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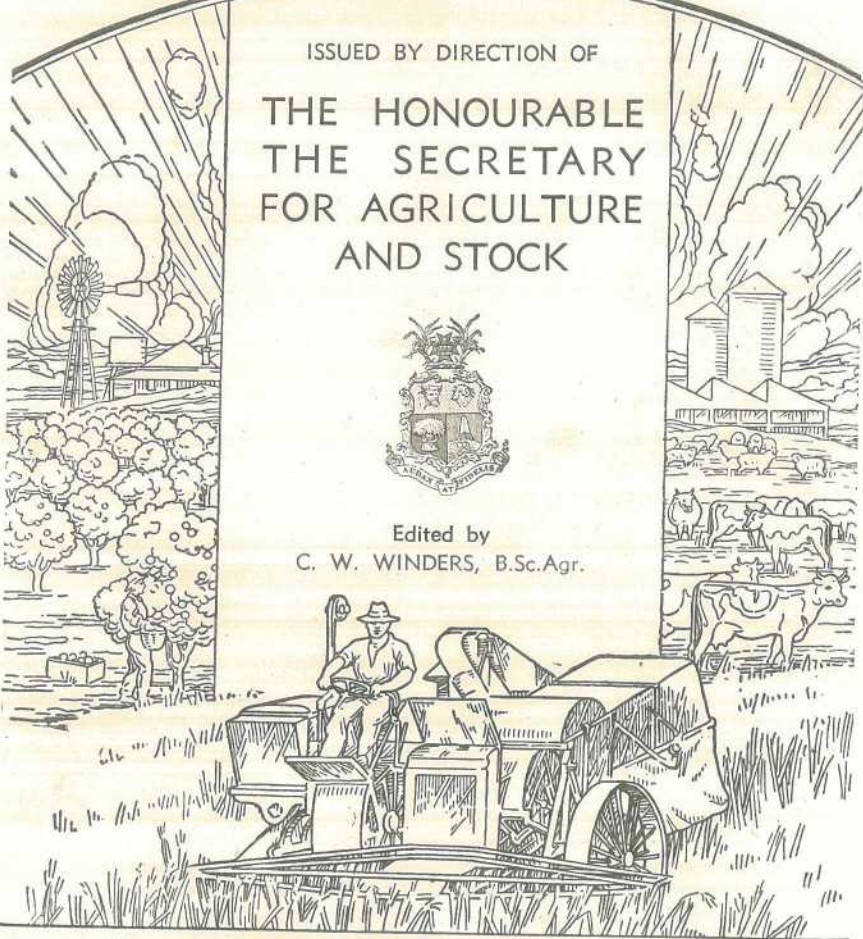
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AND STOCK



Edited by
C. W. WINDERS, B.Sc.Agr.



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QUEENSLAND AGRICULTURAL JOURNAL

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DEPARTMENT OF AGRICULTURE



QUEENSLAND AGRICULTURAL JOURNAL



Irrigated Lucerne Crop, Boyne Valley.

LEADING FEATURES

Spica—A New Wheat Variety

The Plum

The Apricot

Nut Crops

Birdsville Disease of Horses

Animal Protein Factor in Pig Rations

Milch Goats

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Spica—A New Wheat Variety.

D. ROSSER, Assistant Plant Breeder, Agriculture Branch.

SINCE the establishment of a Regional Experiment Station at Hermitage, portion of the wheat improvement programme conducted by the Department of Agriculture and Stock has been concentrated on testing a large number of selections from crosses made previously. One of the first results of this work was the naming and registration of Lawrence, and its recommendation as a dual-purpose wheat (*Queensland Agricultural Journal*, January, 1951). The latest outcome has been the liberation of a new grain variety to be known as Spica.

While Lawrence is a slow-maturing variety suitable for early sowing and feeding-off, Spica is in the quick-maturing class and is intended for main-season or late sowing for grain production. Its rust resistance, coupled with its high yielding ability and satisfactory baking quality, should make it a valuable and popular addition to the range of Queensland wheat varieties.

History of the Variety.

The new variety was developed from crosses made by Mr. R. E. Soutter at the former Roma State Farm. The final cross was made in 1934 between an unfixed hybrid (Three Seas x Kamburico) and an unnamed hybrid selection (Pusa x Flora 3202).

Fixed selections from this cross entered field tests in 1946, and T.S.K.PF.4601 was the designation given to the first of these selections. This selection performed well in its initial yield test, which was a plant breeder's strain trial laid down at Hermitage in 1947. Since then it has maintained an excellent record in larger field trials and in increase plantings which were sown in 1951 in anticipation of its release for general cultivation during the current season.

Name of the New Variety.

This selection (T.S.K.PF.4601) has now been registered with the Registrar of Cereal Varieties in Australia under the name of Spica (pronounced to rhyme with "mica").

The reason for using this name for the new variety may be of interest. The brightest star in the constellation of Virgo has the name Spica, derived from a Greek word meaning an ear of grain. The Latin word *spica* also means an ear of grain. The origin of the word and the suggestion of the spiky nature of the heads of the new variety, combine to make Spica an appropriate name for it.



Plate 1.

Spica Wheat: Heads and Grain. (Approximately natural size.)

Description of the Plant.

In the early stages, growth is fairly erect but somewhat weak. The leaves droop and can be identified by a slight silvery appearance due to a profusion of very fine hairs on both surfaces. This extreme downiness of the leaf blades and the lack of hair on the auricles are characters which it shares with Hofed, a variety not widely grown in this State.

The ripe straw is pale yellow in colour and mid-tall in height, averaging about two inches taller than Puora. It is hollow in structure, and, although fairly slender, is of satisfactory strength for normal Queensland conditions.

The type of ear and grain is illustrated in Plate 1. The ear is prominently awned, of medium size, tapered, and slightly inclined. The chaff is smooth and pale yellow when ripe. The ear bears a superficial resemblance to Three Seas, one of its parents. Most growers will be familiar with the fact that Three Seas is liable to shed grain at maturity. The new variety differs from its parent in showing no signs of shattering. Under the wide range of seasonal conditions experienced between 1947 and 1951, Spica was never observed to shed its grain. Although the ears hold the grain very firmly, threshing is not difficult.

