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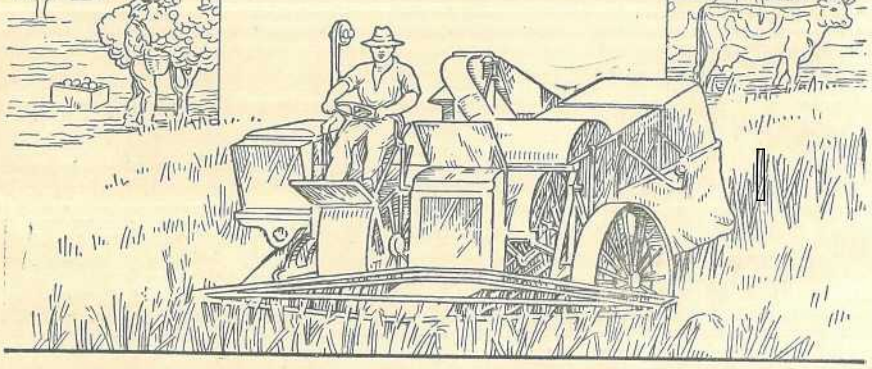

JANUARY TO JUNE, 1940

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QUEENSLAND AGRICULTURAL JOURNAL

Vol. LIII. 1 JANUARY, 1940 Part 1

Event and Comment

The King Speaks to His People.

"I BELIEVE in my heart that the cause which binds together my peoples, and our gallant and faithful Allies, is the cause of Christian civilisation. True civilisation can be built on no other basis," said His Majesty King George VI. in his Christmas broadcast to the Empire.

"Let us remember this through the dark times ahead of us, and when we are making peace, for which all men pray. The New Year is at hand. We cannot tell what it will bring," said his Majesty.

"The festival which we know as Christmas is above all a festival of peace and of the home. Love of peace is profound among all free peoples, because this alone gives security to the home. True peace is in the hearts of men. It is a tragedy that this Christmas there are powerful countries whose whole direction and policy are based on aggression and suppression of all we hold dear for mankind.

"It is this that has stirred our peoples and given them unity unknown in any previous war.

"We feel in our hearts that we are fighting against wickedness. This conviction has given us strength from day to day to persevere until victory is assured.

"At home we, as it were, are taking the strain for what may lie ahead, resolved and confident. We look with pride and thankfulness on the never-failing courage and devotion of the Royal Navy, upon which throughout the last four months has burst a storm of ruthless, unceasing war.

"When I speak of our navy, I mean all the men of our Empire who go down to the sea in ships—the mercantile marine, mine sweepers, trawlers, and drifters.

"From the senior officers to the last boy who has joined up I send a message of gratitude and greeting to everyone of this great fleet, from myself and from all my peoples.

"The same message I send to the gallant Air Force, which, in co-operation with the navy, is our sure shield of defence. Daily they are adding to their laurels and to those their fathers won.

"I would send a special word of greeting to the armies of the Empire, to those who come from afar, and in particular to the British Expeditionary Force. Their task is hard. They are waiting. Waiting is a trial of nerve and discipline, but I know that when the moment comes for action, they will prove themselves worthy of the highest traditions of their great service.

Empire One Purpose.

"To all who are preparing themselves to serve their country on sea or land or in the air, I send greetings. At this time the men and women of our far flung Empire are working at their several vocations with one and the same purpose, all are members of a great family of nations which is prepared to sacrifice everything that the spirit of freedom may be saved to the world.

"Such is the spirit of the Empire, the great Dominions, India, and every colony, large or small. Offers of help have come from all alike. For this the Mother Country can never sufficiently be grateful. Such unity of aim in effort has never been seen in the world before.

"If the New Year brings peace, how thankful we shall be. If it brings continued struggle, we shall remain undaunted.

"Meanwhile, I feel that we all shall find a message of encouragement in the lines which, in my closing words, I should like to read to you:—

> " 'I said to the man who stood at the gate of the year, 'Give me a light that I may tread safely into the unknown,' and he replied, 'Go out into the darkness and put your hand into the hand of God. That shall be to you better than light, and safer than a known way.'

"May that Almighty Hand guide and uphold us all!"

The Minister's Message.

SINCE last I had the privilege of addressing a New Year message to the farmers and graziers of the State, I have been on an overseas mission in quest of information of practical use to our agricultural and stock-raising industries. In pursuit of this knowledge,

I visited many countries with rural problems resembling our own. An opinion brought back is that our practices can be, in the main, compared with the methods in vogue in other lands and that our agricultural prestige does not suffer by such comparison. On the technical side, the work of our agricultural officers compares favourably with the work being performed overseas. In addition, for a variety of reasons, our agriculture is better circumstanced than is the position in some countries which I visited.

However, each country has some contribution to make to the well-being of world agriculture and many countries are capable of challenging us for agricultural markets. It is clear, therefore, that our policy must be in the direction of ever greater efficiency, more especially in our economic organisation. I am convinced that agricultural organisation will increase in importance as time goes on and the countries with the best organisation of its agricultural resources will eventually win in the world markets.

So far, the producers of Queensland have not lagged behind in this economic contest, but other countries are now putting on the pace. Nevertheless, with loyalty to the ideals of orderly marketing, I am sure we can continue to hold our own.

Probably the New Year will bring a degree of much-needed stability to our primary industries, but the need of the United Kingdom at the present will confer no rights in respect to the markets of the future. Our title to these markets will be the merit with which we perform our tasks of production during the war period.

On behalf of my officers and myself, I wish all our primary producers a happy and prosperous 1940.

Frank. W. Bulcock

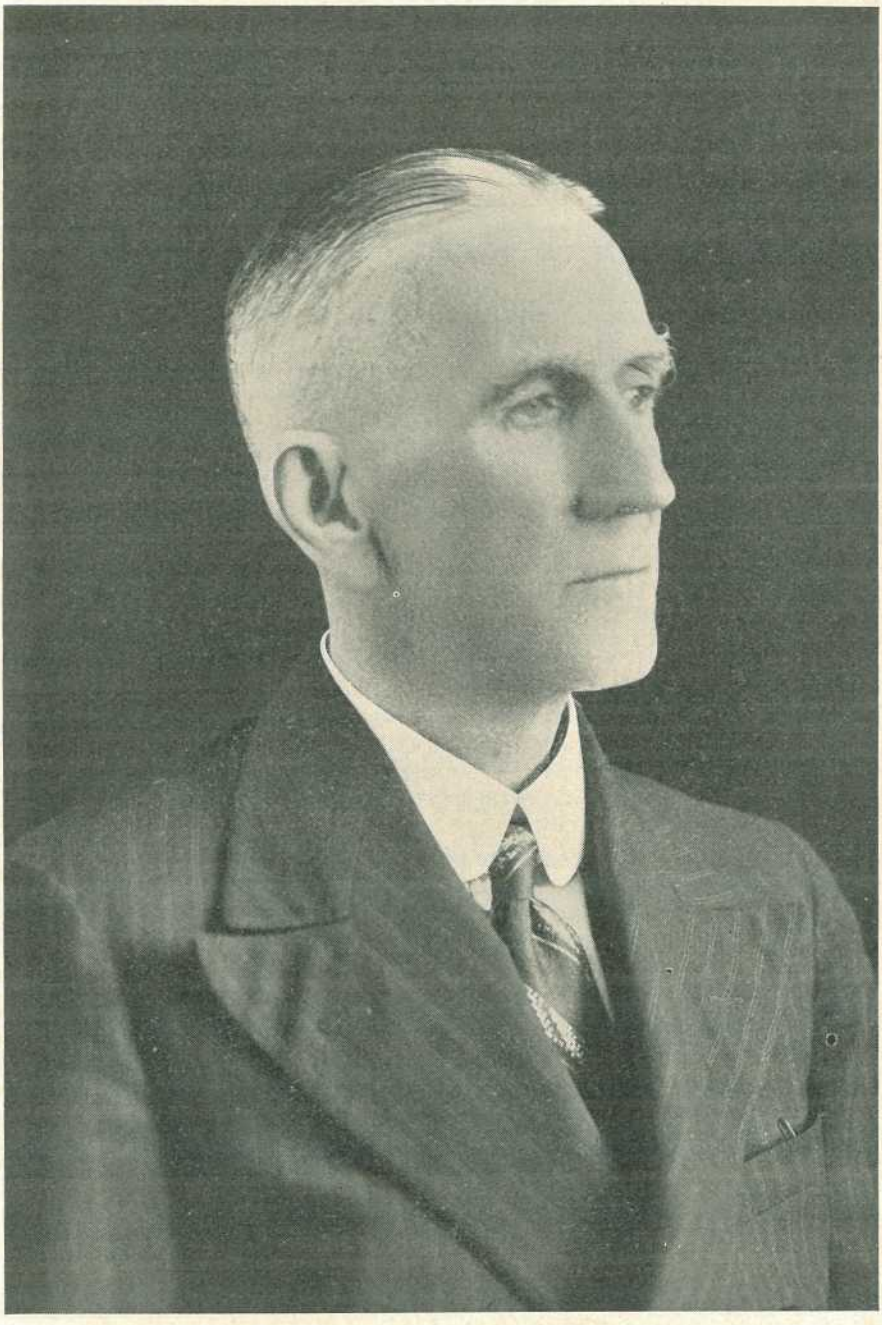

Plate 1.
MR. R. P. M. SHORT, Under Secretary, Department of Agriculture and Stock.

NEW DEPARTMENT CHIEF.

Appointment of Mr. Richard P. M. Short.

MR. Richard P. M. Short, who had been Acting Under Secretary of the Department of Agriculture and Stock since 16th February of last year, has been confirmed in the position of administrative head of the Department after more than 40 years' continuous service.

Mr. Short is the second of three generations who have occupied important positions in the State Public Service, his father having been Commissioner of Police, and a son, at present with the Second Australian Imperial Force enlisted for active service, is an officer of the State Insurance Department.

Mr. Short, who possesses a wide knowledge of men and affairs, has had special opportunity of gaining administrative experience in both major sections of the Department of which he is now the chief, having been an officer of the Stock Branch from 1898 until 1924, when he held the positions of senior clerk and registrar of brands. He also was secretary of the Cattle Tick Committee, which consisted of representatives of the Council for Scientific and Industrial Research and of the Queensland and New South Wales Governments.

While in the Stock Branch he edited "The Drovers' Guide," which was distributed amongst stock owners in this and other States of the Commonwealth.

Mr. Short was appointed senior clerk in the Department in 1925, and continued in that position until his appointment as chief clerk on 1st July, 1933.

Mr. Short also holds the following additional positions in the Department:—

Chairman of the Rural Development Board.

Member of the Standing Committee of the Australian Agricultural Council.

Member of the State Committee of the Council for Scientific and Industrial Research.

He is also trustee for parks and gardens under the jurisdiction of the Department and of certain properties resumed by the Department for experimental purposes.

In his earlier days he was connected with many sporting activities, especially cricket and tennis. He was a member and secretary of the Toombul Electorate Cricket Club in the heyday of that club's success. In latter years he has confined his sporting activities to the bowling green, as a member of the Booroodabin Bowling Club, on one occasion being a member of the champion rink of that club.

Pineapple Culture in Queensland.

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

(*Continued from page* 632, *December,* 1939.)

Chapter III.—VARIETIES OF THE PINEAPPLE.

Much confusion exists regarding the nomenclature of pineapple varieties, because nearly all of the leading varieties are known by different names in different countries. In England, the Smooth Cayenne, which is the favourite variety for hothouse culture, is known as the Kew pineapple, while in Malaya it is called the Sarawak; on the other hand, the Queen is referred to in South Africa as the Natal and in Queensland as the Rough-leaved or Common Rough variety. Some fifty or sixty so-called "varieties" have been listed and described at different times, but the number of commercially important varieties now in cultivation probably does not exceed six or seven.

Hume and Miller have classified the cultivated varieties of the pineapple into three horticultural groups, the representatives of each group resembling each other in general characteristics, viz., the Queen, the Cayenne and the Spanish groups. Included in the first-named group are the Queen and the Ripley Queen. The Smooth Cayenne is the only important representative of the second group, while the Red Spanish (sometimes known as Black Spanish or merely Spanish) is the type variety of the third group.

THE SMOOTH CAYENNE VARIETY.

The Smooth Cayenne variety is easily the most important of those grown at the present time, as it accounts for more than 80 per cent. of the total world production. Because of its size and shape and the texture and colour of its flesh the Smooth Cayenne is the preferred canning variety. Prior to the introduction of several new hybrids, it was the only variety grown for this purpose in Hawaii and it still constitutes the great bulk of the canned output from these islands. It is also the sole variety used for canning in Formosa, Queensland and the Philippines. In addition, most of the fresh pineapples shipped to European markets from the Azores and South Africa are of the Smooth Cayenne variety. Uncertainty exists regarding its origin, but its name suggests that it came from French Guiana. It was introduced into England from France about 1841 and most of the commercial plantings of this variety which are in existence to-day have stemmed from English stock, although Smooth Cayenne planting material is known to have been imported into the Azores from France in 1863. Presumably because it was at one time grown in hothouses at Kew Gardens, the Smooth Cayenne variety early became known in England as the Kew pineapple.

When and where Queensland obtained its first Smooth Cayenne plants is not recorded, but in all probability they were imported direct from England. It is unlikely that the first pineapples grown in this State were of the Smooth Cayenne variety, however, since records show that the original introduction of pineapple planting material into Queensland took place three years before the Smooth Cayenne was introduced into England. Nevertheless, it is known that the Smooth Cayenne was well established in Queensland by the middle of last century because,

in 1903, the existence was reported of plantations of this variety which had then been in production continuously for more than fifty years. At the present time, more than 90 per cent. of the pineapples produced in Queensland are of the Smooth Cayenne variety. In addition to it being the one used exclusively for canning, it is also the only one which is in demand on the fresh fruit markets of the Southern States.

Like all pineapple varieties, the Smooth Cayenne is not particularly stable, since it has a strong tendency to produce bud sports. Many of these differ from the parent only in minor characteristics and, consequently, are not readily apparent. Unless rigorous selection is carried out, however, there is a tendency for some of the more frequently occurring bud sports to be propagated at a faster rate than the original parent type, with the result that distinctive strains are developed. This is particularly true of sports which produce a relatively large number of slips. Over a long period, therefore, the type of Smooth Cayenne which predominates in one country or one locality, may exhibit characteristics which distinguish it from what is regarded as the same variety in other regions or localities. One strain may be characterised by a dwarf, stocky habit of growth, while another may be tall-stemmed and long-leaved. Differences between strains also occur with respect to sucker and slip production, and particularly with respect to the shape and size of fruit. Consequently, there is a considerable divergence of opinion as to what constitutes a typical Smooth Cayenne plant, although the characteristics of a desirable type are relatively easy to define. Such a plant should be stocky and robust, with wide, tapering leaves. The stem should not exceed 12 inches in length and the fruit stalk not more than 6 inches. On fruiting plants, the leaves should average about seventy in number, and the longest should measure between 3 and 3½ feet in length and about 2½ inches in width at their widest part. The upper surface of these leaves should be a dark-olive green in colour with an irregular purplish-red streak extending the length of the leaf but confined largely to the central portion. Ordinarily, though not always, a few spines may occur near the tips or the bases of the leaves, but otherwise the leaf margins should be spineless.

The number of flowers in a single flower spike may vary within wide extremes, depending on environmental conditions, but normally it should lie between 130 and 170. The flowers are a light purple or violet in colour, while the bracts in which they are borne are bright red. The weight of the mature fruit varies somewhat in accordance with the number of flowers making up the flower head, but should average about 6 lb. on well-grown plants. Weights of 14 lb. and over have been recorded for individual fruits. The shape of the fruit may show considerable variation in different strains of the Smooth Cayenne variety. A shape approximating to the cylindrical is preferred for canning. (Plate 2.) Owing to the tendency of large-sized fruit to taper towards the apex, however, shape is to some extent determined by the growth conditions obtaining during the period of fruit development. In south-eastern Queensland the tendency to a conical shape is most pronounced in winter crop fruits and these, for reasons which have previously been outlined, average larger in size than those which mature during the warmer months. However, the pronounced conical shape which is characteristic of some types of Smooth Cayenne, even during the summer, is definitely undesirable, as is also a squat barrel shape, and both of

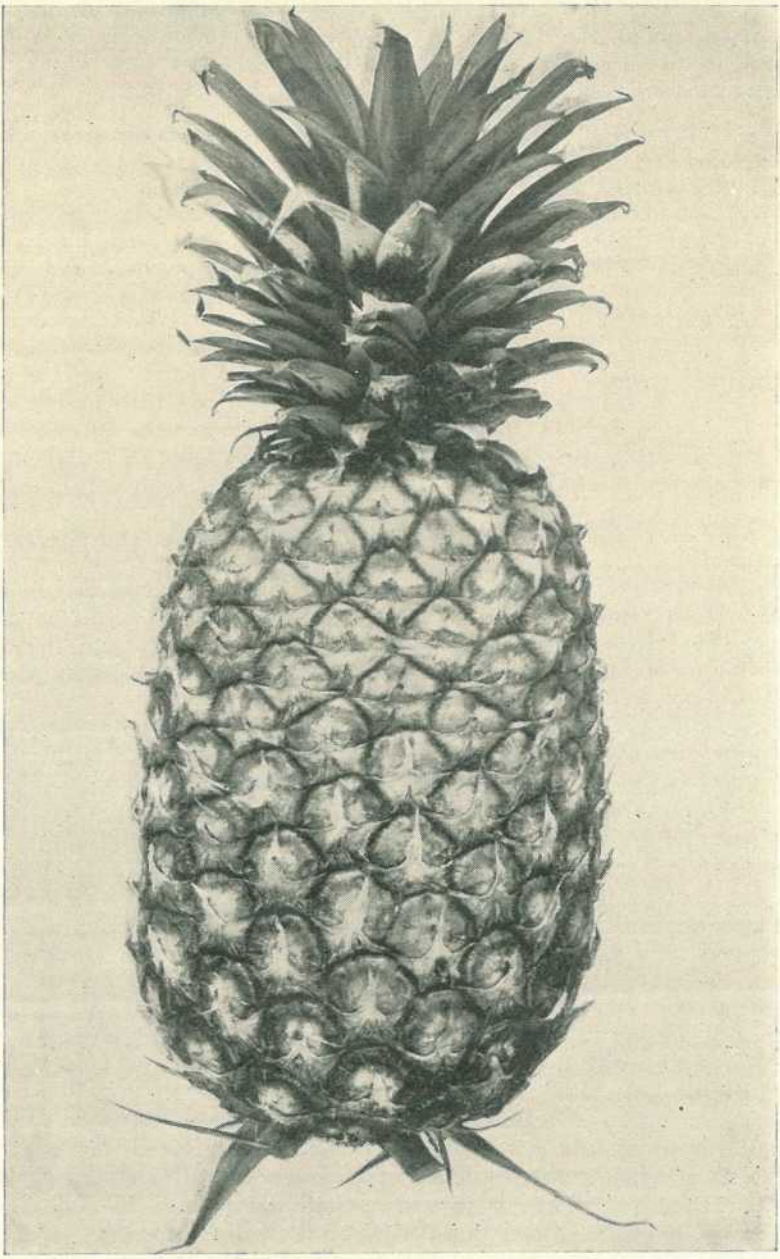

Plate 2.
THE SMOOTH CAYENNE PINEAPPLE.

these tendencies are generally hereditary in character. Because they are smaller, fruits from ratoon fields are usually more cylindrical in shape than those harvested at the plant crop.

A fruit weighing around 6 lb. should have a diameter of approximately 5 inches and should taper slightly towards both ends, but more so towards the apex. It should measure between 8 and 9 inches in length, excluding the crown, and should have square shoulders. The surfaces of the fruitlets or "eyes" should be broad and flat and the tips of the protecting bracts should project only very slightly at the centres of the eyes. Externally, the colour of the ripening fruit is normally deep yellow or coppery-yellow at the base or on one side, shading to green on the other portions, but it tends to become fully coloured as the advanced stages of maturity are reached. The flesh of the fruit should be firm, close textured and juicy, and light yellow in colour. The flavour varies with the conditions under which the fruit is grown and, in South-Eastern Queensland, with the season of the year in which it matures. Summer fruits are generally sweet and full-flavoured in contrast to winter fruits, which are often sub-acid and insipid. The size of the crown varies widely under different nutritional conditions; in shade, or when the nitrogen supply is excessive, it may be as long as the fruit itself. The crown should be single and neckless. Preferably three but not more than four slips should be produced from low down on the fruit stalk and two to three suckers from low on the stem.

In south-eastern Queensland, fruits of the Smooth Cayenne variety mature throughout the year, but chiefly during the months of February, March and April (summer crop), and July, August and September (winter crop). Occasionally, abnormally dry conditions during the early summer months may so delay flowering that the ripening of the main winter crop extends well into October. Fruits which mature between the summer and winter cropping periods are known as "intermediate," and these are absorbed almost entirely by the fresh fruit trade, often at relatively high prices. Intermediate fruits are scarcest during the months of December and May, but the recent introduction of an artificial method for inducing flowering at pre-determined periods is now tending to relieve the customary market shortages during these months, particularly that experienced in May.

VARIETIES OF THE QUEEN GROUP.

The Queen variety was probably the first to be brought under cultivation, and it is said to have been grown in England under hothouse conditions as early as 1688. The delicate and distinctive flavour of most of the varieties belonging to the Queen group have long made them highly prized for table use in all tropical countries, but they have a limited market value because of their relatively unattractive appearance, small size and generally poor shipping qualities. In Queensland, however, where their merits have long been recognised, they are preferred for dessert purposes to the Smooth Cayenne, although this preference does not extend to the Southern States. Varieties of the Queen type are not now used for canning in Queensland, but a strain of the Queen variety known as the "Natal" is used to a limited extent for this purpose in South Africa.

The first pineapples grown in Queensland were probably of the Queen type, of which two varieties have been introduced, namely, the

Queen proper, locally known as the Rough-leaved or Common Rough, and the Ripley Queen. Apart from the Smooth Cayenne, these two varieties, or selections from them, are the only ones now cultivated commercially in Queensland. The Abachi and the Pernambuco are two other varieties of the Queen class which are highly prized for dessert purposes in some countries.

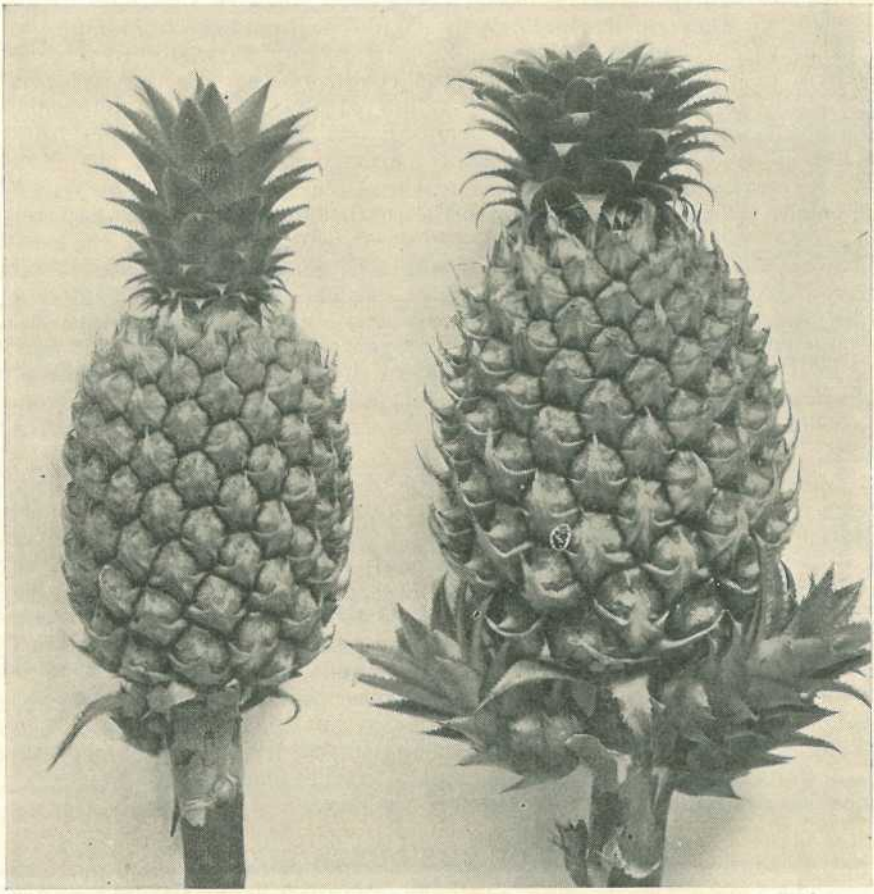

Plate 3.

ON THE LEFT, A FRUIT OF THE QUEEN VARIETY; ON THE RIGHT, ONE OF THE RIPLEY QUEEN VARIETY.

The salient characteristics of the varieties included in the Queen group are as follows:—The habit of growth is dwarf and compact. The leaves are short, broad and stiff, strongly serrated along the margins, and thickly covered with "meal" on both surfaces. The flowers are lilac in colour. According to the variety, the shape of the fruit varies from conical to cylindrical. The eyes are small and pointed and slope upwards. The fruit is bright yellow when fully ripe. The flesh is light yellow, opaque and porous, but it is firm and crisp, sweet, and of a distinctive and very agreeable flavour. The core is small and the crown compact.

The Ripley Queen variety is considered to have originated as a selection from the Queen, which it closely resembles in many respects. It differs chiefly in the colour of its foliage, which is pale green heavily tinged with red, in contrast to the bluish-green foliage of the Queen, and also in the shape of the fruit, which is generally thicker in proportion to its length than that of the Queen (Plate 3). A tendency to a conical shape is common to both varieties during a dry season. Other differences noticeable in Ripley Queen fruits are the flatter crowns, the somewhat larger eyes—the centres of which are characteristically covered

Plate 4.

PLANT OF THE MACGREGOR VARIETY.—Showing the characteristic sturdy, compact habit of growth, free suckering tendency and blocky type of fruit.

with "meal"—the paler colour of the skin, the firmer and more porous flesh and the richer flavour. Both varieties are less juicy than the Smooth Cayenne. Although both Queen and Ripley Queen fruits are on the small side, those of the latter variety average slightly the larger of the two. From plant crop fields, fruits ranging in weight from 2 to 5 pounds are obtained. Large specimens rarely weigh more than 5 pounds and old ratoon fields, particularly those of the Queen variety, commonly produce very small fruits unless rigorous thinning of the suckers has been carried out. Extremely prolific suckering is a characteristic exhibited by both varieties when grown under favourable conditions.

Most of the varieties included in the Queen group, as well as those in other groups, have originated from individual bud sports by a process of selection and propagation. Two varieties which have originated locally in this way and which are now well established in Queensland are the MacGregor, a selection from the Queen, and the Alexandra, a selection from the Ripley Queen.

The MacGregor, which originated at Bulimba, was introduced by Mr. E. Smallman of Ormiston about twenty-five years ago, and was named after Sir William MacGregor, then Governor of Queensland. It differs from the Queen or common rough-leaved variety chiefly in its sturdier, broader-leaved and more vigorous habit of growth and its larger and better-shaped fruit (Plate 4). The tendency of the typical Queen variety to produce conically-shaped fruit during dry weather is

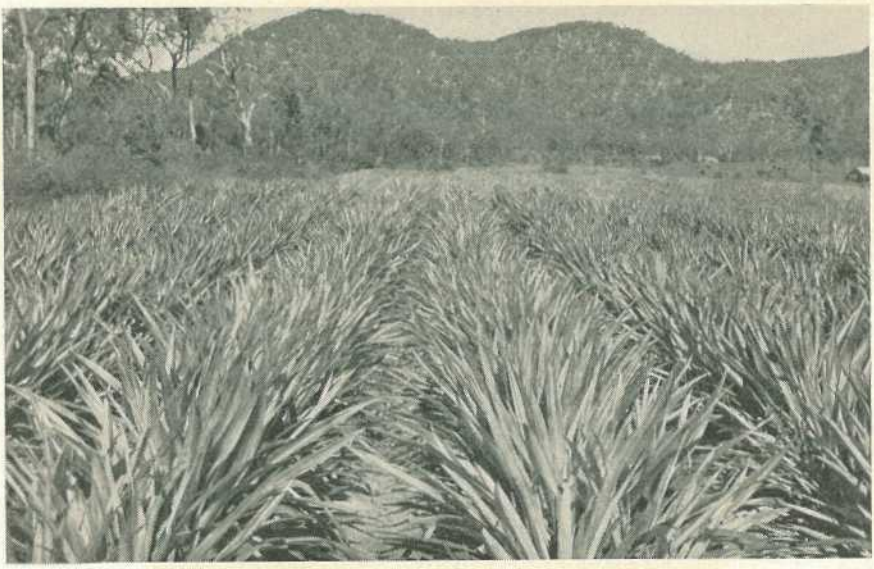

Plate 5.

TWO-YEAR-OLD PLANTATION OF THE QUEEN VARIETY ON MAGNETIC ISLAND, NORTH QUEENSLAND.

much less pronounced in the MacGregor. Well grown MacGregor fruits average about 4½ pounds in weight. As they possess exceptional carrying qualities for a pineapple of the Queen class they are particularly suited for supplying to the far western districts of Queensland, where these varieties are in demand.

The Alexandra was selected from the Ripley Queen variety by the late Mr. Bromiley, of Nikenbah. Like the MacGregor, this sub-variety possesses several points of superiority over its parent variety, notably a more vigorous constitution and larger-sized fruit. The eyes are somewhat flatter and, while retaining the relatively large diameter which is typical of the Ripley Queen, the fruit is more cylindrical and square at the shoulders. The skin of the mature Alexandra fruit is paler in colour than that of the Ripley Queen and not infrequently it is little deeper than a light yellow-green. The Alexandra is said to carry better

than the true Ripley Queen, though not as well as either the Queen or the MacGregor and, because of its larger average size and superior eating quality, it generally commands high prices in the markets.

Both the Ripley Queen and Alexandra varieties are particularly subject to the physiological disorder of pineapples known as "black heart" and, in consequence, these varieties are practically unsaleable in south-eastern Queensland during the winter months. As compared with the Queen or MacGregor, the Ripley Queen is a relatively delicate variety and is highly susceptible to an unfavourable growth environment. In suitably moist but well drained soils, however, it responds to fertilizing to a marked degree, using fruit weight and size as a criterion.

For some years past, none of the varieties of the Queen group have been marketed to any extent outside of Queensland as the interstate trade prefers the Smooth Cayenne, presumably on account of its larger average size, more attractive appearance and better carrying and keeping qualities. Consequently, these varieties are mostly grown adjacent to centres of population for local consumption only: in south-eastern Queensland their cultivation is confined almost entirely to the rural districts included in the Greater Brisbane area. During November-December and May-June, however, when supplies of the Smooth Cayenne from south-eastern Queensland are at a minimum, several thousands of cases of the Queen variety are shipped to Sydney from Magnetic Island in North Queensland and find a profitable market (Plate 5).

VARIETIES OF THE SPANISH GROUP.

The type variety of the group is the Red Spanish and this is the principal variety grown for the United States fresh fruit trade in Cuba, Puerto Rico and Florida. The variety chiefly used for canning in Malaya is also said to be similar in type to the Red Spanish, but it differs from the West Indian variety of that name in that it has smooth-edged leaves. In world commerce, the varieties included in this group probably rank second in importance to the Smooth Cayenne.

The Red Spanish and several other varieties of the same group were introduced into Australia many years ago by the Queensland Acclimatisation Society but failed to become established in favour. A few plants of the Red Spanish variety are still to be found growing in private collections. The chief merits claimed for the Red Spanish variety are its hardy, vigorous constitution and the ability of the fruit to withstand relatively rough handling and long shipment.

The Red Spanish plant is vigorous and erect, with long narrow, spiny leaves, characteristically dark green in colour and often tipped with red. The fruit is typically squat, possessing a large diameter in relation to its length, and generally appears somewhat barrel-shaped. The eyes are large and flat but few in number, which tends to make the fruit appear smaller than it is. Red Spanish fruits usually contain only eighty or ninety eyes, which is approximately half the number in a well grown Smooth Cayenne fruit. Fruits of average size weigh from 2½ to 3 pounds. When ripe, the skin colour is deep yellow, generally suffused with red. The flesh is juicy, white or pale straw coloured and pleasantly sub-acid in flavour. In Florida, the flavour of the Red Spanish variety is regarded as inferior to that of other varieties, but for market purposes it is considered that this disadvantage is more than offset by its excellent shipping qualities.

Besides the Red Spanish, other varieties or strains classed in this group are the Sugar Loaf, Red Ceylon, Mauritius, and Cabezona.

Chapter IV.—IMPROVEMENT OF THE PINEAPPLE BY BREEDING AND SELECTION.

Most of the crop plants now in cultivation are not readily identifiable with the primitive types from which they have originated because of the improvements which have gradually taken place in their productivity, whether of roots, leaves, fruits, or other organs possessing economic value. These improvements have been effected either through cross-fertilization to produce new hybrid varieties from seed, or through the perpetuation, by selection and propagation, of individuals or shoots exhibiting new and desirable characteristics.

Practically all of the varieties of pineapples now in cultivation are considered to have arisen as bud sports from more primitive types, and most of them originated in Central America or the West Indies. During the eighteenth and nineteenth centuries a number of hybrid seedling varieties were raised in European hothouses, but few of these remain in cultivation to-day. No new pineapple of any commercial importance has been introduced into general cultivation for more than a century, apart from selections of the three basic varieties, viz., Smooth Cayenne, Queen, and Red Spanish. During recent years, however, renewed and increasing attention has been given to hybridization as a means of producing new varieties from seed. Work of this kind is now being carried out in Hawaii, Florida the Philippines and, to a lesser extent, in South Africa and Malaya. At the same time, intensive efforts are being directed towards the improvement of existing varieties, particularly the Smooth Cayenne, by the selection and vegetative propagation of plant types exhibiting superior characteristics.

RAISING NEW VARIETIES FROM SEED.

No organised programme of pineapple breeding work has yet been attempted in Queensland, although seedlings have been raised at various times from chance seeds occurring in pineapple fruits. None of the plants raised in this way has shown any particular merit, but progeny of one of them, known as Commonwealth Seedling, are still in existence in the gardens of the Queensland Acclimatisation Society at Lawnton. In Hawaii and the United States, endeavours to obtain new varieties by the use of chance seed have long been abandoned in favour of carefully planned hybridization, because chance seedlings exhibit unpredictable and usually inferior characteristics.

The major objectives sought in pineapple breeding work for the production of new varieties are greater plant vigour, increased resistance to disease, higher productivity and superior fruit characteristics. The difficulty, of course, is to combine all of the desired qualities in a single hybrid. For work of this kind to be tackled on a scale that permits of it having a reasonable prospect of ultimate success not only is painstaking effort over a long period of years required, but also a heavy maintenance expenditure, since a period of approximately three years elapses from the time the seed germinates until the first fruit matures.

In Hawaii, it has been found that practically all of the known varieties of pineapple are of value in breeding work, whether grown commercially or not. Some of the primitive varieties with worthless fruits possess desirable plant characteristics, such as disease resistance and superior root development and, in consequence, are used extensively for breeding purposes. Fertilization of the flowers of the female parent

of a cross is effected by hand pollination and the seeds are obtained from the fruit after it is mature. Crosses are not made haphazardly but on a strictly genetical basis; backcrossing of a hybrid with one of its parents is frequently resorted to.

Propagation of pineapples from seed is almost as difficult as that of orchids and calls for the same care. The seeds are encased in a thick, tough, protective coat, and to facilitate germination this is softened before planting by soaking them in strong acid. The seeds are sown on moist sterilized sand in shallow trays and maintained at a temperature of 90 degrees F. Germination takes place in about ten days. When six weeks old, the young seedlings are pricked out into flat boxes fitted with collapsible bottoms, but they are not removed from the glasshouse

Plate 6.

HYBRID PINEAPPLE SEEDLINGS BEING "HARDENED OFF" IN A LATH HOUSE AT THE EXPERIMENT STATION OF THE HAWAIIAN PINEAPPLE PRODUCERS' CO-OPERATIVE ASSOCIATION PREPARATORY TO BEING PLANTED OUT IN THE FIELD.

until 4½ months later. On removal from the glasshouse they are hardened off in a lath house and again transplanted to larger boxes to give them more room for development. When they are twelve to fifteen months old they are planted out in the field, the collapsible bottoms on the boxes permitting this to be done with a minimum of root disturbance or injury. The fruits mature about two years later.

At the Experiment Station of the Hawaiian Pineapple Producers' Co-operative Association more than 100,000 hybrid seedlings are raised yearly (Plate 6). Except for those which exhibit a weak or spindly type of growth and are discarded early, each of the seedlings is kept under observation until it fruits, since each has a different genetic constitution. The number of these kept for further observation or for breeding purposes after the plant crop has matured varies greatly with the cross; in some it may be less than one per cent., while in others it may exceed ten per cent. In selecting seedlings for further trial, particular emphasis is laid on the canning quality of the fruit.

Once a desirable hybrid has been obtained—and this may require systematic crossing through a number of generations—its further propagation can be carried out only by vegetative means. Even when special methods of propagation are employed, it takes five or six years to obtain sufficient planting material of a new hybrid to plant up one acre. Consequently, the production of new pineapple varieties by cross-fertilization must be regarded as a long-range project and one that is entirely beyond the scope or resources of the average grower.

IMPROVEMENT OF THE PINEAPPLE BY SELECTION OF VEGETATIVE PLANTING MATERIAL.

Only plants which are self-fertilized come true to type when grown from seed; those in which cross-pollination takes place give rise to hybrids. Since the pineapple is normally self-sterile, perpetuation of given varieties or types can be effected only by vegetative methods of propagation. In practice, this is accomplished by planting the various types of offshoots—suckers, slips, and crowns—which arise from a parent stem, or even this stem or "butt" itself. Usually, plants propagated in this way reproduce only the characters possessed by the parent. In a small proportion of the buds from which offshoots develop, however, some of the characters of the parent may be missing or new ones may arise with the result that plants propagated from them differ in varying degree from the parent type. Variations of this kind are known as *mutations* or "bud sports" and are inheritable. The conditions which cause them are not clearly understood, but they should not be confused with the variations in growth or fruiting characters which result from environmental influences, as, for example, the contrasting types of growth which develop under conditions of light and shade. These latter are known as *acquired characters* and are not strictly inheritable, although the conditions under which a plant is grown are often reflected in its progeny, viz., shoots produced by vigorous parents develop into sturdier plants than those taken from weak-growing or diseased stock.

Accidental Selection as a Factor in the "Running Out" of Varieties and the Development of Varietal Strains.

Most of the variations which arise in the form of mutations are so minute as to be imperceptible, but some may be pronounced and thus sharply differentiate the shoot from its parents. In vegetatively propagated plants these differences, however slight or extreme, are perpetuated by planting the shoots which exhibit them. Consequently, unless discrimination is exercised in the choice of planting material, a pineapple variety tends to undergo a gradual but continuous change in successive generations, due to the fact that the types which produce shoots freely are propagated at a faster rate than those which do not. In other words, there will be *accidental selection* of these types. This tendency largely accounts for the so-called "running out" of varieties or strains which sometimes takes place when the same stock is propagated continuously on one farm or in one district over a period of years. What actually happens in such cases is that cultural practices and local environmental influences favour the multiplication of certain undesirable mutations which, if not rigorously culled, will in time supplant the original varietal type. Where deterioration of stock in this way has occurred, its replacement by planting material obtained from another farm or locality will remedy the position only if the new stock is both

more vigorous and of an inherently better type than that which it supersedes. Obviously, therefore, the source from which planting material is obtained is a matter of the greatest importance, though one which is frequently overlooked or ignored.

As a result of accidental selection, a variety which has been grown for a long time in one country or region may exhibit characteristics which distinguish it from the same variety as grown in another country, although in both instances the original supplies of planting material were derived from the same source. Modifications in cultural practices which have been imposed by local conditions are often an important though unrecognised factor in the development of these varietal strains. In the older-established pineapple districts of south-eastern Queensland, slips have not been greatly used for the propagation of the Smooth Cayenne variety until quite recently, because, in this region, slips are produced chiefly in association with fruits which mature during the summer months, while planting is carried out preferably during the spring, after the cold weather has passed. In certain low-rainfall areas in North Queensland, however, particularly around Bowen, slips have always been extensively employed for propagating purposes, since it has been found that the best time for planting in these warm, dry latitudes is during the rainy season which follows the harvesting of the main summer crop. For this reason, the type of plant which now predominates in Bowen plantations is one which is characterised by a much greater tendency to slip production than is inherent in the type commonly grown in the southern part of the State.

