940

AUGUST.

Home Hill	2nd and 3rd
Pine Rivers	2nd and 3rd
Royal National, Brisbane	12th to 17th

SEPTEMBER.

Imbil	6th and 7th
Canungra	7th
Pomona	13th and 14th
Rocklea	14th
Malanda Show	18th and 19th
Beenleigh	20th and 21st
Ithaca	28th

OCTOBER.

Warwick Rodeo	5th and 7th

Orchard Notes

AUGUST.

THE COASTAL DISTRICTS.

Last month's notes are repeated.

CITRUS fruits, with the exception of the late-ripening varieties, will have been harvested by now, and cultural operations should be receiving attention.

Trees which show indications of impaired vigour will require a somewhat heavy pruning both in respect to thinning and shortening the branches. Where the trees are vigorous and healthy a light pruning only will be necessary, except in the case of the Glen Retreat mandarin. The densely-growing habit of this variety leads to a profusion of weak shoots, which, if allowed to develop, will cause overbearing with resultant small and inferior fruit at an early age.

Where trees show signs of failing, look for collar rot at or near ground level. The roots should be examined for disease, and in the North Coast districts for the citrus root bark channeller. A light application of paradichlorobenzene buried a few inches deep in circular drills around the tree and with the surface stamped firmly has been recommended for controlling this pest. The distance between the circular drills should be not more than 18 inches, and care should be taken to prevent the crystals of paradichlorobenzene from coming into contact with the roots. It may be necessary to repeat the application after an interval of three or four weeks.

Where it is necessary to control brown spot of the Emperor of Canton mandarin, black spot, melanose, and scab, the fungicide should be applied at the correct time. The control measures recommended are—

For Brown Spot.

Home-made cuprous oxide mixture (3-80)—

(1) At ½ to ¾ petal fall (i.e., as soon as the majority of the fruit has set)
(2) Two months later.
(3) In late February.

For Black Spot.

Home-made cuprous oxide mixture (3-80)—

(1) At ½ to ¾ petal fall.
(2) Two months later.

For Melanose and/or Scab.

Home-made cuprous oxide mixture (3-80)—

(1) At ½ to ¾ petal fall.

Certain applications of these copper sprays may be combined with various insecticides and mixtures to correct mineral deficiencies, such as zinc. Information regarding these mixtures can be obtained from this Department.

Where for any reason healthy trees of vigorous constitution are unprofitable, they may be headed back—in fact, have the whole of the top removed—leaving a few selected arms. All other branches should be cut away at their source of origin. The three or four remaining arms, of which lengths will vary from 2 to 4 feet, will form the future framework of the tree. Care must be taken to cover the whole of the exposed bark with a suitable coating of whitewash to prevent sunburn. The numerous shoots which will grow from main arms should be suitably reduced, leaving from two to four on each arm. Under favourable conditions, these will be in a fit condition to receive selected buds from desirable trees by the following autumn. It is desirable that when shoots intended for budding have attained a length of from 6 to 9 inches, their terminals should be nipped off in order to stiffen their growth and guard against the possibility of damage by strong winds.

Fertilizing should be finished as early as possible, the mixture for the spring application being high in readily available nitrogen. Ploughing should then be completed, the depth being regulated by local conditions and the nature of the

original preparation of the land. After the ploughing, the land should be worked down to a fine state of tilth. On hillside orchards, attention should be given to the control of possible storm waters. Cultivation should be so arranged as to form shallow drains or banks along the tree rows and across the heaviest slope, leading into suitable side drains which may be grassed to prevent erosion.

The planting of trees may be continued and, with the exception of custard apples, expedited. The attention of citrus growers should be confined to varieties suited to their local conditions.

The pruning of grape vines should be completed, and where cuttings for planting are required these should be selected, trimmed, and heeled-in in slightly dry soil. Canes intended for cuttings should not be allowed to lie about and dry out, but should be treated the day they are severed from the plant. Cuttings are frequently made too long. From 10 to 12 inches is a suitable length which allows for insertion in the soil so as to permit of the top bud, with a short section of the internode, protruding above the surface.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

ALL pruning other than that applied to peaches and varieties which are late in coming into growth should be finished this month, and the planting of young trees, if not already done, should no longer be delayed. Early planting is preferred, the sooner after the fall of leaves the better. When there are indications of the swelling of the buds, the time is opportune for working over unprofitable trees, where the stock is reasonably vigorous. Strap grafting, as advised by the local field officers, is the most satisfactory method of top-working deciduous trees.