The grain is large, amber-coloured, semi-vitreous, and of good bushel weight; it is somewhat angular and irregular in shape. Grain samples from Hermitage Regional Experiment Station in 1951 proved to be 12 per cent. larger than those of Puora grown under the same conditions. The number of grains per ounce for each of the varieties Spica, Puora and Gabo grown in the one trial area was as follows:— Spica, 665; Puora, 744; Gabo, 790.

The variety is in the quick-maturing group, being normally about two days later than Puora in heading and maturity.

Flour Quality.

Initial quality tests carried out on the grain of this variety indicated that it was a wheat of good gluten strength, which should be eminently suited for bread-making purposes. More detailed tests conducted during the last three years have placed it in the "strong" or "medium-strong" wheat class, according to the conditions under which it was grown. While not possessing the extreme gluten strength of Pusa-4 and some other premium wheats, its flour provides an elastic and well balanced dough of a type considered to be well suited to modern baking requirements.

Rust Resistance.

One of the important features of this variety is its resistance to stem rust under field conditions. To date, the variety has been practically immune to attack by stem rust in the mature plant stage. This resistance was unaffected by the advent of new races of stem rust which became prevalent during the 1949-50 season, and which proved capable of attacking such hitherto resistant varieties as Yalta, Kendee, Charter and Gabo.

Spica also shows some resistance to leaf rust. While it is seldom completely free from leaf rust pustules, its reaction to this disease is superior to that of many other varieties in commercial cultivation.

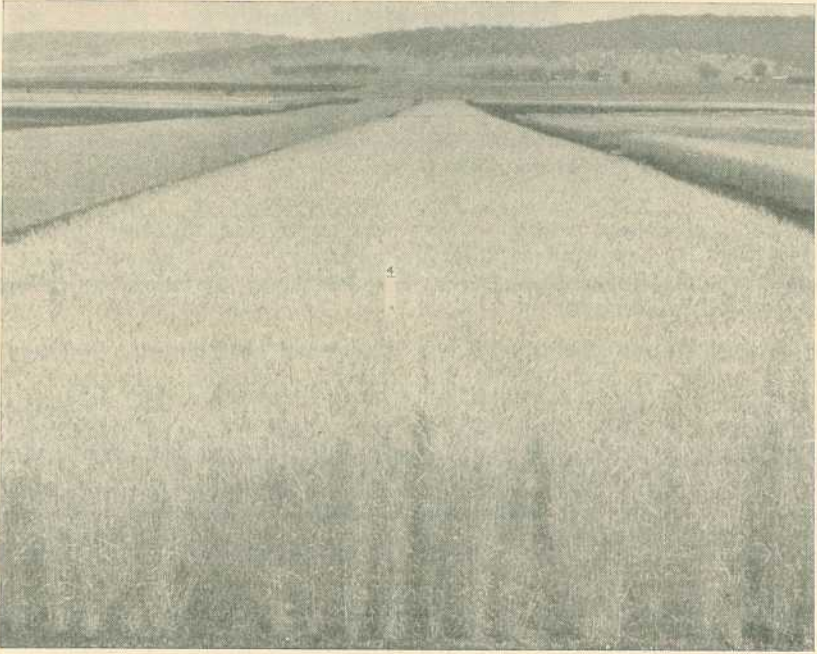


Plate 2.

Spica Wheat: Seed Increase Plot at Hermitage Regional Experiment Station.
Sown 26/6/51; harvested 22/11/51; yield 54 bu.p.ac.

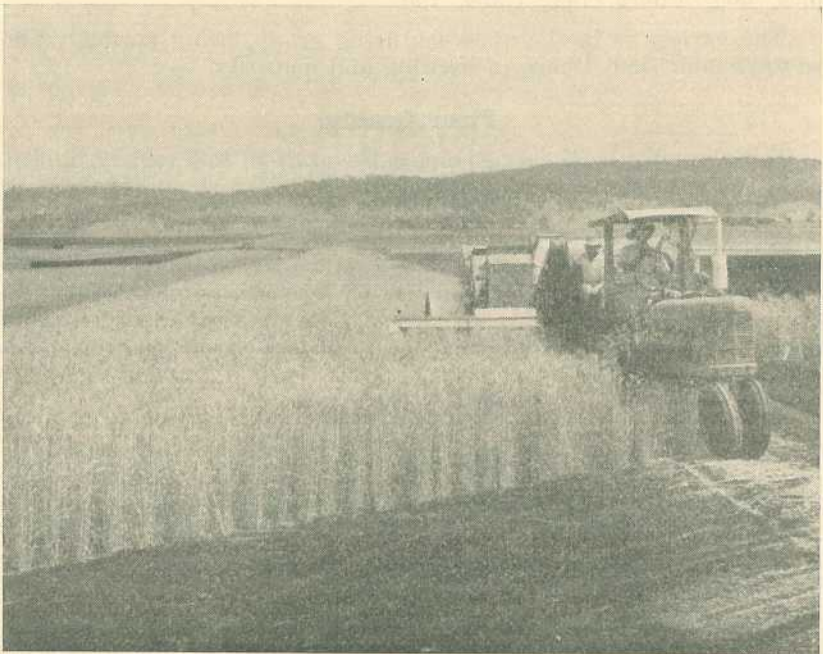


Plate 3.

Spica Wheat: Harvesting of Seed Increase Plot, Hermitage Regional Experiment Station, November, 1951.

Yielding Ability.

During the past three years, Spica has been tested against all the best available varieties in its own maturity class (that is, the quick-maturing group which includes such popular varieties as Gabo, Puora and Seafoam). The detailed testing in these varietal trials followed two years in smaller strain trails. In all such trials the new variety yielded well. One of the significant results of these tests was that its yield performance was equally impressive in the very wet year of 1950 and in the dry season of 1951. Its uniformly high position in the yield tables over the last five years indicates a very promising degree of adaptability.

Based upon the results of such trials, Spica is expected to yield at least as well as Gabo, and to show a considerable improvement over other early maturing varieties such as Puora. A summary of varietal yields in comparison with Gabo and Puora is given in Table 1.

TABLE 1.
MEAN YIELDS OF SPICA IN COMPARISON WITH TWO STANDARD VARIETIES.
(Yields in bushels (60 lb.) per acre.)