The mutations which tend to become predominant in any locality or region as a result of accidental selection are not necessarily undesirable from an economic standpoint. The Natal strain of the Queen variety is a free-suckering, sparsely-slipping type which probably originated in this way, and the relatively low incidence of the objectionable "collar-of-slips" type in Smooth Cayenne plantations in southern Queensland is attributable to the traditional use of suckers for propagating purposes in this locality.

Principles Underlying the Practice of Plant Selection.

From the foregoing, it will be apparent that the accumulation of mutations in a pineapple variety results in a gradual but cumulative divergence from type. Because all mutations are hereditary, however, it follows that their perpetuation can be prevented or accelerated at will by appropriately restricting the choice of planting material. Limiting the choice of shoots for propagating purposes to those produced by plants whose characters it is desired to perpetuate is properly known as *artificial selection* in contrast to selection effected by natural or accidental causes, though artificial selection is generally implied whenever the term "selection" is used alone. Careful and repeated selection is necessary not only for the maintenance of the original characteristics of a pineapple variety, but it is also the only means whereby those original characteristics may be modified or improved. Maintenance involves the elimination of all inferior mutations, while modification or improvement is effected by selective propagation of individuals possessing distinctive or superior characteristics.

Plate 7.

DEMONSTRATION OF TRANSMISSION OF VIGOUR.—Slips planted in double row on left obtained from chlorotic plants; those on right from vigorous green plants. Both lots of slips were of same average weight at time of planting.

Hereditary versus Acquired Characters.

In practising selection, it is desirable to be able to distinguish between hereditary variations and those which result from environmental influences. This distinction is not always easily made, since certain growth characters may originate from either one of these causes; for example, differences in leaf colour and in vigour of growth. For all practical purposes, however, minute variations in form or colour which do not perceptibly influence the productivity of the plant may be disregarded in carrying out a selection programme, cognizance being taken only of those characters which it is desired to eliminate or perpetuate. Relative vigour of growth falls into this category, and a clear conception of the manner in which this factor influences the expression of hereditary characters is necessary for a full appreciation of the principles underlying practical selection methods.

Transmission of Vigour.

In vegetatively-propagated crop plants, such as the pineapple, hereditary variations which are sub-normal in vitality tend to be self-eliminating, because they produce relatively few shoots whereby the type may be perpetuated. In general, therefore, lack of vigour is indicative of an unfavourable environment. This point is of especial significance because it has been conclusively demonstrated that the vigour of the parent stock greatly influences the growth rate and productivity of its progeny. Planting material from wilt-affected plants is strikingly more backward in growth and of lower productivity than that from healthy stock. Similarly, planting material from chlorotic plants is definitely inferior to that taken from plants possessing an abundance of chlorophyll in their leaves, because the amount of starchy substances contained in the stem of a shoot determines the rate and extent of the root development which takes place when it is planted (Plate 7).

Since plants which have been propagated from weak parent stock are sub-normal in vitality, the off-shoots which develop from them are also lacking in vigour. In this way, a modification in vigour of growth resulting from environmental influences, i.e., an acquired character, may be carried through several successive generations. In contrast to those due to inherited tendencies, however, acquired characters do not persist indefinitely, as the descendants of the plants which originally acquired them gradually revert to the average level of growth permitted by the existing environment. Nevertheless, it will be obvious that rejection of all weak-growing, ill-nourished or diseased plants as sources of planting material will have an immediate effect in raising yields. Selection is thus equally desirable with respect to acquired characters as it is with hereditary ones. In addition, undesirable hereditary characters may frequently escape notice in weak-growing plants owing to the masking effects of reduced vigour. For these reasons, it is bad practice to rely on old ratoon fields as the principal sources of planting material, since old ratoon plants are almost invariably undernourished and lacking in vigour, as compared with those which have borne only one fruit. This is indicated by the relatively small-sized fruits which ratoon plants produce. Quite apart from this, however, it is exceedingly difficult to distinguish between healthy and diseased plants in ratoon fields and almost impossible to accurately assess their vegetative and fruiting characters. As already indicated, disregard of the vigour of the parent stock from which planting material is taken is an important factor contributing to the "running out" of varieties.

Objectionable Vegetative Mutations.

Of the many different kinds and degrees of inheritable variations which occur in the pineapple only a small proportion of the defective types have any real practical significance. Although these are generally of exceptional vigour, their importance is measured not merely by their ability to survive but also by their reproductive capacity assessed in terms of the number of slips or suckers which they produce. Consequently, the types which are most objectionable are not necessarily the ones which exhibit the most worthless characters, but those in which defective characters are associated with a high reproductive capacity. When the capacity for vegetative reproduction exists in an extreme form, as it does in the "collar-of-slips" type, it may in itself become highly undesirable. Objectionable vegetative mutations occurring in Queensland plantations include the following—

Plate 8.

TYPICAL "COLLAR-OF-SLIPS" PLANT WITH LEAVES CUT AWAY TO SHOW TOTAL ABSENCE OF SUCKERING.—Note that the fruit is completely hidden by the encircling slips.

"**Collar-of-Slips.**"—As the name implies, this mutation is characterized by the production of an encircling ring of slips crowded closely around the base of the fruit, the number of slips produced being generally more than double the average for normal plants (Plate 8). However, the degree and manner in which this tendency may be expressed is greatly influenced by environmental conditions. In Hawaiian plantations the collar-of-slips tendency is often masked at higher, that is, cooler elevations. In Queensland it occurs in characteristic form only during the late summer months, and then chiefly in plant crop fields. At other times of the year, plants in which the tendency is inherent rarely produce more than three or four slips on the fruit stalk and, in some, slip production may be entirely suppressed. Even during the summer, the expression of the "collar-of-slips" tendency may range from a profuse development of slips down

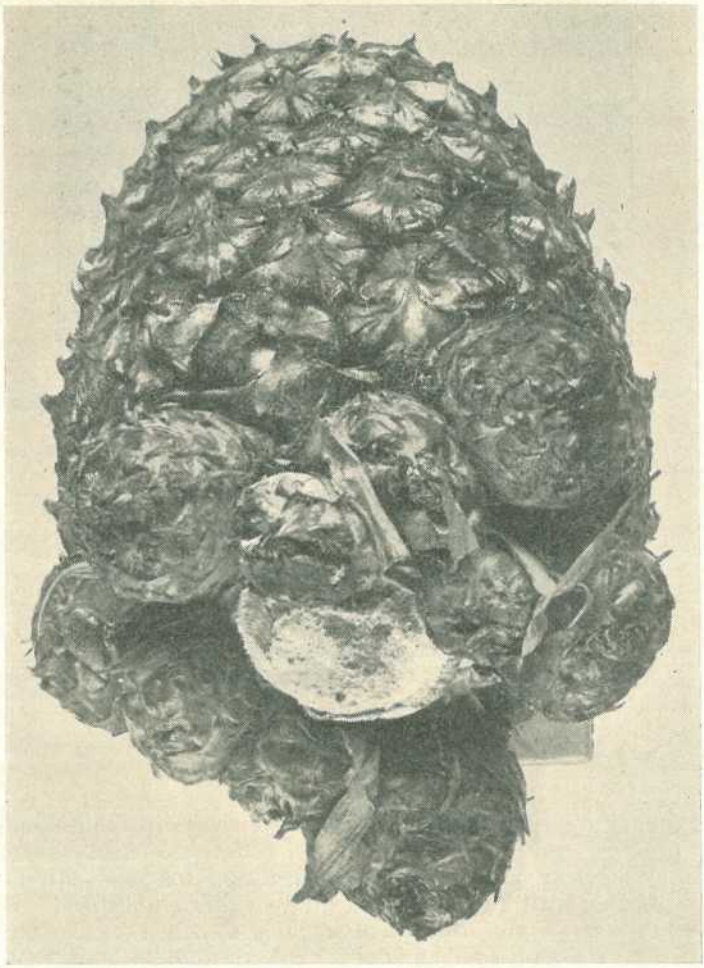

Plate 9.

KNOBBY OUTGROWTHS PROTRUDING FROM THE BASE OF A FRUIT WHICH WAS PRODUCED ON A PLANT POSSESSING THE "COLLAR-OF-SLIPS" TENDENCY.

to an apparently normal type of plant. Except in the latter case, fruits produced on "collar-of-slips" plants usually possess knobby outgrowths protruding from their bases (Plate 9). This tendency, like that relating to slip production, is also extremely variable in expression; knobby fruits may be produced both on "collar-of-slips" plants which are seemingly normal in type as well as on some which do not possess the collar tendency.

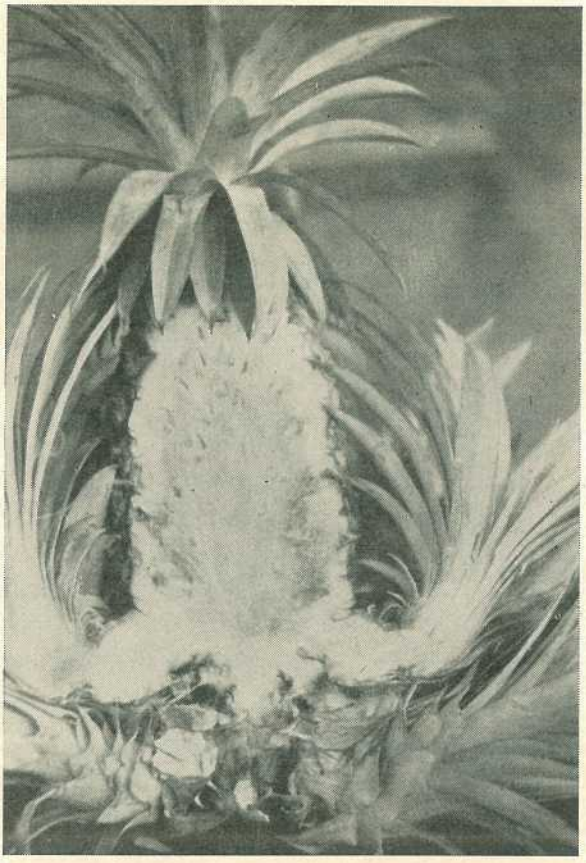

Plate 10.

"COLLAR-OF-SLIPS."—Sectional view showing slips originating from the base of the fruit (cf. Plate 11).

Arbitrary distinctions are made between various expressions of the "collar-of-slips" mutation although the differences are seldom clearly defined. When one or more of the encircling slips arises directly from the base of the fruit the plant is said to exhibit a typical "collar-of-slips" condition (Plate 10): when none is attached to the fruit itself although an excessive number is clustered around its base, the plant is said to be of a "near-collar" type (Plate 11). These two types are often indistinguishable until after the fruit has been picked. A third distinction is sometimes made with regard to plants in which the abnormal slipping tendency is not evident although the fruits which they produce

are knobby, but, as previously remarked, knobby fruits are not produced solely by "collar-of-slips" plants. Since all three of these types are merely different gradations of a single inherited tendency, plants propagated from any one of them may reproduce either the characters of the parent or they may exhibit those of one of the other types or of a normal plant. However, the percentage of apparently normal types resulting from "collar-of-slips" parents is generally considerably less than it is from "near-collar" or "knobby" parents (Plate 12).

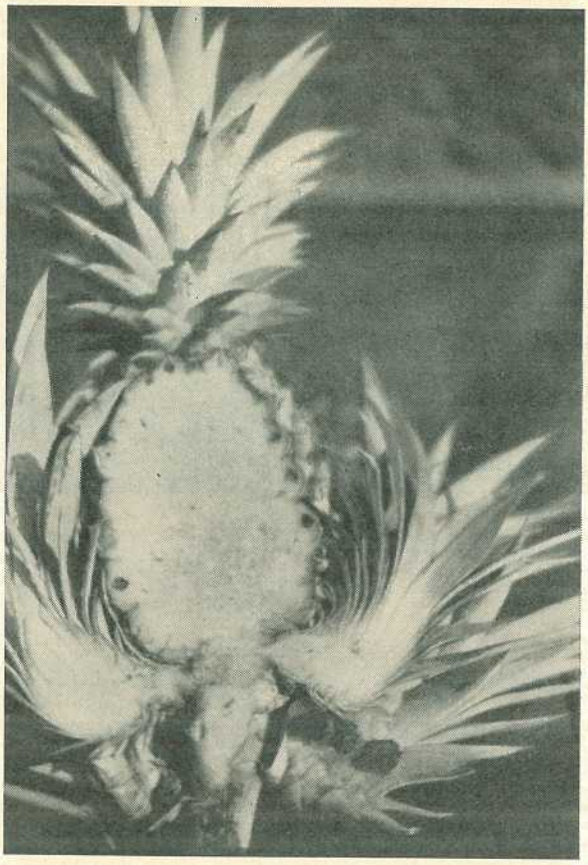

Plate 11.

"NEAR COLLAR-OF-SLIPS."—Sectional view showing slips arising close to but not directly from the base of the fruit (cf. Plate 10).

While the fruits produced on "collar-of-slips" plants are not inferior in quality to those from normal plants, they are usually smaller in size and apt to be conical in shape with prominent eyes. The plants which bear them are vigorous and erect in habit, but the production of suckers is generally retarded and those which do develop usually arise from high on the parent stem. In the Smooth Cayenne variety, the "collar-of-slips" is a delayed fruiting type and not only is the plant crop late in maturing, but, in ratoon fields in which it is prevalent, there is always a high percentage of "holdover" suckers which have failed to flower.

Consequently, the presence of appreciable numbers of "collar-of-slips" plants in a field depresses the yield, not only because the average size of the fruits is smaller, but also because fewer fruits are harvested.

"Collar-of-slips" is regarded as the most objectionable "off" type occurring in Smooth Cayenne plantations. Since the mutation itself occurs very rarely, however, the prevalence of the type has resulted almost entirely from propagation of slips or crowns produced on plants in which the tendency is inherent. Consequently, its elimination can be effected by rigorous selection over a number of generations: provided this is properly carried out, there need be no fear of its recurrence. "Collar-of-slips" is an especially mischievous variation from type in that it offers an obvious and very prolific source of planting material and for this reason it is apt to multiply very rapidly in plantations where no precautions are taken to prevent its propagation.

Plate 12.

FIVE PLANTS PROPAGATED FROM A SINGLE "COLLAR-OF-SLIPS" PLANT, ALL EXHIBITING THE CHARACTERS OF THE PARENT.

Because the "collar-of-slips" tendency is so variable in its expression it is not practicable to completely eradicate it from a plantation in the course of a single generation. The simplest method of effecting its gradual elimination is to consistently break off all slips from plants exhibiting the tendency while the fruits are still immature, whether the tendency be expressed as a "collar-of-slips" or in the form of knobby fruit. This will not only forestall any subsequent temptation to use such slips as planting material, but will also have a beneficial effect on the developing fruit and suckers, provided the removal of the slips is effected before the fruits are two-thirds grown. If there is any likelihood of the crowns being required for propagating purposes, those on "collar-of-slip" fruit should be marked with a dab of white paint at the time the slips are removed so that they may be readily distinguished later and rejected. Since the "collar-of-slips" tendency is typically expressed in the production of an *excessive* number of slips, however, its propagation may be greatly reduced by arbitrarily rejecting as sources of planting material all plants carrying more than the normal number, i.e., three or four. This method may be usefully employed when selection during the period of fruit development has been omitted, as it may be carried out even after the crop has been harvested. If delayed until this time, however, it suffers from the disadvantage that no regard can

be given to knobbiness of the fruit as an expression of the "collar-of-slips" mutation. Still another arbitrary method of selection for the elimination of this objectionable type is to use as sources of planting material only plants which bear early maturing fruit, since the "collar-of-slips" type is characteristically late fruiting. However, all three of these methods for eliminating "collar-of-slips" plants are effective only if (1) they are carried out for several successive generations; (2) all planting material is taken from plant crop fields; and (3), except in the case of the third method, suckers are not used for propagating purposes. Furthermore, they can be successfully applied only during the summer months, since at other times of the year the "collar-of-slips" tendency is apt to be masked. For this reason, it is inadvisable to plant *any* slips which may develop in association with winter-maturing fruit.

The methods which are employed for the selection and propagation of superior types or strains of pineapples afford more positive means for the elimination of the "collar-of-slips" mutation than those which have been described, but they also involve a considerably greater amount of labour. Two of these methods are outlined in a subsequent section of this chapter.

Spiny Leaves.—Reference to this character has already been made in Chapter II. It is the most frequently occurring mutation in the Smooth Cayenne variety. If the cell differentiation leading to spininess occurs sufficiently early in the development of the sucker, slip or crown to affect all of the leaves the character is definitely inheritable; if only a leaf, or part of a leaf, is affected the character may not be transmitted. Spiny-leaved plants are objectionable from a cultural standpoint. Planting material of the Smooth Cayenne variety which exhibits the tendency should be rigorously rejected.

Pandanus Type of Plant.—This giant type is so named because it resembles the common screw-pine of the Queensland coast, in possessing a tree-like stem with buttressing roots. The leaves are shorter, wider, flatter and more numerous than they are in a normal plant, and incline to the parent stem at a much more acute angle. The plants are exceptionally vigorous growers, but flowering is usually very much delayed. Instances have been reported where flowering has not occurred until four years after planting, by which time the stem may have attained a length of three feet. The fruits are inferior in size. Isolated plants of this type occur fairly commonly in Queensland plantations, but as their propensities for both sucker and slip production are weak, the rate at which they multiply is slow. Indiscriminate choice of planting material from old ratoon fields is probably chiefly responsible for the propagation of the type, as it is unlikely that it is ever planted deliberately. The precautionary measures which should be taken to avoid propagation of this and similar worthless variant types are obvious.

Multiple and Fasciated Crowns.—These objectionable vegetative aberrations are generally regarded not as inheritable variations, but as expressions of an excessively lush rate of growth at the time of flower bud development. While this appears to be true for multiple crowns which are fused at their point of attachment with the fruit, another type has been recognised in the Bowen district in which each shoot making up the crown develops separately from its neighbours. Observations suggest that this latter type is hereditary. As shown in Plate 13 the shoots arise

along the line of an arc which extends well down on the shoulders of the fruit on both sides. In conformation and size as well as in vegetative characteristics, the individual shoots closely resemble slips. The fruits are typically undersized and squat in shape, the eyes prominent and the bracts projecting. The plants themselves are vigorous, high-stemmed and high suckering; the leaves are long and erect. Slips are produced freely and a "collar-of-slips" tendency is often apparent. This characteristic may account for the observed predominance of the type in certain plantations. Pending confirmatory evidence from trial plantings, it is therefore considered advisable to regard this type of multiple top as hereditary and offshoots from plants which exhibit the tendency should not be used for planting material.

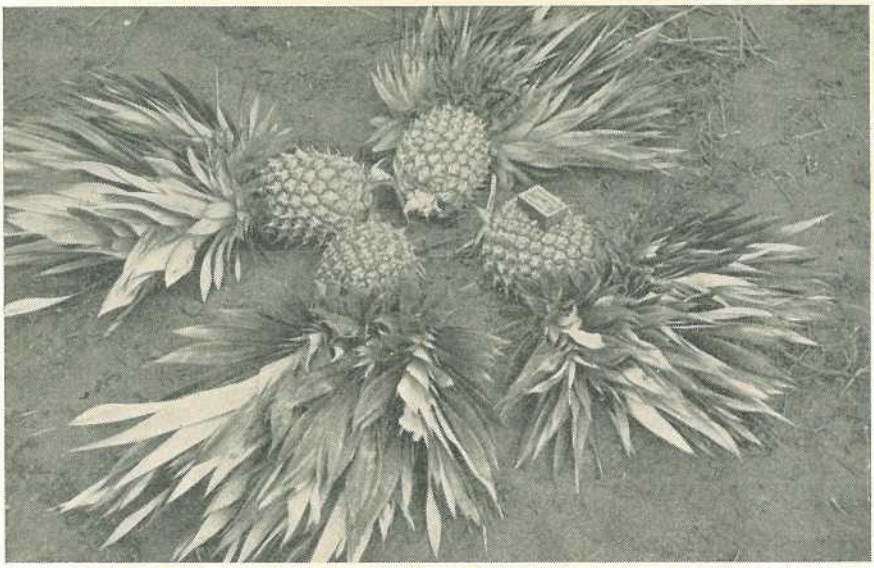

Plate 13.
A TYPE OF MULTIPLE CROWN WHICH IS PROBABLY HEREDITARY.

Defective Fruit Shapes.

While varietal characteristics and plant vigour are the chief factors determining fruit size and shape, fruits may occasionally develop which differ markedly from the normal, particularly as regards their diameter and length. In general, it may be assumed that extreme divergences from type are hereditary in character and, as such, they may be perpetuated or eliminated by selection. Objectionable aberrations of this kind occurring in Queensland pineapple plantations include the following:—

Slender Fruit.—The principal distinguishing feature of this type is its small diameter in relation to its length (Plate 14). Small diameter fruits are not only less suitable for canning than larger ones, but they also yield a smaller return to the grower, since it costs as much to produce a slender pineapple as it does a thicker and heavier one. In addition to being sub-normal in diameter, however, fruits of this type are generally rounded at the top and knobby at the basal end. The plants which

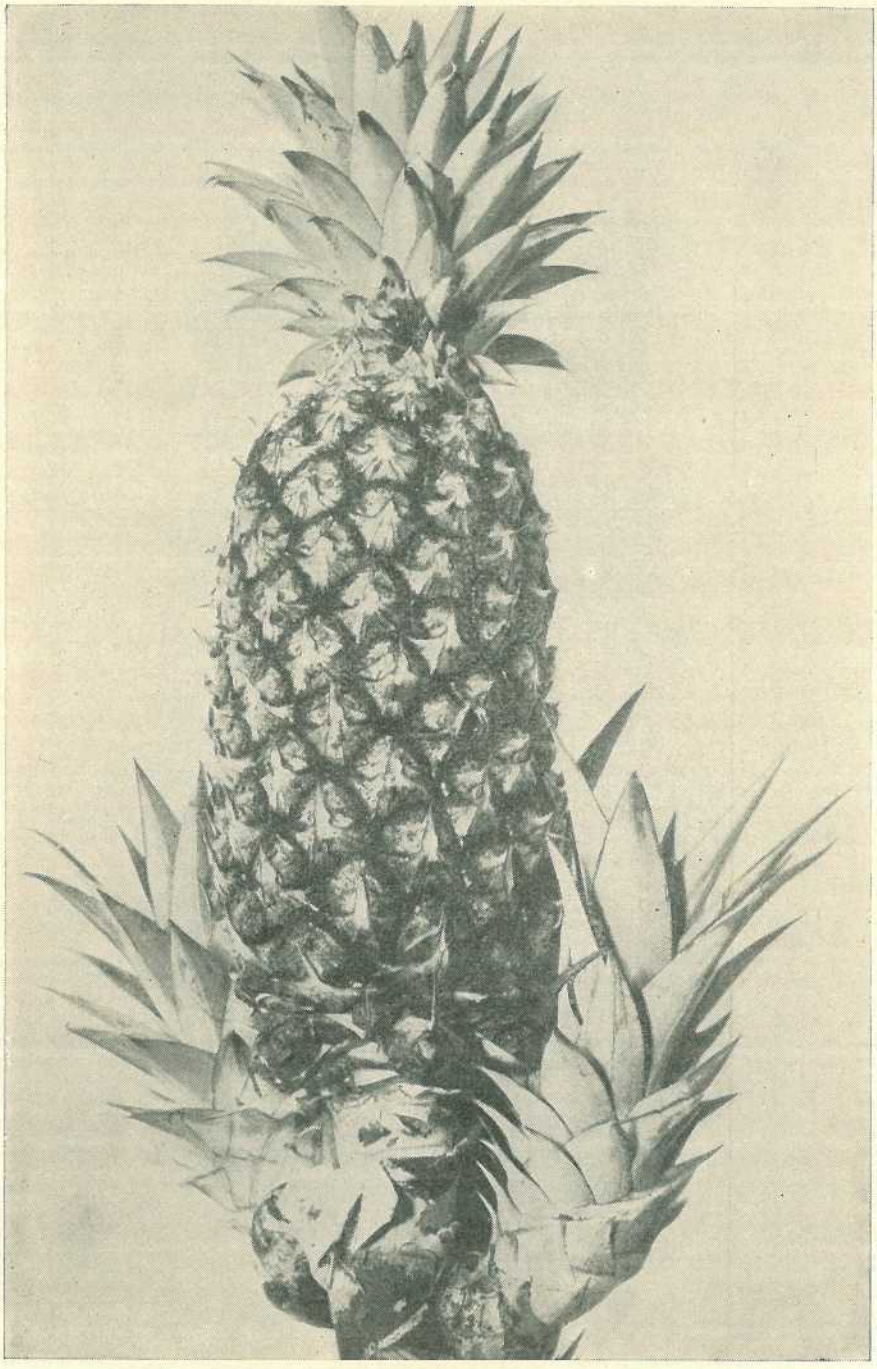

Plate 14.

THE SMALL DIAMETER MUTATION.—Note the knobs at the base of the fruit (cf. Plate 15).

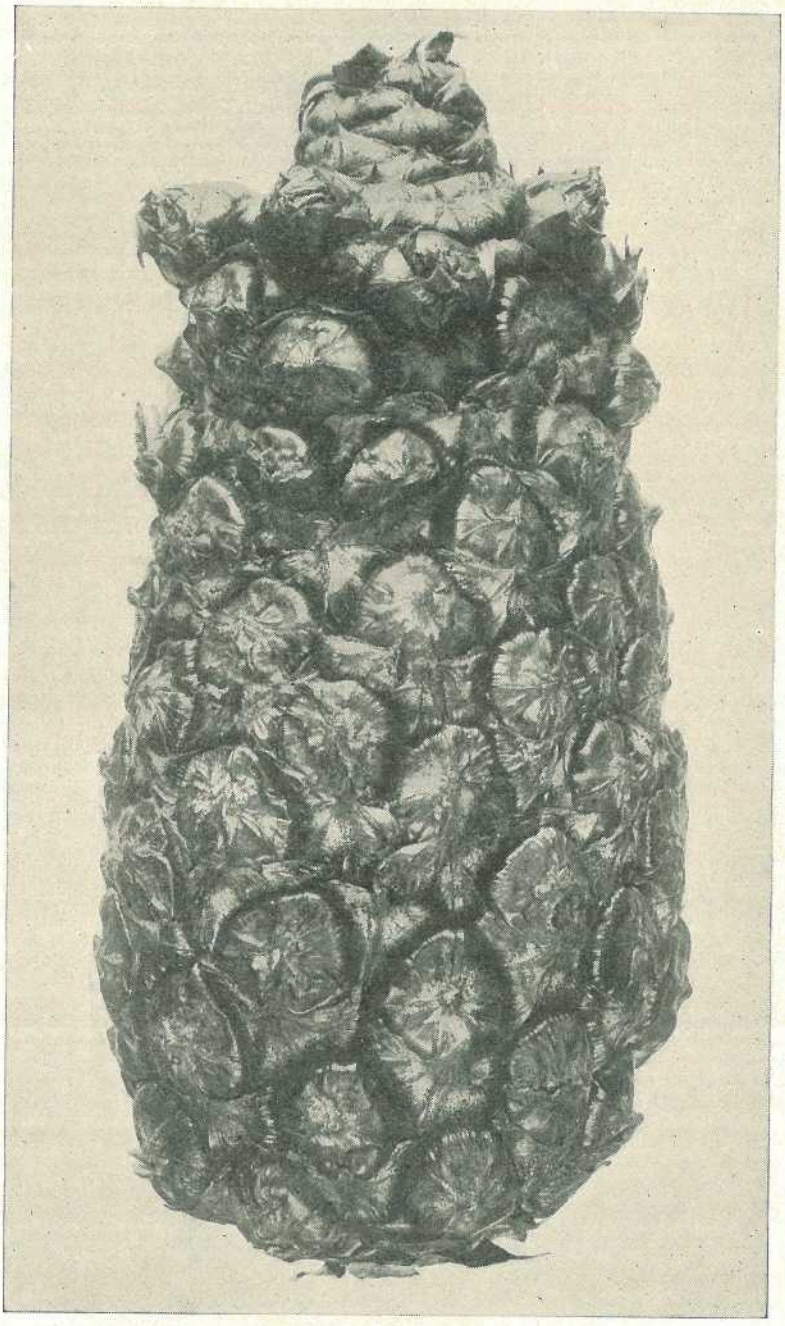

Plate 15.

THE "LONG TOM" MUTATION.—Note the abnormally large, flat eyes, some of which protrude at the top of the fruit to form "knobs" (cf. Plate 14).

produce them frequently exhibit a strong "collar-of-slips" tendency, although slips rarely develop from the fruit itself. Like the fruit which is produced on true "collar-of-slips" plants, the small diameter type is characteristically late in maturing, but, unlike "collar-of-slips," it exhibits little variation from generation to generation. Consequently, it is easily recognised in the plantation and its eradication may be effected with certainty by breaking off all shoots which might be used for propagating purposes while the fruit is still on the plant. This should be done as soon as the fruit has reached a stage of development at which the "small diameter" character becomes apparent. In vigorous plant crop fields, this precaution is often overlooked or ignored because small diameter fruits produced under such conditions, though obviously "off" type, are usually marketable. The small diameter mutation is typically free slipping, which probably accounts for its present preponderance in certain plantations in the Bowen district, where slips have always been the preferred type of planting material.

The "Long Tom" Type of Fruit.—Several years ago, claims were made that a type of Smooth Cayenne fruit which was being produced on a number of plantations in the Mary Valley was particularly suitable for canning purposes by virtue of its characteristically elongated shape. Locally, this type came to be known as the "Long Tom," and its propagation was widely advocated. After fairly extensive plantings had been made it was found that the "Long Tom" fruit, while generally satisfactory in the winter months, was frequently abnormally slender or misshapen during the summer. Sometimes these characteristics were so pronounced as to render the entire crop unmarketable. Even when the fruit was of a size acceptable for canning, the complaint was made that the cores were unduly thick and the flesh coarse. Investigation has revealed that the "Long Tom" type originated as a bud sport on a plantation at Paterson's Siding, near Gympie, and that it was first introduced into the Mary Valley among other planting material in 1915. When the attention of growers was directed to its reputed superiority for canning purposes, there was an immediate demand for planting material. Suckers being difficult to obtain in quantity, most of the fields planted with the "Long Tom" type were propagated solely from slips. It is this strain which was subsequently found to be wholly unsatisfactory. In many respects it resembles the small diameter mutation, but differs from the latter in its slightly conical shape, its larger and flatter eyes and the development of protruding knobs on the shoulders of the fruit instead of at the base (Plate 15). This knobbiness is accentuated during wet summers, but is rarely evident during the winter months. In habit of growth, the "Long Tom" type is similar to the "collar-of-slips." Slips are produced freely, but suckering is poor. The plant is vigorous and erect and the fruit is very late in maturing. No record exists of the occurrence of this defective type outside of the Mary Valley. Where it occurs, it may be eradicated by selection in a manner similar to that suggested for the elimination of the small diameter mutation.

Dry and Bottle Neck Fruit.—These abnormal fruit types are different expressions of the same mutation. In the dry fruit the floral organs are entirely non-functional and the "fruit" structure consists essentially of overlapping swollen bracts attached to a non-edible core.

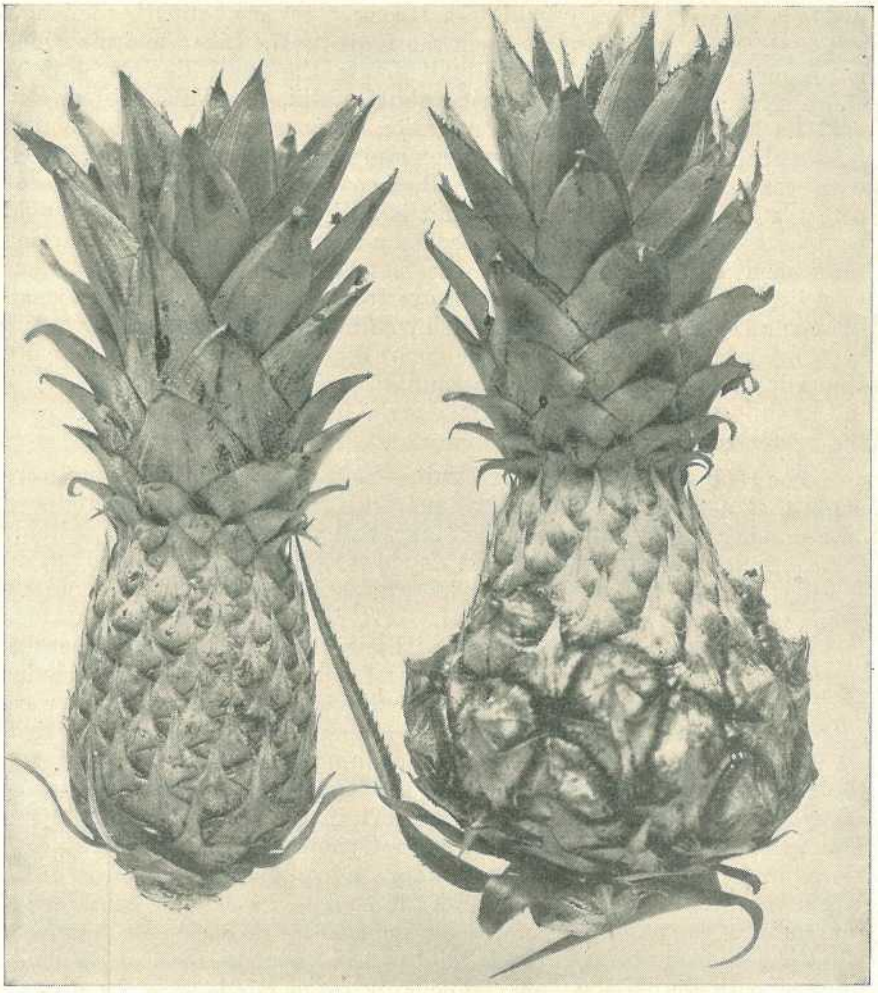

Plate 16.
DRY FRUIT ON THE LEFT: BOTTLE-NECK FRUIT ON THE RIGHT.

The bottle-neck differs from the dry fruit type only in that a varying number of normal florets are produced at the base of the flower spike and these develop into normal fruitlets (Plate 16). The contraction in the diameter of the fruit at the transition zone between normal and vestigial fruitlets produces the typical bottle-neck appearance, from which the abnormality derives its name. The mutation which gives rise to dry and bottle-necked fruit, is unstable and in its mildest form it may be expressed only as a pronounced neck between an otherwise normal fruit and its crown. Dry and bottle-necked fruits are sub-normal in size; the former are invariably worthless and the latter generally so. They are usually produced on plants which are dwarfed and stunted in habit. The condition is always hereditary (Plate 17) and may be eliminated entirely by uprooting all plants which exhibit the tendency.

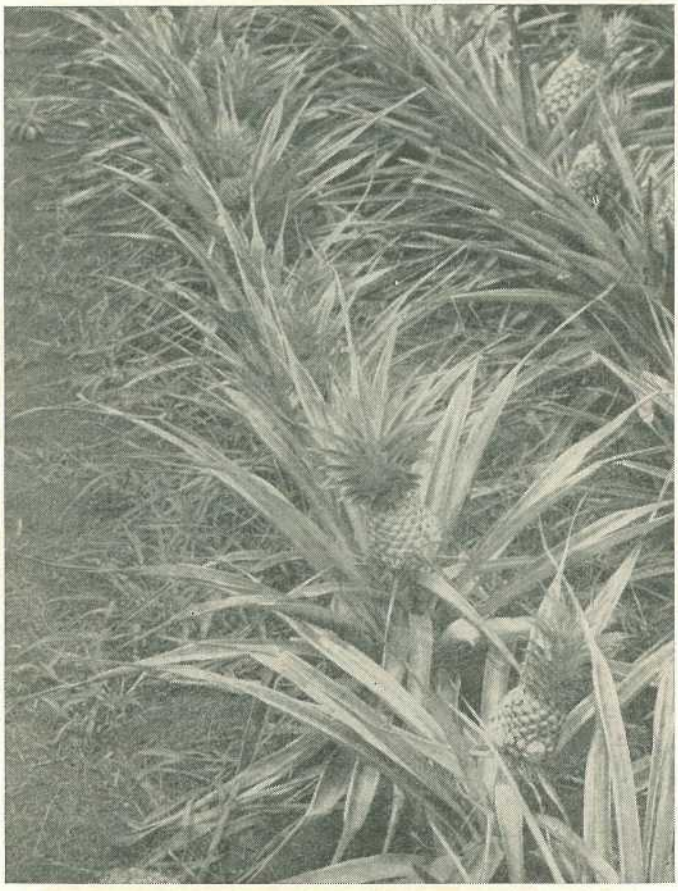

Plate 17.

DEMONSTRATION OF THE INHERITABILITY OF THE DRY FRUIT AND BOTTLE-NECK MUTATION.—Descendants of a single plant which exhibited the bottle-neck character three generations previously.

"Cannon Ball" Type of Fruit.—This is considered to be a variant of the bottle-neck type of mutation in which the diameter of the fruit is equal to or in excess of its length. The fruitlets which develop normally, though relatively few in number, are much enlarged, while the vestigial ones above them are small and inconspicuous and do not form a neck to the crown. In consequence, the fruit is round or elliptical in shape and is usually undersized (Plate 18). It is worthless for canning, and has little other marketable value.

"Crippled" Fruit.—In an hereditary form this type of fruit abnormality is known to occur only in the Queen variety. As the name implies, the fruit is misshapen and distorted and is usually undersized (Plate 19). The distortion arises from the failure of certain fruitlets to develop normally. Those which do develop exhibit considerable irregularity in shape and size; some of them are both greatly enlarged and abnormally flattened for this variety. A dark-coloured corky streak,

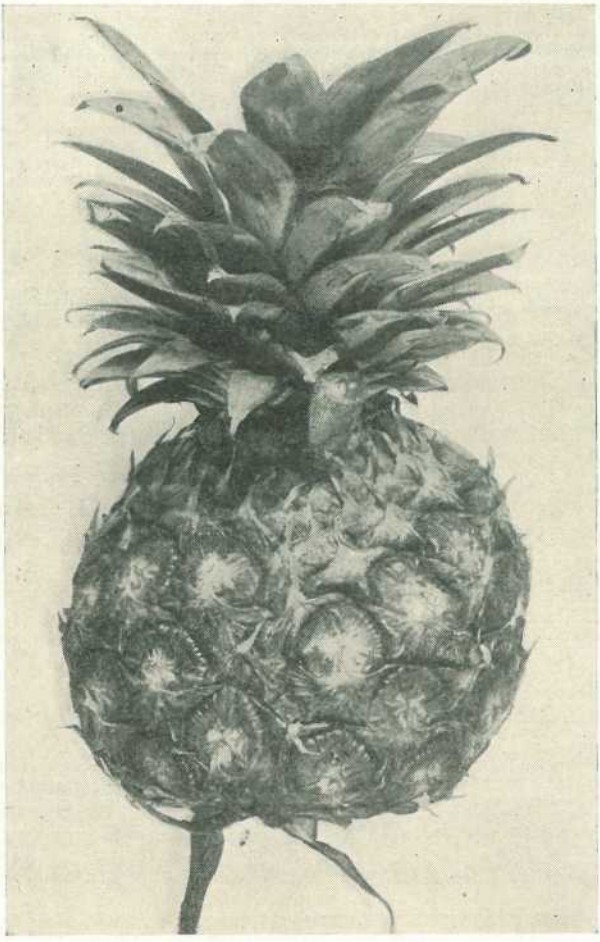

Plate 18.
"CANNON BALL" TYPE OF FRUIT (cf. Plate 16).

about one-eighth of an inch in width, develops medially along the under-surface of the lower leaves of plants or suckers which produce crippled fruit. This character provides an easy and certain means of identifying such plants, even when they are not in bearing. As crippled fruits are worthless, plants which produce them should be uprooted on sight in order to avoid any possibility of their being used as sources of planting material.