The pruning of vines should be postponed as long as circumstances permit, and these can only be gauged on actual observation as they are subject to much variation.

The usual winter working of the land is essential for the retention of moisture and aeration of the soil, but in shallow soils in which many orchards are planted, deep working is most detrimental. The matter of seedling stocks for apples and the inferior plants frequently received from Southern nurseries prompts a query as to how many seeds have been stratified for spring planting, and whether any effort is being made towards raising a local supply of nursery stock.

HOW THE FARMER FEEDS THE ARMY.

Many thousands of young Queenslanders have gone into camp for an extended period of military training, and everyone has brought with him a very healthy appetite. Any good cook will tell you that the most direct route to a man's heart is through his "tummy." As laid down by Napoleon, an army marches on its stomach; in other words, success for the soldier comes from being well fed.

The Diggers of to-day have the advantage of all the recent discoveries of those whose job it is to make a scientific study of food values.

In each of the camps, standard menus have been arranged according to the foods available in seasonable supply. Included in every bill of fare are eggs, bacon, many kinds of vegetables, beef, mutton, fruit, cheese, milk, and butter. Apples, oranges, lettuce, tomatoes, and beetroot for cold salads are supplied regularly to every mess. Butter is on the mess tables at two meals every day. Selected men have been trained as cooks, and a chief instructor in cooking is attached to each camp.

It will be comforting, too, to the relatives and friends of the young soldiers to know that the camps are now equipped with cold storage for perishable foods, and no effort is being spared to feed the men well and safeguard their health in every possible way.

Going through the menu for each meal in camp it will be observed how much our potential defenders depend on the farm for their all-round efficiency.

In Queensland, no less than in the Old Country, our success in the war depends on the industry of our primary producers, and although the plough is the accepted symbol of the peace for which we are striving, it also is, paradoxically, one of our most powerful weapons of war.

Maternal and Child Welfare.

Under this heading is issued each month an article, supplied by the Department of Health and Home Affairs Maternal and Child Welfare Service, dealing with the welfare and care of mother and child.

CLOTHES AND SHOES FOR THE OLDER CHILD.

IN our article last month we talked about clothing the youngest member of the family—this month we shall give some consideration to suitable clothing for the just-as-important older brother or sister. Many of the clothes worn in childhood may delight the eye, but they are not always simple and practical enough to be comfortable, and they sometimes ignore the fact that the main purpose of clothing is to keep the body warm.

The toddler should be dressed in loose, light, comfortably-fitting garments without elastics or tapes, and they should allow for complete freedom of movement. Clothing which is too heavy will tend to limit movement and make the child easily tired, so even winter clothing should be light in weight. Toddlers' clothes should hang from the shoulders and be easy to put on and take off, so that the child may learn to undress himself. This he should be taught to do by the time he is four years of age. Children like doing things for themselves, and so buttons and other fastenings should not be too difficult for tiny fingers to deal with. The clothes should be simple to wash and iron, because with a happy healthy child they may have to be changed several times a day. They should not be expensive, because then mother will "fuss" over them, and so limit the child's activities and worry him unnecessarily. It is no use supplying expensive clothes for a small person who, we hope, will grow normally and very soon grow right out of them. And while on this business of growing, do not forget to provide extra

width and length for the child's filling out. Plenty of room should be allowed at the armholes so that he may use his arms freely, and planty of room in the fork of small trousers or panties. It is not uncommon to see small children, particularly boys, who suffer from irritation and soreness because their rompers or trousers are so short in the leg and hitched up so tightly round the waist that the seams rub them in the fork.

Stockings should be made of wool as a rule and should have square toes and fit easily. In summer they can be quite short, but in winter it is better to have them long enough to pull up to the knees. It is a very foolish practice, and one frequently observed, that a mother muffles up a small child's body in winter in heavy overcoat and scarf, but has skirts or knickers so short, and cotton socks so brief, that the whole of the child's legs are bare, cold, and blue. Leggings or gaiters can be worn in winter when the weather is really cold or wet.

Making Clothes for Toddlers.

Overcoats.—These must be light in weight, porous, warm, and washable in all cases. They should be double breasted to allow of letting out later, and fur and other trimmings should be avoided. Armholes should be large and well cut. An inverted pleat at the back or a flared skirt allows room for movement and sitting.

Dresses for Toddlers and Little Girls.