Planted.	Site.	Spica.	Gabo.	Puora.
June, 1947	Hermitage	61.9	60.2	..
July, 1948	Hermitage	44.5	48.2	40.9
June, 1949	Hermitage	48.7	51.1	41.2
August, 1950	Hermitage	38.5	22.6	15.4
June, 1950	Evanslea	26.6	20.0	19.7
June, 1951	Hermitage	57.8	67.2	50.2
June, 1951	Evanslea	36.8	38.1	28.9
June, 1951	Biloela	32.3	30.3	28.9

Spica Recommended as Grain Wheat.

Spica is recommended to replace Puora, Seafoam and similar rust-susceptible varieties in main-season and late plantings. It is unsuitable for hay on account of its awns and a tendency to lodge when conditions favour heavy growth. In addition, its quick maturity and liability to frost damage when sown early make it unsuitable as a dual-purpose (grazing plus grain) variety. However, its resistance to rust and shattering, together with its capacity to produce high yields under a wide range of conditions, should make it a very useful wheat variety for grain production in Queensland.

Is This a New Strain of Townsville Lucerne?

THE potential value of selection work within existing pasture species is shown by the appearance of what seems to be a superior type of Townsville lucerne (*Stylosanthes sundaica*), an annual leguminous plant.

In the summer of 1949-50, officers of the Department of Agriculture and Stock located a small stand of Townsville lucerne growing on infertile granitic sand near Dayboro, about 30 miles from Brisbane. Seed was harvested from these plants, which in subsequent seasons have continued to regenerate from self-sown seed.

Dayboro would normally be considered too far south for successful growth of this legume, and so far it has not been observed growing in competition with grasses in this district. The plants from which the seed was harvested had no competition and exhibited the customary prostrate habit which is a feature of Townsville lucerne and which seems to restrict its development in densely grassed country.

The seed collected was sown during 1950 in small broadcast plots on forest country in the Bundaberg agricultural district, and seed from commercial stocks of Townsville lucerne was also planted for comparison. Germination was good in both plots.

Neither plot was cleaned of volunteer plants, in order that the ability of the strains to withstand competition could be judged. A difference between the two plots was soon apparent. The plants grown from commercial seed had the normal prostrate habit and made best growth where invasion by local grasses was least. On the other hand, the plants grown from the Dayboro seed showed their ability to compete with grass by assuming an upright habit and spreading fairly evenly over the plot.

Both plots seeded in the autumn and regenerated from seed in the summer of 1951-52. Once more the plants from the Dayboro seed showed an upright habit. Furthermore, this strain was observed to be spreading through neighbouring grassland and competing actively with other tall-growing, vigorous pasture species. The plants on the commercial seed plot were again prostrate and the best plants occurred on areas free of grass.

Heavy seed setting occurred during the autumn of 1952, and as much seed as possible will be harvested. This will be reserved for further official testing, for it is important to determine whether this type will stand up to stocking and mowing, in which case it will have advantages over the prostrate form for pasture use.

Advice on Fertilizers and Soils.

Farmers are reminded by the Division of Plant Industry that inquiries on soil treatment should normally be directed to the Adviser in Agriculture or Adviser in Horticulture stationed in the district concerned. If there is no easily accessible local officer, a letter of inquiry, setting out the problem involved, should be sent to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Soil samples should not be sent with the inquiry. The Department has sufficient information on soil types and their fertilizer requirements to enable it to deal with most inquiries without first making a soil analysis. Should a soil analysis be considered necessary by the Department, the farmer will be notified to that effect and supplied with directions on the size of the sample required and the method of taking it.



The Plum.

K. M. WARD, Senior Horticulturist.

THE several groups of plums have originated in widely separated countries. The European plums (*Prunus domestica*, family *Rosaceae*) are probably native to an area near the Caspian and Black Seas and may be derived from natural crosses between two wild species, the European sloe (*P. spinosa*) and the Myrobalan plum (*P. cerasifera*). The so-called Japanese plums (*P. salicina*) are thought to be native to China and were introduced into Japan about 1500 A.D. Many commercial varieties of this species were produced in America from seedlings and hybrids. Two other groups of less economic importance are the damson plum (*P. insititia*) and the native American plums (*P. americana*, *P. nigra*, and others).

Both European and Japanese varieties of plums have been grown in Queensland for approximately 40 years, commercial production being confined in the main to the Stanthorpe district. The annual State production is 140,000 half-bushels, which is almost wholly sold on the fresh fruit market in Queensland and southern States.

CHARACTERISTICS OF THE PLUM TREE.

Annual Growth Cycle.

Dormant period	.. ..	April to August
Blossoming	.. ..	Late August to late September
Shoot growth	.. ..	September to February
Harvesting	.. ..	Early December to early February
Fruit bud initiation	.. ..	January and February

Flowering and Fruiting Characteristics.

The flowering and fruiting habits of European and Japanese plums are quite different.

In the European plum, the one-year-old shoot carries only vegetative buds (Plate 4, A, 1) and terminates in a leaf bud. In the next year, buds on the previous year's wood develop into short spurs, often referred to as stubs, which carry both flower and leaf buds (Plate 4, B, s); and the current year's shoot growth bears leaf buds only. In the third year, fruit is produced on the three-year-old wood (Plate 4, C, x), spurs are formed on the two-year-old wood, and only leaf buds are formed on the current year's growth. All flowers are borne

laterally. Flower buds of European plums usually contain one or two, but sometimes three, flowers, and in different varieties these may open before, with or after the leaves. The flowers are less numerous than in the Japanese varieties.

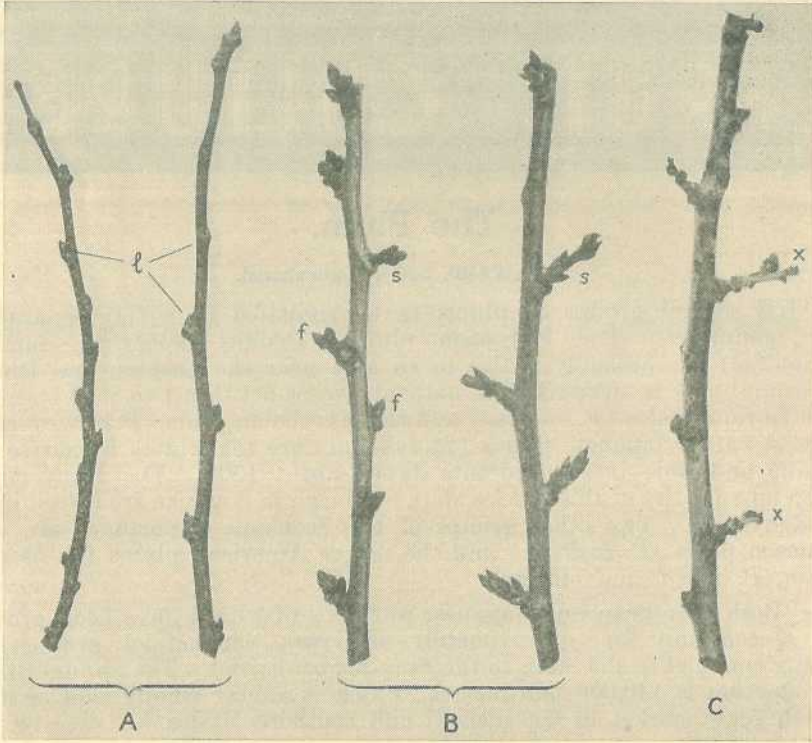


Plate 4.