The "Prickly-eyed" or "Christmas" Type of Smooth Cayenne Fruit.—As the first name implies, this type is characterised by sharply protruding eyes (Plate 20), in which respect it resembles the Queen variety much more than it does the normal type of Smooth Cayenne. It is not hereditary, however; as mentioned in Chapter II, it is the type of Smooth Cayenne fruit which matures in south-eastern Queensland during December and the early part of January, and it is regarded as the normal type for that period. Reference is again made to it here

because it is an exception to the rule that extreme variations are generally hereditary in character. A mutation from the Smooth Cayenne which possesses fruit characteristics somewhat similar to those exhibited by "Christmas" pineapples in Queensland has been reported from Hawaii, where it is known as the "Rough Eye." This hereditary type is not known to occur locally.

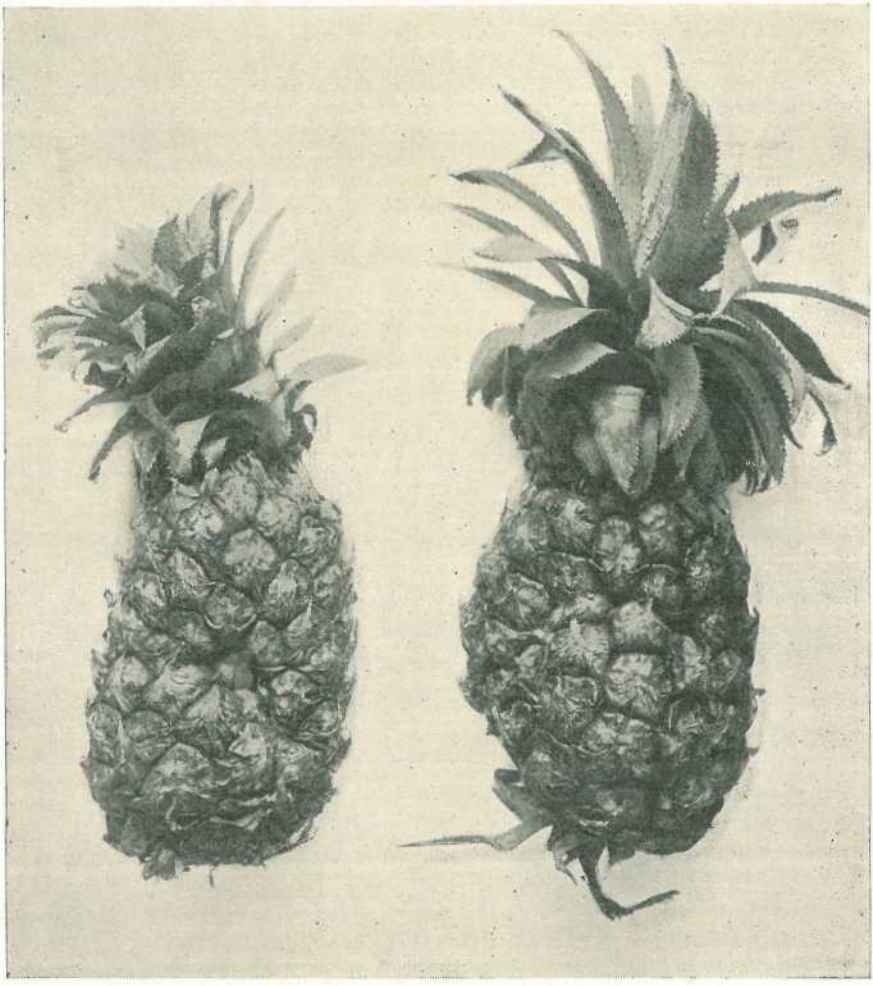

Plate 19.
"CRIPPLED" FRUITS OF THE QUEEN VARIETY.

Selection of Superior Strains.

A pineapple variety can be maintained true to type only through the persistent and systematic elimination of all variations which arise as bud sports. While most of the variations which attract notice are objectionable, a few may display growth or fruiting characters which are superior to the normal. If these desirable characters are inherent in the plants which exhibit them and are not due merely to the influence

of a favourable environment, they will be reproduced in the progeny of these plants in the same way as those of an objectionable type. Thus, by propagating only from plants which exhibit desired characters, it is possible to effect an all-round improvement in the quality and yield of

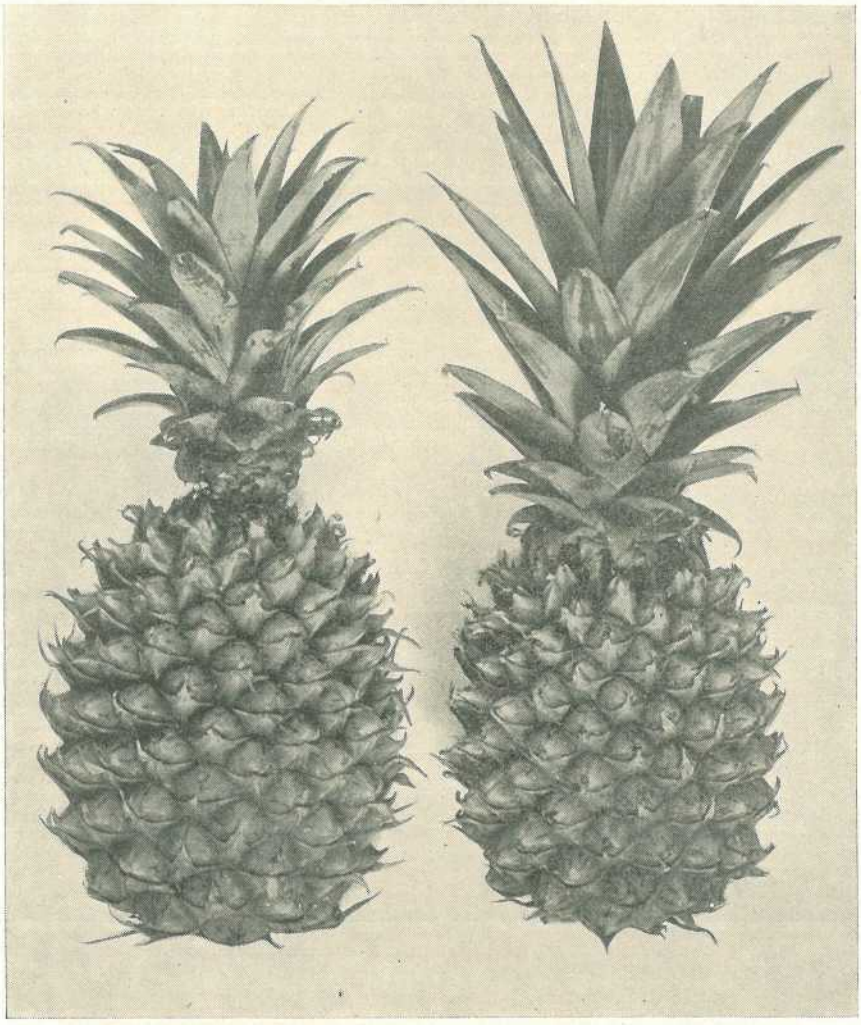

Plate 20.

"PRICKLY-EYED" OR "CHRISTMAS" TYPE OF SMOOTH CAYENNE FRUITS (non-hereditary).

the fruit harvested. If one plant only is selected and this is multiplied by suitable methods of propagation, the result will be a new variety or strain, depending on the degree to which it differs from a normal varietal type. Propagation in this way of new varieties or varietal strains from a single plant is known as *clonal selection*, since all of the plants which stem from one individual are said to constitute a clone. Except for minor differences arising from environmental influences, all of the plants

belonging to a clone are alike (Plate 21). Ordinarily, the plant population of a pineapple plantation is made up of a large number of clones, but the differences which exist between many of these are imperceptibly small. Consequently, in one field numbers of inherently different plants may display similar characters. If these characters are of a desirable type their occurrence in succeeding plantings may be intensified by propagating only from plants which exhibit them. This is known as

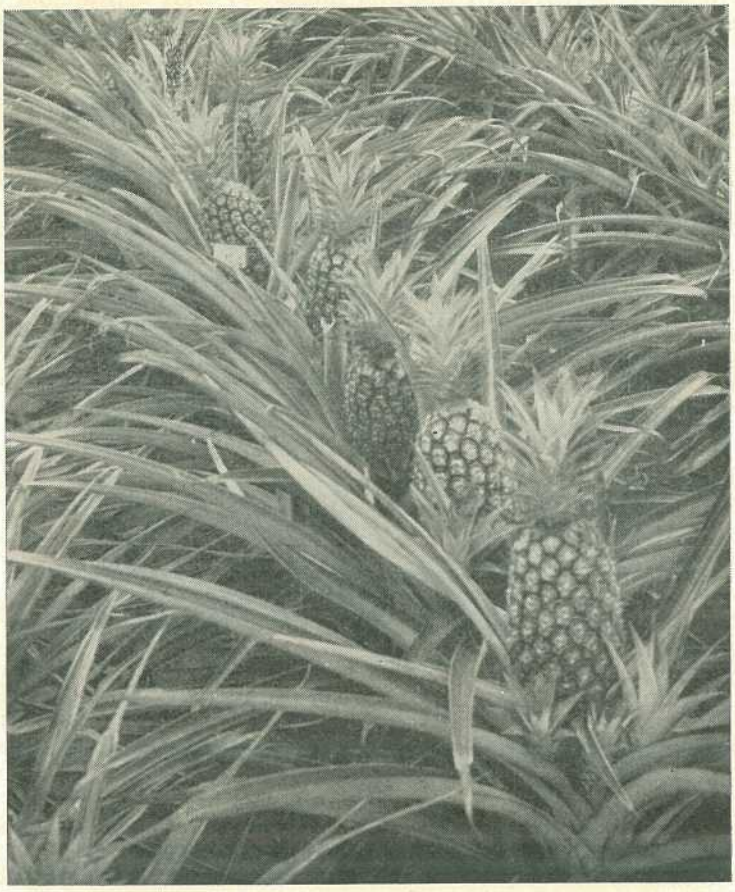

Plate 21.

A CLONE OF SIX PLANTS OF A DESIRABLE TYPE OF SMOOTH CAYENNE, ALL OF WHICH WERE PROPAGATED FROM A SINGLE PARENT.—Note the high degree of uniformity displayed.

mass selection. While clonal and mass selection are both of great value in effecting improvements in pineapple varieties the former is employed chiefly for developing new strains and the latter for raising the level of productivity of existing strains.

Methodically carried out, mass selection leads to a rapid improvement in plant type, fruit quality and yield. "Collar-of-slips" and other objectionable types are automatically eliminated and, by raising the general level of vigour of a plantation, losses from diseases are

reduced. In many Queensland plantations, the depression in yield which results from the cultivation of defective types probably exceeds the losses caused by diseases and pests of all kinds. The latter usually attract more attention simply because they are more conspicuous.

Time of the Year and Stage of Plant Development at which Selection should be Carried Out.—Before considering the plant and fruit characters on which selection is based, attention must again be drawn to the fact that environmental influences exert a profound effect not only on vigour of growth, but also on type of growth. The size and

Plate 22.

WINTER TYPE OF SMOOTH CAYENNE (SOUTH-EASTERN QUEENSLAND.)—With upper leaves cut away to show extent to which growth of suckers has been retarded by unfavourable climatic conditions. Note conical shape of the fruit, which is characteristic for this time of the year.

shape of the fruit, the type of crown, the number of suckers and slips which are produced, and the stage of development which they may have attained when the fruit matures—all these characters, as well as others, differ in degree of expression according to the conditions under which a plant is grown. In south-eastern Queensland, fruit size tends to increase during the winter months, but the growth of suckers is greatly retarded and the development of slips is generally entirely suppressed (Plate 22). Opposite tendencies are apparent during the summer months (Plate 23). The reasons why these seasonal differences occur have already been discussed (Chapter II). The fact that they do occur has an important bearing on plant selection work in that it limits the period during which such work may be successfully carried out. In a plant of the Smooth Cayenne variety, the degree to which the tendency to produce slips is inherent and the manner in which this tendency may be expressed are all-important considerations in determining its economic worth. Consequently, selection in this variety is of value only if it is

carried out at the time of the year and at the stage of plant development at which the slipping tendency is most evident. For all practical purposes, therefore, this restricts the practice of both mass and clonal selection to plant crop fields which mature during the summer months.

Climate as a Factor in Plant Selection.—Because environmental conditions influence the degree of expression of the inherent characters of the pineapple plant, it follows that a variety or strain which has proved highly productive under the climatic conditions existing in one locality is not necessarily adapted to another in which different conditions obtain, even though these may be only a few miles apart. Consequently, the full benefits which are to be gained from plant selection are usually obtained only when it is carried out in the district in which the selected planting material is to be propagated. In other words, it is necessary to select in accordance with local climatic conditions.

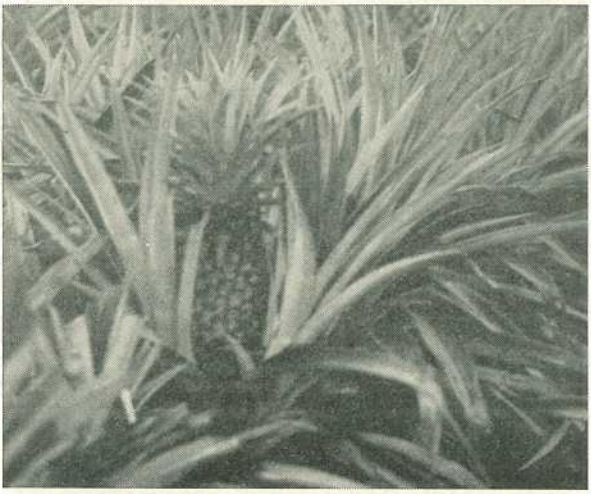

Plate 23.

SUMMER TYPE OF SMOOTH CAYENNE (SOUTH-EASTERN QUEENSLAND).—Note strongly developed suckers and large crown on fruit, reflecting conditions favourable for vigorous growth.

Characters which should be Considered in Practising Selection.—These include: (1) Vigour and habit of growth; (2) suckering and slipping tendencies; (3) fruit characters; (4) uniformity of type; (5) aparent resistance to diseases.

Different plantations may exhibit varying degrees of vigour, according to the conditions under which they have been grown. The differetences which are important in selection work, however, are those which exist between neighbouring plants in the same field. As previously pointed out, vigour in itself is not a criterion of superiority, since some of the most objectionable plant types are vigorous growers. The length of the stem, the type of leaf, the numbers of suckers and slips produced and their position on the parent stem, are all factors which must be taken into account in assessing the vegetative characteristics of a plant. These and other points bearing on the choice of both plant and fruit characters have already been discussed in Chapter II. For the sake of

emphasis, however, attention may again be directed towards the necessity for selecting only from plants in which all of the slips are attached low down on the fruit stalk (Plate 24).

The same discrimination should be exercised with regard to fruit characters as is made with respect to vegetative ones. The size and relative weight of the fruit, its shape, the degree of prominence displayed by the eyes, the nature of the crown and the length of the fruit stalk are all points which should be taken into consideration in selecting

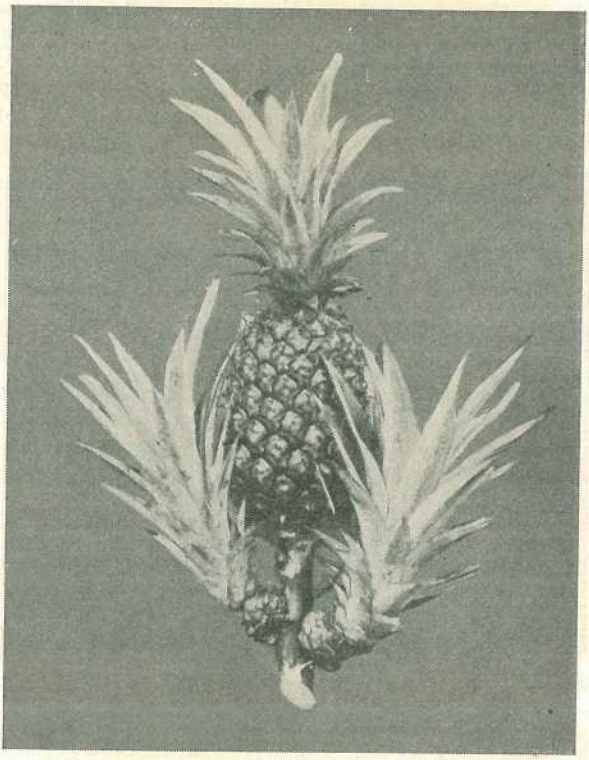

Plate 24.
SLIPS DESIRABLY PLACED ON THE FRUIT STALK.

improved types. The texture, colour, and flavour of the flesh are also important characters, but it is impracticable to determine these without sacrificing the fruit. In mass selection, uniformity of type is a desired quality, particularly with respect to the period at which the fruit matures. Apart from this, late maturing plants often possess objectionable tendencies and should be rejected whatever other attributes they may exhibit. Finally, only disease-free plants should receive consideration in carrying out a selection programme, more especially in fields in which wilt or other diseases occur.

Practical Mass Selection Methods.—Of the various mass selection methods which have been devised, two have been shown to be eminently practicable under Queensland conditions. The first of these is an arbitrary one based on the number and position of the slips on the

parent stem. Consequently, its application is confined to plant crop fields which come to maturity during the summer months. Essentially, the method consists in rejecting as sources of planting material all plants which bear more than three slips, or, in fields which contain a high proportion of "collar-of-slips" plants, all those which bear more than two. Of equal importance to the number of slips is their placement on the fruit stalk. Those springing close to the base of the fruit should be rigorously rejected, as in this position they may arise from a plant with an inhibited "collar" tendency. While the slips themselves may remain on the parent plants until several weeks after the plant crop has been harvested, the actual selection should be carried out just as the fruit is approaching maturity. At this time, those plants which it is desired to use as sources of planting material should be marked by daubing one or two of their outside leaves with white paint. The crowns may also be marked at this time if there is a likelihood that the fruit will be marketed for canning purposes. When the slips and crowns from the marked plants are gathered they should be segregated from all other planting material collected during that season so that they may be planted separately. About fifteen months later, however, before the plant crop of this selected stock is harvested, the plants should be examined individually and any showing abnormalities, such as "collar-of-slips," or those lacking in suckers or slips, or exhibiting a high-stemmed or weak, stunted type of growth, or any affected with wilt should be given a distinguishing paint mark. These marked plants should be left intact until after the planting material has been gathered from the field. This selected planting material should again be planted separately from that obtained from other parts of the plantation and, in due course, the plants which have developed from it should be reselected as before. If sufficient planting material is selected initially to plant up half an acre it will provide stock from which three times that area may be planted in the next generation.

A second practical method of selection for improving plant type and yield combines the principles underlying both clonal and mass selection. This method is genetically sounder than the one which has already been described, but it is somewhat slower and more time-consuming in its initial stages. It consists essentially in segregating the progeny of especially desirable plants as distinct clones during the first generation only, after which mass selection is resorted to for maintaining the improvement which has been gained. Individuals exhibiting characters superior to those displayed by the general run of plants in a field and also a high degree of uniformity among themselves are distinctively marked at the time the first crop approaches maturity. Subsequently, the propagating material obtained from each of these plants—that is, slips, crown, and all suckers except one—is planted together in clones. Planting must be carried out in such a way that there is no possibility of the plants in different clones becoming mixed should any of them die out. In double-row beds, this may be effected without the use of stakes or other markers simply by staggering alternate clones about 6 inches from the line of the row. Just prior to the harvesting of the plant crop the clones are carefully examined and their characteristics compared. Any which are inferior or in which an

abnormal tendency has become apparent are suitably marked so that they will not be used further as sources of planting material. The slips and such other shoots as may be available from the remaining clones are then harvested together as mass selected planting material. This is planted separately from the ordinary field run of planting material and provides a nucleus of improved stock from which further plantings may be propagated. For the complete success of this method it is essential that the identity of the selected stock should be preserved in each successive generation by keeping it segregated from non-selected planting material. In this method, it rarely happens that more than 20 per cent. of the clones originally selected are rejected at the time reselection is carried out. Consequently, if an original selection of 100 clones is made, each averaging five pieces of planting material,

Plate 25.

CLONAL SELECTION IN THE SMOOTH CAYENNE VARIETY: IN EACH ROW, ALL PLANTS BETWEEN STAKES ARE DESCENDANTS OF A SINGLE PARENT, I.E., A CLONE.—Note the difference in size and vigour between the two clones in the foreground, although the plants within each clone exhibit a considerable degree of uniformity.

approximately 400 shoots would be available for further propagation after the undesirable clones have been eliminated. Within a period of four or five years, these would provide sufficient planting material to meet all of the requirements of the average plantation.

As the names implies, mass selection involves the propagation of planting material of mixed origin in contrast to clonal selection which is concerned only with the lineal descendants of a single plant. For this reason, an improvement which has been gained by mass selection can be maintained only by repeating the selection in each successive generation. If this is not done, there is likely to be a gradual reversion to the level of production which obtained before the first selection was made.

Clonal Selection.—While mass selection affords a practical and easily applied method of raising the productivity of commercial plantings, clonal selection—or, as it is frequently termed, *bud selection*—is employed chiefly as a means of developing new varieties or strains. In clonal selection, the planting material obtained from each plant is pooled with that collected from other plants of the same clone through successive generations until the variety or strain represented by the clone has been multiplied to the extent when it may be exploited commercially (Plate 25).

SPECIAL METHODS FOR THE EXPANSION OF NEW STRAINS OR VARIETIES.

The rate at which a new variety or strain can be propagated depends on the number of shoots which it produces. Normally, an average of five shoots of all kinds may be taken from an individual plant of a desirable type up to the time the first fruit matures, i.e., the plant crop. Starting with a single plant, it would take approximately ten years to obtain sufficient planting material of a new variety to plant up one acre if, in each succeeding generation, propagation was restricted to shoots collected at the plant crop. Obviously, speedier methods of building up a new strain or variety are desirable once its superiority has been established. Several ways of accomplishing this have been devised. Basically, all of these consist in forcing into growth a number of the dormant shoot-forming buds on the parent stem, thereby increasing the number of shoots which will be available for propagation purposes.

The simplest way in which this may be accomplished is to remove all offshoots from the plant stem as soon as they are large enough to root when planted out under field conditions. Provided the parent plant is in a vigorous state of growth, other axillary buds will then develop to produce a fresh crop of suckers. When these are large enough to plant they are also removed and the process is repeated as long as new shoots can be induced to develop.

The successful exploitation of this method depends, of course, on maintaining a high growth rate in the parent plant. To achieve this adequate fertilizing is essential and where irrigation is practicable it also may be employed to great advantage, provided it is carried out judiciously.

The Stump Section Method.—A more effective but slower method of forcing dormant buds to develop into shoots which may be used for propagating purposes is to cut the parent stem into small pieces and plant these under suitable conditions of warmth and moisture. This is known as the stump section method. It was devised several years ago in the West Indies, but several modifications have been made in the method which was then described. The procedure which has been found most satisfactory for Queensland conditions is, briefly, as follows:—

Some time after the fruit has been harvested, i.e., when the starch content of the stems is high, the plants which have been selected for sectioning are removed from the field and stripped of their leaves. (Plate 26). The stem which remains is thoroughly washed and laid

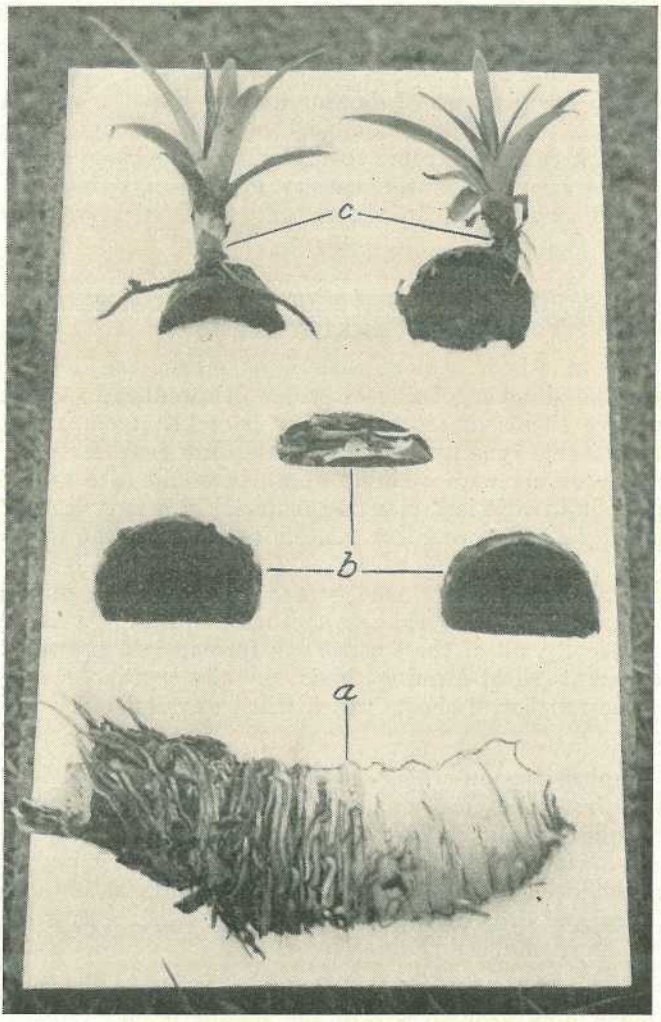

Plate 26.

THE STUMP SECTION METHOD OF PROPAGATION.—(*a*) Stump stripped of its leaves. (*b*) Sections after dipping in potassium permanganate solution. (*c*) Plantlets two months old.

aside in the shade for several days to "cure." It is then cut into wedge-shaped sections about ½ in. thick at their widest part: each of these will have several dormant buds on its outer surface. The sections are surface-sterilized by soaking them in a 5 per cent. solution of potassium permanganate for ten minutes. When they have been thoroughly drained they are planted vertically in hardwood boxes containing rich, friable soil underlying a layer of sawdust. The sections are pushed into the sawdust until they just touch the soil underneath. In the cooler months, the boxes are placed on hot beds covered by protective calico shades, but during midsummer, bottom heat may be dispensed with. Within a month from the time of planting the shoots which develop from the

sections begin to produce their own roots. From one to three shoots usually develop from a section, though all sections may not produce shoots. Those cut from the middle part of a stump generally prove most satisfactory. After three months or so the sections are lifted and divided according to the number of plantlets which have developed from them. These are transplanted into larger flats which are then transferred to a lath house (Plate 27). Nine or ten months later the plants are set out in the field. Plants which have been raised in this way usually take about the same time to come to maturity as seedlings, that is, approximately three years.

By employing the section method of propagation about twenty-five plants can be propagated from each stem. Also available for planting are all of the various shoots which are normally produced on the parent

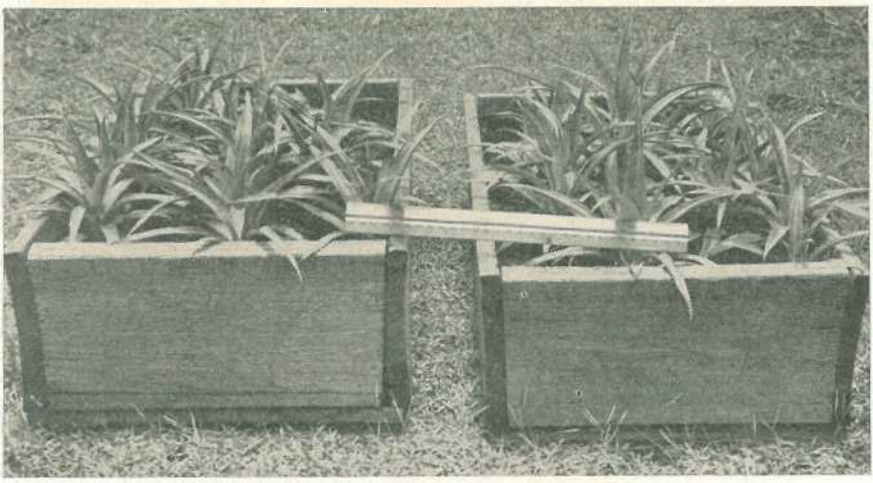

Plate 27.

YEAR-OLD PLANTS PROPAGATED BY THE STUMP SECTION METHOD.—Each box contains the progeny of a single stump. At this stage the plants are ready for setting out in the field.

plant while the fruit is developing. In comparison with ordinary methods of propagation, therefore, the stump section method enables the rate of expansion of a new variety or desirable type to be accelerated six-fold, but the employment of this method is rarely practicable after the second generation, owing to the work entailed and the equipment required. Nevertheless, its use during this period reduces by half the time which would otherwise be required to establish a new variety or strain in commercial production.

Still another method of obtaining an increased rate of propagation in the pineapple has recently been suggested by Macluskie in Sierra Leone. This method is really a modification of the stump section method, from which it differs chiefly in the manner in which the stems are sectioned. Instead of cutting them transversely into ½-inch sections, they are quartered longitudinally. The inner surfaces of the slices are then pared flat, after which they are planted in a nursery bed, rich in organic matter, by pressing them halfway into the soil. Four to

eight weeks after planting the slices are lifted and the plantlets which have developed are sectioned off and transplanted to another nursery bed for further growth before being planted out in the field.

Under Sierra Leone conditions, the Queen variety is said to produce an average of seventeen plants per stem by this method, while the Smooth Cayenne gives an average of only five. Since it is claimed that the stage of stem development at which best results are obtained is that which is reached when the plant is fully grown and just about to flower, i.e., before suckers or slips have begun to develop from it, the method would not appear to possess any advantage over ordinary propagation practice as far as the Smooth Cayenne variety is concerned.

In addition to their value for building up new or improved varieties the special methods which have been described are also employed for propagating varieties which have been imported from other countries. By their use, it is possible to confine importations of a desired variety to a few plants only, thus minimising the risk of introducing new diseases or pests and yet enabling it to be established commercially within a reasonable space of time.

(TO BE CONTINUED.)

FEED TROUGH ON SKIDS.

This portable feed trough, designed by the United States Department of Agriculture, is portable, since it is mounted on 4 x 4 runners. It is 14 feet long. The upright supports are 6 feet apart and are 4 x 4, while all the braces are of 2 x 4.

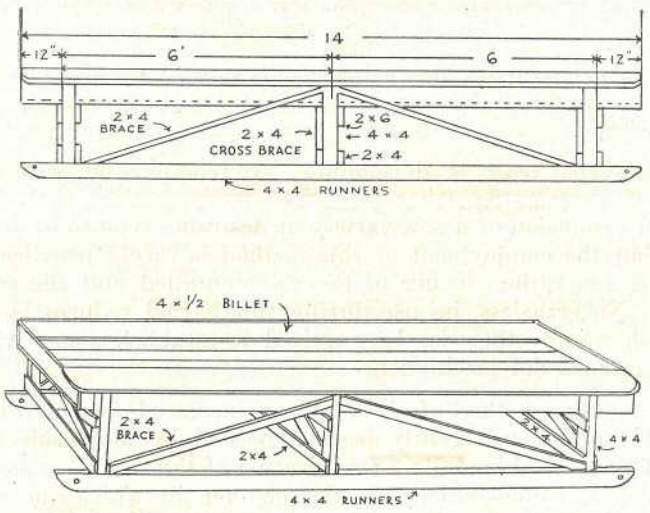

Plate 28.

The crosspieces which support the floor of the rack are 2 x 6, and so are the flanges. The corners are rounded to prevent injury to the stock. The rack can be pulled around to wherever it is needed.

Fused Needle Disease and its Relation to the Nutrition of Pinus.

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CONTENTS.

SUMMARY.

THE distribution of fused needle disease of *Pinus* in Australia and other countries, together with the various symptoms connected with the trouble and the species of *Pinus* affected, are discussed. The typical fused needle condition is thought to be only one of a number of closely-related abnormalities.

The economic importance of the disease, as affecting coniferous plantations, is considered. It appears that the trouble is a limiting factor in the establishment of exotic pines in certain localities.

Experiments showed that all factors, save soil, have no direct influence on the condition. Genetic factors are thought to act in a secondary manner. In connection with soil factors, it is considered that minor elements and the physical nature of the soil can be dismissed as primary causes. The action of phosphorus in relation to pine nutrition is found to be of major importance.

The organic matter complex appears to be fundamentally related to the occurrence of the trouble, and a number of experimental observations concerning this are described and discussed.

Success in the control of fused needle and related abnormalities by the use of phosphatic manures was obtained in a number of field experiments. The theoretical background of this work is discussed and the experiments described. It is thought that the fertilizers act chiefly in a secondary manner by stimulating the production of organic matter and by aiding the development of a satisfactory mycorhizal complex.

The practical application of fertilizer treatment in general plantation practice is described and discussed.

The development of the knowledge of mycotrophy is briefly reviewed, and a general mycorhizal theory to explain the cause of fused needle disease is advanced.

Normal and abnormal mycorhiza are discussed in relation to the occurrence of fused needle disease and related conditions. The unsatisfactory mycorhizal condition is associated, in the case of the majority of fused needle sites, with a low total phosphate value in the soil. The relative absence of surface litter formation is considered to be due to this deficiency. The lack of raw organic matter possessing a relatively high phosphate content is thought to be conducive to the development of faulty mycorhizal systems, with resultant abnormal growth in the trees.

A carbohydrate hypothesis for the physiologic rôle of tree mycorhizas is propounded as an adjunct to the nitrogen-mineral salt theory, and experiments supporting this contention are described. According to this hypothesis, normal mycorhizas supply the tree with an essential part of their carbohydrate supply, and it is to the inefficient functioning of the mycorhizas in this respect that the fused needle condition is due. The supply of additional phosphorus to soils low in this element results in a more abundant phosphatide excretion from the pine roots, thus stimulating normal mycorhiza formation and bringing about a satisfactory balance of conditions for correct mycotrophic activity. The amount of vegetable detritus present is important in this respect, as it is from this source that the carbohydrate supplied to the higher plant by the mycorhizal fungus is obtained. The addition of phosphates to the soils in question stimulates the growth of natural vegetation, and thus aids the development of the necessary supply of vegetable detritus.

PART A.—GENERAL INVESTIGATIONS BEARING ON FUSED NEEDLE CONTROL.

I.—INTRODUCTION.

During the period which has elapsed since the issuing of the first report dealing with investigations into the fused needle disease of *Pinus* in Queensland (Young, 1935) a considerable amount of progress has been made, and at the present time it has been proved that corrective methods, devised during the experimental work, are economically applicable to routine plantation operations with satisfactory results. The investigations on which these results are based had, as their foundation, a hypothesis first suggested in 1934, which presupposes that the mycorhizal complex of the affected trees is in some way connected with the diseased condition. The present paper has been prepared in order to set out the results of the investigations which led to the practical solution of the problem, together with a discussion of the theory underlying the work. A brief rèsumè of the contents of the earlier report has been included in this paper for the sake of clarifying the position leading up to the investigations described.

II.—DESCRIPTION OF THE DISEASE AND ITS IMPORTANCE.

Distribution of Fused Needle Disease.

In Australia, fused needle disease is present in all States of the Commonwealth on many soil types, but has only been considered of importance in Tasmania, New South Wales, and Queensland. The first published reference to it appeared when Samuel (1922) discussed this trouble in relation to its appearance in South Australia. Later in the same year Birmingham (1922) considered the subject with reference to New South Wales. Descriptions and discussions of the disease as it occurs in Western Australia have been published by Kessell and Stoate (1936, 1938). Investigations into the cause of the fused needle condition were commenced in Queensland in 1933, and have been carried on by the writer, along with other aspects of forest pathology, since 1934.

Records of the occurrence of the disease outside Australia have been made in *Pinus radiata* in England (Rayner, 1938; and Jones, 1938), in California at the Institute of Forest Genetics and in plantations of *Pinus radiata* at San Bernardino (Rodger, 1931), in South Africa (Sherry, 1938; and Ludbrook, 1939), and in New Zealand north

of the kauri line. No records of the trouble have been made in the naturally occurring stands in the United States of America, which is the native habitat of the majority of species of exotic conifers of forest importance in Australia. One doubtful record of the occurrence of fused needle disease is a case of needle-twisting observed by Addoms (1937) in *Pinus tæda* used in nutritional studies in the Eastern United States. In this instance the abnormality was thought to be caused by the effects of low humidities, but an artificial increase in this factor made no difference to the occurrence of the condition. It is reported that the twisting was observed more frequently in the plant house than in the field.

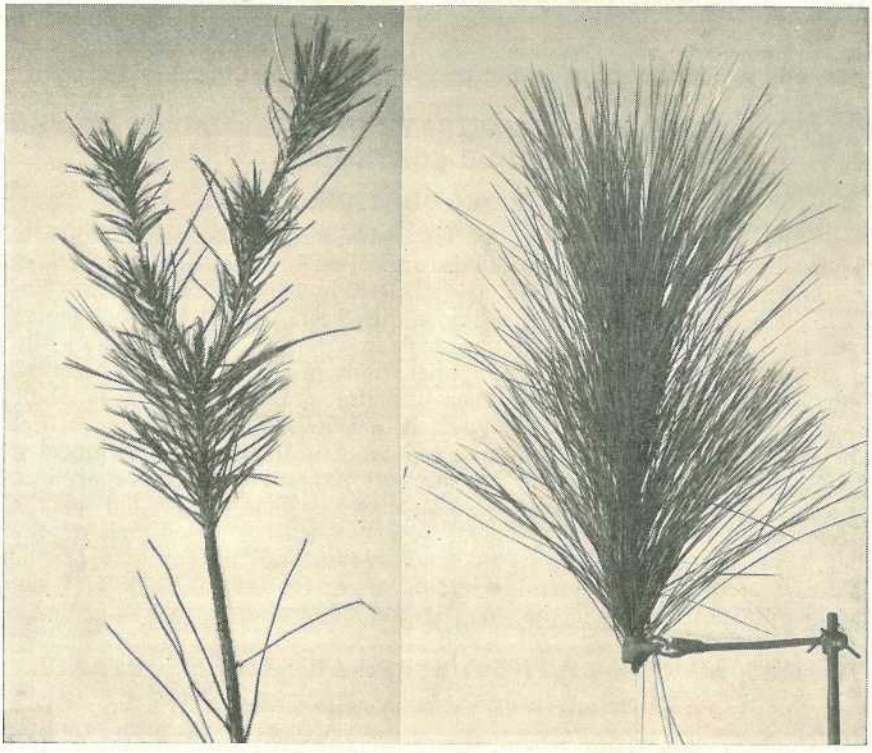


Plate 29.

FUSED NEEDLE SYMPTOMS IN PINUS CARIBÆA.—(Left) affected branch, showing suppression and resinosis of terminal bud; (right) healthy branch for comparison.

Symptoms of Fused Needle Disease in Australia.

The symptoms of the malady in Australia have been described by Samuel (1922), Birmingham (1922), Young (1935), Kessell and Stoate (1936, 1938), and Ludbrook (1937).

There appears to be some confusion as to the types of growth which may be included under the heading fused needle, needle fusion, or curly needle, and it is considered that, as a result of experience in Queensland and observations carried out in New South Wales, the definition of fused needle might be legitimately expanded to cover a number of other growth abnormalities.

The description of the disease given by Young (1935) and Ludbrook (1937) covers the symptoms exhibited by the trouble in its typical form. This is manifested by the stunting of the tree, accompanied by the twisting and adhesion of the needles of each fascicle. In *Pinus tæda* and *P. caribæa* a resinosis of the terminal buds often appears at the same time. This resinosis frequently occurs as a copious exudate, but more often gives the bud a hard, varnish-soaked appearance. The terminal bud is often suppressed by the mechanical action of the dried resin, and new buds develop below it, giving rise to a condition of multiple leaders. The same reaction is experienced by the branches. The fasciated type of branching thus produced frequently recurs, and, as a result, a very shrubby, stunted tree is produced.