Materials:

For cold weather.—Viyella, wool, voile, or any other good woollen, wool and cotton, or wool and silk material.

For hot weather.—Washing cottons, silk, or artificial silk.

The dresses should have good turnings for lengthening the skirt and bodice, and also at the side seams and sleeve seams. Avoid tight armholes and wrist bands. Necks should be fitted carefully, and should never have draw strings, and elastic should never be used to hold up a puffed sleeve. Short magyar sleeves cut in one with the bodice are cool and comfortable, and epaulette sleeves are suitable for muslin or other light material. Warm dresses should have long sleeves gathered into wristbands. Button and buttonholes make the best fastenings.

Knickers for Little Girls.

These are often made to match the dresses, although artificial silk stockinette in summer and silk and wool stockinette in winter are also recommended. Pure wool stockinette tends to thicken with washing and is unnecessarily warm. The back of the knickers must be cut longer and slightly wider than the front to allow ample room for bending and sitting. Avoid elastic at waist and knees. It is not necessary for a knicker waist to be tight enough to hold the garment in place. The knickers should be attached to a liberty bodice by means of buttons and buttonholes.

Liberty Bodice.

Aertex cellular cotton is an ideal material for a liberty bodice, as it is porous and easily washed. Avoid heavy calico. Double material is unnecessary. The bodice should fit the child's figure loosely and should extend well below the waist. Stitch bands of wide tape along the whole length to take the strain at all points where garments are

buttoned on to it. It is most important that there should be two sets of knicker buttons on the bodice, the one above the other, so that the length may be adjusted for use with knickers which vary in size.

(To be continued next month.)

You may obtain information on all matters concerning infant and child welfare by visiting the nearest Maternal and Child Welfare Centre (Baby Clinic), or by writing to the Sister in Charge, or by communicating direct with the Maternal and Child Welfare Centre (Baby Clinic), Alfred street, Fortitude Valley, N.1, Brisbane.

IN THE FARM KITCHEN.

FOR WINTER MENUS.

Apricot Short-cake.

Sift 2 level cups plain flour, 4 level teaspoons baking powder, ½ level teaspoon salt, and 2 level tablespoons castor sugar. Beat 1 egg and add to ½ cup milk. Rub 3 level tablespoons butter into dry ingredients and form into a soft dough with the milk. Divide mixture into two equal parts. Press one part into a well-greased and floured sandwich tin. Spread with butter, then cover with the remaining dough, which must be rolled out smoothly to fit the tin. Bake in a hot oven for about twenty-five minutes. While still hot, split through the middle and spread with apricot jam, to which is added 1 tablespoon whipped cream and a few finely-chopped almonds. Join together and sprinkle well with icing sugar.

Raspberry Muffins.

Sift together 1½ level cups plain flour, 2½ level teaspoons baking powder, ½ level teaspoon salt; add ¼ cup sugar. Beat 1 egg well, add 1 cup milk and 2 level tablespoons butter (melted), mix lightly and place a little in a well-greased and floured patty or small muffin pan, add 1 teaspoon raspberry jam, then place another spoonful of mixture on top. Bake in a hot oven for about twenty minutes.

Jam Rollettes.

Sift 2 cups flour, 4 level teaspoons baking powder, a good pinch salt. Rub in 2 level tablespoons butter, add 1 tablespoon sugar. Beat 1 egg well, add ¾ cup milk, and then add it to dry ingredients, forming it into a soft dough. Flatten out to about ¼ inch thick; spread with jam, roll up, and cut off pieces about 1 inch thick. Place in well-greased and floured patty pans and bake in a hot oven for about fifteen minutes. Dust with icing sugar and serve with boiled custard.

Baked Jam Roll.

Sift 8 oz. flour, 1 level teaspoon baking powder, and a pinch salt together; rub in 5 oz. butter until mixture looks like fine breaderumbs. Form into a firm dough with about ½ cup water. Roll out and spread with jam, roll up and place in a well-greased loaf-tin and bake in a moderate oven for about forty-five minutes.

Baked or Steamed Jam Sponge.

Place 2 tablespoons jam in a well-greased basin for boiling or a round cake-tin for baking. Sift 1¼ level cups plain flour, 1½ level teaspoons baking powder, ¼ teaspoon salt, and ½ cup castor sugar. Beat 1 egg well and add ½ cup milk, a little essence to taste. Add this to flour, beating well all the time. Melt ¼ cup butter, add to mixture, and beat until creamy. Pour into prepared moulds and bake in a moderate oven for about forty-five minutes or steam for one hour.