Fruit-bearing Wood of European Plum. A—shoot growth at end of 1st growing season; B—shoot growth at end of 2nd growing season carrying fruiting bud (f) on spurs or stubs (s); C—shoot growth at end of 3rd growing season—fruit was borne at x, and shoot is no longer fruitful.

The Japanese plums bear fruit on one-year-old wood as well as on older wood (Plate 5). The flower clusters each contain three or more flowers, and because of this habit, Japanese plums are commonly used for ornamental purposes. Flowers are also borne on spurs which develop from latent buds on the branches of mature trees.

Fruiting spurs on both European and Japanese trees lengthen and bear fruit for a number of years before becoming unproductive. Flowering is so profuse that a setting of 1 per cent. or less is normally adequate for a satisfactory crop. Setting is usually heavier in Japanese than in European varieties.

VARIETIES.

The two principal commercial groups of plums, European and Japanese, can be separated from each other without difficulty.

European plum trees have dull green, serrated leaves which are relatively thick, wrinkled on the surface, thinly hairy to hairy on the

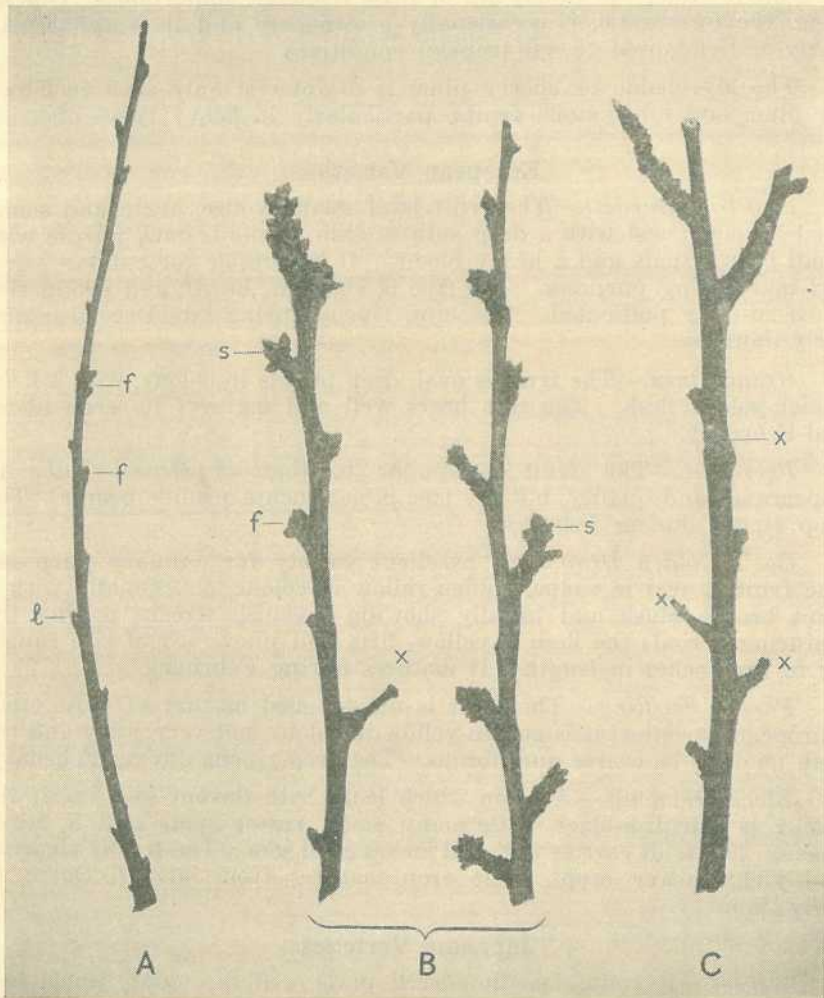


Plate 5.

Fruit-bearing Wood of Japanese Plum. A—1st season shoot bearing leaf (l) and flower buds (f); B—2nd year shoots bearing flower buds (f) and spurs (s), and a fruit stalk (x); C—3rd year shoot which has borne fruit at x and is now barren.

upper side and covered with soft hairs beneath. The fruit is commonly bluish-purple but some varieties are yellow, red or green. The group includes the many varieties which are known as prunes.

Japanese varieties have leaves with a relatively smooth, shiny upper surface, and a smooth dull surface beneath. The fruit is rarely purplish, but commonly yellow or red in colour, and usually pointed at the apex, though a number of varieties are rounded.

Damson plums are noted for their tartness and are used mainly for jellies and jams.

Native American plums are of little economic importance. One of them, the *Chickasaw*, is occasionally grown here and it is apparently fairly well adapted to sub-tropical conditions.

The Myrobalan or cherry plum is of interest only as a rootstock for plum and other stone fruits, particularly in heavy types of soils.

European Varieties.

Angelina Burdett.—The fruit is of medium size, ovate and somewhat asymmetrical with a deep suture; skin colour is dark purple with small brown spots and a heavy bloom. It is suitable for culinary, dessert and drying purposes. The tree is vigorous, hardy and productive when suitably pollinated. The crop ripens during late December and early January.

Grand Duke.—The fruit is oval, deep purple in colour, with a firm, golden-yellow flesh. The tree bears well and matures its crop about mid-February.

President.—The fruit is similar to that of *Grand Duke* in appearance and quality, but the tree is not such a prolific bearer. The crop ripens during February.

Coe's Golden Drop.—An excellent variety for culinary purposes. The fruit is oval in shape, golden-yellow in colour, occasionally with a faint bronze blush and usually showing greenish streaks during the maturing period; the flesh is yellow, firm and juicy. Fruit size ranges up to two inches in length. It matures during February.