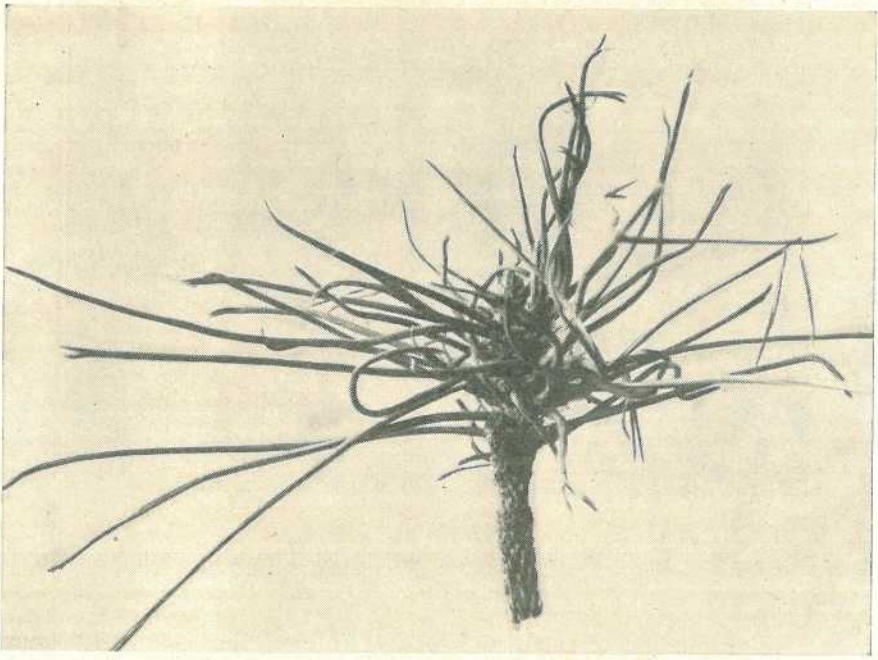


Plate 30.

TWIG OF PINUS CARIBÆA. Showing fused fascicles.

Observations in Queensland have shown that the needle fascicles on affected trees may develop normally as regards the emergence of the needles from the fascicle sheath, but these, later, may fail to separate. They are typically twined about each other. The contiguous surfaces adhere by means of a resinous film, and the union is often reinforced by the outgrowth of epidermal cells of one needle into the opposite stomata of its neighbour (Young, 1935). This outgrowth probably occurs as a result of pressure due to the constriction of the developing needles in the fascicle sheath. In bad cases the needles remain short and often become stouter, and, in very severe cases, scarcely emerge from the sheath. In lightly-affected cases the needles often do not adhere, but are loosely twisted about each other.

Another symptom often noted in connection with the disease is the appearance of "concertina" needles. When these occur, the fascicle has failed to open until very late, resulting in a bunching and concertina-like folding of the needles. This phenomenon is often present on trees which do not have any other indication of fused needle, but it has been observed on numerous occasions to precede the definite onset of fusion during the same or the following growing season. In other cases, however, the trees have behaved normally. This appearance is common in *Pinus caribæa*, and also occurs in *P. palustris*. The shedding of a large proportion of the needles only one year old is common in all the forms noted.

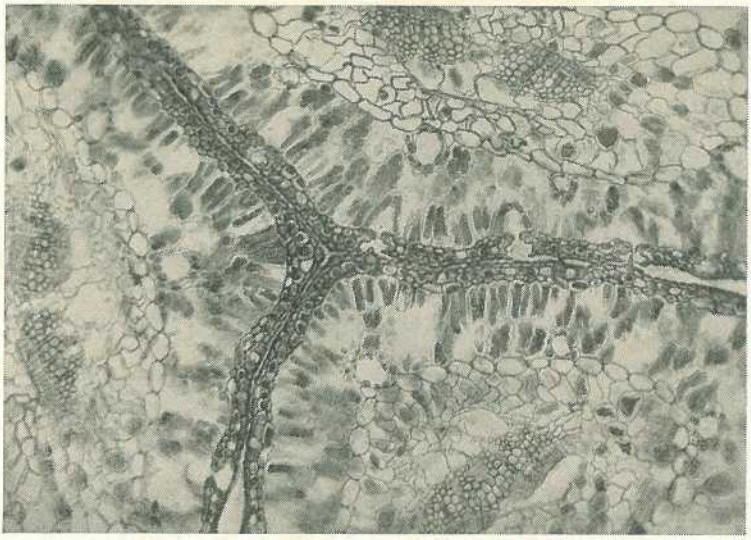


Plate 31.

FUSED FASCICLE OF PINUS CARIBÆA. Section showing outgrowth into the stomata of the opposite needle. (× 70.)

The production of small and usually infertile but persistent cones is also a characteristic of many badly fused trees.

Microscopically, the needles of fused trees exhibit an absence of starch granules, whilst in healthy trees the starch is usually abundant. Ludbrook (1937) states that the phloem of the stem and branches of severely affected trees often exhibits a light-brown discolouration. In Queensland, however, numerous sections cut from diseased tissue of *Pinus tæda* and *P. caribæa* have failed to demonstrate the presence of this abnormality.

In the majority of cases examined, mycorhizal roots of fused-needle-affected trees exhibit an abnormal darkening in colour and, for the most part, are thin and of the simple type. Microscopic studies with these roots show an unbalanced association in which the mycorhizal fungus has developed a parasitic habit with the formation of intra-cellular haustoria—that is, a pseudo-mycorhizal condition is present. There is also a disproportionally large number of dead as compared with functional mycorhizas on trees in affected situations; considerable

numbers of what appear superficially to be normal coralloid mycorhizas are present, but a microscopic examination of these usually demonstrates the presence of a diseased condition. This is evidenced by the almost total obliteration of the cortical cell structure of the rootlets by fungal growth, which occurs as a toruloid mass. The mantle is, in these cases, often only two or three cells thick.

These mycorhizal characters are, from the writer's observations, of general occurrence in unhealthy, poorly-developed stands of *Pinus* spp. in New South Wales and Queensland even when actual needle fusion is absent. This fact, together with other evidence, has led to the conclusion that this lack of vigour and general poverty may be related in its origin to the more typical condition known as fused needle.

In plantations at Beerwah where clean chipping of the soil surface has been carried out in connexion with experiments with fused needle disease it has been noted that both a yellowing and thinning of the crown and some rosetting have occurred on these plots, and not on the unchipped controls, whilst fused needle proper has also been accentuated by the treatment, as will be seen when the experiments are discussed later. The development of one form into another—such as thin crown and yellowing into fused needle, and rosetting into fused needle —together with the apparent inherent variability of various individuals of any one species as regards fused needle susceptibility, has led to the conclusion that these abnormal conditions cannot each be placed in different categories, and that they are all symptoms of the same cause. It is considered that these forms can legitimately and conveniently be classified as types of fused needle. Some of the abnormalities are briefly discussed here.

A condition which is evidenced by the shortening of the needles of plantation trees of from two years of age upwards, which is usually accompanied by the shedding of a large proportion of the needles of the previous year, and often of needles of the current year, is frequently observed. A similar abnormality has been noted by Kessell and Stoate (1938), in Western Australia, and is known to them as "rosetting." The affected trees are dwarfed in habit. The symptoms are of more frequent occurrence in *Pinus radiata* than in *P. tæda* and *P. caribæa,* though in the latter it is not uncommon on bad sites. The condition in Queensland occurs most frequently on sites subject to fused needle disease, and in some instances, trees affected in this manner (*P. tæda* and *P. caribæa*) have been noted to develop later the typical symptoms and often possess twisted, if not fused, needles. In the case of *P. tæda* and *P. caribæa,* which are the principal species cultivated in Queensland, the proportion of "rosetting" to fusion, as calculated from observation plots, is as 1 : 9 in the case of *P. caribæa* and 1 :11 in *P. tæda.* In *Pinus radiata* at Pechey typical needle fusion is rare, though rosetting and other abnormalities are frequent. This state of affairs was also noted in Southern New South Wales.

Another abnormality of frequent occurrence, the incidence of which appears to be related to that of fused needle proper, is a thin-crowned appearance. In this case, as the term indicates, there is a more or less scanty development of needles on the affected trees, and a good canopy is not formed. Even on sites very badly affected with fused needle disease, one condition has not been observed to develop into the other. Trees showing thin crown are usually of a spindly, lightly branched form and exhibit a great reduction in growth. The abnormality

has been described under the name "thin crown" by Kessell and Stoate (1938), in *Pinus radiata* in Western Australia, and has been observed in that species in Queensland and New South Wales. A similar condition is frequently seen in *P. tæda* on fused-needle-affected areas at Beerwah. The condition has rarely been noted in *P. caribæa*.

In some cases a chlorotic condition occurs which appears to be associated with thin crown. This condition—"yellowing"—was described by Kessell and Stoate (1938). It has commonly been noted in Queensland in *Pinus tæda* and *P. caribæa* on sites subject to severe fused needle, and is assumed to be the same as that described from

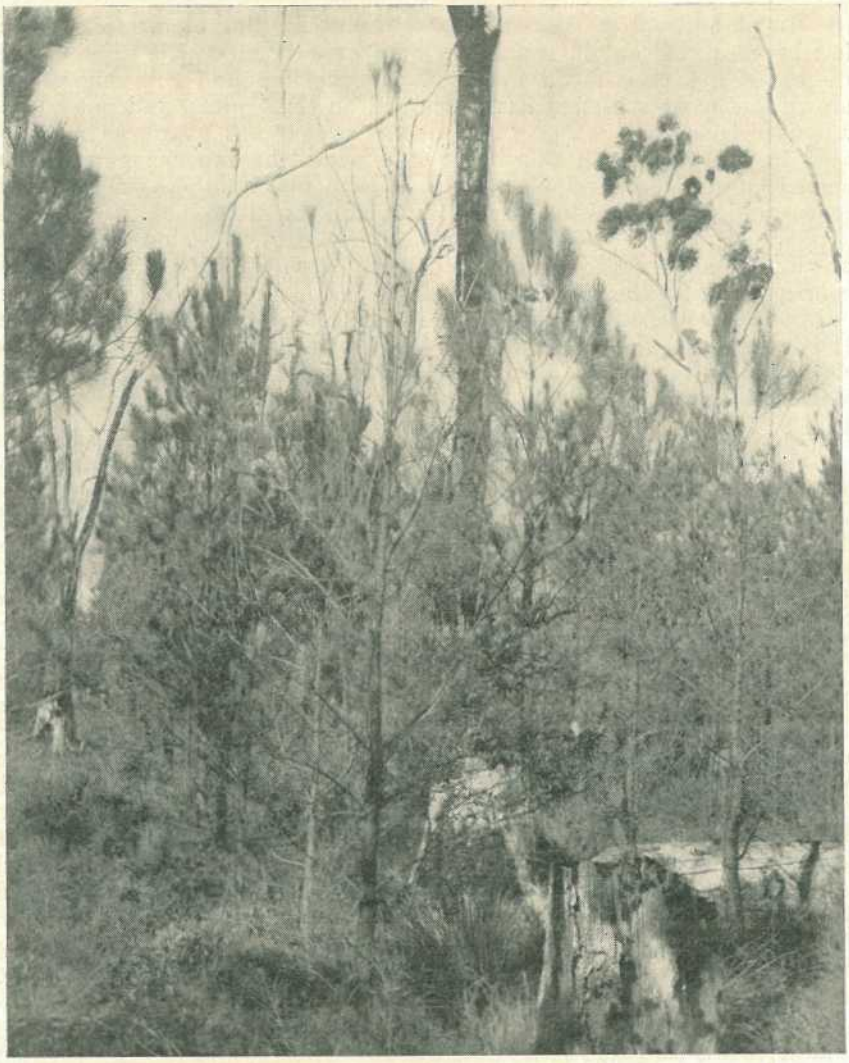


Plate 32.

"THIN CROWN" TYPE OF FUSED NEEDLE DISEASE IN PLANTATION AT BEERWAH (*Pinus tæda*).

Western Australia. The appearance of the trees affected is distinct from the chlorotic colouring due to bad drainage, the latter condition showing a general yellow appearance without reduction in foliage. Most of the "yellowing" trees appear to suffer from thin crown in some degree, and in Queensland the two conditions appear to grade into one another. Kessell and Stoate (1938) have noted an improvement in thin-crown trees between the tenth and fifteenth years. This improvement accords well with the similar experience in fused-needle-affected trees and the litter and mycorhizal theory propounded later in this paper.

The occurrence of fused needle, rosetting, thin crown, and yellowing on the same sites and their apparent interrelationship indicated that the abnormalities named might be closely related in their respective causes. This is also borne out by the response of trees possessing any one of the types of abnormality referred to to treatment with phosphatic fertilizers. Microscopic examinations of mycorhizas of trees affected with all the various abnormalities from New South Wales and Queensland have presented similar pictures.

From the point of view taken here, it is considered that an investigation into fused needle disease is really an investigation into the causes of the unsatisfactory growth of *Pinus*. From a consideration of the literature and observations by the writer, this poor growth is, on the whole, more in evidence in some of the other States than in Queensland. Contrary to the view expressed by Ludbrook (1939) that fused needle is probably a distinct condition to that evidenced by general ill-health, and that the investigation of fused needle is of less importance than that of the latter more common condition, it is thought that such investigations are of considerable economic importance in that they are, in fact, enquiries into the causes of the ill-health of the worst-affected individuals of trees suffering from different manifestations of the one disease. Ludbrook (1939) has also considered that fused needle investigations are really more important with *Pinus tæda* and *P. caribæa*, since these are the two species most intensively planted in coastal Eastern Australia which exhibit the disease. This, however, is not necessarily the case, because, although the disease occurs commonly in its typical form with these two species, it is considered from observations recorded in New South Wales that other species—notably *Pinus radiata*—exhibit troubles which are probably identical in origin and occur with greater frequency.

Ludbrook was unable to find any significant differences in mycorhizas obtained from "healthy" and diseased trees, and was inclined to the opinion that it was, therefore, unlikely that any reliance could be placed on diagnosis by root studies. Through the courtesy of Dr. Ludbrook, the writer was able to examine a number of these sections. It was seen that both the typically fused and the unfused trees—the latter exhibiting, however, a generally poor and unsatisfactory type of growth —possessed an incorrect mycorhizal equipment. In all cases the fungal symbiont showed a definite parasitic picture, with abundant healthy, undisintegrated intercellular mycelia ramifying freely through the cortex of the roots. No Hartig net, as such, was visible, the cell walls having been disrupted by the penetrating hyphæ.

One preparation showed a healthy mycorhizal condition. This was made from roots of trees collected under an abnormally healthy (for that plantation) stand of *Pinus radiata*, growing at Belanglo, in New South Wales. In this case a typical Hartig network, with what

appeared to be mycelia being digested by the so-called phagocytic action of the cortical root cells, was present. The short roots were enveloped by a fungal mantle of the usual healthy type.

SUSCEPTIBLE SPECIES.

Since 1935, when a list of species of *Pinus* susceptible to typical fused needle disease was published (Young, 1935), further additions to the number attacked have been made by Ludbrook (1937) and the writer, and the species now known to be susceptible are as follows:—*banksiana, caribæa, cembra, contorta, densiflora, echinata, excelsa, halepensis, insularis, lambertiana, luchuensis, montezumæ, muricata, palustris, patula, ponderosa, radiata, serotina,* and *sonderregerri.* The list composed by Ludbrook contains all these, save *patula* and *sonderregerri. Pinus patula* was first noted as being attacked by Rodgers (1931) in California, and later by the author in Queensland. The presence of the diseased condition in *P. sonderregerri* has been noted in Southern Queensland.

If the wider application of the term "fused needle" is accepted, it is considered that *Pinus pinaster* can also be included in the list of species subject to the disease. This pine often exhibits the poverty-stricken type of growth usually associated with fused needle in other species, although the typical fusion of the needles is absent. It can, therefore, be classified as a species exhibiting a disease type different from the typical picture presented by *Pinus tæda* and *P. muricata.* Sections of mycorhizas from this species collected in plantations in Southern New South Wales have shown the typical abnormal symptoms. *Pinus radiata* appears to be an intermediate type, which exhibits the typical form of the disease, but with a greater proportion of the non-fused type.

The order of susceptibility of the species of plantation importance in Queensland is as follows:—*Pinus tæda, P. caribæa, P. palustris,* and *P. patula. Pinus tæda* is relatively much more susceptible than any of the other three species noted; *P. palustris* is but infrequently affected; and it is rarely that an affected tree of *Pinus patula* is found. *Pinus radiata* is of little importance in Queensland, as the use of this tree as a plantation species has been abandoned owing to its unsatisfactory reaction to Queensland conditions as compared with other species.

(TO BE CONTINUED.)

Passion Fruit Growing in Queensland.

H. BARNES, Director of Fruit Culture, and J. M. WILLS, Fruit Branch.

PASSION fruit growing has developed into an industry of considerable importance in Queensland. Once regarded largely as of minor consequence, it has now become with many fruitgrowers a main source of income.

Although in constant demand as a fresh-fruit market commodity, passion fruit is becoming of even more importance as a component in canned tropical fruit, salads, fruit drinks, and confectionery.

Though there are a number of varieties in existence in the State, only one—the purple-fruited *Passiflora edulis*—is grown commercially.

In some parts in the south-east of Queensland, hitherto regarded as essentially banana-growing and dairying districts, there is little virgin land left for banana-growing. Old plantations usually carry a good cover of grass, but at times, because of altitude and inaccessibility to dairy stock, they are unsuitable as grazing areas. On such areas, which otherwise may remain unutilised, the planting of passion fruit has already proved payable.

The passion vine is a vigorous and adaptable plant, but it does not follow that because of this plantings may merely be made at random and the vines allowed to grow without care. On the contrary, considerable attention is necessary in order to obtain the best results, and disappointment is the usual result of "hit or miss" methods of cultivation.

The prospective grower is recommended to commence with a small area, which may be afterwards increased. Four to five acres of vines is, generally, the maximum area one man can attend to, if horse-drawn or mechanically-driven cultivators are used. On less accessible sites, where hand-cultivation is the only practicable method, the area should be substantially less for efficient working; in such circumstances, two or three acres will be found quite large enough to occupy the full time of the grower.

Climatic Conditions.

The Queensland coastal climate, particularly in the south, is very suitable for passion fruit growing. The vine thrives under warm, humid conditions, such as prevail in the coastal area. Self-sown plants may commonly be found growing along the edges of rain forest clearings, roads, and snigging tracks, where they establish themselves with remarkable ease, and produce fruit of quality and quantity in competition with natural vegetation.

Under normal seasonal conditions, heavy rainfall assures sufficient soil moisture for most of the year for the maintenance of vigorous growth, the exception being perhaps in early spring. Attention to cultivation will usually offset any ill effects of a dry spring, but where it is prolonged into a dry summer some defoliation and loss of fruit may be expected. Some growers have found passion fruit growing profitable enough to warrant the installation of an irrigation plant.

In the south-eastern parts of Queensland, frosts occur on flat and low-lying land, but severe frosts are rare on hillside country. When deciding to grow passion fruit, this fact should be kept in view. Light frosts will do little harm to the vines, but a severe cold snap will kill the young top growth and may destroy the vines completely.

Plate 33.

An established passion fruit vineyard at Springbrook on one of the numerous small, richly fertile plateaux of the Macpherson Range, bordering New South Wales in the south-eastern sector of Queensland.

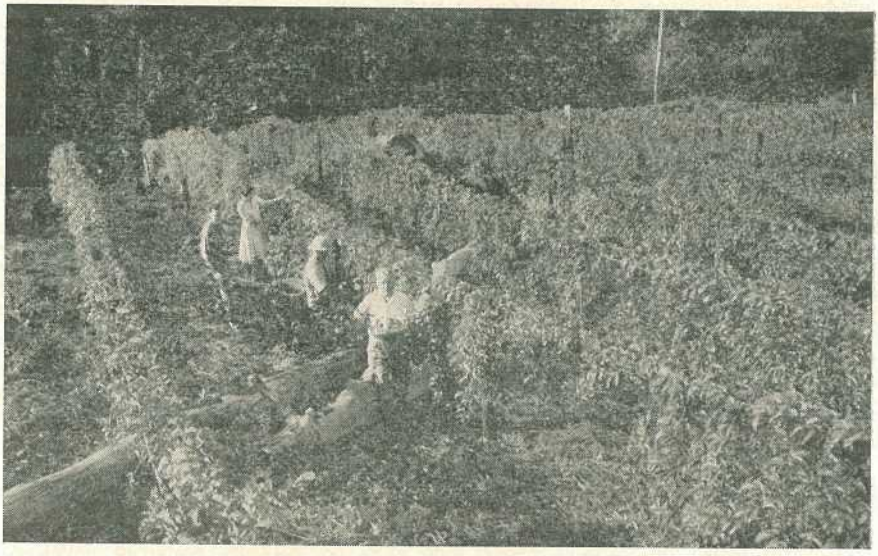


Plate 34.

A YOUNG PASSION FRUIT VINEYARD ON RED-OAK SOIL AT MUDGEERABA.

Cropping Habit.

Each crop is borne on new growth. The time which elapses between planting and first fruiting varies considerably, and depends chiefly on the time of planting and the strength and vigor of the vines. Vigorous plants commence to bear earlier than less robust ones, and may produce a few fruits at six months. As a general thing, however, vines planted in the early spring produce the first commercial crop in from twelve to fifteen months. When autumn planting is practised, a small crop may be borne the following summer or autumn, and the first big crop eighteen to twenty-one months after planting.

Plate 35.
A ONE-TIME BANANA PLANTATION TRELLISED FOR PASSION FRUIT VINES.

In favoured localities two crops are generally borne yearly—a main summer crop and a secondary winter crop. Approximately ten weeks elapse between the time of setting of the fruit to maturity. Blossoming occurs usually during August, September, and October for the summer crop, and during February and March for the winter crop. Marketing of the summer crop commences in October and may extend to January, with the heaviest pickings in November and December. The winter crop is usually harvested in May and June.

More or less continuous growth occurs in some years when weather conditions are favourable, and this results in the production of flowers and fruit right through the year. Occasionally, definite intermediate crops are obtained. The most evident of these is harvested during the months of February and March, following a November and December blossoming. These intermediate crops, although light, are usually very profitable, since they are marketed outside the periods of peak harvest. However, they are not normal, and are often followed by light settings of fruit for the main crops.

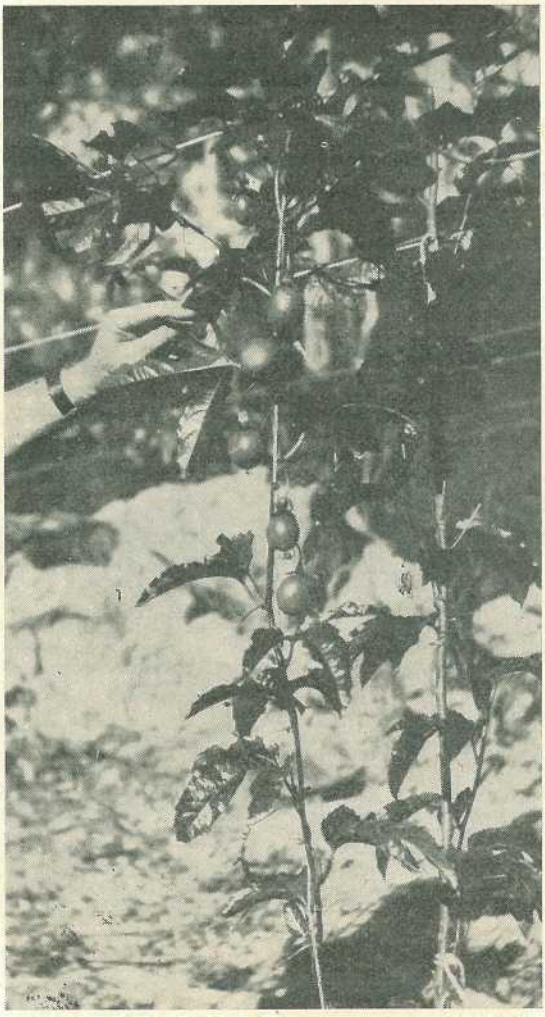


Plate 36.
A SIX-MONTHS OLD VINE SHOWING FIRST FRUIT.

At high altitudes of 1,500 to 2,000 feet above sea level, flowering and cropping habits vary very widely on individual plantations, being influenced by the immediate local conditions. In general there is a main summer crop, which matures later than that on lower lands, with a subsequent winter crop; but on some plantations there is continuous cropping and flowering all the year round. This is influenced to some extent by pruning and consequent forcing of new growth on which the flowers are borne. Other areas, which are exposed to cold winds or lack sufficient sunlight during the winter months, bear exceptionally late crops. On still other sites, the crops are matured very early, even before those on the low lands. Growers planting on such locations are fortunate in being able to harvest their fruit during a period when the market is in short supply, and when prices are consequently considerably higher than those prevailing during the period of peak harvests.

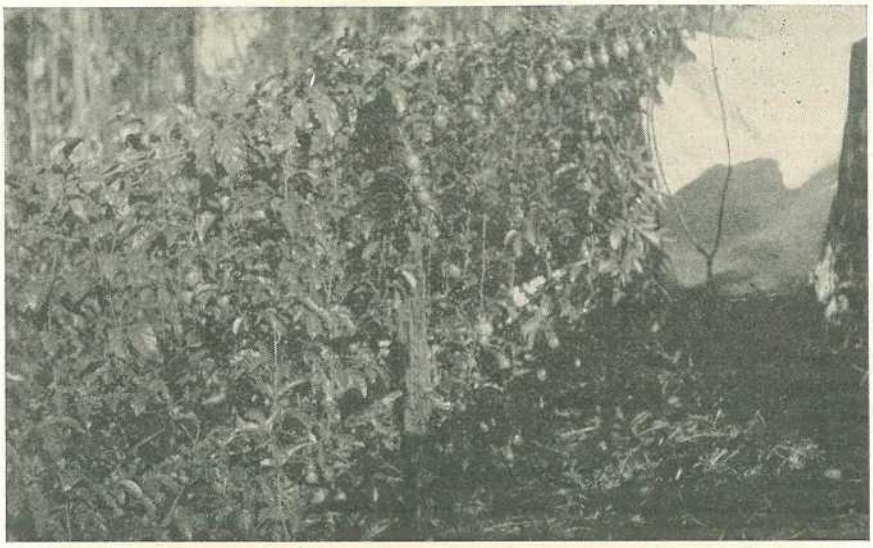


Plate 37.
VINE TEN MONTHS OLD SHOWING STURDY GROWTH OF TWIN LEADERS, DENSE VIGOROUS LATERALS, AND ADVANCED FRUIT.

Plate 38.
RISING GROUND ON ONE SIDE AND A SOLID BELT OF TIMBER PROVIDE GOOD PROTECTION FROM WINDS.

The profitable life of the vine is about four years when grown under proper cultural conditions. Maximum cropping is obtained with the second summer crop, following which the tendency is for the vines and the quality and appearance of the fruit to gradually deteriorate. Reasonably good crops may, however, still be obtained for another year or two.

Selection of Site for a Plantation.

Six important factors should be considered in selecting a site for a passion fruit plantation, viz., aspect, elevation, shelter, soil, drainage, and accessibility.

Aspect, elevation, and shelter generally will go together, as a good aspect is often elevated above frost level and sheltered from heavy winds. The aspect for preference should be from east to north, open to the morning sun, and backed by rising ground or dense natural timber to protect it from westerly and southerly winds. An aspect from east to north is naturally warmer, and this fact has a marked influence on the early maturity of the vines and the production of large crops of high grade fruit which colour and ripen evenly and rapidly. The exposed tops of ridges should be avoided where the soil has washed; vines rarely do well when planted on such situations.

Vines are not very exacting in respect of choice of soils. Any which are reasonably fertile are usually quite suitable, but it is of the greatest importance that they be well drained. Stagnant water at the roots and sour soil conditions are fatal. Soils on which vines are at present growing successfully range from rich rain forest to light scrub and forest soils. In the case of the first-mentioned, vines have a tendency to produce very heavy rank foliage which becomes rather a disadvantage, in so far that extra work is entailed keeping the growth within reasonable bounds and checking fungus diseases to which the vine is subject. Good scrub and forest lands produce vines of good average growth without the tendency to excessive foliage, while there is little, if any, difference in cropping propensities. Normally, forest and scrub soils do not possess as great an amount of humus as those of rain forest origin, and after being cleared of the natural timber for two or three years it may be observed that they dry out rather too quickly. This can be rectified, and the ground made to absorb and hold moisture better, by growing and turning in cover crops during the winter. In addition, the fertility and mechanical condition of the soil also will be improved.

In common with the banana, passion vines thrive on stony ground, and, except that cultivation is made more difficult, the presence of surface stone is not undesirable. Moreover, it has the advantages that it prevents soil erosion on hillsides, and assists in the retention of soil moisture and the maintenance of a higher soil temperature during winter. It is obvious that the latter is important in maintaining the vigor of the plants and inducing an earlier response to spring conditions.

Drainage.

Throughout the coastal districts in South Queensland there is a heavy yearly rainfall, but during normal wet seasons, half the annual fall may be precipitated during two or three months, hence the need for a well-drained soil.

Elevated and sloping sites are usually drained sufficiently, but drains across the slope should be made at intervals to carry surface run-off and control soil washing. These cross or contour drains should be

as short as conveniently possible to avoid the necessity for having to carry too much water, and should have but a very gradual fall into main drains provided at intervals. By keeping the surface of the soil well broken up, absorption of rain is increased and the possibility of erosion is lessened.

On more or less level land where drainage is at all faulty, main drains up to 2 feet deep should be opened up at convenient intervals, and a series of shallower drains constructed to lead into them.

Accessibility.

The method of cultivation will be decided by the site selected. Mechanical or horse-drawn implements are, of course, more economical, but necessitate the thorough cleaning of the land in the first instance. The presence of logs, stumps, and stones makes hand cultivation necessary, with a corresponding increase in the time and labour required.

Plate 39.
PREPARING HILLSIDE LAND BY HAND FOR PASSION FRUIT.

When elevated sites are selected, the provision of a "flying-fox" or overhead wiring system will be found a great convenience for the quick and safe transport of fruit to the packing shed, and for this reason a suitable site for a shed should be found or provided. Instructions for the erection of a wiring system may be obtained on application to the Department of Agriculture and Stock, Brisbane. Where possible, the packing shed should be conveniently situated alongside a good road providing access at all times to a railway siding. It should be borne in mind that daily despatch of fruit to market is desirable and that any disorganisation of or delay in transport may result in considerable loss.

Preparation of the Land for Planting.

The land in which vines are to be planted should be well prepared in order that the young plants may establish themselves rapidly and

develop a good root system which can traverse a greater area from which to draw available plant food. Where ploughing is possible, this should be well and deeply done, and the soil later worked down finely. On land which it is not possible to plough, the soil should be broken up by hand, mattocks or steel pronged forks being used for this purpose. Preparation should be completed by the end of August, so that any rain which falls will all be absorbed and the land will be in good condition for planting.

Coastal soils are known to be deficient in lime, and an application of from ½ ton to 1 ton per acre will assist in correcting acidity and generally improve the condition of the soil.

Mulching.

Paper mulch 18 inches wide is used in some localities to keep down weed growth around the young plants and under the trellises where mechanical or horse-drawn implements cannot be used and hand-clipping has to be done. The soil is prepared by forming "lands," that is, the ploughing of at least four furrows towards the centre, and, after breaking down the soil finely, laying the paper on these, care being taken to cover the edges with soil to prevent the paper being lifted and torn by the wind. Holes are punched in the paper at the required distances apart, and the plants set through them. The young plants should be watered in, the planter being careful to see that the crown is well clear of the soil.

Planting Distances and Trellising.

Eight to 10 feet is usually allowed between rows, and 15 to 16 feet between plants. The number of plants required to the acre at the various distances are: 8 feet by 15 feet = 363 plants, 8 feet by 16 feet = 343 plants, 10 feet by 15 feet = 290 plants, and 10 feet by 16 feet = 270 plants. In general, the more fertile the land the greater should be the distance apart within the limits shown above.

Nothing is to be gained by crowding the plants, which should be allowed room for a natural vigorous development and to permit of cultivation with implements where possible, without risking damage to the trellises even when wide spreaders are used on the horizontal type of trellis. Planting too close in the rows has little or no advantage, for after the first year the foliage of the vines will become too dense. It will then be necessary to cut out possibly, half the number of vines in order to keep the foliage sufficiently open to admit light and allow for the free circulation of air throughout the vine. Also, it is necessary to permit dead leaves to fall clear to the ground, carrying with them perhaps fungus spores which would more readily infect other portions of the plant if allowed to remain caught up in a mass of foliage on the trellis.

For the proper development and ripening of the fruit sunshine and air should penetrate to all aerial parts of the vine, hence the necessity, wherever possible, for running the trellises in a north-south direction. The vines will then have an even distribution of sunlight over the whole of the growth on the trellis. On hillside plantations it is not always possible nor desirable to adhere to this rule, since factors such as the conservation of surface soil are all important. Less erosion is likely to follow where the vines are planted across the slopes and

Plate 40.

VINES PLANTED UP AND DOWN THE SLOPE.—Note the green cover crop to improve the soil and check erosion.

Plate 41.

RAIN FOREST OR "SCRUB" LAND CLEARED FOR PLANTING.—To assist in conserving surface soil, the unburnt logs should be placed across the slope.

the soil hilled along the rows with cultivation. Any stones, unburnt logs, &c., should also be placed in the rows. Each row will thus eventually provide a surface drain which will carry off its share of excess water during periods of heavy rain.

In commercial vineyards, trellises are mainly of two types, the vertical and the horizontal. Both have advantages and disadvantages, but on the whole the horizontal is considered the more suitable. The outlay for wire, posts, and strainers and their erection is a factor which often influences the type of trellis to be erected. A vertical trellis is less costly, and therefore if posts and strainers have to be purchased, many growers erect this kind of trellis at first, and for later plantings use the horizontal type. Wherever it is possible for a grower to split and erect his own posts and strainers, a considerable saving will result. Usually there is plenty of suitable timber growing handy. Most of the natural hardwoods last longer than the passion vines, and may therefore be safely used, but if selection is possible posts should be split from bloodwood, ironbark, grey gum, or yellow stringy. These timbers will last for many years.

Substantial trellises only should be erected, because they must bear a heavy weight of vine and fruit. The top wire in whatever kind of trellis is built should be not less than 6 feet from the ground in order to permit plenty of room for fruit-bearing laterals and to allow them ample light and air.

In a horizontal trellis (Plate 42) the two wires are run side by side, while in a vertical trellis the wires are run one above the other as in an ordinary fence. The posts for the trellis should be 7 feet 6 inches long, 7 inches wide, and about 4 inches thick. They should be set 18 inches in the ground, and 15 or 16 feet apart, dependent on the distance apart it has been decided to plant the vines.

The strainer posts should be of much heavier timber, and may be either round or split. They should be set 2 feet 6 inches in the ground, and must be well strutted or stayed, so as to take the strain of the wires, the portion in the ground to be free of sapwood. One strainer to every 80 yards will prove sufficient in most locations. The posts should be erected with their width across the row.

For a vertical trellis (Plate 43) holes are bored in the posts through which the wire is run. One wire is run as close to the top of the post as practicable, and a second and sometimes third wire is run usually at 12 and 18 inch spacings below, 15 inches being the average spacing between these wires.

As stated previously, the horizontal type of trellis is considered most suitable. The distance between the two wires may be anything from 9 to 24 inches, but wide spacing has the advantage over the closer method in that it permits the entry of sunlight and air between the two sets of laterals, thus promoting the flowering and setting of fruit on the inner growth of the vine. At the same time this practice assists materially in maintaining a more open growth, allowing dead and diseased leaves to fall clear to the ground, carrying with them any fungus spores adhering to their surfaces.

In order to keep the wires apart in a horizontal trellis, a T-piece not less than 2 inches by 2 inches, cut to the length desired, is fastened to the top of the post and the wires run through holes bored in the ends of the T-pieces and strained on the strainer posts.

Plate 42.
HORIZONTAL OR "T" TYPE OF TRELLIS WITH TWO WIRES.

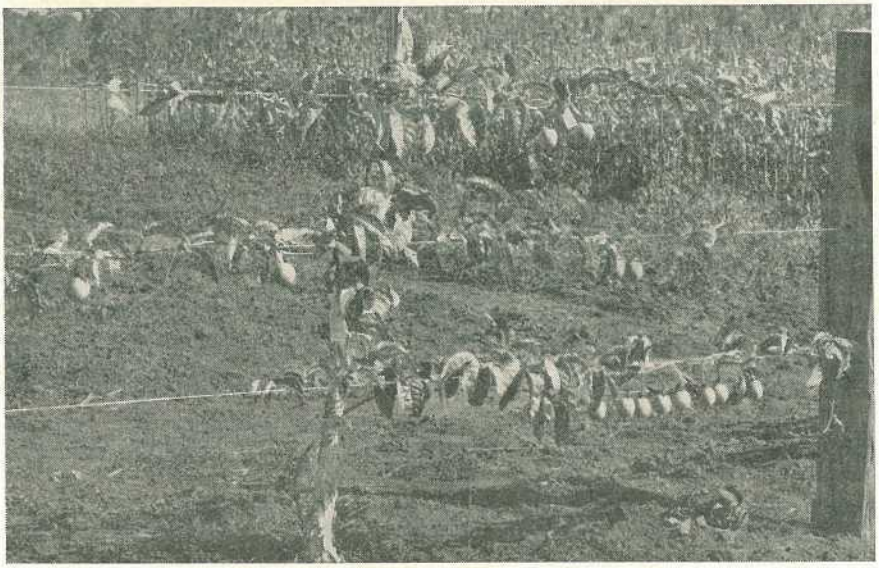


Plate 43.
VERTICAL OR FENCE TYPE OF TRELLIS WITH THREE WIRES.

It is an advantage to make some provision whereby the wires can be kept strained, and so prevent heavily-laden laterals from sagging to the ground. Small cast-iron rollers (Plate 44) may be procured cheaply and are excellent for this purpose, being easily operated and always in position.

Various gauges of wire are used. Some growers prefer No. 8 galvanised iron wire, while on some of the more recently erected trellises 10 by 12 gauge high tension steel wire has been used. This wire, although rather thin, is very strong and carries the weight satisfactorily; also, there is less stretching and sagging between the posts than is the case with iron wire. Black iron wire, although cheaper to buy, should not be used, as it soon rusts, stretches, and sags, necessitating propping up between the posts in order to keep the laterals and fruit clear of the ground.

Plate 44.

TRELLISES MUST BE WELL STAYED.—Note cast-iron rollers by means of which the wires can be easily strained.

Should the wires sag between the posts, stakes may be placed temporarily in position to support the wire until the crop has been harvested; then, after pruning, when the weight on the trellis has been reduced, the wires may be restrained with little possibility of the wire snapping.

An Extension Trellis.

The recommended practice is to keep lateral growth of the vines off the ground, and growers are advised to cut back vigorous growths to within 6 inches of the soil surface. When vines lie on the ground the fruit becomes badly scarred and of little value, except as low-grade or factory fruit. Shortening of laterals undoubtedly removes a considerable amount of growth capable of carrying fruit, and the following description of a temporary extension trellis shows how it is possible to increase the length of laterals without hampering cultural, spraying, or harvesting work, and enables a grower to get a higher yield of high-grade fruit from his vines.