Steamed Jam Roll.

Chop 4 oz. suet finely; sift 8 oz. flour with 1½ teaspoons baking powder and a good pinch salt. Add 1 tablespoon fine white soft breaderumbs and prepared suet. Form into a firm dough with a little water or milk. Knead a very little. Roll out and spread with apricot jam, sprinkle with a few chopped walnuts or coconut. Roll up and place in a greased nut loaf tin. Cover with greased paper and steam for one and a-half hours. Turn out and serve with a light cream sauce.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF MAY IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1940 AND 1939, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	May.	No. of years' records.	May, 1940.	May, 1939.		May.	No. of years' records.	May, 1940.	May, 1939.
North Coast.	In.		In.	In.	*South Coast—contd.*	In.		In.	In.
Atherton	2·24	39	3·56	2·69	Gatton College ..	1·58	41	0·86	0·71
Cairns	4·47	58	2·38	2·63	Gayndah	1·56	69	0·61	0·28
Cardwell	3·58	68	3·44	1·55	Gympie	2·82	70	1·20	1·35
Cooktown ..	2·77	64	0·99	1·04	Kilkivan	1·84	61	1·35	1·57
Herberton ..	1·70	54	2·35	0·80	Maryborough ..	2·99	69	1·32	2·15
Ingham	3·70	48	4·00	2·43	Nambour	5·10	44	3·18	4·77
Innisfail	12·37	59	7·51	11·33	Nanango	1·52	58	1·78	0·49
Mossman Mill ..	3·67	27	2·28	0·96	Rockhampton ..	1·60	69	0·31	1·41
Townsville ..	0·95	69	0·16	0·45	Woodford ..	3·02	53	0·90	2·61
Central Coast.					*Central Highlands.*				
Ayr	1·06	53	0·28	0·12	Clermont ..	1·29	69	0·27	0·37
Bowen	1·25	69	0·79	0·60	Gindie	0·91	41	..	0·09
Charters Towers ..	0·76	58	0·29	0·23	Springsure ..	1·23	71	0·58	0·82
Mackay P.O. ..	3·82	69	2·05	6·28	*Darling Downs.*				
Mackay Sugar Experiment Station	3·41	43	1·18	7·11	Dalby	1·27	70	2·80	0·01
Proserpine ..	4·20	37	2·82	3·46	Emu Vale ..	1·13	44	0·76	0·12
St. Lawrence ..	1·74	69	0·34	0·75	Hermitage ..	1·18	33	..	..
South Coast.					Jimbour	1·16	52	3·79	0·20
					Miles	1·51	55	0·72	1·09
Biggenden ..	1·76	41	0·41	1·32	Stanthorpe ..	1·78	67	0·55	0·55
Bundaberg ..	2·61	57	0·73	0·84	Toowoomba ..	2·17	68	1·74	1·38
Brisbane	2·80	88	0·71	1·35	Warwick	1·49	75	0·97	0·08
Caboolture ..	2·98	53	1·37	2·30	*Maranoa.*				
Childers	2·14	45	0·19	0·91					
Crohamhurst ..	5·06	47	2·21	4·31	Bungeworgorai ..	0·95	26	..	0·20
Esk	2·03	53	1·32	0·93	Roma	1·43	66	0·65	0·49

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—MAY, 1940.

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	29·95	81	71	84	12	65	22	99	10
Herberton	..	72	56	79	13, 15	36	23	235	11
Rockhampton	30·10	79	58	86	1	49	23	31	7
Brisbane	30·16	73	55	82	1	49	19	71	6
Darling Downs.									
Dalby	30·18	72	45	79	5	34	19	280	6
Stanthorpe	..	65	38	71	17	25	19, 26	55	3
Toowoomba	..	66	48	72	17	43	19	174	5
Mid-Interior.									
Georgetown	29·99	87	57	91	1, 3, 4, 15	45	22	1	1
Longreach	30·10	80	49	86	4	41	22	3	1
Mitchell	30·16	72	43	78	17	30	27	90	3
Western.									
Burketown	30·02	85	60	91	17	49	22	5	2
Boulia	30·11	78	50	84	7, 8, 28, 29	44	14, 22, 23	10	1
Thargomindah ..	30·14	73	50	84	16	37	27	12	2