Pond's Seedling.—The fruit is not as good as that of most other European varieties; it is golden-yellow in colour, not very juicy and the flesh tends to be coarse and fibrous. The crop ripens during February.

Black Diamond.—A plum which lacks both flavour and juice; the colour is purplish-black with many small russet spots and a heavy bloom. The fruit carries well and makes good jam. The tree is vigorous and yields heavy crops. The crop matures from late December to early January.

Japanese Varieties.

Wilson.—A round, medium-sized plum, red in colour, juicy, and suitable for dessert and culinary purposes. The tree is vigorous and sets heavy crops often with little cross-pollination. It is one of the earliest varieties and matures its fruit during December.

Burbank.—A globular fruit which is red in colour, dotted with yellowish spots and possesses good flavour. Its transport qualities are good. Primarily a dessert variety of little value for jams or canning. The crop matures from late December to January.

Santa Rosa.—The fruit is large, oval and purplish-crimson with a dark red flush; a good dessert quality plum which carries well. The variety ripens during January.

Shiro.—A fairly large, yellow plum with an almost semi-transparent flesh. The tree is a heavy bearer and matures its crop during early January.

October Purple.—A large, heart shaped, dark-purple plum with firm, juicy yellow flesh of good quality. Yields are good. The crop matures in the latter half of January and early February.

Narrabeen.—A large, rounded, reddish plum with yellow dots and a yellow flesh; juice and flavour make it a dessert quality variety. The tree bears crops which mature during January and early February.

Satsuma.—Often referred to as the "blood plum" because of its purplish-red coloured flesh; a large dark-red plum which is best suited for jams and other culinary uses.

POLLINATION.

The European plum varieties grown in Queensland are very largely self-incompatible and will not, therefore, bear satisfactory crops unless cross-pollinated. Consequently, in planting out an orchard, provision must be made for the interplanting of cross-compatible varieties. Angelina and Coe's Golden Drop are notoriously poor bearers when planted alone. Angelina can be interplanted with President, Grand Duke, Black Diamond, and Pond's Seedling. All of these varieties flower at approximately the same time, and, as they are cross-compatible, they may successfully be interplanted with each other. Coe's Golden Drop flowers later and should, therefore, be interplanted with Green Gage, President or Grand Duke, the flowering periods of which overlap that of Golden Drop.

European and Japanese plums do not effectively pollinate each other, except in a few cases of minor importance. Most Japanese varieties, like the European, are largely self-incompatible and the best crops are set when different varieties are interplanted. The several varieties commonly grown at Stanthorpe can be interplanted provided the flowering periods overlap sufficiently. Wilson and Santa Rosa varieties show a moderate degree of self-fruitfulness and may set satisfactory crops even in the absence of cross pollination.

CLIMATIC REQUIREMENTS.

Plum trees rank next to the apple in winter hardiness and are generally less subject to low temperature injury than the peach or apricot. There is a considerable variation in the cold-hardiness of different varieties. The buds of the Japanese plums are usually less hardy than those of the European, but the open flowers of Japanese plums are more resistant to cold than those of either European plums or apples.

The winter chilling requirements of the plum are less than those of the apple, and in the Stanthorpe district the trees flower three to four weeks earlier. Japanese varieties require less chilling than European; they therefore set somewhat earlier and usually set better crops following a warm winter. Plum trees need a winter period of two months or more during which the average temperature is 48 deg. F. or less. In localities where winter chilling is inadequate, the flower and leaf buds are slow to open, bud shedding is common and the fruit matures late. Some varieties are more suited to warm localities than others.

Early flowering is undesirable in the Stanthorpe district because of the risk of blossom injury from late frosts. Dangerous atmospheric temperatures during blossoming and fruit setting range from 28 deg. to 31 deg. F.

Plums require a moderate annual rainfall of 30-35 inches which is well distributed through the growing season. Moist atmospheric conditions during the ripening of the fruit are, however, undesirable because they favour the development of brown rot.

SOIL REQUIREMENTS.

Plum trees grow satisfactorily on soils ranging from fertile clay loams to light granitic sandy loams. In general, European varieties grow best on loams and clay loams, while Japanese plums show a preference for lighter soils. The suitability or otherwise of the different soil types for plums is to some extent bound up with the type of rootstock used. Trees on Myrobalan roots are better adapted to rather heavy soils than most other deciduous fruits. Nevertheless, the best root development takes place in soils with good drainage and aeration.

The optimum soil reaction for plums lies between pH 5.5 and 6.5. As with other fruit trees, plums live longer and yield better on the more fertile soil types. The most suitable Stanthorpe soils are the deeper alluvials with a relatively heavy subsoil.

PROPAGATION AND ROOTSTOCKS.

Both European and Japanese plums are propagated by nursery budding on various rootstocks. The most widely used stock in many districts is the Myrobalan plum, which is compatible with most cultivated varieties and usually produces a very vigorous tree. This stock is adapted to a wide range of soils and shows a fair tolerance to poor drainage. In districts with a light soil, plums are frequently worked on peach stocks, some of which are resistant to nematode attacks. At Stanthorpe, peach stocks are commonly used. However, Myrobalan stocks are preferable on the heavier soils.

Marianna, a variety of the Myrobalan plum, has been used as a plum rootstock, partly because it can be propagated by cuttings, and partly because of its resistance to nematodes. It is less tolerant of heavy soils than the Myrobalan and also less drought resistant; it is not a good stock at Stanthorpe. Apricot and almond stocks have also been used as rootstocks for plums but the results have not been satisfactory.

Problems of incompatibility between certain European plum varieties (for example, prunes) and peach stocks can be overcome by double working. This involves budding a compatible plum on a peach root, and then working the desired variety on to the intermediate stock.

PRUNING.

The Non-bearing Tree.

Early pruning of the plum tree is designed to force the development of scaffold branches which are strong enough and numerous enough to carry heavy crops of fruit. This can be achieved by cutting back the main shoots hard in the first few years, so that the tree has 12 to 20 secondary scaffold branches when it reaches maturity. The main scaffold branches should possess wide crotch angles and join the trunk at different levels.

The Bearing Tree.