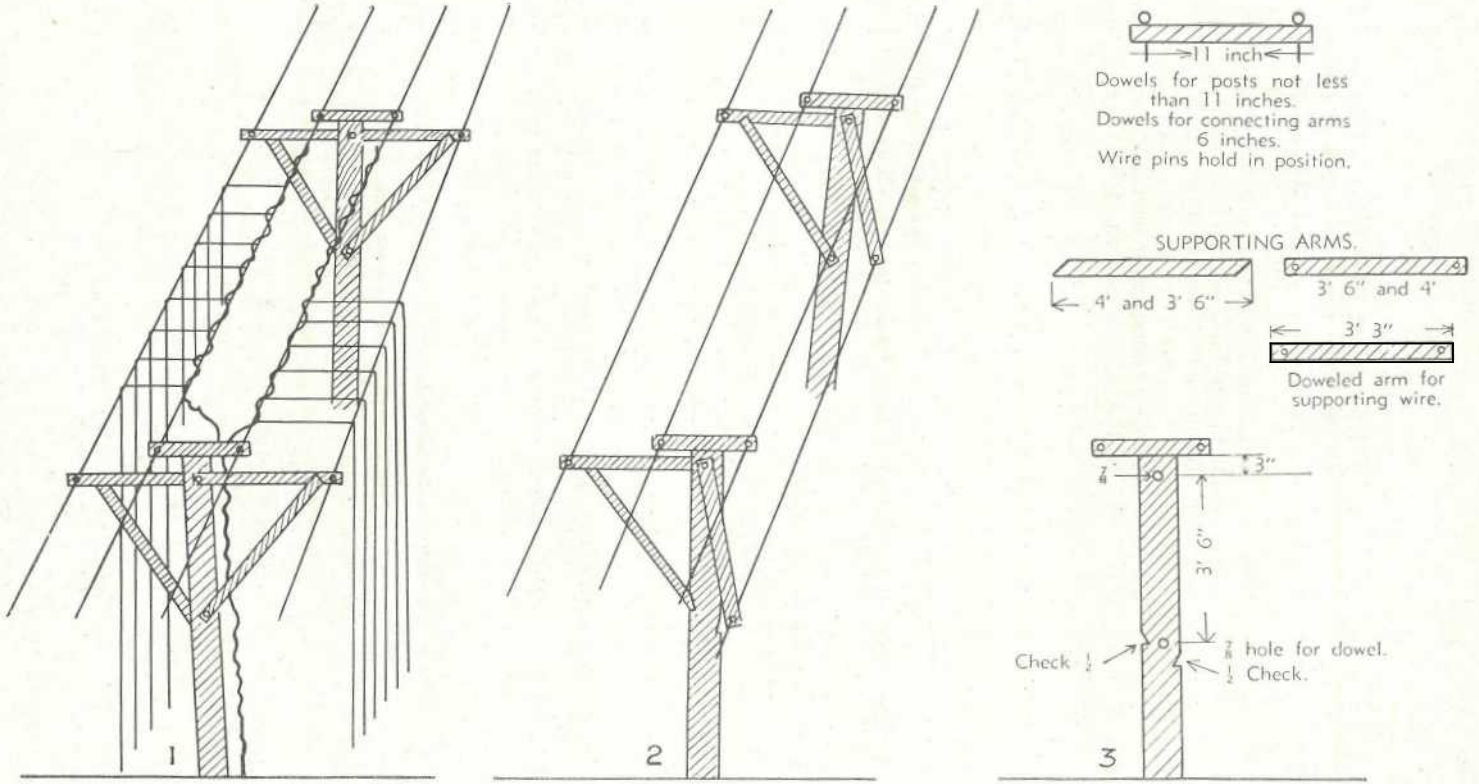


Plate 45.

DIAGRAM SHOWING HOW THE EXTENSION TRELLIS IS ATTACHED TO THE MAIN TRELLIS.

Plate 45 illustrates a simple way of attaching an extension set of wires to existing trellises. This extension system makes possible increased lateral growth for an extra 2 feet on each side of the vine, or giving a net gain of 4 feet over the whole lateral growth of the vine. In addition, the extra shade provided by the extension gives greater protection from the direct rays of the sun for the main stem of the vine; this is very noticeable where trellises are 6 feet or more above the ground. Moreover, a greater area of ground is shaded during hot weather, and this helps to keep the surface soil at a moderate temperature, reduces the loss of moisture through evaporation, and makes weed control easier, thus reducing chipping costs and allowing more time for spraying and other jobs. After the fruit has been picked, and, if seasonal conditions are suitable, the bearing laterals should be pruned right back. The extension trellis can then be lowered out of the way beside the trellis posts, thus allowing full use of the space between the rows of vines for the planting of small crops or the planting of green cover crops. When the new laterals have grown sufficiently to warrant its re-erection, the extension trellis can be raised into position again, the wire automatically picking up the lateral growth as it is strained to the proper tension.

The measurements given in the diagram are suitable for trellises where the rows are planted 8 feet apart. Where the planting distance is wider, the length of components may be increased. The system can be installed on either horizontal twin-wire trellises or on the vertical fence type; in the latter type, however, only the laterals from the leaders on the top wire should be trained over the extension. If sawn timber is used, approximately 15 feet of 2 inch by 1 inch hardwood battening is needed for an extension at each supporting post in the trellis, viz.—

2 horizontal arms to support wire, each 3 feet 3 inches;
2 supporting members, each 3 feet 6 inches to 4 feet.

The few inches left over will provide sufficient material to make the dowels, which are cheaper than bolts and nuts. A ⅜-inch hole should be bored about 3 inches below the top of the post to allow for the wooden dowel on which the extension arms hinge. Of course, holes of similar size are bored in one end of each extension arm, a smaller hole for the wire to pass through being bored at the other end. The arms are set on opposite sides of the post as illustrated. Dowelling is strongly recommended, because the supports are not likely to be knocked out of the check notches during rough weather or when working among the vines.

The extension arms should be at least 3 feet 3 inches, or up to 3 feet 6 inches if desired, and this should allow sufficient room for the grower to reach the centre of the trellis from either side of the vine, in order to prevent the vine growth from matting and harbouring disease-infected leaves; at the same time, sufficient space is left to pass up and down the rows between the sets of trellis.

The supporting arms should be set at such an angle as to ensure the maximum support. Wooden dowels on which the arms are hinged should be sufficiently long to allow a small hole being bored at each end. Through these a nail or wire pin can be pushed, thus holding the arms in position. The same applies to the dowel holding the arms together near the end through which the wire runs.

No. 10 gauge galvanised wire is suitable for the extension. It should be strained when the arms have been dowelled in position,

sufficient length being left at the strainer post so that it can be slackened off slightly when the extension is not in use. Small iron rollers suitable for straining the wire can be purchased cheaply. The wire for the extension is run through the straining post used for the main trellis. No extension arms should be attached to the strainer. The strain on the wire should be just sufficient to support the weight of laterals without sagging between posts. When the extension is not required it may be dropped to hang down alongside the post, the dowels holding the arms together near the wire being removed to facilitate this.

It is not necessary to completely dismantle the extension if the wood used is hardwood, but if softwood is used then it should be dismantled and stored until needed again. If the system is dismantled it will be necessary to mark or number each row and each section of the extension; the posts also from which it is removed should have identification marks so that when required again each member can be re-erected in its original position.

Propagation.

Passion fruit plants may be propagated either from seed or cuttings, though the latter practice is rare. Growers are recommended to raise their own plants, and for this purpose only fully matured fruits selected from healthy vigorous vines should be used. Great care should be given to the selection of the fruits for seed purposes, as the passion vine is subject to several diseases and the possibility of transmitting these diseases by seed cannot be ignored. The seed may be allowed to remain in the fruit, which will naturally dry up, until it is required for planting. Another method is to remove the pulp, place it is a vessel of water for a few days until it ferments, when the seeds will easily separate from the fruit pulp. The seeds should then be washed in clean water and placed in the shade to dry.

Should early spring-ripened fruits be selected and the seeds planted immediately, seedlings will be ready to plant out in summer. A later sowing would provide seedlings suitable for autumn transplanting.

If spring planting is desired—this being the season most preferred—then seedlings should be raised from fruits maturing in the previous late summer. Such seedlings should be well grown before winter and be available when seasonal conditions are suitable for transplanting with every prospect of the young vines rapidly establishing themselves in their new situation. The site of the seed-bed should be very carefully selected. It should not be in close proximity to any other passion vines, either cultivated or otherwise, owing to the possibility of introducing woodiness or other diseases into the nursery. The soil should be friable and contain an abundance of plant food. After the soil has been well worked into a fine state of tilth, the seeds should be planted about half-an-inch deep in shallow drills made about 9 inches apart, the soil afterwards being firmly pressed and covered with half-an-inch of fine horse manure as a mulch. The seedlings should appear in from four to six weeks, and as they develop they may be thinned out to about 4 inches apart; those remaining will then develop into sturdy plants with good root development. Lanky, weak plants will result from any crowding in the seed-bed.

Some growers first erect the trellis and then plant several seeds at the required planting distance under the trellis, afterwards selecting

the most vigorous of their young plants and removing the others. This practice is not recommended. Germination is often poor, the young plants are exposed to infection from any diseased vines which may be in the vineyard, and, generally, they require extra attention until they become well established.

Transplanting actually may be done at any time during the year, but from September to February is recommended, with a preference for the spring months. March to August planting is generally not advisable, except in very warm situations, as the plants often do not establish themselves satisfactorily and remain stunted.

When plants have reached a height of about 9 inches, they may be safely transplanted. If they have been allowed to grow much more than this, about a fortnight before transplanting the excessive top growth should be cut back and the larger roots severed by pushing a spade down full depth between the rows.

Transplanting.

Dull, cool or moist weather is better for transplanting than hot, sunny or windy days. Under the latter conditions evaporation of moisture from the young plants is likely to be excessive. Except when the plants are set through paper mulch, it is advisable to dig large-sized holes for the reception of the plants. Approximately 12 inches in diameter and 12 inches deep is best. The position of each hole should be midway between the trellis posts. When planting, spread the roots evenly in a downward direction at about 45 degrees, and fill in fine top soil, which should then be well firmed. When the hole is completely filled with soil, the plants should be growing at approximately the same depth as they were in the nursery, but not deeper. If planted too deeply the crown of the plant is likely to be attacked by a fungus rot, which will destroy it.

Only as many plants as can be planted within an hour or two should be dug from the bed at one time, and after removal from the nursery they should be kept continually covered with a wet sack until planted. It is a good plan to give the bed a thorough soaking with water the day before digging the plants. The roots of the seedlings will leave the bed more easily, and will not be excessively damaged. They will also absorb moisture, which will assist them to recover from the shock of transplanting.

Training the Vine.

From the beginning the grower should have a definite system in mind, and train the vine systematically, so that a good solid framework is modelled on the trellis.

Within a few weeks after transplanting the young seedlings will have become established and vigorous growth will develop. Numerous shoots will appear from the crown of the plant and in most cases they rapidly overtake the original growth of the vine. When they have attained a growth of from 12 to 18 inches, one, two, or four (according to the grower's wishes) of the most vigorous growths should be selected to form the main stems of the vine. All other growth should then be carefully cut away. Light stakes or poles should be driven into the ground alongside the young seedlings and fastened firmly at the top to the wires on the trellis. The stakes act as supports for the vine until

they have become firmly established on the wires. With the growth of the stems it is necessary to keep them tied at intervals of 9 to 12 inches to the stakes in order to prevent them from being broken or damaged through being blown about by wind.

Plate 46.

LIGHT STAKES SHOULD BE USED AS SUPPORTS FOR THE VINES UNTIL THEY HAVE BECOME FIRMLY ESTABLISHED ON THE WIRES.

The common practice with growers is to tie the vines after giving them a twist round the stakes. This is not the best method, because it necessitates at a later stage searching for the ties and removing them; if they are permitted to remain, they may cincture the vines as they grow. The best way is to tie a leaf stalk and tendril to the stakes, leaving the main stems clear of the ties. This is equally efficient as tying the stems, and avoids the necessity for later removal of the ties. Some extra time may be necessarily spent in the first place, but it will be more than made up later on.

Pieces of strong sacking cut into squares about 6 inches by 6 inches will unravel easily, and the strands make quite good ties.

All side branches arising from the stems between the ground and the wires should be carefully suppressed. Leaves only on the stems between the ground and the wires should be allowed to remain; these shade the stem and aid the development of the young plants.

Plate 47.
SHOWING THE DEVELOPMENT OF FOUR STEMS.

Each grower must decide for himself whether he prefers one, two or four stems, but two stems are considered most satisfactory. The vines cover the trellis with comparative rapidity, and if planted in the spring produce a good crop in twelve to fifteen months. In addition, there is the advantage that, if one stem is damaged through any cause, the vine is not completely lost, the second stem remaining to carry on until a new stem or new leader is produced. It is important that the stems be as nearly as possible the same size, otherwise the more vigorous

stem will rob the smaller and outgrow it. Vines trained on a single main stem take longer to establish a complete cover on the trellis, but during early life are much easier to keep in control, as the growth is not nearly so dense as that developed by the multiple stem system. On sloping land, where trellises may for some reason have been erected up and down the slope, two leaders are best, and as vines always grow more vigorously up hill than down, they should be trained on the wires to grow in the direction of the top of the plantation.

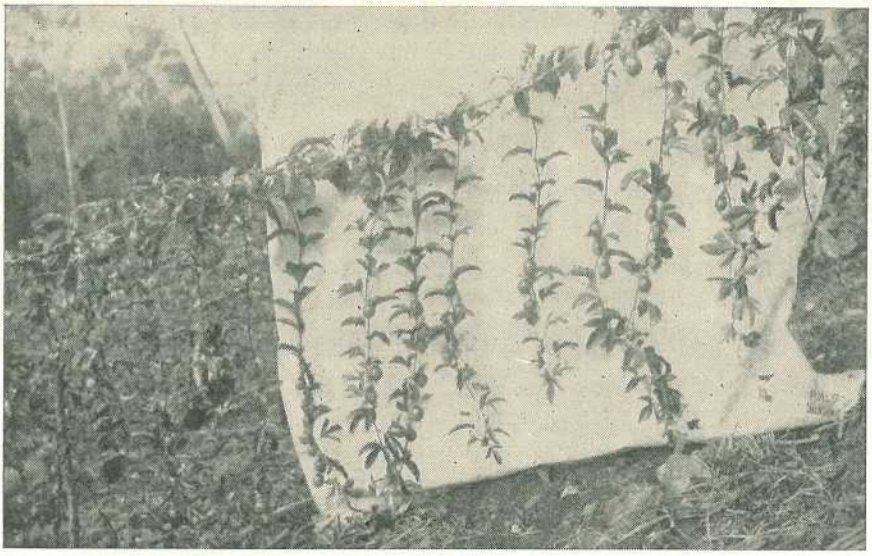


Plate 48.

LATERALS WHEN TRAINED TO GROW STRAIGHT DOWNWARD ASSIST IN KEEPING THE VINE OPEN, AND THE WORK OF SPRAYING, HARVESTING, AND PRUNING IS SIMPLIFIED.

Training on the Vertical Trellis.

In the case of the vertical trellis, if only one stem is left it should be allowed to grow until it reaches the bottom wire, when the top inch or so should be pinched out. The stem will then throw out side branches near the top. Three, or perhaps four, of these should be selected, growing as near to one another as possible. Two should be trained in opposite directions along the bottom wire, and the other one or two carried on to the top wire where, if only one is carried on, the tip should be again pinched out and two side branches allowed to grow for training in opposite directions along the top wire. If two branches are carried on from the bottom wire, they are merely trained in opposite directions along the top wire.

When two main stems are allowed to grow from the ground, the tip of one should be pinched out on reaching the bottom wire and two branches allowed to develop for training along the bottom wire, whilst the second stem is permitted to grow until it reaches the top wire where it is similarly treated.

In the case of four main stems, two are trained in opposite directions along each of the wires.

Training on the Horizontal Trellis.

With the horizontal trellis, if only one stem is left the tip should be pinched out when the wires are reached, and four branches growing as close together as possible should be allowed to develop for training in opposite directions along the two wires.

If two stems are left, the tips are pinched out and two branches allowed to grow from each, whilst with four stems they are merely trained in opposite directions along the wires as they reach them.

The sections of the vines which grow along the wires are termed "leaders." They should not be permitted to ramble along the wires at will supported only by the tendrils, but should be given long, gradual turns round the wires and loosely tied at intervals, care being taken to maintain the turning in the same direction to prevent sagging loops. Sharp turning round the wires should also be avoided, as this may tend to check the sap flow. As the leaders proceed along the wires, lateral growth will develop, and this will be accelerated if leader terminals are nipped out on reaching the approaching growth of the neighbouring vine.

The laterals should be encouraged to grow straight down rather than be allowed to grow in any direction. By controlling the laterals in this way the vines are kept more open, and the work of spraying, harvesting, and pruning is made very much easier.

Other Forms of Trellis.

Apart from the vertical and horizontal trellises described, there are a number of modifications which some growers adopt with varying results. In the main they are more expensive to erect, and it is doubtful whether recompense is obtained for the additional outlay.

Plate 49 illustrates a horizontal trellis with three wires. Two leaders are grown along the middle wire and the side laterals are trained over the outside wires.

Plate 50 shows another form of horizontal trellis with four wires in which four leaders are grown along the inside wires and the side laterals trained over those outside. This system permits of wider cross pieces being used on the trellises, but often results in a mat or shelf of vines on the top of the trellis, which holds dead and diseased leaves instead of permitting them to fall to the ground.

Plate 51 shows a six-wire vertical type of trellis on which twelve leaders are allowed to grow. The use of a trellis, such as this, results in the side laterals from the top leaders tending to exclude light and air, and consequently smothering those on the bottom wires.

Plate 52 illustrates a trellis made with welded sheep fencing. This type is used in Victoria, where the growth of vines is very slow in comparison with their vigorous development in Queensland. The stems or leaders are spread fanwise over the wires. Good crops are borne and the vines are well spread, but considerably more time is occupied with pruning than when the two-wire horizontal or vertical trellis is used.

Cultivation.

Caution is needed in regard to the use of cultivation implements, especially when the vines are in vigorous growth. Passion vines are comparatively shallow rooted, and not a few growers have suffered considerable loss when, with the best intentions in the world, they have

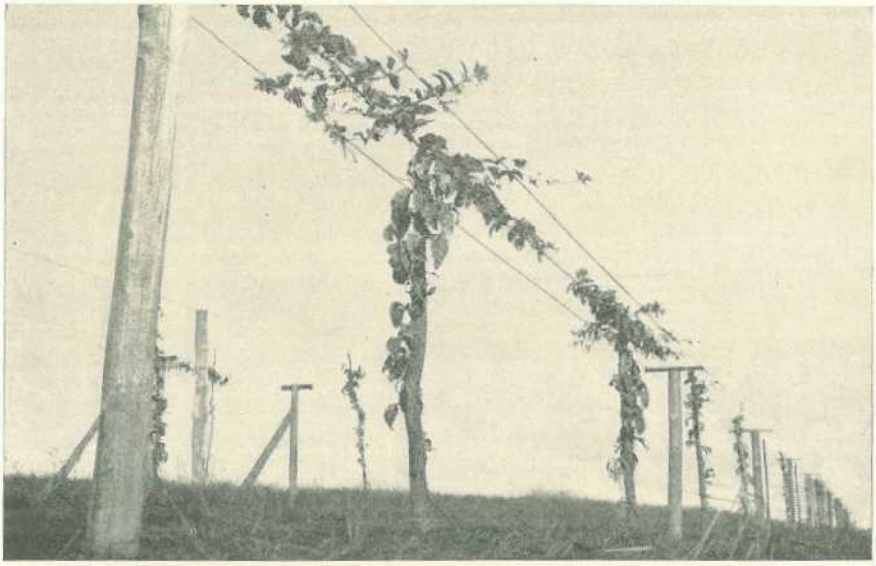


Plate 49.
A HORIZONTAL TRELLIS WITH THREE WIRES.

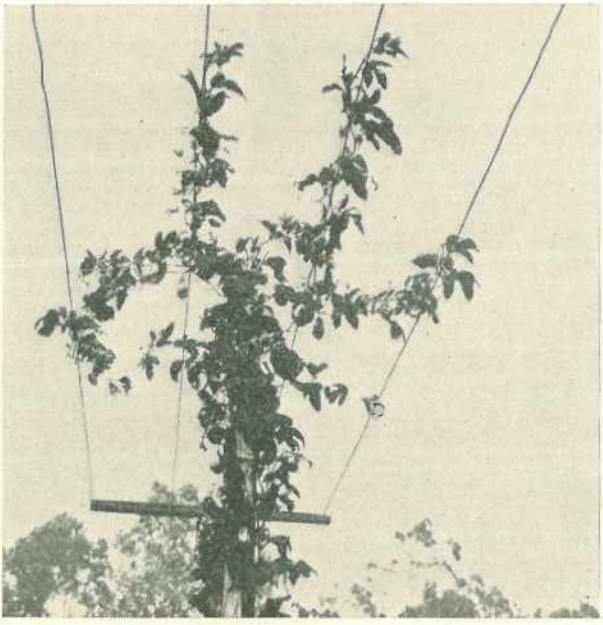


Plate 50.
A HORIZONTAL TRELLIS WITH FOUR WIRES.

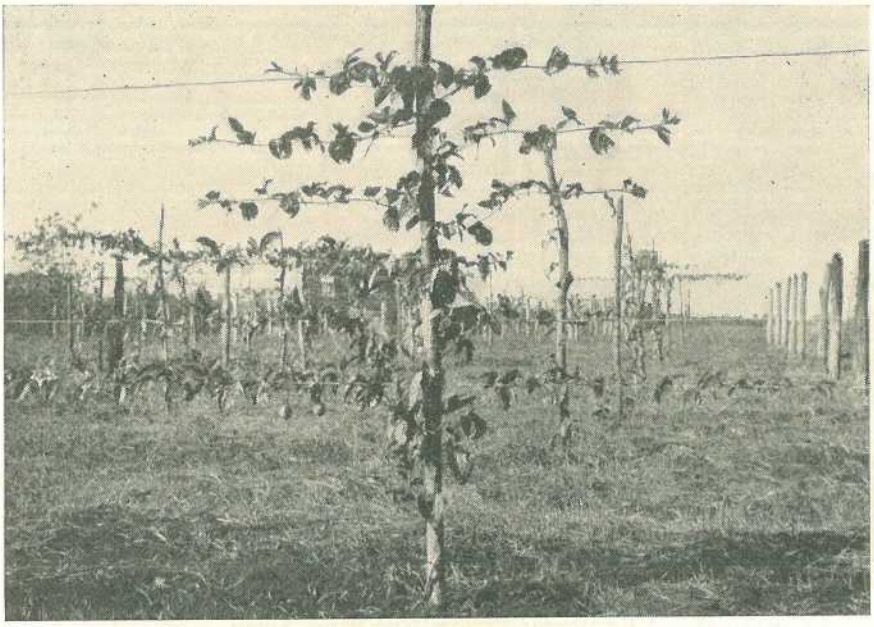


Plate 51.
A SIX-WIRE VERTICAL TYPE TRELLIS.

Plate 52.
A TRELLIS MADE WITH WELDED SHEEP FENCING WIRE.—The leaders are spread fanwise.

ploughed or cultivated deeply at a time when a good crop was hanging, and afterwards found their fruit just withered and fell, and the vines assumed a sickly yellow appearance. Such a condition will follow the cutting and breaking of feeding roots at a time when the vines most need their support. Cultivation, then, during the main growing and fruiting periods should be shallow and confined merely to the control of weeds and the breaking-up of the top inch or so of surface soil to prevent caking.

It is more or less essential to break up the soil deeply once a year, and this is best done during the winter about July after the vines have been pruned. Where horse or tractor drawn implements are used,

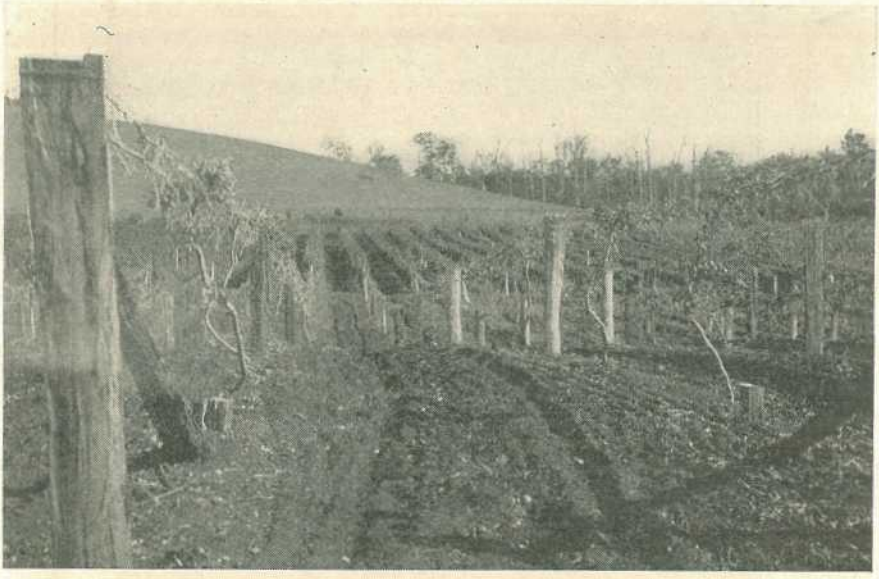


Plate 53.

DEEP CULTIVATION SHOULD ONLY BE CARRIED OUT TOWARDS THE END OF WINTER.—Note that these vines were pruned before being given a thorough cultivation.

the land up to within 18 to 24 inches of the vines may be ploughed to a depth of about 6 inches, whilst on steep and rough locations, or where the land has not been stumped, cultivation as deeply as possible up to the same depth is best achieved by the use of mattocks or pronged hoes.

Care is also essential when attempting light cultivation or weed control around the immediate base of the vines in order to ensure that the crown and main roots are not injured by implements. Soil-frequenting fungal organisms often quickly enter at such points of injury and set up a condition known as base rot. It is preferable to hand pull all weeds in the vicinity of the stems. Furthermore, during cultivation the crown of the vines should not be covered with soil or with destroyed weed growth, but left exposed to the sun and air. Little trouble will then be encountered with base rot.

Vines should be kept well cultivated along the lines set out from the time they are planted. They will then develop rapidly and produce good crops. Vines insufficiently cared for when young lack vigour, and their development is retarded. Even if they do produce a large quantity of fruit, it is usually small and of poor quality. Older vines will also suffer during hot dry spells if cultivation is neglected, as the soil cannot hold sufficient moisture at such times to support both vines and weeds.

Green Manuring.

The growing of green manure crops planted between the trellises towards the end of summer and prior to the wet season is a matter which should be given attention. Crops such as cowpea, Poona pea, tick beans, field peas, mustard, lupins, and others are suitable. If grown through

Plate 54.
RECONDITIONING PASSION VINE SOILS.—Green-manure crop of mustard ready for turning under.

the wet season and into the winter, they will not seriously interfere with the growth of the vines, they will assist in controlling erosion, and when turned under will materially assist in improving the fertility of the soil. On soils of good to medium fertility a dressing of about 200 lb. of superphosphate to the acre at the time of sowing the seed will be of considerable assistance in the production of a good cover.

On poorer soils or in vineyards which have been badly washed, or where hot fires have occurred, the condition of the soil can be improved by turning under green cover crops. On badly washed areas where difficulty may be experienced in getting legumes, such as cowpeas and Poona peas to grow, mustard will generally provide a good first crop, subsequently peas may be planted successfully. Cover crops on poor soils will be materially assisted with a preliminary dressing of 200 lb. each of sulphate of ammonia and superphosphate.

Plate 55.
A GOOD CROP OF SKINLESS BARLEY IN A YOUNG PLANTATION, PLOUGHED UNDER IN FEBRUARY.

Plate 56.
AFTER THE VINES HAVE COVERED THE TRELLISES, COVER CROPPING SHOULD BE CONFINED TO NARROW STRIPS DOWN THE MIDDLE OF THE ROWS.

Plate 55 illustrates a good crop of skinless barley planted between young vines, after it has been ploughed under in February. The land was wonderfully benefited from this crop. It should be noted, however, that after the vines have covered the trellises, ploughing in February should be limited to the middle of the rows, as the root system of the vines will have extended well out by that time. Green crops, planted subsequent to the first year's growth of the vines, should be confined to a narrow strip along the middle of the rows as shown in Plate 56.

Irrigation.

Earlier it was mentioned that, if a dry spring extends into a hot, dry summer, some defoliation and loss of fruit must result. The provision of irrigation water where available will prove an entire guard against such a setback, and will prove profitable in other ways in so far that the vnes can be kept growing and blossoming practically throughout the year. It will be noted under the heading of pruning that the time for doing this work is governed to some extent by prevailing weather conditions. Aided by irrigation, this handicap disappears. The vines can be well watered prior to pruning, and again after the operation without danger of suffering any check, and furthermore, can be forced into growth at once for the production of an early crop. Furrow irrigation is to be preferred where the land is nearly level, but on sloping land overhead spraying is quite successful.

During very dry periods, the owners of some plantations resort to hand watering where irrigation is not possible, and it is remarkable how about a quart of water poured round the stem of each vine every second day will enable the plants to retain not only foliage, but fruit. The watering is best done late in the afternoon to avoid loss by evaporation.

Fertilizing.

The passion vine, being a vigorous grower, demands a plentiful supply of available plant food. The soil, therefore, should be at least reasonably fertile. Where planted on good virgin land there should be ample nutritive elements available for the first year or two. Subsequently, and also from the outset on poorer areas, artificial fertilizers will prove of considerable benefit.

A recommendation as to the best formula to use for all plantations cannot be made dogmatically, for better results have been obtained by the application of certain mixtures on some areas, whereas other mixtures have been equally successful in other plantations. Each grower, whilst applying a general mixture to his vines, should carry on small scale experiments with others and note any difference. The amount of fertilizer required will depend to some extent on the fertility of the land, poorer areas requiring more than those of better quality, but from 4 cwt. to 8 cwt. per acre will prove a reasonable application.

The various fertilizer dealers stock general orchard mixtures which have given good results in many instances, whilst other growers experimenting with a special 10-6-10 mixture of sulphate of ammonia, superphosphate and sulphate of potash have produced excellent crops. Whatever fertilizers are applied are best divided into two dressings, one during the winter cultivation about July, and a second about January, in order to be in time for the autumn flowering for the winter crop.

Pruning.

Some growers claim that pruning definitely gives them bigger and better crops, others say they get just as big crops from unpruned vines, but admit that the size of the fruit and its quality is not as good as that from pruned vines. In any case, whatever influence pruning has on the size of crops, the wise grower will prune for the following reasons:—

To keep the vine in good health;

To remove diseased, dead, and unprofitable growth;

To keep the growth in check on the wires in order to admit light and air and prevent congestion;

To induce the production of healthy, vigorous wood on which high-grade fruit is set;

To replace spent, bare leaders by the development of new ones;

To keep the lateral growth clear of the ground and properly spaced;

To regulate the time of bearing so that the highest market prices are obtained for the fruit;

To assist disease control and increase the life of the vine;

To cheapen the cost of spraying.

When left unpruned, vines soon become a tangled mass of wood and foliage in which fungus diseases may develop and rapidly shorten the life of the vine. It is essential, therefore, to maintain an open habit of growth in order to admit plenty of light and air to all parts. All dead and diseased wood should be cut away and burnt in order to reduce the risk of infection. The best fruit is produced on healthy vigorous laterals, and the object naturally is to produce the greatest amount of such growth possible. It will be found that, by checking the growth of laterals when they are about 6 inches from the ground, strong secondary laterals on which fruit will be borne will be produced all along the sides of the laterals, and the bearing area of the vine will be thus increased considerably. In addition, the vine will be kept free of the blemished fruit which would be produced if the laterals were permitted to grow on the ground. The checking of laterals to keep them clear of the ground may be done at any time without harming the vine.

Passion vines should be given a heavy pruning once each year. There are modifications in some instances which are discussed later on. Usually, July or August is the best time, when most of the winter crop has been harvested, and before spring growth commences. The most suitable time for commencement of pruning will vary in different districts, and possibly even in different parts of the same district, due to environmental factors bearing on growth and crops, as described earlier. A most important feature also to be borne in mind is that *vines should not be severely pruned during a very dry spell.* The soil should be in good condition so far as moisture is concerned. Severe pruning when the ground is dry has caused the death of many vines. Pruning at about the time mentioned is preferable from the aspect of control of a serious fungus disease known as Brown Spot, information concerning which is obtainable upon application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

There are no hard and fast rules for pruning. Each vine may present a different problem, and consequently only general recommendations as to the procedure will be discussed. It should perhaps be mentioned that pruning is apt to prove a slow and tedious job, and much patience is required to do the work properly. However, the grower will be well repaid for the time and care expended. Firstly, with the aid of a reaping hook, all laterals should be severed at about 12 inches below the trellis wires. When this has been done, the great bulk of the vine has been removed, and it is possible to obtain a much clearer view of the more intimate pruning required. From the leaders on the wires all dead, diseased, and spindly wood should now be cut away, using a pair of secateurs, and the stumps of the stronger laterals which

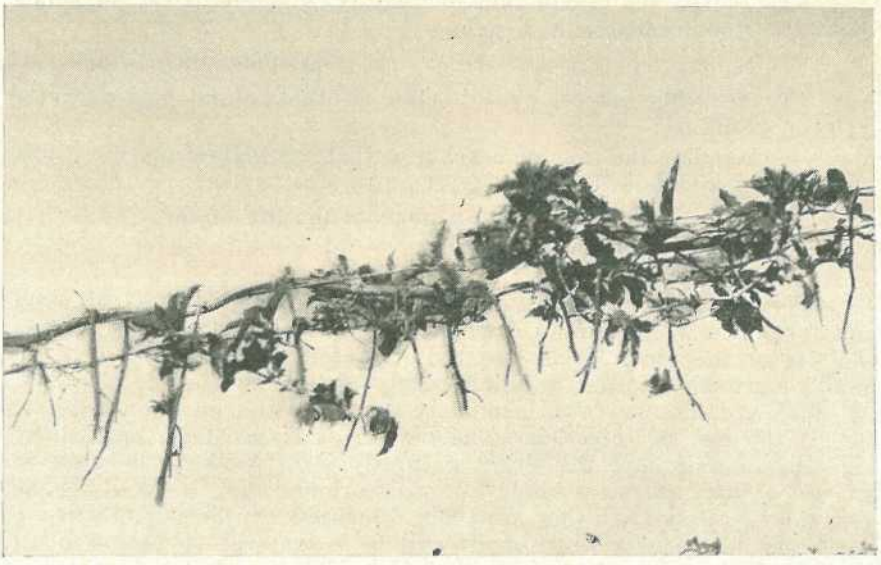


Plate 57.

VINE AFTER PRUNING.—The laterals are cut back to 9 to 12 inches from the leaders on the wires. It is at this stage that deep cultivation is best carried out.

it is intended to leave should be allowed to remain about 9 to 12 inches long. Each shortened lateral will then have two or three buds from which the new growth will start for the next crop. It is not advisable to cut back more severely than this, as the bearing capacity of the vine may be affected.

Some growers prefer to give two light prunings each year—one during the winter, and a second about January-February after the main summer crop has been harvested and before flowering for the winter crop commences. Others, in addition to heavy winter pruning, like to give a light pruning following the summer crop. Both modifications give good results, the latter in particular. When conditions are too dry for severe pruning during the winter, the system of two light prunings can be safely adopted.

Light pruning (by which is meant in general the cutting away of up to half the length of the laterals) at any time of the year, provided

there is sufficient soil moisture, will cause the vine to put forth new growth and blossom, the development of which regulates the period of production of a crop.

Under ordinary circumstances heavy pruning in the winter will produce a big summer crop and a somewhat smaller winter crop. By shortening back the flowering laterals about October and sacrificing portion of the summer crop, a bigger intermediate crop will be secured, provided, of course, that the weather is not dry. Similarly, by pruning back the flowering laterals for the ordinary winter crop about February, a late winter crop can be secured.

In warm localities the vine puts out vigorous growth much earlier than in exposed and colder areas. The grower is advised to carefully note his own local conditions and prune to suit that particular location.

Replanting.

As the commercially useful life of a passion vine is generally about four years, if a grower wishes to continue, some provision should be made for continuity of production. This may be done by rotation and by replanting.

Under normal vineyard conditions the heaviest crops will be produced when the vines are from two to two and a-half years old, after which they gradually decline in production and quality of the fruit. In order, therefore, to keep up a supply of good quality fruit, new vines should be coming into bearing every two years.

Young seedlings may be planted midway between the older vines, and after the summer crop has been harvested every second vine may be cut out and the new vines trained on the trellis in the vacant spaces. As they come into bearing the remaining older vines should then be replaced in turn by fresh seedlings.

Although this method gives a replanting every two years, and a fairly high grade of fruit is produced, it has the disadvantage of necessitating an increased amount of pruning and spraying, as the young vines become infected with brown spot and woodiness to a much greater degree than if planted out in a fresh area.

By rotation areas can be kept isolated from each other either by distance or natural vegetation. Young seedlings planted out do much better under this system. They are not so much exposed to infection from diseased neighbouring plants, are more vigorous in growth, and produce earlier and heavier yields.

Under rotation extra trellises and more extensive cultivation are necessary. This additional expense is offset, however, by the advantages already mentioned. Under this system, too, the land can be periodically spelled from passion vine growing, and the trellises more easily repaired or replaced as required.

Whatever method is decided on, it must be borne in mind that to obtain the maximum profits from passion fruit growing provision must be made for the setting out of new vines at regular periods to replace the older ones as their production falls in quality and quantity. Experience suggests that a two-year system of replanting or rotation is the most satisfactory. This necessitates the planting out of young vines during the spring of every second year.

A three-year rotation or replanting could be adopted, provided the vines remain healthy, vigorous, and productive. Either rotation or replanting must, however, be done at a shorter period than every four years if quality and quantity production of fruit is to be maintained.

Harvesting and Packing.

Harvesting, packing, and marketing is quite as important as production, and every grower should aim at presenting to buyers well-matured, properly graded, attractively packed fruit. Enhanced prices received for well got-up fruit will justify the time and labour expended on its preparation for market.

Fruit should be gathered daily, preferably in the early morning or late evening, when the fruit is cool; it is then not so likely to arrive on the market in a wrinkled or shrivelled conditon. All dropped fruit should be picked up first, as a couple of hours in the hot sun is sufficient to cause severe scalding and possibly render the fruit unsuitable for packing.

The degree of maturity at which the fruit is picked from the vine is of vital importance, and judgment is required in order to obtain the right colour without the fruit being so far forward that it is likely to wrinkle. Good colour is very desirable, and during the cooler weather the fruit should be picked when it has assumed a deep purple. However, during hot weather fruit should be gathered when just a light purple shade has extended over half to three-quarters of the surface of the fruit.

When harvesting during wet weather allow the fruit to dry off thoroughly before being packed. All fruit should be carefully picked to prevent the skin being damaged. This is best achieved by grasping the fruit in the hand with the thumb and forefinger on the fruit stalk, then with a forward pressure of the thumb and a backward pressure of the forefinger, the fruit will be easily detached at a point where the fruit stalk joins the tendril just above the dead flower.

The picked fruit should be placed—not dropped—into the picking boxes or tins, which should be placed on the ground or slung on the body. These, when filled and until despatched, should be kept as cool as possible and sheltered from strong winds.

Bordeaux spray can be removed by immersing the fruit in a weak solution of hydrochloric acid for one and a-half to two minutes, afterwards washing off with fresh water and being allowed to drain before packing.

Passion fruit forwarded to the fresh fruit market should be packed in half-bushel dump cases, and full instructions for packing the different grades are contained in an illustrated booklet which may be obtained on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Fruit intended for factory use need not be packed in cases, but may be forwarded to the canneries in sugar bags or similar containers.

Diseases and Pests.

The passion vine does not usually suffer from any serious attack by insect pests. Spotting of the fruit results from the feeding activities of some minor sucking insects, but little damage is done beyond a slight

blemish of the outer skin. As the pulp is not affected, the fruit is not harmed. Fruit flies have been known to attack the fruit in its green stage. The eggs, however, do not mature, but the skin surrounding the puncture becomes hard and detracts somewhat from the appearance of the matured fruit.

Fungus diseases such as brown spot and a virus disease known as woodiness or bullet, to which the passion vine is very susceptible, are the main causes for the premature failure in many vineyards. Powdery spot is a minor fungus disease which attacks the terminal growths and fruit during the cooler months of the year. Its attack is more serious on vines up to eighteen months old, since the proportion of the plant affected is then relatively greater.

Brown spot is the most troublesome disease affecting the vine. It attacks leaves, stem, runners, and fruit, causing considerable damage, and if neglected will result in the death of the vine within two years. Young vines are not so seriously attacked as older ones, as the more open growth admits light and air, and permits most of the affected leaves to fall to the ground, carrying the fungal spores with them.

Woodiness is a serious virus disease, and growers are advised to exercise every care in an effort to prevent its spread.

A pamphlet dealing with the control of passion vine diseases may be obtained on application to the Department of Agriculture and Stock, Brisbane, B. 7.

QUEENSLAND SHOW DATES FOR 1940.

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

FEBRUARY.

Stanthorpe	1st to 3rd
Killarney	9th and 10th
Warwick	13th to 15th
Clifton	21st and 22nd
Allora	28th and 29th

MARCH.

Amiens	3rd
Goombungee	8th
Boonah Bushman's Carnival	25th
Oakey	27th and 28th

APRIL.

Pittsworth	2nd and 3rd
Toowoomba	15th to 18th
Dalby	22nd and 23rd
Kingaroy	30th April and 1st and 2nd May
Tara	30th April and 1st May

MAY.