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	July, 1940.		August, 1940.		July, 1940.	Aug., 1940.
	Rises.	Sets.	Rises.	Sets.	MOONRISE. Rises.	Rises.
					a.m.	a.m.
1	6·44	5·8	6·33	5·24	2·23	3·48
2	6·44	5·9	6·33	5·25	3·17	4·41
3	6·44	5·9	6·33	5·25	4·12	5·33
4	6·44	5·9	6·32	5·25	5·7	6·22
5	6·44	5·10	6·31	5·25	6·2	7·9
6	6·43	5·10	6·30	5·26	6·54	7·54
7	6·43	5·10	6·30	5·26	7·43	8·38
8	6·43	5·11	6·29	5·26	8·31	9 21
9	6·43	5·12	6·28	5 26	9·14	10·5
10	6·42	5·12	6.27	5·27	9·54	10·50
11	6·42	5·12	6·27	5·28	10·39	11·37
					p.m.	p.m.
12	6·42	5·13	6·26	5·29	11·22	12 27
					p.m.	
13	6·41	5·13	6·24	5·29	12·5	1·19
14	6·41	5·14	6·23	5·30	12·51	2·13
15	6·41	5·14	6·23	5·30	1·39	3·8
16	6·41	5·15	6·22	5·31	2·30	4·2
17	6·40	5·15	6·21	5·32	3·23	4·56
18	6·40	5·15	6.20	5 32	4·18	5·49
19	6·40	5·16	6·19	5·32	5·14	6·41
20	6·40	5·17	6·18	5·33	6·9	7·33
21	6·39	5·18	6·17	5·33	7·3	8·23
22	6·38	5·18	6·17	5·34	7·56	9·14
23	6·38	5·19	6·16	5·34	8·48	10·5
24	6·38	5·19	6·15	5·34	9·39	10·57
25	6·38	5·20	6·14	5·34	10·30	11·49
26	6·37	5·20	6·13	5·35	11·22	..
27	6·37	5·20	6·12	5·36	..	12·42
					a.m.	a.m.
28	6·36	5·21	6·11	5·37	12·14	1·35
29	6·36	5·22	6·10	5·37	1·6	2·28
30	6·35	5·22	6·8	5·37	2.0	3·19
31	6·34	5·23	6·7	5·38	2·54	4·9

Phases of the Moon, Occultations, &c.

5th July.	●	New Moon	9 28 p.m.
12th „	☽	First Quarter	4 35 p.m.
19th „	○	Full Moon	7 55 p.m.
27th „	☾	Last Quarter	9 29 p.m.

Perigee, 10th July, at 5.0 a.m.
Apogee, 25th July, at 3.0 p.m.

Toward the end of May Venus (the Evening Star) shone with exceeding lustre. Now the brilliant planet is getting rather too far into the bright twilight to be well seen, but it is interesting in a telescope as it appears as a beautiful crescent. Our sister world is passing in between us and the sun; therefore, the sun shines chiefly on the other side, leaving only a slender crescent sun-lit visible from planet earth. This crescent will grow more slender until Venus is lost in the sunset glow. On 26th June Venus will pass nearly between the earth and the sun. We shall then be at our nearest to the earth's twin sister planet, which will be only about 27,000,000 miles away. Were we native to that brilliant world "We should see the globe we groan in, fairest of the evening stars." From Venus the earth would appear a splendid object, very much larger than Venus ever appears to us, as the whole earth would be illumined by the sun, whereas, when Venus is at its nearest to us, she is quite invisible as the night side only is presented this way. After Venus has passed the sun, she will, of course, soon appear on the other side, and we shall have Venus as the Morning Star, rapidly becoming very brilliant.

Jupiter is the bright "star" rising a little before dawn and may be seen near the dying moon on 3rd June.

Midwinter will occur when the sun reaches his farthest north during the first hour of 22nd June. After that date, very gradually at first, he will begin to move southward to bring us the summer.

The sun is a little out of the centre of the almost circular path the earth makes around him. Therefore, at one time of the year we are farther from him than at any other. On 4th July this will occur and then we shall be 94,500,000 miles from the great power station from whence the earth draws all her energy. This great distance, which is more than a million and a-half miles greater than the average, does not cause the cold of winter, for in the northern hemisphere it is mid-summer.

4th Aug.	●	New Moon	6 9 a.m.
10th „	☽	First Quarter	10 0 p.m.
18th „	○	Full Moon	9 2 a.m.
25th „	☾	Last Quarter	1 33 p.m.

Perigee, 6th August, at 1.0 p.m.
Apogee, 22nd August, at 8.0 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.