The principal reasons for pruning bearing plum trees are (1) to thin out excess fruiting wood and thus control fruit size and numbers, and (2) to control growth so that all parts of the tree receive sufficient sunlight and are accessible for spraying, thinning, harvesting and other operations (Plate 6). Fruiting wood is produced very freely on the plum tree and it is therefore a simple matter to provide a well distributed supply of two-year-old fruiting spur wood and one-year-old renewal wood each year.



Plate 6.

A Well Formed Plum Tree in the Early Bearing Stage of its Life.

Treatment of Terminal Shoots.

When a tree is approaching or has reached maturity, terminal shoots can be induced to produce fruiting wood either by leaving them unpruned or by pruning them lightly. The setting of fruit on the terminal shoots will greatly reduce leader growth and tend to stabilise the size of the tree. Subsequently, terminal growth will require only light pruning.

Treatment of Laterals.

The laterals or spur-bearing shoots which bear most of the fruit are distributed over the whole of the tree. Unless thinning is necessary to ensure reasonable fruit size, these shoots are left unpruned until after the crop is harvested. They are then cut out to make room for renewal wood which will bear the next season's crop.

Treatment of Spurs.

Fruiting spurs, as distinct from spur-bearing laterals, may attain lengths ranging up to 12 inches. They bear fruit for a number of years and should be retained until they begin to lose their fruitfulness, when they are cut back to force new growth.



Plate 7.

A Top-worked Plum Tree. Wilson plum strap-grafted on Narrabeen, showing one season's growth.

Summer Pruning.

In young trees, excessively vigorous shoots should be cut or pinched back at the tip to hasten the development of other shoots required for scaffold branches. This is done early in the growing season. At the same time, unwanted shoots can be removed and others tied into suitable positions.

RE-WORKING.

Plum trees can be re-worked to another variety but the operation should be restricted to healthy trees. Two methods are commonly used; in both of these the tree is first deheaded or cut back to within one to two feet of the trunk. Scions of the desired variety can then be worked on the stumps by means of a suitable graft such as the strap graft (Plate 7). Alternatively, buds may be worked onto selected shoots

which arise from the stumps during the next growing season. The first of these two methods is preferred at Stanthorpe, where the wounds heal quickly and the grafted scions rapidly develop into new branches.

European varieties can be top-worked with buds from both Japanese and European plums. Japanese varieties, however, must be top-worked only with Japanese buds; takes with European buds are seldom good. In general, it is best to work European varieties onto European rootstocks, and to confine Japanese varieties to Japanese rootstocks. European plums, but not Japanese, may be top-worked with apricots.

TREE NUTRITION AND ORCHARD MANAGEMENT.

Efficient soil management is just as necessary in the plum as in the apple orchard at Stanthorpe. Winter green manure crops, stimulated where necessary by artificial fertilizers, and supplemented where practicable with other forms of organic matter, greatly assist in developing fertile soil conditions.

The plum responds fairly rapidly to nitrogenous fertilizers, though not so quickly as the peach and apricot. Young trees require fairly large amounts of nitrogen, but later on, complete fertilizer mixtures containing nitrogen, phosphoric acid and potash will probably be needed on all but the most fertile soils. Liberal supplies of nitrogen are required in early spring to assist in fruit setting, and this dressing appears to increase the resistance of the trees to frost injury. Where a green manure crop is turned in during late winter, a nitrogenous fertilizer may be required to offset the temporary demand made on this element by the decomposing crop. In addition to the green manurial treatment, the following fertilizer programme should be followed in Stanthorpe orchards:—

- (i.) *Young trees up to 8 years of age.*—Late winter (August)—Sulphate of ammonia, $\frac{1}{4}$ lb. to $\frac{1}{2}$ lb. for each year of age of the tree; thus, 6-year-old trees would receive $1\frac{1}{2}$ to 3 lb. per tree.

Mid-spring (October)—5-13-5 mixture, $\frac{1}{2}$ lb. for each year of age of tree.

- (ii.) *Mature trees.*—Late winter—8-12-4 mixture, $\frac{1}{2}$ lb. for each year of age of tree, with a maximum of 10 lb. per tree.

Mid-spring—5-13-5 mixture at same rate.

In both cases, the late winter application should be made when the green manure crop is turned in or shortly afterwards, and spread over most of the root area of the trees.

Plum trees rarely show symptoms of zinc deficiency (little-leaf), even when apple trees in the same soil type are severely affected by the disorder. Treatment with zinc sulphate sprays is apparently rarely necessary in the Stanthorpe area.

CROP THINNING.

Thinning of the crop by hand is a recognised practice in plum orchards and is beneficial even where severe pruning is done to reduce fruiting. Thinning improves the size, quality and colour of the fruit, and thus helps to meet the market demand for large attractive plums. Thinning also reduces the adverse effect of overcropping and minimises the breakage of fruiting branches.

The amount of fruit removed depends on the vigour of the tree, the variety and the method of pruning, but a fruit spacing of from two to four inches is usually adequate for Japanese varieties. As European plums will size up in clusters, they require less thinning than Japanese plums and may often be left unthinned. Fruit in the interior and lower portions of the tree, which are heavily shaded, are likely to be poor in colour and should be severely thinned. Wilson, Burbank and some other varieties usually require heavy thinning, but a number of varieties tend to thin their crops naturally and require only light thinning.

The most appropriate time for thinning is immediately after the natural shedding of fruit has taken place, usually in late spring. Excessive cropping is associated with small fruit size in the current crop and may affect fruit bud formation for the next season's crop; early thinning is therefore essential.

Thinning is most commonly carried out by hand. Other methods include the jarring of branches with a short length of rubber hose, and brushing the flower clusters with a loose broom or switch made of twigs, but both are unsatisfactory after the pit of the fruit has commenced to harden. Dinitro-ortho-cresylic acid and other blossom-thinning sprays have given mixed results and are seldom used here.

HARVESTING.

Plums of good dessert quality should be picked as near to full maturity as practicable, consignments for distant markets being picked a little earlier than those for near markets. For a period ranging from one to several weeks before full maturity, plums undergo distinct changes of colour. In Japanese and light-coloured varieties, the first marked change in skin colour is from green to yellowish-green, and this is followed by more definite yellowing, after which the fruit assumes its characteristic red or yellow colour. Blue or purple varieties change from green to greenish-blue or reddish-purple followed by dark blue or purple. Development of full colour is accompanied by a softening of the flesh, commonly beginning at the end of the fruit opposite the stem, and fruit is frequently picked for local markets at this stage. Because plums gain rapidly in weight, size, sugar content and flavour during the later stages of ripening, it is advantageous to harvest as late as possible. Once the fruit has been picked it gains little in sugar content, and ripening then consists in a softening of the flesh and a deepening of skin colour.