Yarraman	3rd, 4th, and 6th
Longreach	6th to 8th
Nanango	9th to 11th
Murgon	16th to 18th
Ipswich	21st to 24th
Kalbar	25th
Gympie	30th and 31st and 1st June

JUNE.

Bundaberg	6th to 8th
Blackbutt	7th and 8th
Boonah	12th and 13th
Toogoolawah	28th and 29th

JULY.

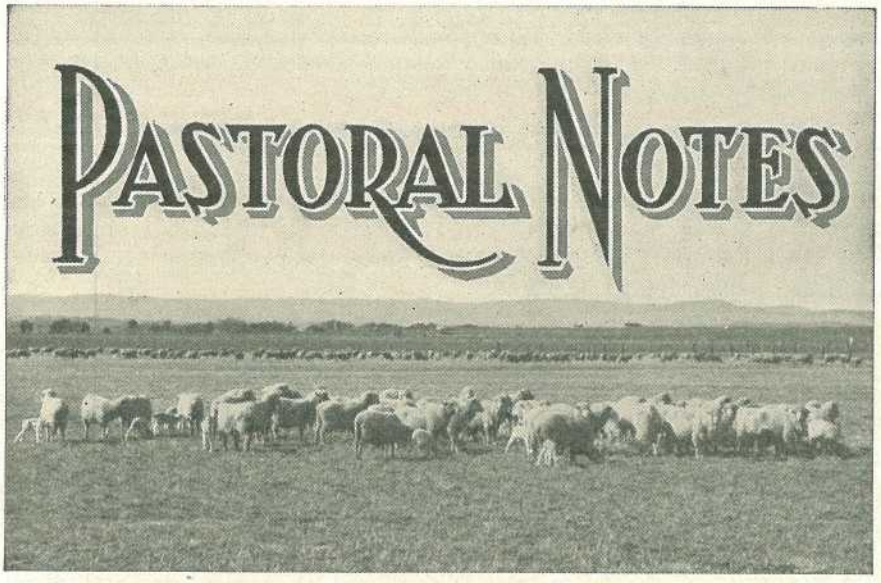
Cleveland	12th and 13th

AUGUST.

Pine Rivers	2nd and 3rd
Caboolture	8th and 9th
Royal National, Brisbane	12th to 17th

OCTOBER.

Warwick Rodeo	5th and 7th



Yellowwood—Poisonous to Stock.

YELLOWWOOD (*Terminalia oblongata*) is a small tree common in the Central districts of Queensland, particularly about Emerald, the leaves of which have been proved to be poisonous to sheep. The tree should not be confused with the large timber tree found in South-Eastern Queensland, and known by the same name.

The leaves are mostly an inch to one and a-half inches long, and the flowers small and insignificant. The fruit is about an inch long.

Sheep are prone to eat the leaves when these are shed by the tree, as happens in dry weather and, therefore, at a time when other feed is likely to be scarce.

Symptoms Produced.—The leaves are not unpalatable to sheep. Symptoms consist of nervous disorders manifested by "fits." These, however, do not appear until after the sheep have been eating the leaves over a period of several days or even weeks. If the sheep are disturbed, these "fits" may be aggravated. The animal is seen to drop down in its tracks as though stunned, and lies trembling and rigid, or the head may be raised and swayed from side to side. The attack may last from a few seconds up to nearly a minute. When on its feet again, it sways unsteadily for a few moments—then moves off to join the flock.

The presence of strangers, or loud noises near the animals, seems to induce the "fits."

So far as is known, cattle are not affected, although a peculiar wasting disease of animals in the yellowood areas is possibly associated with the eating of the leaves. This is a subject for further investigation.

Post-mortem.—On post-mortem, the plant is found to have been rolled into hard masses or lumps which tend to block the intestine and set up digestive disturbances, such as impaction. These results have

been confirmed in experimental tests. Sheep are usually found dead on the edges of water holes or where they have fallen over the branches of fallen trees, and where they have found difficulty in again rising to their feet.

General.—As with many other poisonous plants, the chemical nature of the poison present in the leaves and responsible for the "fits" is not known. Nothing can, therefore, be recommended for administration to the animal to combat the effects of the poisonous agent. Sheep which have been on the plant for some time suffer a considerable loss of condition and there is also a corresponding loss in wool production.

BLOATING OF CATTLE.

Acute bloating of ruminants, cattle particularly, may occur at any time from a variety of causes, but most commonly through turning hungry cattle on to luxuriant green feed, or on to herbage country, after heavy rains and when the young herbage is making rapid growth.

Under station conditions, where stock are not seen every day, little can be done to prevent loss, but on smaller holdings losses may be minimised if a stack of dry hay is provided and to which stock have access before and after being allowed on to green feed. The long, dry hay assists regurgitation, which is difficult when large quantities of short, succulent feed has been eaten, and, if it is available, animals will always take a few mouthfuls, with beneficial results.

Symptoms of bloating appear quickly. Animals stop feeding and stand still with arched backs, turning their heads frequently to the abdomen, which increases rapidly in size—the swelling becoming most marked on the left side. As the abdomen enlarges, breathing becomes more and more difficult. In very acute cases the nostrils dilate, the animal stretches out its tongue, bellows, and finally staggers and dies in convulsions.

In less acute cases the development of gas is slower, and frequent belching and vomiting prevents its excessive accumulation. In these cases the use of a gag made from a stick about 8 inches long and 2 inches in diameter, with holes at each end through which a thin rope is run to form a rough bridle—the stick being smeared with tar or grease before being put into the mouth—is of value, as it facilitates belching.

Massage of both flanks, applying moderate pressure with both fists upwards and downwards—particularly over the whole of the left flank—while the animal stands with its head uphill, is also beneficial.

Puncture of the rumen with a trocar and canula saves many valuable animals. The instrument must be sterilised by boiling for ten minutes before use. It is wise to keep it ready, wrapped in a sterile towel. The trocar, with its protecting tube, is pushed into the most prominent point of the left flank, usually midway between the point of the hip and the middle of the last rib. Holding the instrument in the left hand, a sharp blow with the palm of the right hand causes it to penetrate the skin, abdominal wall, and the rumen.

The point of the trocar is directed towards the right elbow.

The trocar is withdrawn gradually from its sheath, allowing the gas to escape slowly, giving immediate relief to the animal.

When gas ceases to escape, a cork may be used to close the canula, which is left in position and secured by a clean bandage tied over it and round the body of the animal. Any further accumulation of gas is allowed to escape slowly by removing the cork. When no longer required the canula is withdrawn, and the small puncture dressed with tincture of iodine.

STRANGLES.

Strangles in horses is so called because one of the chief symptoms is a swelling of the glands of the throat, thereby causing strangling or interference with swallowing and breathing. It is an exceedingly contagious disease.

In addition to the swellings of the throat, there is usually a dirty discharge from the nose and sometimes the mouth, with occasionally a severe cough.

There is nearly always fever and loss of appetite, the latter due mostly to difficulty in swallowing.

The swellings develop into abscesses which contain pus, and these may or may not burst naturally and discharge their contents, in which case the patient usually improves.

The cause of the disease are small bacteria which are very easily spread from one animal to another by means of water and feeding troughs, bedding, harness, hands of attendants, &c., as well as by direct contact.

In attempting to treat the disease, particular attention must be paid to the isolation of all affected animals, and great care must be taken that none of the sources of infection mentioned is allowed to contribute to the contagion.

Inoculation of all the in-contact horses with a vaccine has definitely proved of value in preventing the disease.

Treatment of affected horses consists in painting the swellings with strong tincture of iodine once daily for three days in order to bring them to a head, and then opening them by surgical methods and keeping them well syringed out. Inhalations of medicated steam are used for relieving the congestion of the air passages.

Drugs such as potassium nitrate (salt petre) and potassium chlorate may be added to the drinking water, and an electuary of green extract of belladonna is frequently given. In bad cases the use of the new sulfanilamide preparations has proved of great value.

It must not be lost sight of, also, that although strangles most commonly occurs in young horses (yearlings and two-year-olds) it may occur in any age from foals to aged horses, and atypical cases are by no means rare where abscesses occur in all parts of the body, notably the chest and limbs, with or without an affection of the throat.

SCRUB FEEDING OF SHEEP.

In the case quoted it will be noted that the amounts given total 19 cwt. 102 lb., which is 10 lb. under the ton. It is, of course, too much to expect that a grade formula consisting of round figures will give quantities that exactly total a ton. The separate amounts of ingredients should therefore be "rounded off"—in this case by adding, say, 3 lb. each to the sulphate of ammonia and sulphate of potash, and 4 lb. to the superphosphate.

In conclusion, it might be well to point out that only a certain number of grade formulæ will be found to total anywhere near the ton with the ingredients available; obviously, a 2-10-2 would amount to only a portion of the ton while a 10-10-10 would amount to far more than the ton; consequently, neither of these grade formulae—or other "extreme" formulæ—can be found on the market in Queensland.

Edible shrubs and trees which are useful as a supplementary ration for sheep cover a large area of Queensland. Methods of feeding vary according to the class of edible bushes available. Stock owners accustomed to scrub feeding make full use of the varieties available and proportion the day's supply to vary the feeding to best advantage. Although some of the shrubs and trees are not relished under normal conditions, the intensity of a drought gradually reduces the sheep to starvation point, and it is then that whatever top feed is on the property should be made full use of. The system of making this available to the sheep varies according to the habit of growth, but there are few now who destroy the tree to feed the sheep. Lopping is the usual practice.

The digestibility of many of the edible varieties of vegetation leaves much to be desired; consequently they are very poor substitutes for grasses and herbage. When the stage is reached at which the sheep begin to lose condition, and before they fall away to any appreciable degree, scrub feeding should commence. At first the sheep are not inclined to eat much, and then only the most palatable portions. Very little need be provided at the start, and this should consist of a large proportion of the best available. As the sheep take to it, increase the supply, and gradually lessen the percentage of the most palatable until a well-based scrub ration is provided in keeping with the varieties available on the property. If sheep have to be scrub fed for a lengthy period, they are likely to develop digestive disorders, but this is influenced by the nature of the shrubs or trees they feed on. Some varieties will carry them on for many months without showing any ill effects on their condition, but a good lick should be of considerable help in retaining their normal health and condition, no matter what class of vegetation they are fed on. The water to which they have access should be the first point for consideration before preparing a lick, for during very dry weather sheep will drink much more water than they do when juicy food is available.

If the water is slightly salty, say 30 grains to the gallon, it can be considered normal, but if over that amount the salt in a lick may be reduced until the total reaches 250 grains to the gallon, when no salt is needed. Salt alone is not the only ingredient required in a lick as many other minerals, the chief of which are lime and phosphoric acid, are equally essential.

Analyses of most of our trees and shrubs show rather a low and an uneven mineral content, the lime being fairly well supplied, but they lack in phosphoric acid. Analyses also show rather high carbohydrate and usually a low available protein content. It may, therefore, be assumed that a lick should be based on the salt content of the water available and carry protein, phosphoric acid, and lime. A sterilised bone meal carries these three ingredients; it is recommended as the base of the lick, say 60 parts. Other ingredients are salt, 30 parts; Epsom or Glauber salts, 5 parts; and molasses, 5 parts. As the protein content of bonemeal is low, this ingredient can be added by using meals —such as cotton seed, peanut, wheat, linseed, or other such meal—all of which supply a most important want. Blood and meat meal, however, carry a greater protein content and may be used to advantage in supplying this element in a lick. Neither is attractive to sheep however, therefore any mixture supplied should carry an ingredient to induce the sheep to take to it. If salt is lacking in the water, it may be used to advantage in inducing sheep to take the desired amount of mixed lick. In the absence of salt, cotton seed or similar meals are attractive, and the intake of lick regulated to about ½ oz. per head per day through their use. The action of a good lick is to stimulate the digestive organs and so whet the appetite as to cause the sheep to eat more and, at the same time, make better use of the food consumed—a decided advantage when scrub feeding.

Practically all our Western timbered country carries a proportion of useful edible shrubs and trees, which include a wide range of varieties (too numerous to mention here) growing over large belts of country. Too much value cannot be placed on the useful fodder trees of the West, and when scrub feeding becomes necessary every effort should be made to preserve them.

CULLING THE EWE FLOCK.

No operation on the property, as a part of general management, is of more importance than the systematic culling of the ewe flock.

All work on a grazing place has for its object, as a matter of course, the making of money. Judged from this point alone, culling definitely pays. It costs no more to feed a profitable sheep than a waster.

From another point of view, the opinion is ventured that 2,000 well-bred and well-fed sheep give a greater return than 3,000 indifferently-bred and half-fed animals. Then, again, the additional space one is able to give the smaller number must come into consideration.

Culling should be done when the fleece has about twelve months' growth, and should apply not only to the ewe flock, but also to the young sheep, especially those which it is intended to keep as future breeders. It is necessary to have fixed a definite type in the mind and consideration should be given to a type suitable to the particular district in which the property is situated, and stick closely to that type.

Any sheep not measuring up to the standard should be rigorously rejected, and this does not apply only to the covering of the animal. Apart from the fleece, some of the common deficiencies which should be taken into account are: Want of size and conformation, body wrinkles denoting the "fly trap" sort of sheep, a leaning towards delicacy of

constitution, bad feet and heads, besides many other deficiencies recognised readily by a good classer during the practical operation.

Regular culling leads to the establishment of a good flock, but the full benefit of the practice is not achieved unless better rams are provided for in the policy adopted.

DERMATITIS.

A condition manifested by intense irritation, and development of dropsical swellings, and later death of unpigmented surfaces of an animal's body, sometimes occurs during summer in country where trefoil and St. John's wort grow. It is only on white unpigmented patches of the animal's skin that the condition appears, Pigmented or coloured portions of the skin remain unaffected. Feeding experiments have proved that the ingestion of these plants, together with exposure to strong sunlight, bring about the condition. Cattle so affected show signs of much irritation, biting and licking themselves. Within a few days excoriation of the skin of unpigmented areas occurs. Animals become feverish and lose condition rapidly.

Sheep are affected similarly; the ears and face become thickened and dropsical, and the lips become hard and leathery. If shade is provided, animals seek it readily to obtain relief.

Staining of white patches on cattle with ordinary washing blue is protective. An application of a solution of permanganate of potash made with rainwater to a deep pink colour gives relief.

SORGHUM POISONING ANTIDOTE.

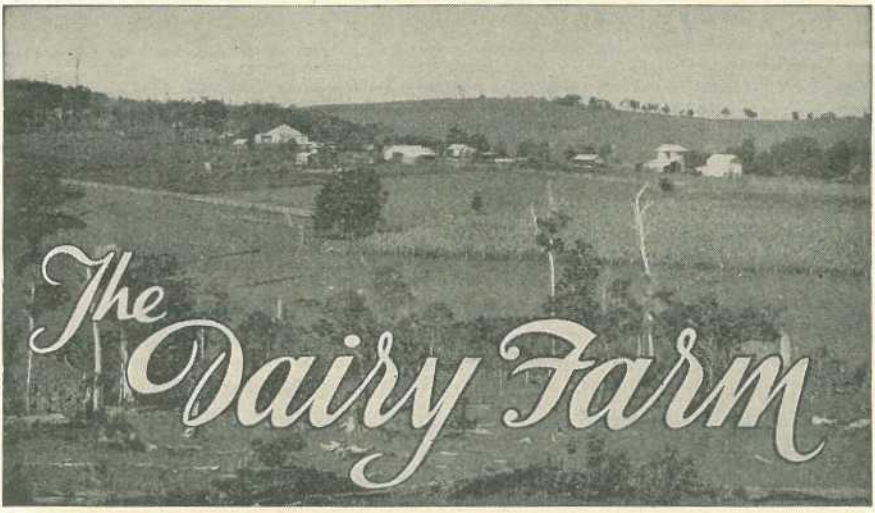
Molasses diluted sufficiently to allow of drenching is regarded as an antidote for sorghum poisoning, a quart being advisable for a cow.

The best antidote, however, is a mixture of solutions of carbonate of soda (washing soda) and sulphate of iron. The procedure is to dissolve 1 oz. of washing soda in 1 pint of water, and, in a separate pint of water, ½ an oz. of sulphate of iron. These ingredients should not be mixed until immediately before application as a drench. Two pints of the mixture are sufficient for a cow, and half a pint for a sheep. If drenching cannot be done, the mixture may be poured into the stomach through a canula inserted as for a bloat, a hand's-breadth forward of the point of the hip bone on the left or near side.

The solutions of each ingredient may be concentrated, but they must be kept separate in glass, coloured preferably, wood or earthenware containers—not iron—and made up with the addition of water to contain 1 oz. of washing soda and ½ oz. of sulphate of iron to the 2 pints of the mixture.

Larger doses of carbonate of soda and sulphate of iron could be given, but it is questionable whether an increased dose would be of any advantage.

Sulphate of iron may be bought for about 3d. per lb., and washing soda for slightly less. A few pounds of each kept on hand for emergencies might obviate a serious loss.



Lubricating the Separator.

BEFORE the separator is used it should be seen that the sight feed lubricator is working satisfactorily. It is absolutely necessary for the machine to receive the correct flow of oil from the lubricator before the separation process begins; otherwise the spindle—one of the most expensive parts of the machine—will show signs of wear long before it is due. Ten drops of oil a minute is a satisfactory adjustment to make on the lubricator. Any increase in this number of drops will not help in the lubrication, although the oil will not go to waste, for it drops into the reservoir at the bottom of the machine.

As soon as separating is finished, the lubricator should be shut off to prevent any more oil from dropping into the machine.

It is advisable to form a habit of cleaning the working parts—the parts that have to be oiled—at the beginning of every month. Take the back cover off the machine, drain out the oil, put in a cup of kerosene or petrol and give the machine a good turn, so that all the moving parts will be thoroughly cleansed. Drain off the kerosene or petrol in the same way as the oil, then replace it with clean, fresh oil, turn the machine again, so as to distribute the oil over the parts, then stop the machine and drain again. This will leave the separator in a thoroughly clean condition, ready to receive fresh oil that will give 100 per cent. lubrication.

Another important point to remember about separator lubrication is that the particular type of oil used must be suitable for high-speed lubrication. Cheap, thick oil should not be used, as it may reduce very considerably the efficiency of the separator.

The whole of the cleaning-out and renewing of the oil can be done well within half an hour, and the time spent will be more than repaid.

THE SEPARATOR FLOAT.

Probably the most neglected part of the separator is the float, the function of which is to regulate the flow of milk into the bowl.

This means that it should be perfectly balanced, otherwise an irregular flow occurs and inefficient separation and fluctuation of tests result.

It has been frequently found that floats are badly dented or leaking. To this condition is added the danger of throwing the float out of balance by unskilful repairs. It has also been found that leaking floats have been repaired without first emptying them, which makes them heavier than designed.

Probably the most serious aspect of damaged floats is the fact that cracks and badly soldered joints provide just the right conditions for the growth of bacteria. Consequently, milk passing over them becomes contaminated, resulting in many cases of cream being graded down.

Dairymen would be well advised to give consideration to this matter, and when repairs are necessary to have them done by a competent tradesman, who should be advised of the importance of the work.

BLOOD MEAL FOR DAIRY STOCK.

Blood meal feeding to dairy cattle presents little difficulty when the meal is fresh and free from objectionable odour. It may be incorporated in the regular feed or mixed with appetising food such as maizemeal, bran, pollard, cotton seed. Care must be exercised, however, to see that the feed box is kept clean.

In the presence of moisture, blood soon fouls and an objectionable smell results from the fermentation. Stock dislike this intensely and considerable difficulty may be experienced in getting animals into the bail where such food has lain.

PROTEIN AND MEAT MEAL.

Protein meal is a meat meal prepared from the clean edible portions of viscera of animals slaughtered, inspected, and passed for human consumption, together with carcases which have been rejected because of some fault rendering the carcase unsuitable for human food. The carcases of immature calves are also utilised for purposes of stock food manufacture. In process of manufacture of protein meal, a soft bone meal is added to the meat to assist in more complete treatment of the meal when passing through the grinding and sieving machinery. The whole mixture is then subjected to cooking at 60 lb. steam pressure for 4 to 6 hours, the time varying with the assortment of the charge (i.e., the mixture). Further heat treatment is then required to render the fat highly mobile for purposes of separation from the crackling (or remaining fatty fibrous matter). This treatment alone is sufficient to render the finished article sterile and free of risk from a disease point of view, hence protein meal is quite a safe product to use.

Meat Meal is a stock food prepared in a similar manner to protein meal, but the raw products consist entirely of livers and lungs from animals slaughtered and passed for human consumption. The carcases or viscera of animals condemned for tuberculosis are not used in the manufacture of protein meal, meat meal, or any other edible line, and hence there need be no fear of transmitting disease through use of these meals; but it is essential in storing them to keep them in a dry place where there is a strong draught of air for this maintains the condition and prevents formation of mould and of objectionable odours.

PROFITABLE DAIRYING.

The first essential is to have every cow in the herd tested to make certain that she is worth keeping. As the animals must be adequately and properly fed, the next important factor is that governing production.

A good water supply is necessary. An ideal condition is, of course, sufficient water at convenient points in every paddock. Many dairy farmers, however, are satisfied with at least one good watering place. That means that if the herd is feeding at a distance from the water the cows do not go to the trough to drink as frequently as they would if it were closer to their grazing ground. On hot days it takes quite a lot out of animals to walk any distance, and when they do come in to water they stay in its vicinity. As the area surrounding the water is usually bare from over-grazing, they get very little to eat. So, in either case, the milk flow is seriously affected.

Another point which is often overlooked is the destruction of grass and herbage caused by the extra tramping of the animals going to and fro. Cows frequently destroy more feed with their feet than they actually eat.

Subdivision of paddocks will provide succulent pastures carrying a full complement of proteins, which the cattle relish and clean up as they proceed without tramping half of it into the ground. With pastures under complete control, the herbage and grasses can be fed off as required; and, in times of plenty, all surplus growths may be mown and conserved either as hay or ensilage.

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.

"DON'TS" AND "BUTS" FOR DAIRY FARMERS.

DON'T have the cowshed roof covered with dust and cobwebs;
BUT lime-wash it and brush it down regularly.

DON'T have heaps of manure just outside the cowshed door;
BUT carry it away daily to the paddock.

DON'T wash a whole herd of cows with one bucket of water;
BUT use one bucket of water for every two or three cows.

DON'T use old pieces of bagging for udder cloths;
BUT use clean cloths kept for the purpose.

DON'T leave udder cloths screwed up in damp bundles;
BUT boil them daily and hang them out to dry away from the dust of the yard.

DON'T follow the practice of wet-handed milking;
BUT always milk with clean dry hands.

DON'T milk into kerosene tins or use them for cream, the folds and crevices provide ideal conditions for bacteria;
BUT invest in well-made milk buckets and cream cans.

DON'T commence milking into the bucket immediately;
BUT direct three streams of milk into a separate vessel for rejection. This milk is bacteria laden and contains little fat.

DON'T allow milk and/or cream to stand in or near the milking bails or dusty yards;
BUT remove it immediately to the dairy or milk stand as the case requires.

DON'T use cloths for straining milk. They are too risky;
BUT use a cotton wad type strainer and strain only once.

DON'T use hot water directly on utensils after milking, as it will bake the milk serums on to the metal;
But rinse or soak them first in cold water.

DON'T wipe the utensils with a cloth after washing;
BUT sterilise them by boiling or steaming and allow them to dry without wiping.

DON'T abuse or knock your cows about, for this is one of the chief causes of dirty yards;
BUT treat them kindly—a contented cow will give more and better milk.

DON'T delay the cleansing of any dairy equipment after use;
BUT remember that it is much more difficult once the milk or cream residue has been allowed to harden.

DON'T forget to cool and stir any cream as provided by the Dairy Produce Acts;
BUT persevere and get "*Choice*" grade every time. It can be done.

Preparing Pigs for Show.

IN planning the exhibition of pigs at shows several important points must be kept in mind. The exhibitor should study carefully the prize schedule long before he proposes to exhibit, and should aim at having animals entered in the class or classes for which they are most suited.

The award for a class for boar over twelve and under eighteen months, or under two years, is more readily won, other things being equal, with a boar carrying all the age the class will allow than with a younger animal. The prize for sow with littler not more than eight or ten weeks old is more frequently won with a really good sow with a litter eight or ten weeks old than with an equally good sow with a litter eight or ten days old. Size for age is important. In a class for sow twelve months of age, the sow should be fairly forward in her gestation period. A sow not in pig at that age creates suspicion in the mind of the judge, and she does not or should not stand the same chance of winning. Mature animals should be guaranteed breeders. Pigs are judged on a performance basis, as well as on conformation, plus pedigree, plus age.

Selection of Stock.—The possibility of securing premier honours, while depending very largely under present conditions on bodily conformation, colour markings, and freedom from faults, depends also on the time the exhibitor is willing to give to the preparation of his stock, and the businesslike attitude he adopts towards the job. Successful exhibitors spare no effort to ensure having their stock ready at the time of judging. Some animals are good feeders and are contented, others are stubborn and dislike strange surroundings—refusing to eat and losing bloom.

Condition and Management.—Show pigs should not be fattened to excess. This reduces their breeding capabilities. Fat covers a multitude of minor faults which should not be present in prize-winners. If pigs

cannot win in medium breeding condition—other things being equal—they should not win at all.

Appearance catches the eye of the judge, whether it be of live pigs or of other exhibits. The animals should be shown in a clean, attractive condition. Warm water, soft soap, a stiff dandy brush, a softer oily brush, and a sharp knife for trimming the hoofs are necessities. Some pigs have overgrown hoofs, which gradually cause the forelegs to become inbent or the hindlegs misshapen. Removal of natural markings and clippings of the hair of pigs is objected to, and may result in disqualification. Clippers are not necessary in the show pig pen. For dressing the hair and softening the skin, a colourless oil should be used. Cocoanut oil is best, but rather expensive. Petroleum jelly is very useful. Some traders sell a special oil for pig dressing. The oil may be applied after washing: the objective is a clean glossy coat of hair on a mellow skin.

Preperation and Exercise.—Avoid selecting animals with definite faults—such as an overgrown tongue, ears torn or damaged, and irregular markings. Bad tempered, snappy animals should not be exhibited.

Train the animals to move about at will and to become used to strangers. Mature animals should be paraded before the judge in order to show off their good points. Bacon and pork pigs and younger classes are not paraded at most shows, but they may be moved about judiciously in their pens.

Agricultural shows provide opportunities for displaying stock for sale that do not present themselves on the farm. Full advantage should be taken of such opportunities.

Finally, the exhibitor should be a good sport—a good loser as well as a good winner.

POINTS OF A GOOD BOAR.

When selecting a boar the best available should be bought, for during his life he may be the sire of hundreds of pigs, while the sow can only produce a limited number. If the boar is good he will improve the standard of the herd. His selection, therefore, is of very great importance.

The boar should come from a large, thrifty litter, and be obtained from a reliable breeder. He should be a little more on the compact side than the sow, not too chunky or short, but showing full development at every point, and of a strictly masculine type representing the full type of his breed. He must show quality, smoothness, and evenness in every part, have a typical masculine head, with eyes and ears wide apart, the jowl reasonably full and well laid on to the shoulders, which should be smooth and free from wrinkles. He should have a full heart-girth extending well down to the bottom lines, nearly or quite on a level, with as deep a flank as possible. He should possess rather short or medium length legs, with bone of fair size and quality, pasterns short and straight, and the hoofs well set, legs standing square, straight, and well under him. A long, wide and deep ham, and tail well set up are also desirable characteristics.

MAIZE AND PORK QUALITY.

Because of its relatively high fat content and the low melting point of its fat, maize can cause the production of soft fat in pork and bacon.

A sweeping statement is sometimes made that "maize-fed" pigs are soft as compared with pigs which have been fed on wheat or barley. The statement really needs some qualification so far as Queensland pigs are concerned. A large number could be classed as "maize-fed," but they rarely receive sufficient maize to cause soft pork or bacon.

Maize is the most widely grown grain in Queensland, but the pig industry is not dependent on this crop. It is very closely associated with dairying, the pigs being used primarily to consume the milk by-products —separated milk, butter-milk, and whey. Pasture, forage crops, and root crops also form a large part of the diet of pigs on some Queensland farms, and the grains—maize, wheat, and barley—are really only used as supplementary foods.

These points should be borne in mind when reading the advice of some overseas authorities, who state that maize should not constitute more than about 35 per cent. of the grain allowance of pigs. This may be sound advice under English conditions where pigs frequently receive a diet which is about 90 per cent. grain and which usually does not contain milk products, but under Queensland conditions, where the feeding systems are as stated, there appears to be little danger of pigs receiving sufficient maize to depreciate their carcass quality.

Most of the pigs produced in Queensland can be classed as "milk-fed."

CHARCOAL FOR PIGS.

Digestive efficiency in farm animals depends largely on their ability to grind their food well. Thorough mastication is therefore linked with ease of digestion. Some animals may eat food rapidly without ill-effects. Thus the domestic fowl swallows quickly, but it has a remarkable mechanism in the gizzard for grinding the food to a fine state for subsequent digestion and absorption.

The pig is not so well equipped as the fowl to handle rapidly eaten food, yet under most farm conditions fast eating is the rule. The pig can be helped to make better use of its foods in the following ways:—

(i.) By feeding easily digested material;

(ii.) By grinding the less digestible foods;

(iii.) By ensuring the animals sufficient feeding room;

(iv.) By arranging for some open grazing where the animals may eat at their leisure;

(v.) By feeding aids to digestion.

It is the last with which this note is concerned.

Charcoal and coke are extraordinarily cellular in structure and possess a great number of surfaces. At these surfaces rapid digestion of food can take place. By feeding either of them in powdered form, coarse lumps of food become coated with a film possessing an actively digesting surface.

An alternating and cheaper method is to throw coarse charcoal or coke into the pig sty and let the animals grind and eat as they feel inclined.

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 ..	White Leghorns and Australorps
E. J. Blake, Rosewood ..	Sunnyville ..	White Leghorns, Australorps, White Wyandottes and Rhode Island Reds
R. H. & W. J. Bowles, North Rockhampton	Glenmore Poultry Farm and Hatchery	White Leghorns and Australorps
J. Cameron, Oxley Central ..	Cameron's ..	Australorps and White Leghorns
M. H. Campbell, Albany Creek, Aspley	Mahaca Poultry Farm and Hatchery	White Leghorns and Australorps
J. L. Carrick & Son, Manly road, Tingalpa	Craigard ..	White Leghorns
N. Cooper, Zillmere road, Zillmere	Graceville ..	White Leghorns
R. B. Corbett, Woombye ..	Labrena ..	White Leghorns and Australorps
T. G. Crawford, Stratford ..	Rho-Isled ..	Rhode Island Reds
Dr. W. Crosse, Musgrave road, Sunnybank	Brundholme ..	White Leghorns, Australorps, and Rhode Island Reds
Dixon Bros., Wondecla	Dixon Bros. ..	White Leghorns
Rev. E. Eckert, Head street, Laidley	Laidley ..	Australorps, White Leghorns, and Langshans
Elks & Sudlow, Beerwah ..	Woodlands ..	Australorps and White Leghorns
W. H. Gibson, Manly road, Tingalpa	Gibson's ..	White Leghorns and Australorps
Gisler Bros., Wynnum	Gisler Bros. ..	White Leghorns
G. Grice, Loch Lomond ..	Kiama	White Leghorns
J. W. Grice, Loch Lomond ..	Quarrington ..	White Leghorns
Mrs. M. Grillmeier, Mount View, Milman	Mountain View	Australorps, Minorcas, and Rhode Island Reds
C. & 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 ..	Anconas and White Leghorns
J McCulloch, Whites road, Manly	Hindes Stud Poultry Farm	White Leghorns, Australorps. and Brown Leghorns
A. Malvine, junr., The Gap, Ashgrove	Alva ..	White Leghorns and Australorps
H. L. Marshall, Kenmore ..	Stonehenge ..	White Leghorns and Australorps
W. J. Martin, Pullenvale ..	Pennington ..	Australorps, White Leghorns, and Langshans

Name and Address.	Name of Hatchery.	Breeds Kept.
J. A. Miller, Racecourse road, Charters Towers	Hillview ..	White Leghorns
F. S. Morrison, Kenmore ..	Dunglass ..	Australorps, Brown Leghorns, and White Leghorns
Mrs. H. I. Mottram, Ibis avenue, Deagon	Kenwood Electric Hatcheries	White Leghorns
J. W. Moule, Kureen	Kureen ..	White Leghorns and Australorps
D. J. Murphy, Marmor ..	Ferndale ..	White Leghorns, Brown Leghorns, Australorps, Silver Campines, and Light Sussex
S. V. Norup, Beaudesert Road, Cooper's Plains	Norup's ..	White Leghorns and Australorps
H. W. & C. E. E. Olsen, Marmor	Squaredeal Poultry Farm	White Leghorns, Australorps, Black Leghorns, Brown Leghorns, and Anconas
A. C. Pearce, Marlborough ..	Marlborough Stud Poultry Farm	Australorps, Rhode Island Reds, Light Sussex, White Wyandottes, Langshans, Khaki Campbell and Indian Runner Ducks, and Bronze Turkeys
E. K. Pennefather, Oxley Central	..	Australorps and White Leghorns
G. Pitt, Box 132, Bundaberg ..	Pitt's Poultry Breeding Farm	White Leghorns, Australorps, Langshans, Rhode Island Reds, and Brown Leghorns
G. R. Rawson, Mains Road, Sunnybank	Rawson's ..	Australorps
J. Richards, Atherton	Mount View Poultry Farm	White Leghorns and Australorps
H. K. Roach, Wyandra	Lum Burra ..	White Leghorns and Australorps
C. L. Schlencker, Handford road, Zillmere	Windyridge ..	White Leghorns
A. Smith, Beerwah	Endcliffe ..	White Leghorns and Australorps
A. T. Smith, The Gap, Ashgrove	Smith's ..	White Leghorns and Australorps
T. Smith, Isis Junction	Fairview ..	White Leghorns and Langshans
H. A. Springall, Progress street, Tingalpa	Springfield ..	White Leghorns
A. J. Teitzel, West street, Aitkenville, Townsville	Teitzel's ..	White Leghorns
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkin's Poultry Farm	White Leghorns and Australorps
W. A. Watson, Box 365, P.O., Cairns	Hillview ..	White Leghorns
G. A. C. Weaver, Herberton road, Atherton	Weaver's Stud Poultry Farm	Wyandottes, Indian Game, Barred Rocks, Australorps, White Leghorns, Anconas, Rhode Island Reds, Buff Orpingtons, Black Orpingtons, and Buff Leghorns.
H. M. Witty, Kuraby	..	White Leghorns and Australorps
P. A. Wright, Laidley ..	Chillowdeane ..	Brown Leghorns, White Leghorns and Australorps
R. H. Young, Box 18, P.O., Babinda	Reg. Young's ..	White Leghorns, Brown Leghorns and Australorps

Following is a list of new registrations received up to the 19th December, 1939:—

J. E. Caspaney, Kalamia Estate, Ayr	Elvington ..	White Leghorns
T. Duval, Home Hill	Duval's.. ..	White Leghorns
F. G. Ellis, Sunny Corner, Old Stanthorpe road, Warwick	Sunny Corner	Australorps
F. McNamara, Vogel road, Brassall, Ipswich	Frammara ..	White Leghorns and Australorps
C. Mengel, New Lindum road, Wynnum West	Mengel's ..	Australorps
S. E. Searle, New Cleveland road, Tingalpa	Tingalpa ..	White Leghorns
J. Steckelbruck, The Gap, Ashgrove	..	White Leghorns and Australorps

THE PURCHASE OF POULTRY.

At this time of the year, the upward trend of egg values tempts many beginners, and also persons who keep a few fowls, to increase their income from poultry by purchasing pullets or hens. The idea is fairly sound, but there are numerous pitfalls for the inexperienced buyer.

Assuming that the beginner sets out to buy pullets about four or five months old, it is only natural to expect that the quoted price will have an important bearing on the transaction. For instance, if pullets four to five months old are obtainable from one source at 6s. per pair and from another at 10s. per pair, the cheaper lot may be bought.

The inexperienced buyer seldom appreciates the necessity for paying the higher price, as the birds are of the same age and breed. It should be borne in mind, however, that there is usually a definite reason for the difference in the price, and that difference can be summed up in one word—quality. The cheaper birds may have been culled from flocks, as the result of their being backward or stunted in growth. Such birds cannot be expected to commence egg-laying at the normal time and be profitable. If they are culls as pullets, it is unwise to breed from any of them. They cannot return a profit, irrespective of the purpose for which they are used.

After allowing for feeding costs and a slight increase in egg values, it is unlikely that the more expensive birds will show any profit during their pullet year. It is quite probable, however, that they will repay their purchase price. At the same time, many of these birds should make suitable breeders and their use for this purpose would be profitable.

Much the same applies in the case of hens. Cheap hens are usually unsuitable as breeders, whereas many breeding birds may be selected from the more expensive birds. The purchase of old hens is not good business, apart from their value as future breeders. Again, while the beginner may be able to distinguish a pullet before it begins laying, once production starts it is more difficult to separate hens which have just completed a moult and pullets which have been laying for a few weeks. It is also very difficult to distinguish between a hen that is fifteen months old and one four years old. This means that in buying alleged first year hens the birds could be any age above that mentioned.

In such circumstances, it is advisable for the prospective buyer to inspect the flock from which it is proposed to make the purchase before parting with his money.

MARKING EARLY LAYING PULLETS.

The marking of early laying pullets provides a practical method of selection where the trap nest is not used.

Records obtained by trap nesting in various parts of the world show that —

(1) Early laying pullets are, as a rule, the highest producers;

(2) Birds that lay late into the autumn and are late in moulting are also high producers.

As the early layers and late moulters are high producers, a marking system will assist in distinguishing between profitable and unprofitable fowls.

In one convenient system of marking, a coloured leg band is placed on the left shank of all pullets which start to lay before six months of age. A band of another colour is attached to the left shank of pullets starting to lay when six and seven months of age, and a third coloured band is used for fowls which commence to lay in the eighth month. Pullets that do not lay until after the eighth month should be culled from the flock, or kept in a pen by themselves, and forced for egg production.

Pullets which are early layers show the following characteristics:—

(1) A large red comb;

(2) An active disposition and a ravenous appetite;

(3) Roominess between the keel and pelvic bones;

(4) An occasional disappearance of the yellow coloration round the vent in some yellow shanked varieties.

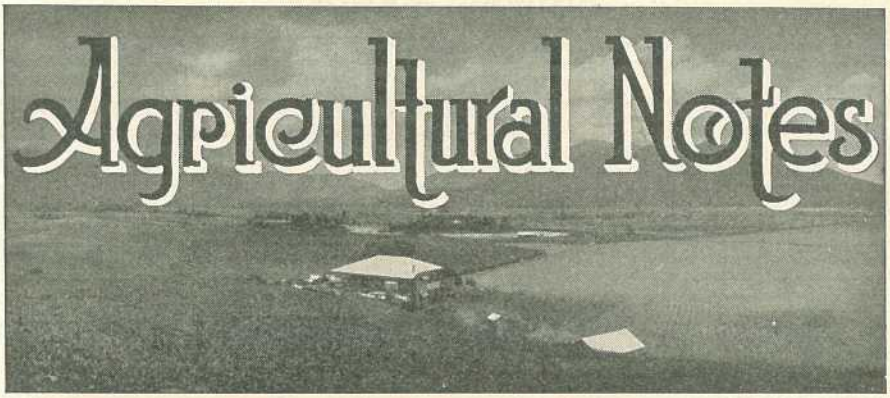
In small flocks, individuals showing the abovementioned characteristics may be caught in the nests and then marked.

During the following season, all fowls which were marked as late maturing the previous autumn and moult in December, January, and February may be culled. All the early laying birds, and those that moult after 1st March may be kept for layers or placed in a special breeding pen and mated to a male known to have come from a high laying hen that has been trap nested. In this way the egg production of the offspring may be raised.

The points outlined provide a simple method of selection which will, properly used, raise the level of production in a flock.

PRIMARY PRODUCTS FOR SECONDARY INDUSTRY.

Much attention is now being given to the study of crops for food and clothing; but, so far, not so much attention has been given by research institutions and industries to the use of farm products in mills and factories making the thousand and one things people need after their backs have been covered and their stomachs filled. The human stomach is of limited capacity, but the "stomach" of industry is practically insatiable under normal conditions. So efforts to find ways and means of economically using farm products in making materials for use in all sorts of manufacturing processes will have to be increased. There have been enough results in recent years to indicate great possibilities, but, so far, they had almost no effect on the farmers' market, because, for example, cellulose and other raw materials are produced in such immense quantities in waste products, as well as in crop surpluses, that consumption in industry must be on a vast scale in order to affect the crop market materially. However, it is not only necessary to provide the raw materials of the farm in such form that industry can use them easily, but it is necessary to provide them at reasonable cost to the manufacturer, as well as at a reasonable profit to the producer. Together the engineers and chemists may help to solve these problems by working out new ways of processing farm products, cheaper equipment and methods of production, more efficient storage, and more effective preparatory processing on the farm.



Potatoes in Central Queensland.

IN Central Queensland, the winter crop of potatoes is normally planted between mid February and March, and as the growing season is short, harvesting is usually in full swing by June. Climatic conditions are responsible for the comparatively short period between planting and maturity, and also the smaller yields in comparison with those obtained in more temperate regions.

Trials have disclosed that although the tubers attain normal size, the number per plant in this crop is comparatively low, which suggests that yields could be increased by closer planting. This opinion is confirmed by the successful crops obtained in areas where the seed tubers have been spaced 9 inches to 12 inches apart, instead of the wider 12 inches to 18 inches usually practised in the southern districts. As the yield per plant in the winter crop is apparently not reduced by the closer spacing, this method is valuable where small areas are under cultivation, particularly when irrigation facilities are available.

Fertilizer trials conducted on average soils have not shown any marked increase in yields, but further experimental work is necessary before a definite recommendation can be made. However, crops grown on the poorer soils, particularly of old cultivations, should benefit from substantial applications of phosphoric acid and potassic fertilizers.

As heavy rains are likely to be experienced at this period of the year, well-drained, free-working soils are to be preferred. Deep ploughing will be found to assist drainage, besides providing more favourable growing conditions.

If seed potatoes are purchased from outside sources, preplanting treatment with hot formalin or acid corrosive sublimate may be desirable.

Although cut tubers are permissible for spring planting, seed for the autumn crop should definitely comprise whole tubers only.

Attention is also directed to the control of Irish blight and other diseases by means of suitable sprays, full particulars of which may be obtained on application to the Department of Agriculture and Stock.

ANIMAL MANURE.

The unused dung of farm animals in Queensland must represent a great loss of national wealth each year. On almost every dairy farm one can see this waste from the freshly voided piles round the milking yards to last year's undisturbed cake lying bleached and useless in the field.

Idle dung is not only idle money, it is wasted money. About four-fifths of the food consumed by farm animals is excreted, and the fertilizing constituents of this manure are equal pound for pound to the best obtainable.

The urine soaks into the earth and soon makes its nutrients available to the plant roots, but the dung lies on the surface and if left unbroken may take years to decompose.

The direct results of this condition are readily observed. A definite area is temporarily spoiled for grazing, and when eventually grass grows around or through the heap it is completely ignored by stock until there is nothing else left. By this time the grass has aged, become harsh, and lost much of its nutritive value.

The indirect results are not usually recognised. Rats and other vehicles of disease revel in droppings, and transfer any infection to feed bins, troughs, and stored foods.

These disadvantages can not only be eliminated, but, by using a proper system of conservation and distribution, be converted to profit.

The material which accumulates in sties and stalls or where animals congregate can be readily collected and tipped into a nearby excavation. The excavated earth can be banked to form a run-off. A covering of palings, old posts, sheets of iron or other suitable material should be used to avoid trouble to stock and inconvenience to farm workers. Manure stored and covered in this way loses little of its fertilizing value. Manure piled in the open and exposed to the weather loses much by fermentation and leaching.

When land is to be manured the pit can be opened and the material removed.

Where the paddocks are large and the droppings widely distributed a system of conservation is not practicable. In such cases periodic visits should be made with a rake and the dung under shade trees, around watering places, or along "pads" broken up and scattered. This allows the material to dry quickly and continuous tramping by stock soon works it into the soil.

The benefits derived from the farm manure are twofold. It supplies plant nutrients as well as an excellent medium for the production of humus—the organic water conserving colloid of soil.

The daily production of dung per 1,000 lb. live weight is approximately—

Cow	52 lb.
Horse	40 „
Pig	50 „

This means that on a farm running 35 cows, 4 horses, and 4 sows, there would be a weekly production of 6 tons. If only one-third of this could be collected it represents at least 100 tons of good fertilizer each year.

GIANT SETARIA (GIANT PANICUM).

In the past more or less confusion has arisen in connection with the sale for sowing of so-called panicum seed—*Setaria italica*. Botanically the seed in question is not a panicum, but belongs to the genius Setaria, a common collective name for which is "foxtail millet."

At the present time *Setaria italica* (so-called panicum) may be divided into three main types, viz.:—giant, dwarf, and an admixture of both. The so-called giant panicum offered for sale in Queensland is frequently a mixture of the giant and dwarf varieties. In order to clarify the position, it has been decided that the giant and dwarf varieties shall be respectively called giant setaria and dwarf setaria. To ensure that these products will not lose their identity so far as farmers and others are concerned, they should be referred to in catalogues and other publications as follows:—

Giant Setaria (Giant Panicum), and

Dwarf Setaria (Hungarian Millet).

It may be mentioned that the identification of the giant or dwarf varieties is comparatively simple, and is carried out by the Seed Testing Station, Department of Agriculture and Stock, Brisbane, a period of about 14 days being required for the purpose.

PARA GRASS FOR DAMP PLACES.

Para grass—known in Queensland also as *Panicum muticum* and giant couch—is grown to a large extent in many tropical and sub-tropical countries. The grass is a rapidly-growing perennial, spreading by means of thick runners which grow along the ground and root at the joints. Vertical shoots are produced at the joints and reach a height of up to 5 feet. The runners spread very quickly, and the area occupied by the grass rapidly increases in size as the mat of foliage is produced.

Stock are fond of both leaves and succulent stems, but the trampling of animals may injure the runners, and under some conditions it is advisable to cut the grass and feed it green rather than graze it heavily. The feeding value of Para grass is fairly good.

Para grass has proved very useful on our coastal country. In North Queensland it has established a good reputation and is widely grown. It grows best on moist or even swampy land, and a paddock on a wet portion of any coastal farm might well be planted with Para grass to provide a change of diet from paspalum. Heavy frosts cut the grass back rather severely, but recovery in spring is rapid.

Seed of Para grass is usually of poor quality; hence the planting of roots or stem cuttings is the usual method of setting out the grass. These may be planted on ploughed land in furrows or started by mattocking in on the edges of waterholes or damp patches. Roots may be purchased in most of the coastal districts. A small number of cuttings will multiply rapidly in warm, showery weather.

A WARNING AGAINST PLANTING "MISSES" WITH A SECOND VARIETY.

It is not unusual practice for canegrowers in Queensland, after they have planted a field with one variety, to replace setts which have failed to germinate by planting setts of a second, quick-germinating variety. The result, of course, is a mixed stand. While we do not wish to condemn this practice out of hand it is nevertheless important that growers should only follow the practice with a full realisation of the possible ill-effects.

In the first place, it is essential that the variety used for supplies be an approved variety, otherwise both farmer and miller will be liable to heavy penalties for the growing or crushing of a disapproved variety. The fact that the disapproved variety was only used to supply misses would be no defence.

Secondly, a variety which is approved when planted, but which is subsequently disapproved, can only be cropped for three years after the calendar year of planting; it must then be ploughed out. During the past year we have noted several cases in which the second variety used for planting misses, has since been disapproved, the result being that in order to get rid of this variety it has been necessary to plough out the whole field.

Thirdly, there is the question of disease eradication orders. It is possible that the variety used for planting the misses may become diseased and its destruction rendered necessary, but, in order to destroy the scattered stools, the whole field may have to be ploughed out.

If a second variety must be used for the planting of misses it would be wise, therefore, to choose a disease resistant variety which is not likely to become the subject of a disease eradication order or to become a disapproved variety.

A.F.B.

USE OF SALT BAGS AS SEED CONTAINERS.

The use of bags which had previously contained salt for packing seed is attendant with risk unless due precautions are taken.

Salt—particularly crude salt—because chiefly of certain impurities which it contains, absorbs much moisture from the air, especially in humid weather. Both the salt dissolved by this moisture on a bag used previously for holding salt, and the damp conditions caused by the salt, can be deleterious to the keeping qualities of the seed packed in it.

If old salt bags—because of the current shortage—must be used, it is advised that they be *thoroughly soaked* in successive lots of water, and then *completely dried* before use.

A good way of soaking is to fasten the bags below the surface of a flowing stream, if possible, for a few hours; the bags should be "thinned out" sufficiently to allow free access of the water to all parts. It is no use merely soaking the bags in one lot of water, and then spreading them out to dry. The job should be done completely, using several waters if necessary.

Planting Fruit Trees.

IN planting out orchard trees to ensure their being placed exactly in the same position indicated by the marking pegs, a planting board will be found very useful, and is easily made. A board about 4 or 5 feet in length, 4 or 5 inches in width, and 1 inch thick, will serve the purpose readily. A "V" notch is cut in one side at the centre and a similar notch at each end, and the board is ready for use.

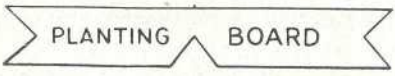


Plate 58.

The centre V is placed agains the peg denoting the position of the tree, and pegs driven in at the notches at both ends of the board. The board and tree pegs are then removed, leaving the two pegs at the ends of the board in position. The hole to receive the tree is then dug. When ready to plant, the board is brought into use again, being fixed as before at the ordinary soil level between the two remaining pegs. The tree is placed in the hole at the centre V in the board, taking the position formerly occupied by the tree peg, and the soil filled in.

The planting board serves another purpose, in that it ensures planting the tree at the proper depth. The correct depth at which to plant the tree is the depth at which it was grown in the nursery; the mark can usually be distinguished on the tree. The union of the stock and scion is always a weak spot in a tree and liable to attack from fungus disease; it should, therefore, be kept above the level of the soil. When using the planting board, the union, if kept level or slightly above the top of the board, will ensure the tree not being planted too deeply.

In digging the holes for the trees, the surface soil should be taken out and kept on one hide, and the subsoil at the bottom of the holes should be finely broken up. Provided the orchard has been properly

prepared there is no need to dig deep holes; so long as they are large enough to space the roots without cramping they will serve the purpose. A little top soil may be returned to form a small mound at the bottom of the hole. The roots, which should be carefully washed and trimmed, should be spaced as evenly as possible, and with a downward and outward slope from 40 to 50 degrees. The spaces are filled with fine soil, and pressed firmly, water being applied and allowed to soak in before the hole is completely refilled with soil. Where there is a danger of the trees being scalded by the sun, they should be protected by cylinders of paper tied around the trunks.

The season for planting is determined by location and local circumstances. Where frosts are likely to occur, July or early August planting is preferable to autumn, but where there is no danger of frost injury, autumn planting is satisfactory, as it enables the trees to obtain a roothold before the winter, thereby materially assisting an early spring growth.

THE GROWING OF SUMMER LETTUCE.

While lettuce thrives best in the early spring and autumn, good grade summer lettuce can be produced on the heavy soils of the highlands where the temperature of the air and soil is moderately cool.

Lettuce, particularly at this time of the year, cannot stand a check, therefore an even supply of moisture and plant food must be available.

The preparation of the soil should include the digging in of a generous supply of farmyard manure. Besides supplying the necessary readily available food, this manure greatly assists in the retention of moisture and in keeping the soil cool.

As frequent waterings will be necessary, any extra time required for levelling the land will be well spent.

If the land is dry when the beds are formed, it will be advisable to thoroughly soak them before sowing the seed as it will be found that the beds are inclined to settle unevenly after the first watering.

The seed being very small, should be sown as shallow as possible and covered with just sufficient soil to ensure germination. A top dressing of fine manure after sowing, will greatly assist in the germination, seedling, and maturing stages. Very thick seeding, besides being wasteful, entails much additional work in thinning. Successive sowings should be made at intervals of ten days throughout the summer. The seedlings should be thinned before crowding takes place. Thinning is best done with a light hoe, blocking out the plants to approximately 12 inches apart in the row; further thinning by hand to one plant in any place, may be necessary. To enable the plants to develop deep roots, overwatering at this stage should be avoided. More frequent waterings will be required as the plants increase in size.

Lettuce is a shallow rooter and a poor forager, and, therefore, well regulated waterings will do much to assist the growth of a strong, deep-rooting plant. Over-watering is very damaging, and it will take some experience to tell just when the lettuce needs water. Generally, a tough appearance and a darkening of the leaf are symptoms pointing to a lack of water.

It is very important to select a variety for planting which grows well in the locality under consideration. Climatic conditions and market requirements also should be considered. In this respect, both "Imperial F" and "Iceberg" are recommended.

REPLACEMENT OF CITRUS TREES IN ESTABLISHED ORCHARDS.

Citrus growers who desire to replace unprofitable or decadent trees in established orchards should haul them out and remove all old roots from the soil.

Occasionally, replaced trees do not make satisfactory growth. The poor development of the young trees, however, is usually due to faulty soil preparation. After removing and burning all the old roots the hole should be left open for some time before the new tree is planted. A few weeks before replanting, the soil should be thoroughly cultivated and levelled off. A generous dressing of rotten stable or farmyard manure or some other well-decayed humus-forming material is then mixed with the soil. In frost-free areas, replanting may be done in autumn, but where the frost risk exists, July or August planting is preferable.

Before planting, the roots of the young trees should be trimmed and all broken ends cut off cleanly. The soil should be firmly tramped around the roots. The tree should be set at precisely the same height at which it was growing in the nursery—i.e., with the bud above soil level. After the tree has been set and the soil around it will tramped, but before the hole is completely filled, apply a bucket of water, and when this has soaked in the hole should be filled with loose soil without further tramping.

When the rooting system is established, apply ¾ lb. to 1 lb. of sulphate of ammonia to each tree. The fertilizer should be scattered in a circle from 9 inches to 18 inches from the base of the young tree and then raked or chipped into the soil.

BANANA RUST CONTROL.

Banana growers in the area in which rust usually occurs, particularly those on first cut plantations, will be well advised to look out for the first of the new season's rust, which already has been noticed in some localities. In order to ensure clean fruit at maturity it also would be advisable to commence bagging and dusting with a nicotine dust once a fortnight. Full particulars of control methods are available in pamphlet form from the Department of Agriculture and Stock.

In the earliest stages of rust damage, a black smudge will be noticed in between and where two fruits touch, the top hand usually being the one affected most. Numbers of thrips, which are responsible for the damage, will also be observed on the bunch.

Three very important things must be observed if growers expect good results from the control treatment.

1. The bag must be of good quality hessian with a very close weave, similar to that of a sugar bag. Chaff bags and bags with a similar mesh

are too open in the weave for use where rust is bad. On the other hand, potato bags are too coarse and have a tendency to damage the fruit at the tips, through rubbing.

2. The bunch must be bagged as soon as possible after being thrown, preferably before the bracts are shed.

3. The first dusting particularly, and subsequent dustings, must be thorough.

In places where rust is only slight, good quality chaff bags will reduce the damage and otherwise improve the quality of the fruit, but if the damage is severe the good quality hessian bags, plus a fortnightly dusting for from 8 to 12 weeks, are essential.

To ensure treating the bunches as soon as possible after they are thrown, it is advisable to go through the plantation at least once a week. It makes the fortnightly dusting programme much easier if each week's baggings are distinctively marked. For instance, the bags which are placed in February should be marked with a "2" to denote the second month of the year. Underneath the "2" should be marked "1," "2," "3," or "4" to indicate in which week of the month the first dusting was given. When subsequent dustings are given the bunches marked "1" and "3" will be dusted one week and the bunches "2" and "4" in the following week. By marking the bags in this way with the month and week of bagging, the grower also will be greatly assisted in determining the approximate time when a bunch is ready to cut.

LABELLING THE EXPORT APPLE CASE.

With fruit for export, close attention should be given to details in the general "get-up" of fruit labelling.

It is often found when inspecting fruit at the ship's side that labels have not been carefully pasted on the ends of the cases. If the labels have become detached or torn, there is no means of identifying the owner or the trade description of the contents of the case.

Care in applying the labels is therefore necessary. A good paste is made as follows:—

Take 1 lb. flour, ½ oz. alum, and 1 pint water. Mix with a little cold water, then add boiling water until the paste thickens. If the resultant paste is too thin, it should be boiled slowly and a little more flour added with vigorous stirring until the consistency is right.

When applying the labels they should first be soaked for a short time in clean water. The paste is then applied by using a broad brush first to the case end and then to the label. The pasted surfaces are applied to each other, the label and the case being pressed into close contact by rubbing the surface of the label with a damp rag.

The following points should be observed:—

Place the label squarely on the end of the case.

Use rubber stamps for filling in particulars of varieties, &c. Pencil or writing of any description is not permitted.

Apply the rubber stamp squarely in the spaces on the label.

It must not be forgotten that Queensland's overseas consignments compete with the world's best fruit on the United Kingdom and European markets. Quality fruit should not be handicapped by a faulty finish to the case.

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

DURING December payable to high prices for all fruits were returned to growers. The advent of the stone fruit crop did not materially affect the prices of other fruits owing no doubt to the shortage of marketable fruit.

Supplies of all stone fruits have been light as a result of frost and hail damage. The quality has been good and a ready demand has continued.

New season apples have made their appearance, but many should have been left on the trees for another month. Growers are strongly advised not to spoil the early market with consignments of apples in too green condition. Probably early prices will be the most payable for apples because of the restricted shipments during the export season.

Pineapples have been in short supply. Many growers are sending this fruit into market in too green condition, resulting in slower sales and a tendency to lower values.

The following were the ruling market prices during the last week of the month of December, 1939:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: Small, 4s. 6d. to 6s.; Sixes, 7s. 6d. to 9s.; Sevens, 9s. to 11s. 3d.; Eights and Nines, 12s. 6d. to 14s.

Sydney.—Cavendish: Sixes, 10s. to 13s.; Sevens, 13s. to 16s.; Eights and Nines, 16s. to 18s.

Melbourne.—Cavendish: Sixes, 10s. to 12s.; Sevens, 12s. to 14s.; Eights and Nines, 14s. to 16s.

Adelaide.—Cavendish: Sixes, Sevens, Eights, and Nines, 14s. to 20s.

Lady's Finger, 2d. to 8½d. per dozen.

Sugars, 2d. to 6½d. per dozen.

Pineapples.

Brisbane.—Smoothleaf, 2s. to 8s. per dozen, 6s. to 12s. per case; Ripley, 2s. to 4s. per dozen, 9s. to 12s. per case.

Sydney.—Smoothleaf, 12s. to 20s.

Melbourne.—Smoothleaf, 12s. to 20s.

Papaws.

Brisbane.—Yarwun, 3s. to 6s. tropical case; Gunalda, 2s. 6d. to 4s. bushel; Local, 1s. to 3s. 6d. bushel.

Sydney.— 6s. to 15s. tropical case.

Melbourne.—6s. to 10s. tropical case.

Mangoes.

Brisbane.—Commons, 4s. to 7s. bushel; Special Varieties, 9s. to 12s. bushel.

Sydney.—12s. to 15s.

Melbourne.—10s. to 16s.

Passion Fruit.

Brisbane.—Firsts, 6s. to 8s.; Seconds, 4s. to 6s.

Sydney.—7s. to 10s.

Melbourne.—6s. to 10s.

CITRUS FRUITS.

Oranges.

Brisbane.—Imported New South Wales, 12s. to 14s.

Grapefruit.

Melbourne.—Palestine, 36s. (Export Citrus case.)

Lemons.

Brisbane.—Locals, 8s. to 14s.; Gayndah, 16s. to 18s.; Benyenda, 18s. to 23s.; Victorian, 18s. to 24s.

DECIDUOUS FRUITS.

Apples.

Brisbane.—Stanthorpe Cookers, 5s. to 15s. All small green apples should not be sent, as they are practically unsaleable. Imported Apples: Yates, 8s. to 16s.; Sturmer, 9s. to 13s.; Democrat, 10s. to 16s.; Granny Smith, 12s. to 18s.

Pears.

Brisbane.—Broom Park, 9s. to 15s.; Winter Cole, 10s. to 18s.; Josephines, 12s. to 17s.

Peaches.

Brisbane.—Local, 1s. to 2s. tray; Stanthorpe, 3s. to 8s.; small fruit hard to sell.

Nectarines.

Brisbane.—5s. to 9s. half-bushel

Plums.

Brisbane.—Wilsons, 8s. to 13s.; Santa Rosa, 6s. to 10s.; Shiro, 5s. to 9s.; Other varieties, 4s. to 9s.

Apricots.

Brisbane.—New South Wales, 6s. to 11s.; Stanthorpe, 4s. to 11s.; Special Large higher.

Cherries.

Brisbane.—8s. to 12s. a tray.

OTHER FRUITS.

Grapes.

Brisbane.—Local White, 4d. to 7d. lb.; Local Black, 9d. to 1s. lb.; Coominya, 18s. case.

Tomatoes.

Brisbane.—Ripe, 1s. to 4s.; Coloured, 3s. to 7s.; Green, 3s. to 6s.

MISCELLANEOUS VEGETABLES, &c.

(Brisbane unless otherwise stated.)

Watermelons.—Small, 1s. 6d. to 4s. 6d. dozen; Large, 6s. to 15s. a dozen.

Rockmelons and Canteloupes.—Brisbane, 2s. to 5s. dozen; Melbourne, 12s. to 16s. tropical case.

Cucumbers.—2s. 6d. to 5s. bushel.

Pumpkins.—Brisbane, 4s. to 5s. bag; Sydney, 7s. to 11s. bag; Melbourne, £10 to £12 per ton.

Marrows.—Brisbane, 6d. to 2s.; Melbourne, 6s. to 8s. case.

Lettuce.—6d. to 2s. dozen.

Cabbages.—Locals, 1s. to 5s. dozen; Stanthorpe, 3s. to 7s.

Beans.—6s. to 10s. sugar bag.

Peas.—5s. to 6s. sugar bag.

Beetroot.—3d. to 1s. 6d. bundle.

Parsnips.—4d. to 1s. 3d. bundle.

Carrots.—3d. to 1s. bundle.

Rhubarb.—6d. to 9d. bundle.

DAMAGE TO CANE SOILS BY ARSENIC.

The use of white arsenic as a means of grub control has been employed in the Giru area for a number of years. While our entomologists have agreed that in certain circumstances a partial control is possible, the practice has been discouraged as being costly and often disappointing. At the same time the possibilities of damage to the soil due to arsenic accumulations have been stressed.

There was brought to our notice recently a case of a farmer who had consistently employed arsenic for this purpose in a field in which the cane now grows only about 12 in. tall and then dies off. Analysis of a sample of soil from the field showed the presence of arsenic at the excessive rate of 600 parts per million of soil. As arsenic is held tenaciously by the soil, in a manner similar to phosphate, it will probably be many years before the excess arsenic has been leached away or rendered inactive.

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

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 and the Jersey Cattle Society production charts for which were compiled during the month of November, 1939 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (STANDARD, 350 LB.).				
Penrhos Elva 2nd	A. Sandilands, Penrhos, Wildash	12,129·29	520·142	Rosenthal Pendant's Prince.
Sunnyside Cissy 16th	P. Moore, West Wooroolin	11,183·05	407·565	Cosey Camp Rupert
Highfields Perfect	J. A. Heading, Highfields, Murgon	9,590·4	403·117	Headlands Red Robin
SENIOR, 4 YEARS (STANDARD, 330 LB.).				
Sunnyside Mabel 16th	P. Moore, West Wooroolin	9,674·69	386·345	Countess Lad of Cosey Camp
Happy Valley Melba	R. R. Radel, Happy Valley, Coalstoun Lakes	9,012·04	352·381	Burradale Emperor
SENIOR, 3 YEARS (STABDARD, 290 LB.).				
Penrhos Pansy 3rd	A. Sandilands, Penrhos, Wildash	9,442·94	366·378	Rosenthal Pendant's Prince
JUNIOR, 2 YEARS (STANDARD, 230 LB.).				
Rosenthal Dove 20th	D. J. Robinson, Robina, Womina	7,249·25	306·346	Rosenthal Peggy's Admiration
Penrhos Evelyn 5th	A. Sandilands, Penrhos, Wildash	7,102·48	305·514	Rosenthal Surprise
Sunnyside Milkmaid 2nd	P. Moore, West Wooroolin	6,206·55	246·622	Sunnyside Moneymaker
JERSEY.				
MATURE COW (STANDARD, 350 LB.).				
Dawn of Southport	C. Huey, Ashview, Sabine	6,759·2	363·891	Werribee Twylish Starbright King
SENIOR, 4 YEARS (STANDARD, 330 LB.)				
Toxteth Fairy	W. C. Dun, Wolvi	5,495·3	374·303	Trinity Knight
SENIOR, 3 YEARS (STANDARD, 290 LB.).				
College Starbright 4th	Queensland Agricultural High School and College, Lawres	7,361·94	422·428	Belgonia Peggy 9th's Duke
JUNIOR, 3 YEARS (STANDARD, 270 LB.).				
Bellgarth Vera Belle 2nd	P. Kerlin, Killarney	5,261·0	295·824	Bellgarth Bellboy 2nd
JUNIOR, 2 YEARS (STANDARD, 230 LB.).				
Cabulcha Noble Girl	J. M. Newman, Caboolture	6,316·95	341·288	Cabulcha Milray's Autocrat
Calton Loranthe	D. R. Hutton, Bellgarth, Cunningham	5,660·82	267·218	Laddie of Calton
Ashview Roseen	C. Huey, Ashview, Sabine	6,259·35	265·452	Martinvale Duke
Oxford Brown Roselyn	E. Burton and Sons, Wanora	4,608·5	256·069	Oxford Peer
Bellgarth Hazel	P. Kerlin, Killarney	3,848·0	237·292	Trecarne Renown
Ashview Marleen	C. Huey, Ashview, Sabine	4,751·1	231·814	Martinville Duke

General Notes

Staff Changes and Appointments.

Mr. C. R. Mulhearn, B.V.Sc., Government Veterinary Surgeon, who has held the appointment of acting director of the Animal Health Station at Oonoonba, has been appointed director of the Station.

Mr. D. J. Doyle, clerk in the Department of Public Works, has been appointed an inspector under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock.

Mr. E. C. Powell, Isis Central Mill, Childers, has been appointed an honorary inspector under the Sugar Experiment Stations Act.

Mr. W. A. G. Haylett, inspector of stock, slaughter-houses, and dairies, Department of Agriculture and Stock, Toowoomba, will be attached to the Willowburn bacon factory.

Mr. A. F. Singh, inspector of stock, slaughter-houses, and dairies, Willowburn, will be attached to the Finnie abattoir.

Mr. E. F. Duffy, agent, Banana Industry Protection Act, Dayboro, has been appointed also an inspector under the Diseases in Plants Acts, and will be transferred to Brisbane.

Mr. J. A. Mobbs, inspector, Diseases in Plants Acts, Brisbane, has been appointed also an agent under the Banana Industry Protection Act, and will be attached to Dayboro.

Mr. W. J. Park, inspector of stock, slaughter-houses, and dairies, has been transferred from Biloela to Toowoomba.

Mr. G. W. Edgar, Austinville, has been appointed an honorary protector of fauna and honorary ranger under the Native Plants Protection Act.

Mr. L. D. Carey, staff inspector, has been appointed acting chief inspector of stock and acting chief inspector of slaughter-houses, Department of Agriculture and Stock.

Mr. A. G. Pegler, manager of Dyneover Downs, Eulo, has been appointed an honorary protector under "*The Fauna Protection Act of* 1937," in respect of the sanctuary embracing Dynevor Lakes.

Messrs. S. S. Carrick (Springbrook), O. K. Ostwald (Peachester), and H. D. D. Aird (Tamborine) have been appointed honorary protectors and honorary rangers, respectively, under the Fauna Protection Act and the Native Plants Protection Act.

Messrs. E. M. Bauer, South Molle Island, and E. M. Catherwood, West Molle Island, have been appointed honorary rangers under the Native Plants Protection Act.

Constable L. V. Hosier, Iron Range, Portland Roads, has been appointed also an inspector under the Slaughtering Act.

Mr. H. S. Hunter, Senior Clerk (Marketing), Marketing Branch, Department of Agriculture and Stock, has been appointed Director of Marketing, Brisbane.

Mr. L. Cain, Clerk (Marketing), has been appointer Senior Clerk (Marketing), Marketing Branch, Department of Agriculture and Stock.

Mr. M. L. Cameron, formerly private secretary to the Secretary for Agriculture and Stock, has been appointed Chief Clerk, Chief Office, Department of Agriculture and Stock.

Mr. E. S. Keehn, an inspector under the Diseases in Plants Acts, has been appointed Private Secretary to the Secretary for Agriculture and Stock.

Mr. M. D. O'Donnell, Inspector of Stock and Dairies, will be transferred from Lowood to Toowoomba, and Mr. E. J. Taylor, Inspector of Stock, from the Zillmere bacon factory to Lowd.

Mr. F. Limpus, senior, Keppel Sands, has been appointed an honorary protector of fauna and an honorary ranger under the Native Plants Protection Act.

Milk Supply.

Regulations have been issued under "*The Milk Supply Act of* 1938" covering the proceedings in relation to the election of representative of producers and wholesale vendors on the Brisbane milk board.

Cotton Board.

An election to fill the vacancy on the Cotton Board, caused by the death of the late Mr. F. A. Kajewski, resulted as follows:—

John Alexander Peach, Ropely East, Gatton	170
Charles Litzow, Vernor	43
Otto Granzien, junr., Mount Beppo, Toogoolawah	37

Mr. Peach will be appointed for the remainder of the term which ends on the 30th December, 1940.

Fruit Marketing Organisation Acts.

An Order in Council has been issued under the Fruit Marketing Organisation Acts giving notice of intention to extend the operation of the provisions of such Acts for a further period of five years from 1st January, 1940, to 31st December, 1944. It is provided in the order that five hundred fruitgrowers may make a request for a ballot on the question of whether or not the Acts should be continued for such period. Such requisition must be lodged on or before 23rd January, 1940.

Regulations relative to the conduct of a ballot of fruitgrowers on the question of the continuance of the Acts for a further five years, should such become necessary, have also been approved.

Wild Life Preservation.

An Order in Council has been issued under "*The Fauna Protection Act of* 1937" declaring the property of Messrs. A. R., L., and S. North at Wivenhoe, Fernvale, and adjoining lands to be a sanctuary. Messrs. A. C. Ditchmen (shire inspector, Esk Shire Council), A. R. and L. North have been appointed honorary protectors of fauna within the sanctuary.

Orders in Council have been issued under the Fauna Protection Act declaring the town of Inglewood and Dynevor Lakes on Dynevor Downs Holding, Eulo, to be sanctuaries for the protection of fauna.

Banana Levy.

The Executive Council has approved of an extension of the banana levy regulation for a further period of two years from 1st January, 1940. This levy has been in force for some years and is controlled by the Committee of Direction of Fruit Marketing.

The Peanut Industry.

By proclamation the Peanut Industry Protection and Preservation Act came into operation on the 18th December, 1939.

Cane Assignments.

Orders in Council have been issued under the Regulation of Sugar Cane Prices Acts covering fresh assignments of lands to sugar mills in Queensland.

Potato Standards.

A Regulation has been issued under "*The Fruit and Vegetables Acts,* 1927 *to* 1935," prescribing grade standards for potatoes. These cover No. 1 and No. 2 grades, seed potato grade, and chat grade. No. 1 grade shall consist of sound potatoes which shall have similar varietal characteristics and a mature skin, reasonably free from decay and damage, and not less than 3 oz. in weight. No. 2 grade potatoes shall comply with those of No. 1 grade except as to maturity of skin and weight. They shall be not less than 1½ oz., but less than 3½ oz. Seed potato grade shall be not less than 1½ oz. in weight. Chat grade shall consist of potatoes grown in Queensland which comply with the standard of No. 1 grade, except that they shall not have a mature skin and shall be less than 2 oz. in weight.

Potatoes shall be deemed to comply with the standard of a grade if at least 95 per cent. by weight comply with that standard.

Every bag or container shall be clearly stencilled with the name and address of the grower, and the grade and name of the variety, in letters and figures not less than 1½ inches long, and, in the case of seed potatoes, the word "seed" shall be stencilled on every container.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of Mr. W. D. Francis, Botanist.

Red Head or Milky Cotton Bush.

W. and McD. (Calliope)—

The specimen is the red head or milky cotton bush (*Asclepias curassavica*), a native of South America. This plant is common as a weed in many parts of coastal Queensland, both north and south. As a rule, it is not very plentiful. Generally, stock avoid it, for it is rare to see it trimmed. It is a poisonous plant which causes gastro-enteritis.

Johnson Grass.

H.C.M. (Colinton)—

The specimen is Johnson grass (*Sorghum halepense*), a common weed of cultivation in most warm-temperate countries. There is no easy way of getting rid of it, and all methods should be aimed at keeping down the leaf-growth by repeated cutting or mowing, as the vigour of the underground runners depends on the presence of the leaves.

Pigs are very fond of the white underground runners, and have been found very useful in keeping the plant in check. Like most members of the sorghum family, however, it contains a prussic-acid-yielding glucoside, and there is always a little danger in allowing pigs to feed in this way.

Sodium chlorate as a spray has been found effective. Two or three sprayings are needed, and it takes five or six months to kill the grass. Following are the experiences of a local farmer, Mr. W. J. McBaron, of Corinda:—

> "The sodium chlorate is non-poisonous, but it has been found that clothing which has been wetted by a solution of it will burn like gunpowder when dry, and it is impossible to put it out. The clothes are safe while they remain wet. One pound of sodium chlorate should be used to 1 gallon of soft water, to which has been added some soap powder, and this spray should be applied when the grass is old and in head. It is necessary that these three conditions should be observed in order to make the spray adhere thoroughly to the leaves. Spraying should be commenced as soon after Christmas as possible. If it is begun earlier than that, the grass will be too vigorous, and if it is started much later, there will not be time to finish the job before all growth is stopped by the winter. The only effects noticeable after this first spraying will be a slight withering of the leaves and a stooling out from the base. This growth must be caught with the second spraying as it comes to head, and, in a few weeks, all the roots will begin to die back, commencing with the points and the destruction of all the eyes along the roots. If the plants are let alone, it will be found that by the spring the parent stool will be dead and all the roots dried up. As a rule, no third spraying will be needed, except for the odd pieces which always are missed. Care must be taken not to overlook any of these, as otherwise all that has been done will be useless. If it is only a small patch on which the Johnson grass is growing, the seed heads should be reaped as soon as they have formed, but, if this is not done, care should be taken not to let any seedling grass get a hold in the following spring. Ordinary cultivation will kill the seedlings, as in the case of other grasses, if dealt with at an early stage."

The chief distinguishing feature between Johnson grass and other sorghums is the long, white, underground runners.

Dog Burr.

L.A.B. (Brisbane)—

The specimen from the Theodore district is *Bassia tricuspis*, sometimes known as Dog Burr. Along with other members of the genus *Bassia*, it is sometimes called prickly saltbush. It is rather a bad burr in many areas, particularly in cleared brigalow country. In spite of its prickly nature, it is generally regarded as one of the best of these bassias as a fodder.

Candle Nut.

D.W. (Kuttabul)—

The specimens are from the candle nut tree (*Aleurites moluccana*). This tree is often cultivated in gardens and parks in Southern Queensland. It is native to the rain forests of North Queensland, the East Indies, and the Pacific Islands. The nuts contain an oil which is inflammable, and they are used in place of candles as a source of illumination in Pacific Islands by the natives.

The nuts are often eaten by human beings without ill-effects, but at times rather severe illness is caused by them. The nuts cannot be recommended for human food.

The tree is ornamental, a rapid grower, and produces a dense shade. The wood is light, pale in colour, and easily worked.

"Turkey Berry."

C.L.M. (Maryborough)—

It was interesting to have the name "Turkey Berry" for *Rivina lævis*. We note your remark that *Senebiera didyma* is one of the worst examples of cream-tainting weeds. The use of the name "carrot" for this plant is unfortunate. *Apium leptophyllum* belongs to the carrot family. *Senebiera didyma* belongs to the cress family. The confusion of common names is very regrettable. In fact, they are so independable, that it is so often necessary to use botanical names.

Hoary Cress—A Serious Pest.

S.V. (Crow's Nest)—

The specimen is hoary cress (*Lepidium draba*). This plant is a very serious pest in cultivation in most warm temperate countries, and has been established in the Southern States for some years past. We have previously received it only once from Queensland, and yours is the first flowering and seeding specimen. It is a very serious weed pest to have become introduced into this State. If the patches are small, digging out, taking care to get rid of the extensive underground stems, is the most satisfactory method of control; or cutting-off continuously, and so exhausting the underground parts.

The plant is a very serious weed in cereal crops in England, and it has there been found that sulphate of ammonia in fairly strong solution (3¼ cwt. in 100 gallons of water) has been satisfactory as a means of control. Several sprayings are necessary before the roots are exhausted. Arsenical sprays may be tried, but they have the disadvantage of being very poisonous, and injuring the standing crop.

"Desert Poison Bush."

V.E.D. (Isisford)—

The specimen is desert poison bush or Hartley poison bush, *Gastrolobium grandiflorum*. This is generally regarded as one of the worst poison plants we have. The poisonous principle is an alkaloid. Drying does not affect the properties of the plant. Commonly sheep browse on country infested with this bush without any ill-effects, but the danger is always there. Like many poisonous plants, most trouble is experienced with travelling stock. We have no definite information on the stage at which the plant is most poisonous, and reports concerning it are somewhat conflicting. Some people claim that the young shoots following a burn are the worst, but this may simply be because of the fact that they are more palatable to sheep than at the later stage.

"Never Fail"—A Common Grass.

W.J.L. (Cambooya)—

The specimen of "Never Fail" is *Stipa aristiglumis*, a fairly common grass on the Darling Downs. We have little information about its fodder value, but species of *Stipa* are generally looked on as of rather poor value. In the Southern States the genus is a very large one, and many of them produce a very objectionable spear-head, and are, in fact, the common "spear grass" of South Australia and parts of New South Wales.

Rural Topics

Psycho-Analysis for Cows.

Psycho-analysis has beaten machinery! At least, this is hinted at in all notices recently about a very sensitive Jersey cow. Milked by machine, this spirited animal found life too dull and materialistic to rouse her best feelings—and her best efforts—and so her milk yield was very disappointing. But a very understanding dairy farmer took her in hand, sympathetically studied her little ways and soon helped the timid beast to find herself and, incidentally, fill the bucket. Now her yield is the talk of the neighbourhood.

Makers of milking machines will not have to take this "rebuff" lying down. They will have to find some alternative. After all, nothing is impossible to machinery these days, and, apart from the churning out of caressing music—or changing the record—at milking time, it should be possible to devise some means for the cow to have her horoscope and other little diversions produced mechanically. Another job for the agricultural engineer!

Making Swamp Lands Profitable.

Here's a story of a remarkable achievement by a dairy farmer down on the Richmond River, who has converted a low, reed-bearing area into a richly grassed dairy farm, and with it won the pasture championshop of the Northern Rivers of New South Wales. His farm, an area of 330 acres, is now carrying 130 milking cows, 33 heifers, 19 calves, and 1 horse—all the result of sowing the right grasses and of careful pasture management.

Having ploughed and sown with a pasture mixture almost every available acre, he finds that maintenance of these pastures is now his chief concern. This he does by frequent grassland harrowing, mowing of tall growth and weeds, and fertilizing once a year with superphosphate and sulphate of ammonia in conjunction with rotational grazing. On his class of country—all low-lying—he has found out by experience that the heavy carrying capacity of the rye grass-cocksfoot-clover pastures can be maintained for at least four or five years. On the average, ninety-three cows are milked throughout the year. Every day, both in summer and winter, the herd is grazed on improved sown pastures for two or three hours. The plant used for the job consists of a tractor, a combined seed drill and fertilizer distributor, two ploughs, three sets of harrows, and a mower. The total purchase price for the whole outfit was £501.

New Plough to Shorten Farmer's Day.

A new mechanical plough has been demonstrated in the United States, for which it is claimed that it will "revolutionise agriculture" all over the world. This machine, it is said, will make the horse obsolete.