Experience is needed to decide when the harvesting stage has been reached, as from year to year plums may show variations in the ripening period. The most important factor determining the ripening date is the temperature during the growing season; high temperatures advance the date, low temperatures delay it.

Since the fruit does not ripen uniformly on the tree, several pickings are made. As the season advances, fruit may be picked with slightly less colour and a little firmer.

Plums are highly perishable and must therefore be handled with great care. Stems should be retained on the fruit as far as practicable, the flesh must be unbruised and the skin left intact with the bloom disturbed as little as possible.

The Apricot.

M. A. HANNIGAN, Senior Adviser in Horticulture.

THERE appears to be some doubt as to whether the apricot (*Prunus armeniaca*, family *Rosaceae*) is a native of Armenia or of Western China. The botanical name suggests that the plant originated in Armenia, although it was known to the Chinese more than 2,000 years ago.

In Queensland, the Granite Belt and Warwick districts are the only areas where apricots are grown commercially. The apricot is, however, not particularly well suited to climatic conditions in the Granite Belt and annual production has remained at approximately 20,000 half-bushel cases for the past decade. The whole crop is sold on the fresh fruit market.

GROWTH AND FRUITING HABITS.

The flower buds are borne either singly or in pairs on one-year-old lateral wood and on short spurs on the older wood (Plate 8). Spur development is greater in apricot than in peach trees.

The leaf and flower buds of the apricot require less winter chilling than most other stone fruits but the tree has a pronounced tendency to shed flower buds after a warm winter. In the Stanthorpe district, the trees blossom from the middle to the end of August; at Warwick, on the southern fringe of the Darling Downs, about three weeks earlier.

VARIETIES.

Only a limited number of varieties have proved suitable for the climatic and soil conditions in Queensland. The most widely grown are as listed.

Granite Belt:—

Newcastle.—An early maturing variety which bears heavy crops; the fruit is rather small and of indifferent quality.

Trevatt.—A popular mid-season variety which usually matures its crop in mid-December; it is a fairly consistent bearer, and ripens its fruit evenly.

Moorpark.—A mid-season variety with fairly large fruit of good quality; the two sides ripen unevenly and the variety is therefore unsuitable for canning or drying; the trees are not consistent croppers.

Tilton.—A late variety with relatively large fruit of good quality.

Oullins, an early strain, and *Mansfield Seedling* are other varieties of commercial interest.

Southern Darling Downs:—

Glengarrie.—An early variety that matures its fruit about the end of October; it blossoms at the end of July and is therefore subject to frost damage.

Newcastle and *Moorpark* are also grown in this area.

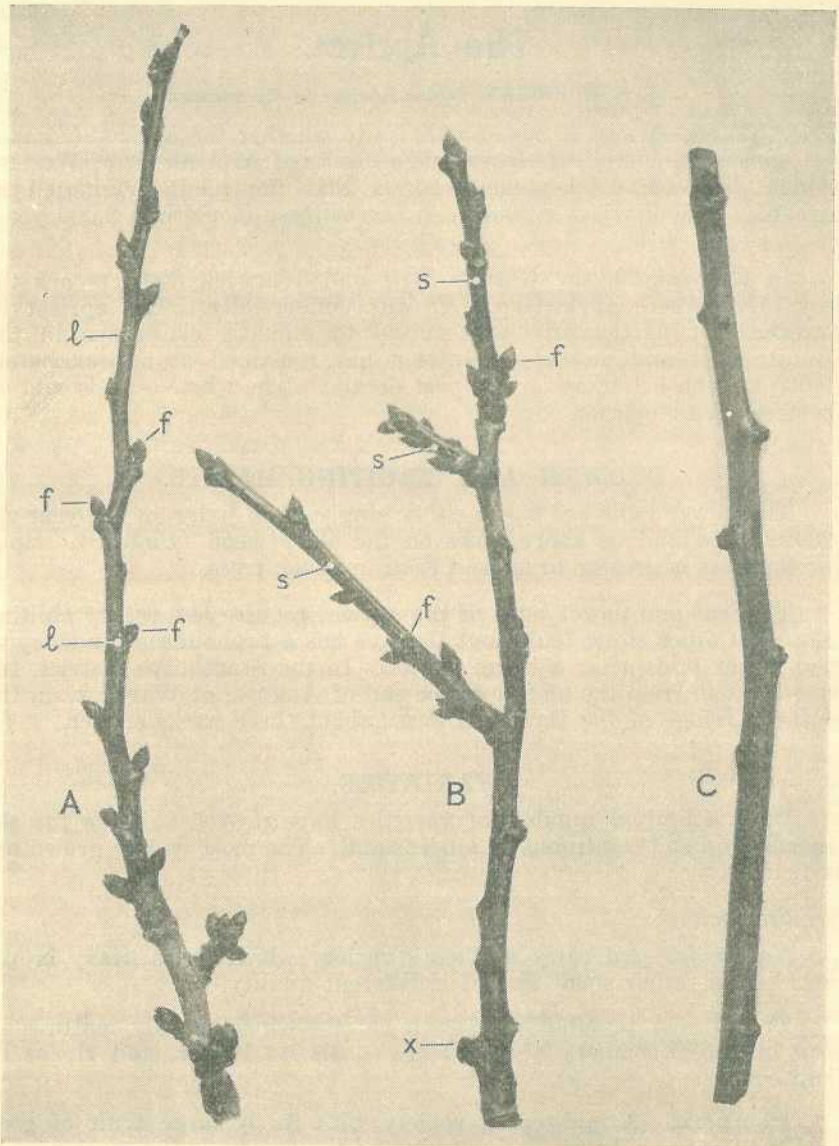


Plate 8.

Fruit Bearing Wood of the Apricot. A—at end of 1st growing season, bearing flower (f) and leaf (l) buds; B—at end of 2nd growing season; fruit was borne at x, two side buds and the terminal bud produced short shoots (s) bearing flower buds; C—2-year-old, unfruitful wood.

SOIL AND CLIMATE REQUIREMENTS.