It is a four-wheeled tractor coupled to a plough and other farm machinery. It has a hydraulic attachment which keeps the blade of the plough automatically at any depth. It has, too, a weight shifting device, enabling the tractor to rear itself up and free itself if the buried blade becomes wedged. The big rubber-tyred wheels are braked separately, so that the tractor can turn quickly.

For the new plough, it is said that it will shorten the farmer's day and help to bring about the new age of mechanical farming which "could have the important economic effect, if adopted on a world-wide scale, of relieving the pressure of land-hungry nations for greater shares of the earth's surface."

Blood Meal for Dairy Stock.

Blood meal feeding to dairy cattle presents little difficulty when the meal is fresh and free from objectionable odour. It may be incorporated in the regular feed or mixed with appetising foods, such as maize meal, bran, pollard, and cotton seed. Care should be taken, however, to see that the feed box is kept clean.

When moisture is present, blood soon fouls, and an objectionable odour results from the fermentation. Stock dislike this intensely, and it may be difficult to get animals into the bail where such food has lain.

Farm Work as a Punishment.

Here is an interesting news item from England:—

Charged with stealing oil from a garage, a Northumberland (England) man has been committed to farm labouring in the evenings without pay as punishment.

Another New Way with Whey.

Whey, once a cheese factory product fed exclusively to pigs and fowls, is now regarded as the source of three commercial products—milk sugar; a concentrate rich in protein; and a solution abounding in vitamin G. A new process developed by the United States Bureau of Dairy Industry splits up the whey powder into these three potentially useful commodities.

Of these three constituents, the milk sugar offers the greatest usefulness. Baby foods, confectionery, medicinal preparations, and explosives are products already derived from milk sugar. The cost of extracting the sweetening from the powdered whey, compared with the expense of developing other sugars, is a temporarily discouraging factor. However, by useing the so-called alcoholic extraction method, the chemist who discovered the method of recovering sugar from whey, believes that production may be made cheaper.

It has been found to be practicable to recover from 70 to 75 per cent. of the milk sugar from this cheese by-product. The quality is said to be comparable with the refined milk sugars of commerce. The bitamin G concentrate is potentially valuable as a poultry food, stimulating growth in chickens and the hatchability of eggs. The third product derived from whey powder, a protein-rich concentrate, may be whipped and used as a substitute for egg whites.

Fleets of high-powered motor trucks and highway networks have lessened the distance between farms and centrally situated cheese factories. Formerly, farmers' milk was sent to small cheese factories here and there in a dairying district, and the whey returned to the farm as feed for fowls and pigs. Now, with the small cheese factory vanishing from the rural landscape, and the increased burden of a multiplied whey output on large cheese factories, drying machinery has been installed in the factory plants for converting whey into powder.

In America last year, more than 1,000,000,000 lb. of this by-product was pressing for a market—hence the importance of this new method of recovering milk sugar and other commercial commodities from whey.

Sorghums for Fodder and Grain.

Cultivation for sorghum and fodder and grain production in districts where climatic conditions may be unsuitable for maize is occupying the attention of the Department of Agriculture and Stock.

About six years ago, twenty varieties of grain sorghum were introduced from South Africa, six from the United States, and six from Egypt. They have all been tested out in different parts of the State, and some of them have already proved their capacity to produce good grain yields under conditions which were against the production of maize for grain.

A special agricultural investigator who visited Queensland recently had this to say of the sorghum crops he saw on the Darling Downs and elsewhere:—

"I was much impressed with the uses to which grain sorghums are being put and with their popularity with stockowners. They have proved very satisfactory in low rainfall areas where maize is a risky crop because of faulty grain setting, or to a serious check in growth due to dry weather.

"There are two main reasons why sorghums are beginning to occupy an important place in farm cropping programmes; first, because of the uses to which the crop can be put; and, secondly, to the development of varieties suitable to harvesting with the ordinary wheat header."

The two main uses for grain sorghums are for fat lamb raising and for cattle fattening—especially for topping them off for market. The method of feeding most in use is to turn the stock into the paddock when the grain is ripe. The carrying capacity of these sorghums fed in this way is exceptionally high, and the percentage of waste is apparently very small. They are mostly utilised as feed in the autumn and winter.

Grain sorghums can be grown cheaply, and the fact that they can be harvested with the ordinary header with certain minor adjustments, suggests the draught reserve possibilities of the crop. Yields, of course, vary with conditions, but up to fifty bushels to the acres have been obtained in Queensland. The grain is being increasingly used for feeding dairy cattle, horses, pigs, and poultry.

Ploughing for Victory.

The farmers of war-time Britain are ploughing their way to victory. The British Government realises that returns to farmers must keep in step with production costs. Careful account is being kept of the costs and farmers are not being asked to attempt the impossible.

Food supply is a constant topic between administrators and producers, and that, of course, is of first importance for, after all, food is one of the few things which is of equal interest to each and every citizen.

Not only the big man with the plough, but also the little man with the spade, is asked to get busy on the job of feeding the nation. Last war Britain became a nation of allotment holders, whose contribution to the total food supply was of decisive importance—especially in 1918. Already a nation-wide campaign has been launched in the Old Country to obtain recruits to the ranks of Britain's food producers.

Simple facts are placed straight-forwardly before the people. "Do you know," they are asked, "that half-a-million more allotments properly worked, will provide potatoes and vegetables that will feed another million men and women and one-and-a-half million children for eight months out of twelve?"

Producers are appealed to dig, cultivate, plant and sow. "Dig for Victory" is the motto of everyone with a garden in Great Britain.

Naturally, it is not all easy going and many farmers are faced with the great difficulty of increased commitments. Like the rest of the community, they are only too willing to go to any lengths to serve the country, but simply cannot afford to take big risks from a financial point of view.

The Ministry of Food has fixed maximum prices for many kinds of farm produce at about pre-war levels. Prices for stock foods, too, have been fixed at about the same level. But there has been a rise in the price of some of the things which farmers have to buy—agricultural implements, utensils, and the like, and costs of production, to the farmer, are creeping up.

It will not be long, however, before the full scheme of price control is established. In arriving at the prices to be paid, all such factors which do determine the cost of production will be taken into consideration and farmers' prices will be adjusted in the light of prevailing circumstances.

Some adjustments have already been made in the prices of fat cattle and of eggs. Similar adjustments will be made from time to time for these and other commodities if and when adjustments are necessary.

The big aim is to give every producer a fair and square deal. That is as it should be, for food producers should be the last to be penalised for their patriotism.

Baled Hay or Ensilage?

Down in the south-western districts of the State, and around Moree, below the Border, there is a good deal of talk about the comparative merits of baling hay for fodder and placing it in pits for ensilage. In recent months baling has become a very common practice, but some flock owners say baled hay is unsuitable for sheep.

One grazier in New South Wales, who has about 1,200 tons of silage underground, contends that hay is too dry for sheep, because of the air getting into the bales. He says, further, that ensilage properly made, is definitely preferable, and that his own experience in getting excellent results from feeding breeding ewes with ensilage proves that this form of hand-feeding is better. Baled hay, he adds, has yet to prove itself as a sheep food.

There is plenty of room for argument in those contentions. Still, there is this to be said for ensilage—it is put down when it is in a tender and luscious condition, and, as the air is kept out of it, it remains palatable for a long time. It is like a tin of sardines. Keep the tin shut and the sardines are all right to eat—especially on toast—but make a hole in the tin or open it, and the sardines are useless, in fact dangerous, as food.

Still and all, a good supply of hay, whether in bale or stack, is a jolly fine standby in a dry time.

A Tale of a Cow's Tail.

A cow's tail is valued at a fiver (£5) a foot in a district in the State of Massachusetts in America. When a savage dog bit off 2 feet of tail from a cow, the dairy farmer claimed in court against the owner of the dog and got judgment for fifty dollars. It was certainly a very expensive bite!

New Processes in Wool Economy.

Experiments which may open many new avenues for the absorption of Australian wool and wool by-products are being conducted by the Council for Scientific and Industrial Research.

Although the sale of the whole of the Australian clip will be assured while the war lasts, the results of the Council's investigations may enable the industry to be placed on a sounder economic basis than it has been in recent years.

Work has been proceeding on a new process to prevent shrinkage and "felting" of woollen goods, and tests done in the Commonwealth laboratories have given striking results.

Other experiments have shown that yarns made from wool and treated to prevent shrinkage are more extensible, and have a slightly higher breaking strength than untreated yarns. Treated and untreated yarns also have been tested under oscillating stress, which is the sort of stress materials made from such yarns undergo in every-day wear.

In these tests, treated yarns have always been better than the untreated yarns, resisting two or three times the number of stresses that will tear ordinary yarns.

The production of wool fibre on different areas of the sheep's body is being estimated, and it is hoped that a method may be developed by which both fleece weight and the scoured weight of the fleece of any sheep can be calculated from a small sample.

Investigations have been extended to include the examination of fleece wax, of which 70,000 tons is recovered from the Australian wool clip every year.

It has been discovered that some of the ingredients have unusual chemical characteristics which may give them an economic value. Another by-product known as "suint" is also being closely examined. About 20,000 tons of this substance is produced every year from the clip, and it is believed that it is possible to extract about 10,000 tons of potassium carbonate from it.

Where are the "Walers"?

Ex-Light Horsemen of the old A.I.F. will agree that probably, from a military point of view, there was never a better horse foaled than the old "waler," their companion of the Palestine Campaign.

Australia is said to have lost much of its former glory as a breeder of horses and horsemen. Before the days of the motor car, people who had the money, spent freely on horses of quality, and buyers from India and other Eastern countries bought big drafts of "walers" regularly. With a ready and profitable market available, breeders concentrated on high-class stock.

In 1914, when so many Queenslanders embarked for service overseas with the Australian Light Horse, the horses they took with them were of a high standard, and they proved their stamina and courage in the deserts of Eygpt, Sinai, and Palestine.

It would be a tremendous pity if horsebreeding in Australia were allowed to slump any further.

Some people have suggested that trotters would make good Army horses, but the sooner they forget about that idea the better. Their stamina and courage may be all right, but a trotter or a pacer has only one gait, and one that would be utterly wearisome on a long march—especially if it were a forced march. Place a few trotters in a squadron of Light Horse, and watch the result. At the order "walk march," the squadron moves off, most of the horses walking and the trotters and pacers shuffling along, too fast or too slow. At the "trot" they are not so obviously out of step, but when the order "gallop" snaps out the troops on the galloping horses sit upright in line, but the poor troopers on the trotters have to bend forward in their saddles or else "rise" to the trot.

As for draught horses—good useful farm sorts—we seem to be doing all right as yet. Artillery sorts—horses that would go well in a gun team—are as yet fairly plentiful, so the Army authorities say.

The day of the horse is definitely not done, and the Army will require thousands of remounts and gunners before this war is over. So, obviously, we should not allow ourselves to slip in one of the industries which has made Australia famous wherever there are riders to "prong" the "pig skin." But, all the same, the sooner we take stock of the position and improve our breeding methods—or, rather, return to the old horsebreeding standards—the better for Australia.

The Useful Goat.

A word for the pocket edition of the cow—the goat and its value in mining camps and other places where it is not always possible to keep a cow, and where a goat will thrive.

Many goats have only a short milking period—about four months—and are not heavy producers even when in milk. The best of the nannies in milk breeds will produce for about nine months, and one nanny made a record recently of nearly seven quarts during a nine-months' lactation period. A good milker will give enough for a small family and may be kept on one-sixth to one-eighth the quantity of feed required for one cow.

It costs less to buy a goat than a cow—often goats are given away—and less to keep one. The milk is very wholesome. Goat milk has about the same range in butter fat content as cow milk, and varies in the same way with breeds and individual members of a breed. The fat in goat's milk, however, is in finer divisions, and though the cream does not "rise," it can be separated mechanically.

A Point in Lamb Raising.

In breeding fat lambs, strength of constitution is just as much required in the stock as in breeding a general flock. A sturdy, well-shaped lamb will thrive from the first, while a weakly one will be a useless encumbrance on which good food will be thrown away. It is of the greatest importance that the lamb should continue to thrive from the date of birth until time of sale to the butcher. The farmer should, of all things, avoid an undesirable ram, for such a sire has no type with which to stamp his progeny, cannot be depended on, and will prove in the future, as he has done in the past, a disappointment to the owner.

Orange Pulp as a Stock Food.

Here is an item of news from the *Citrograph* (California) which will interest the citrus grower who may, at times, be troubled with the problem of making use of surplus oranges. Science workers in California have demonstrated that dried orange pulp has a definite value as a feed for livestock. Because of its bulk it is best suited for the cattle or sheep ration. It is not a balanced feed in itself, and should be mixed with other feeds to add variety to a whole ration and also a considerable proportion of digestible nutrients.

According to digestion trials carried out at the Davis University Farm, dried orange pulp has an average analysis of 6 lb. of digestible protein and 72 lb. of digestible carbohydrates—or a total of 78 lb. of easily digested material in 100 lb. of feed. To put in another way—it takes about 128 lb. of orange pulp to obtain 100 lb. of digestible nutrients. In this respect it compares well with barley, wheat, maize, grain, sorghum, and beet pulp. However, as a stock food, orange pulp has not the same palatability as the grains I have mentioned, so it could not be used to the same extent as other feeds. It was found that the dried pulp could make up to 20 per cent. of the concentrate ration.

Fresh oranges, because of their high water content, are worth about a tenth of the dried product for feeding purposes. Fresh oranges, too, are relished by most livestock, but when fed whole the stock soon learn to extract the juice and reject the rind.

So successful have been the trials that orange meal dryers have been installed in some citrus districts for using up culled oranges and surplus fruit which otherwise would be wasted. The pulp has even been stored in trench silos as winter feed for stock.

It is not suggested that the idea could be practically applied in Queensland, but it is interesting to know that the orange, whether fresh or as dried pulp, has a definite stock-feeding value. It is certainly a fact worth keeping in mind.

Ham and Eggs as a "Chain" Lunch.

Pig and poultry raisers will be interested in a Canadian version of the "chain letter" scheme. This time it is a ham and eggs chain. One enthusiast for ham and eggs—naturally he wanted to make a lot of money out of the practical application of his idea—gave a party for six friends, at which ham and eggs was the feature dish. Each guest was pledged in turn to give a similar party for six others within a fortnight. The originator calculated that at the tenth round of such luncheon events a trifling total of over 90,000,000 people would all sit down simultaneously to ham and eggs!

War Time Agriculture.

War has intensified the "Grow more food" campaign in Britain—and that slogan has now become a grim warning. Needless to say, it is being acted on promptly and efficiently. Certainly there are no more interested spectators of the progress of the campaign in the Old Country than the farmers of the Dominions.

To make the campaign a success, the British Government has given complete latitude to county executive committees which are controlling the campaign. These men do not deal merely with acres on paper. Having a first-hand knowledge of local farm lands and conditions, they are not obliged to strangle effort with red tape or put on a strait-jacket of regulations, but are free to insist that, say, wheat should not be planted where they know another crop will do much better.

It is thought, however, that the main crop will be wheat. Under the scheme of the Government, a grant of a premium of £2 an acre is made for the ploughing up of the land that has been under grass for seven years or more. The Minister in charge is himself a practical farmer. Experts in agricultural research also are fully engaged in the campaign, and the farmers have the full backing of scientific knowledge and assistance.

In fact, the whole scheme is thoroughly organised, not only in respect of war-time needs, but also in respect of post-war problems which shall arise inevitably.

Economists, in fact, are to-day compiling a record of reactions to every war-time innovation or modification of methods. Take milk for example. Milk deliveries in London are now restricted to one a day. The opinions of producers, distributors, and customers are being scientifically noted, and the savings weighed against the inconveniences. With every change the same careful noting is proceeding.

Obviously, the idea is to produce at the end of the war a complete picture showing the strains, stresses, evolutions, and damage to the industry during the supreme emergency. Files of vital and relevant facts so sensibly marshalled will be of inestimable value to whatever Government is in power after the war. On it, no doubt, the future of British agricultural policy as a whole will be based and shaped.

A revival in agriculture is expected to mark the immediate post-war period, but whether it will be sustained and developed are points on which experts are likely to argue for a long, long time.

Householders with a patch of garden also have responded to the slogan, "Grow more food." Millions of small home gardens have been extended wherever possible. Vegetables have been planted wherever it is possible for them to grow. And springing up in the most unexpected places are small market garden allotments, tilled by workers living in crowded areas where there is no room for home gardens. Even box gardening is being encouraged and expert advice has been made available to everyone who wants it.

There is no doubt about Britain's will to win.

Citrus Fruits as Fertilizer.

Citrus growers of California are certainly out to get everything they possibly can from their crops. In addition to using surplus and culled fruit as stock feed, either fresh or as meal and pulp, they are turning it into fertilizer—and good fertilizer it makes, too. Near some of the larger packing centres, citrus shredding machines have been placed. Tests have proved the value of the shredded product when returned to the soil in the form of fertilizer. The machines shred the fruit at the rate of five tons an hour. The shredded mass is then carted to the citrus groves and dumped and spread. The whole cost of the operation is said to be no more than the cost of dumping the fruit in the ordinary way.

Here is what the chemists say about shredded citrus fruit as fertilizer:—

> "From the chemical determinations it is clearly evident that the orange waste is of equal value in all respects to dairy manure."

The inventors developed the process after working on the idea that cull fruit could be turned to practical use at small expense, and at the same time eliminate the criticism directed at the dumping of apparently good fruit.

From *The Citrograph* (California).

Farm Notes

FEBRUARY.

A LATE sowing of sorghum will provide succulent fodder during the early winter months, or if not required for immediate use, the crop may be conserved as silage or stover. The saccaline variety is favoured for this purpose, as it will withstand mild frosts, and continue to supply good feed well into the winter.

There is still ample time to sow early maturing millets, Japanese millet, white panicum, or French millet, if additional green fodder is desired, while buckwheat also is suitable, as it will ripen in eight to ten weeks.

In the cooler districts, a first sowing of oats, barley, or wheat for grazing may be made towards the end of the month, but elsewhere March sowings will be early enough.

February is regarded as the best month for planting the late or autumn potato crop, the acreage planted exceeding that of the spring or early crop, because of the increased soil moisture usually available. Plant whole seed, preferably not less than 2 inches in diameter, and treat it with hot formalin or corrosive sublimate in accordance with recommendations issued by the Department of Agriculture and Stock. Farmers who are dissatisfied with their returns, and who do not regularly apply fertilizers, would be well advised to ascertain the increased yields usually resulting from their judicious use.

First sowings may be made of mangolds, swedes, field turnips, and other roots utilised for pig and cattle feed. Crops should be drilled in spaced rows so as to permit of cultivation between the rows, and the thinning of plants to suitable distances apart. Where only small areas are sown, the "Planet Junior" type of hand seeder will be found very useful. Because of the importance of increasing the area under lucerne, attention should be given to the adequate preparation of land reserved for late March-May sowings. The semi-permanent nature and value of a lucerne stand certainly warrant the best possible seed-bed, for once the crop is established only light surface cultivation can be given.

In the wheat areas, summer fallows will now be in fair condition, and with the assistance of sheep to keep down weed growth, good tilth can be maintained by using rigid tyne cultivators, spring tooth cultivators, and harrows. Wheatgrowers generally are well aware of the importance of maintaining a good surface mulch.

Maize and other row crops will now be well advanced, so that any cultivation given should be as shallow as possible, consistent with the work of weed destruction.

The harvesting of a variety of crops will occupy much time as the season advances. Too much care cannot be given to the grading, bagging, baling, and generally attractive packing of all products placed on the open market, for inferior grades or poorly packed produce are rarely profitable.

AGRICULTURAL ARITHMETIC.

When any branch of primary industry is unusually profitable a general tendency often develops in the direction of inflating land values. False values often tempt us to buy properties at ridiculous prices, thus starting with an over-load of interest. Over-valued land raises the cost of running a farm in every operation. The arithmetic of profits never varies. It is as constant as the coming of night and day. The man whose land costs him £25 a cow, and whose herd produces 300 lb. of butter-fat a cow, can produce butter-fat at an average land cost of not much more than 1d. a lb., but the man whose land cost him £100 a cow, and whose herd produces only 125 lb. of fat a cow (which is about the Australian average), has to face a land cost of a 1s. ½d. for every lb. of butter he produces.

The man who has paid an uneconomic price for his land, and who has failed to build up an economic level of production per cow, or who has failed in the past to keep the feed up to his cows so that they could produce up to their inherited capacity, now has a great war-time opportunity of correcting his mistakes. The nation's anxieties are the dairy farmers' opportunity—From *The Live Stock Bulletin.*

Orchard Notes

FEBRUARY.

THE COASTAL DISTRICTS.

FEBRUARY in coastal Queensland is frequently a wet month, with plant growth rampant. Where green cropping is not practised it is not always possible to keep weed growth in check by cultivation.

The main crop of smooth-leaf pineapples will be ready for canning, and care should be taken to see that the fruit is sent to market with the least possible delay and in the best possible condition.

Bananas for shipment to the Southern States should on no account be allowed to become over-ripe before the bunches are cut; at the same time, every banana should be well-filled.

Citrus orchards require careful attention, as there is frequently a heavy growth of water shoots, especially in trees which have recently been thinned out, and which must be removed. Citrus trees may be planted now where the land has been properly prepared, and it is also a good time to plant most kinds of tropical fruit trees.

A few late grapes and mangoes will ripen during the month.

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

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

THE marketing of later varieties of peaches and plums and of mid-season varieties of apples and pears, as well as of table grapes, will fully occupy the attention of fruitgrowers in the Stanthorpe district, and the advice in these notes for the last two months on handling, grading, packing, and marketing is again given with emphasis.

Extra trouble taken with fruit pays every time. Good fruit, evenly graded and honestly packed, will sell when ungraded and badly packed fruit is a drug on the market.

Early in the month it will be necessary to keep a careful watch on the crop of late apples for codling moth. If there is a slightest indication of attack, a further spraying will be necessary, as the fruit that has previously escaped injury is usually that which suffers the most.

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

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

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

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

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.

BABY'S FIRST MONTH.

IN previous articles we have stressed the importance of the care given to the expectant mother, known as ante-natal care. We have recommended her to place herself under the care of a doctor or visit one of the ante-natal clinics, established in connection with the Maternal and Child Welfare Service. We have stated the two main reasons why she should do this—one is for her own comfort and safety, the other for the safety of her expected child.

In this article we assume that the mother has received the care which we have advised, and that she has become the mother of a strong, healthy baby.

IMMEDIATE CARE OF BABY.

As soon as the mother is made comfortable, the baby is washed and dressed. A bandage or binder made of cellular cotton material, rather than flannel, is necessary to keep in position the dressing, which has been applied to the stump of the cord. When this has healed there is no further need for it. The baby should pass urine within the first twenty-four hours. For the first few days the motions are dark green or tarry in appearance. This is a normal condition, and castor oil should not be given.

FEEDING.

Training Necessary.

Most babies know how to suck when they are born. Occasionally we find one who cannot do so, and he will require expert handling and

careful training. If baby, who is often very sleepy during the first few days of life, is allowed to be undisturbed, after a day or two he may refuse to suck. There is no more difficult baby to manage than one who has never learned to suck. Feeding him from a bottle will result in further disinclination to take the breast, and make the task of establishing natural feeding harder.

Natural Feeding Best.

It is universally admitted that natural feeding is safest and best for baby. Almost every mother can feed her baby either wholly or partly if she wishes to do so. The smallest amount of breast milk is valuable, because the giving of this helps baby to digest what artificial food he may require. In most cases the supply of breast milk can be increased by proper management, and the aid of a welfare trained nurse should be sought whenever the supply is short.

Baby's progress during the first year depends upon the management and handling which he receives during the first few weeks of life. Baby is put to the breast after the mother has rested, generally in about six hours after his birth, leaving him about two minutes at each breast. Care should be taken to see that he is sucking and not merely dozing. During the first day he is put to the breast once every six hours. On the second day he is fed four hourly and allowed to remain three or four minutes at each breast. On the third day, when the milk supply usually has become established, he is fed three hourly, or four hourly, if he is a strong, vigorous baby, allowing him to feed for fifteen minutes. The average baby feeds from fifteen to twenty minutes, a strong baby may take all he needs in ten minutes. Although the milk does not come into the breasts until about the third day after the child is born, there is present in them from birth a little creamy looking fluid which is very nutritious, and no other food should take its place during these first few days. Sucking stimulates the breasts to secrete and also forms an important part of baby's daily exercise, for not only does it develop his jaws, but it improves the circulation of his whole body.

Feed Regularly.

By educating baby from birth to take his food regularly at stated times, it will be found that he learns to wake when his feed is due, and that he will take all that he needs for his growth and development and to satisfy his hunger during the hours of 6 a.m. and 10 p.m. Some babies will turn night into day and upset the household, unless they are managed carefully. When there is delay in the establishment of breast feeding beyond the third day, feed baby on what milk can be expressed and boiled water.

Avoid Early Artificial Feeding.

Baby should not be given an artificial milk mixture before he is seven days old and adequate efforts to stimulate the flow of breast milk have been made. The supply of breast milk may diminish temporarily when the mother resumes the responsibility of her household duties. Baby may cry as the result of hunger, the mother will be apt to think that her milk is disagreeing, and will be tempted to feed him on an artificial milk mixture.

Visit Child Welfare Centre.

It is at a time like this that a visit to a Maternal and Child Welfare Centre is so helpful. By such a visit, time is saved and mistakes avoided.

When a mother is unable to make a visit, she should write for advice to the nearest centre.

Prevention of Infection.

Avoid exposing baby to infections, such as colds, influenza, whooping cough, measles, &c., particularly when he is young. Visitors are often thoughtless in regard to the danger of infection, forgetting that the infection of even the common cold may have serious consequences when it is conveyed to a baby.

These articles, received from the Maternal and Child Welfare Service, are published each month. The next article will deal with the value of rest and sleep in childhood and the making of baby's bed.

If there is any information a mother requires regarding the feeding, general care, and management of her baby, she is invited to write to the Sister in Charge, Maternal and Child Welfare Centre, Alfred street, Fortitude Valley, N1, Brisbane.

IN THE FARM GARDEN.

TOMATOES ON THE MENU.

Stuffed Tomatoes.

Take 6 firm, ripe tomatoes, salt and pepper, 1 teaspoonful minced onion, soft breadcrumbs, ½ cupful dry breadcrumbs (buttered).

Wash tomatoes, remove stem ends, and scoop out centre pulp, leaving a shell a quarter of an inch thick. Sprinkle with salt. Chop, pulp, and mix with an equal amount of soft breadcrumbs. Add onion, which has been sauted, and season to taste. Fill tomatoes with stuffing and place in a greased baking dish. Sprinkle with buttered crumbs and bake in a moderately hot oven for twenty minutes. Serve with cheese sauce.

Tomato and Sausage Pie.

Take 4 tomatoes, 1 lb. sausages, 1 or 2 parboiled onions, 1 gill stock, 1 lb. mashed potatoes.

Peel the tomatoes by placing them for a minute or two in boiling water, then slice them and put them at the bottom of a greased pie-dish. Season to taste. Lay on the sausages and then the onions, sliced. Add 1 gill of stock. Now pile the mashed potatoes on top and cook in a moderate oven for three-quarters of an hour. Serve hot.

Tomatoes on Toast.

Take 4 tomatoes, 4 rounds of toast, salt, and pepper, 1½ oz. of butter, chopped parsley.

Toast and butter the bread while hot. Slice the tomatoes and place on the toast. Sprinkle with seasoning and chopped parsley and place a small pat of butter on each slice. Grill for five or six minutes. Serve for breakfast with crisp fried bacon.

Tomatoes Scalloped.

Take ½ pint tomato pulp, 2 or 3 tablespoonfuls breadcrumbs, ½ oz. butter, ½ teaspoonful finely-chopped onion, salt and pepper, sugar, nutmeg, browned crumbs and butter.

Obtain the pulp by passing tomatoes through a fine sieve or use preserved pulp. Heat the butter in a saucepan, fry the onion until lightly browned, and add half the tomato pulp and white breadcrumbs gradually until the mixture has the consistency of very thick cream. Add a pinch each of sugar and nutmeg, season to taste with salt and pepper, and pour the mixture into well-buttered scallop shells. Cover lightly with browned breadcrumbs, add two or three small pieces of butter, bake in a moderately hot oven from ten to fifteen minutes, then serve as quickly as possible. This should be sufficient for six or eight shells.

Tomatoes a la Nicoise.

Take ½ lb. cooked salmon (free from skin and bone), ½ gill mayonnaise, ¼ gill of aspic (liquid), 4 even-sized tomatoes, some green salad.

Pound the salmon, add the mayonnaise, season and rub through a sieve, then incorporate the aspic. Cut the tomatoes into quarters, remove the pulp, and re-shape with the prepared puree. Arrange tastefully on a hors d'oeuvre dish upon a bed of finely shredded and seasoned green salad.

Tomato Slices au Gratin.

Take 6 slices tomato, 3 tablespoonfuls finely-grated cheese, 3 streaky rashers, 6 rounds French toast, salt and pepper, parsley.

Cut six thick slices of tomato and warm them through in the oven. To make the French toast, cut rounds of bread the same size as the tomatoes, toast them on one side and butter the untoasted side. Cut the rind from the rashers, fry the bacon until crisp, then chop it into small pieces. Put a slice of tomato on each round of toast, season with salt and pepper, cover each with chopped bacon, and heap grated cheese on top. Place the tomatoes under the hot griller until the cheese is melted and becomes brown. Serve them very hot, garnished with parsley. Sufficient for six slices.

Tomatoes and Mushrooms.

Take 1 lb. tomatoes, ½ lb. mushrooms, 2 oz. grated cheese, 1 oz. butter, 1 oz. flour, ½ pint milk, salt and pepper.

Peel and wash the mushrooms, remove the stalks and slice the tomatoes. Arrange the mushrooms and tomatoes alternately in a fireproof dish. Melt the butter, mix in the flour, and add the milk gradually. Stir till it boils; add nearly all the cheese, and season. Pour the sauce into the dish, and put some slices of tomato and grated cheese on top. Bake in a fairly hot oven for twenty minutes.

Tomatoes Grilled.

Take 4 medium-sized tomatoes, 4 slices hot buttered toast, salt and pepper.

Wash and dry the tomatoes and cut in halves from top to bottom. Make the toast and butter while hot. Put the tomatoes on the tray of the griller and grill slowly until soft without breaking. Sprinkle with salt and pepper. Lift two pieces of tomato on to each slice of toast and garnish with a small sprig of parsley.

Tomato and Rice Savoury.

Take 2 tomatoes, 1 teacupful rice, 1 onion, 2 gills tomato puree, 3 oz. cooked ham, salt and pepper, 2 oz. butter, chopped parsley, dripping.

Wipe the tomatoes and cut into slices. Put them into a baking tin with a little dripping and cook in the oven until tender, being careful to keep the slices whole. Wash the rice and boil it until soft in a saucepan of boiling water with a little salt added—it will take about fifteen minutes—and then strain it. Chop the ham. Peel and chop or grate the onion. Melt the butter in a saucepan and fry the onion in it until tender. Stir in the rice and ham. Season with pepper and salt and mix together. Stir in the tomato puree and make all thoroughly hot, then put into a pie-dish, place the slices of tomato on the top and sprinkle over chopped parsley. Serve very hot.

Tomato Cheese.

Take 5 or 6 tomatoes, 2 oz. cheese, seasoning, breadcrumbs.

Cut the tomatoes into slices and put a layer into a greased pie-dish. Grate the cheese and sprinkle a layer over the tomatoes, then breadcrumbs. Continue with alternate layers until the dish is full, but finish off with breadcrumbs. Bake for half an hour in a quick oven.

Tomatoes and Eggs.

Take 4 tomatoes, 2 eggs, salad, chopped parsley, ½ oz. butter.

Wash, wipe, and cut the tomatoes in halves and scoop out the centre. Melt a little butter in a saucepan and scramble the eggs with the pulp of the tomato and add seasoning to taste. Fill this into the tomatoes; sprinkle some chopped parsley over them. Serve with green salad. Or if preferred fry the tomatoes for a few minutes and serve on fried bread.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF NOVEMBER IN THE AGRICULTURAL [illegible] DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1939 AND 1938, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Nov.	No. of years' records.	Nov., 1939.	Nov., 1938.		Nov.	No. of years' records.	Nov., 1939.	Nov., 1938.
North Coast.	In.		In.	In.	*South Coast–contd.*	In.		In.	In.
Atherton	2·59	38	5·59	6·82	Gatton College ..	2·89	40	3·54	5·97
Cairns	3·87	57	3·53	3·54	Gayndah	3·01	68	3·41	6·13
Cardwell	4·16	67	4·97	3·52	Gympie	3·29	69	3·27	3·72
Cooktown ..	2·52	63	0·56	3·56	Kilkivan	2·66	60	1·43	6·66
Herberton ..	2·65	53	4·35	5·12	Maryborough ..	3·24	68	2·83	4·21
Ingham	3·84	47	1·93	5·69	Nambour	4·27	43	4·09	5·53
Innisfail	6·37	58	5·55	6·02	Nanango	2·82	57	2·48	5·57
Mossman Mill ..	4·56	26	10·16	6·28	Rockhampton ..	2·46	68	4.66	3·86
Townsville ..	1·90	68	1·36	2·68	Woodford ..	3·31	52	2·07	2·85
Central Coast.					*Central Highlands.*				
Ayr	1·76	52	0·52	0·19	Clermont ..	2·07	68	1·94	6·51
Bowen	1·26	68	2·60	0·69	Gindie	2·23	40	..	3·26
Charters Towers ..	1·46	57	0·18	1·73	Springsure ..	2·31	70	2·78	9·19
Mackay P.O. ..	3·10	68	1·59	2·72	*Darling Downs.*				
Mackay Sugar Experiment Station	2·84	42	..	5·30	Dalby	2·90	69	2·05	7·76
Proserpine ..	2·91	36	0·69	3·13	Emu Vale ..	2·78	43	1·47	4·75
St. Lawrence ..	2·40	68	2·34	2·40	Hermitage ..	2·58	33	..	..
South Coast.					Jimbour	2·62	51	2·00	4·85
					Miles	2·66	54	0·87	3·83
					Stanthorpe ..	2·75	66	1·74	3·09
Biggenden ..	2·82	40	4·49	5·78	Toowoomba ..	3·34	67	3·93	3·91
Bundaberg ..	2·74	56	5·41	5·72	Warwick	2·65	74	2·26	4·25
Brisbane	3·81	87	2·54	4·76	*Maranoa.*				
Caboolture ..	3·64	52	4·18	3·08					
Childers	2·81	44	5·25	5·82					
Crohamhurst ..	4·64	46	3·02	4·31	Bungeworgorai ..	2·23	25	..	0·75
Esk	3·31	52	2·41	6·34	Roma	2·17	65	1·58	1·18

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—NOVEMBER, 1939.

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	29·87	87	75	90	26	70	13	56	4
Herberton	..	83	61	94	25	55	21	435	11
Rockhampton	29·94	89	68	102	24	61	1, 2	466	7
Brisbane	29·98	81	64	92	29	56	1	254	9
Darling Downs.									
Dalby	29·96	87	59	99	24	47	6, 8	205	9
Stanthorpe	..	78	51	88	24	32	8	174	12
Toowoomba	..	80	56	92	24	42	8	393	11
Mid-Interior.									
Georgetown	29·87	97	71	103	22	64	16	136	5
Longreach	29·89	93	66	108	25	52	8	101	5
Mitchell	29·91	89	62	105	25	42	8	193	8
Western.									
Burketown	29·87	95	74	102	24	61	9	40	2
Boulia	29·84	94	70	109	23	56	8	101	5
Thargomindah ..	29·88	89	65	105	24	53	6	106	5

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	January, 1940.		February, 1940.		MOONRISE. Jan., 1940.	Feb., 1940.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	a.m.
1	5·0	6·50	5·25	6·46	11·9	..
2	5·1	6·50	5·26	6·46	11·50	12·2
3	5·1	6·50	5·27	6·45	a.m.	12·49
4	5·2	6·51	5·27	6·45	12·31	1·40
5	5·3	6·51	5·28	6·44	1·15	2·31
6	5·3	6·51	5·29	6·43	2·2	3·25
7	5·4	6·51	5·29	6·43	2·51	4·15
8	5·5	6·52	5·30	6·42	3·43	5·12
9	5·5	6·52	5·31	6·41	4·37	6·5
10	5·6	6·52	5·32	6·40	5·41	6·54
11	5·7	6·52	5·32	6·39	6·26	7·45
12	5·8	6·51	5·33	6·38	7·17	8·34
13	5·9	6·51	5·34	6·38	8·9	9·26
14	5·10	6·51	5·35	6·37	9·2	10·17
15	5·11	6·51	5·35	6·36	9·47	11·6
						p.m.
16	5·12	6·50	5·36	6·36	10·37	12·3
17	5·13	6·50	5·37	6 35	11·31	12·56
					p.m.	
18	5·13	6·50	5.37	6·34	12·26	1·55
19	5·14	6·50	5·38	6·33	1·18	2·47
20	5·15	6·49	5·39	6·33	2·14	3·42
21	5·16	6·49	5·39	6·32	3·11	4·35
22	5·17	6·49	5·40	6·31	3·45	5·25
23	5·18	6·48	5·41	6·30	5·2	6·12
24	5·19	6·48	5·41	6·29	5·56	6·56
25	5·19	6·48	5·42	6·28	6·49	7·42
26	5·20	6·47	5·43	6·27	7·36	8·26
27	5·21	6·47	5·43	6·26	8·23	9·14
28	5·22	6·47	5·44	6·25	9·6	9·59
29	5·23	6·46	5·45	6·24	9·49	10·47
30	5·24	6·46	..	..	10·30	..
31	5·25	6·46	..	..	11·18	..

Phases of the Moon, Occultations, &c.

2nd Jan.	☾ Last Quarter	2	56 p.m.
9th ,,	● New Moon	11	53 p.m.
18th ,,	☽ First Quarter	4	21 a.m.
25th ,,	○ Full Moon	9	22 a.m.

Apogee, 14th January, at 10 p.m.
Perigee, 26th January, at 9 p.m.

Observers will have found it interesting of late to notice the gradual approach of Mars towards Jupiter. By the 8th the ruddy Planet will pass the great, slowly travelling, Jupiter. About 8 o'clock they will be seen westward of the meridian, Mars setting at 10.58 p.m. and Jupiter a few minutes later.

A conjunction of Venus and the crescent Moon will occur on the 12th, but below the horizon—though in a clear sky the planets shine with a steady light they scintillate in the denser atmosphere near the horizon.

The Moon will accompany Jupiter on the 15th, Mars on the 16th, and Saturn on the 17th. The actual "conjunctions" will take place in daylight.

Mercury rises at 3.45 a.m., 1 hr. 15 min. before the Sun and sets at 5.35 p.m., 1 hr. 15 min. before it on the 1st; on the 15th it rises at 4.22 a.m., 49 min. before the Sun and sets at 6.12 p.m., 39 min. before it.

Venus rises at 7.10 a.m., 2 hr. 10 min. after the Sun and sets at 8.48 p.m., 1 hr. 58 min. after it on the 1st; on the 15th it rises at 7.37 a.m., 2 hr. 26 min. after the Sun and sets at 8.49 p.m., 1 hr. 58 min. after it.

Mars rises at 11.15 a.m. and sets at 11.25 p.m. on the 1st; on the 15th it rises at 10.29 a.m. and sets at 10.35 p.m.

Jupiter rises at 11.15 a.m. and sets at 11.25 p.m. on the 1st; on the 15th it rises at 10 29 a.m. and sets at 10.35 p.m.

Saturn rises at 12.59 p.m. on the 1st and sets at 12.37 a.m. on the 2nd; on the 15th it rises at 12.7 p.m. and sets at 11.41 p.m.

On a clear and moonless night about 9 p.m. on the 9th, the most luminous constellations will be seen from east to north-west. The Southern Cross is rising in the south-east, above it shines Canopus, second in brilliance to Sirius, and Achernar and Fomalhaut of first magnitude light up the western sky, the latter nearest the horizon.

1st Feb.	☾ Last Quarter	12	47 a.m.
8th ,,	● New Moon	5	45 p.m.
16th ,,	☽ First Quarter	10	55 p.m.
23rd ,,	○ Full Moon	7	55 p.m.

Apogee, 11th February, at 12 noon.
Perigee, 24th February, at 8 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.