Apricots can be grown in soil types ranging from light sandy loams to heavy loams, but good natural drainage is essential. Shallow soils overlying an impervious clay subsoil, and therefore subject to water-logging, are unsuitable for the crop. The heavier soils south and

south-west from Warwick produce larger trees than the granitic sandy loams at Stanthorpe. Trees planted in rich alluvials tend to make excessive vegetative growth and usually bear light crops of poor quality fruit.

Well sheltered and warm positions are preferred for the crop, since the tree blossoms earlier than most other stone fruits and is therefore more susceptible to injury from spring frosts.

ROOTSTOCKS.

The three principal rootstocks used for propagating apricot trees are seedling apricot, peach and the Myrobalan plum. The type of soil in which the trees are to be planted largely governs the stock used. On deep sandy loams, the seedling apricot or peach stock is preferred; on heavier soils which are inclined to be wet, trees worked on Myrobalan plum stock are longer lived than trees worked on to apricot or peach. Seedling stock trees are budded to the desired variety.

TRAINING AND PRUNING.

During the first five years after planting, the young tree must be equipped with a strong framework so that it can carry a heavy crop of fruit without any limb breakage or splitting. The wood is somewhat brittle and a comparatively short main trunk is therefore essential. The young tree is headed back about 15 inches above ground level after it is planted, the cut being made above a bud. In the following season, three or four evenly spaced branches will develop and each is cut back in the winter to a length of about 15 inches. The cut on each limb should be made above a bud which is so placed that leaders developing from it and the one immediately below will form part of an evenly spaced circle of leaders round the tree. A five-year-old tree should be from seven to nine feet high with six to eight leaders. From then on, pruning consists in thinning out the fruiting wood to balance the size of the crop with the vigour of the tree.

The apricot bears its fruit on one-year-old wood and on the spurs of the leaders and main arms. All laterals should be tipped if they are longer than 10 inches, while long laterals on the inside of the tree are cut back to one-third of their length. Fruit spurs on the shortened laterals generally remain fruitful for about three years. At this age, they are cut off where they join the main stem or leaders. Vigorous and unfruitful laterals are also completely removed. Renewal wood develops at the base in both cases and the fruit is therefore carried close to the main limbs and leaders.

Strong laterals near the top of the leaders should be removed. When tipping the leaders, the cut should be made about half an inch above a bud because of the tendency of apricot wood to die back behind the cut. In vigorous trees it is often necessary to prune the leaders back to a suitably placed lateral; the lateral is not tipped.

SUMMER PRUNING.

Summer pruning of the young tree hastens the development of a well shaped tree. All unwanted shoots are removed as they appear in order to admit light to the rest of the tree. After the trees commence to bear, summer pruning is still necessary. When the crop has been harvested, vigorous wood in the centre of the tree and in other positions where it is not wanted should be shortened back to about 10 inches. Late in the summer any shoots competing with the leaders can be cut right back.

The apricot is very subject to attacks by fungi which gain access to the tree through large pruning cuts. These should therefore be painted over with a Bordeaux paste.

CULTIVATION.

The life of the apricot tree as well as its cropping behaviour is mainly determined by the cultural practices adopted in the orchard.

Soils in the Granite Belt are low in organic matter and green manuring is highly desirable in that area. The main crops used are New Zealand blue lupin and Black Winter rye. With the former crop, the orchard is ploughed in late January or early February and a mixture of 1 cwt. of sulphate of ammonia and 1 cwt. of superphosphate per acre (or 2 cwt. of a 4:15:2 mixture) is applied at or a short time before planting the lupin seed in late February. When Black Winter rye is planted, the orchard is ploughed in February and the seed is sown in March after an application of $1\frac{1}{2}$ cwt. of sulphate of ammonia to the acre. The green manure crop is turned under or disced into the soil a few weeks before the trees commence growth in spring.

Ploughing or cultivation of the orchard is necessary in late spring but no further soil treatment is then needed until mid-autumn.

FERTILIZING.

Regular fertilizer applications are needed to improve the fertility of most apricot orchards. In the late winter, an 8:10:8 or similar fertilizer should be broadcast around the trees at the rate of $\frac{1}{2}$ lb. for each year of tree-age, with a maximum of 8 lb. per tree. This fertilizer is often applied when the green manure crop is turned under. An application of a water-soluble fertilizer in November at the rate of $\frac{1}{2}$ lb. per year of age of the tree, with a maximum of 8 lb., is also beneficial; a 5:14:5 mixture is satisfactory.

FRUIT THINNING.

Reduction in the number of fruits can be brought about by pruning and by hand thinning. The apricot tree naturally sheds a proportion of its fruit soon after setting has occurred, and again when the stone is hardening. Thinning may be necessary after this second shedding, and the amount of fruit allowed to remain will depend on the vigour of the tree. In thinning, small fruit is removed and clusters are reduced so that apricots are uniformly spaced over the tree. Thinning during the "final swell" may result in an increase in fruit size. Size of fruit is governed to some extent by its position on the tree; there is a tendency to larger fruit on outer branches than on the inside, shaded limbs.

HARVESTING.

For the fresh fruit market, apricots are allowed to remain on the tree until they are thoroughly ripe, but still firm enough to carry to market. The earliest stage at which the fruit can be picked is after the green colour of the skin has changed to pale yellow or straw; if picked before this change occurs it will not develop full flavour. Because the crop ripens rapidly, harvesting extends over a short period only, and fruit which has matured sufficiently to develop proper flavour must reach the consumer within a few days of picking. It must be handled without bruising. In preparing apricots for market, the fruit must be well graded for size and colour, and suitably packed.

Nut Crops.

A. A. ROSS, Horticulturist.

NUT crops are of little economic importance in Queensland at the present time, and local production supplies only a small proportion of the market demand. Three species—the Macadamia nut, the walnut and the pecan nut—are, however, grown on a limited scale. Of these, the first is an indigenous tree with a great potential for the future, once selected strains are propagated for orchard plantings. The walnut and the pecan nut, on the other hand, are already established in world commerce and production is primarily a matter of finding the right varieties for conditions in this State.

THE MACADAMIA NUT.

The Macadamia nut (*Macadamia ternifolia*, family *Proteaceae*), which is known commonly as "Queensland Nut," "Australian Nut" "Bopple Nut" and "Bush Nut," is native to the coastal rain-forests of south-eastern Queensland. Approximately 300 acres of seedling trees have been planted in the coastal area between Maryborough and the New South Wales border. A typical mature tree is shown in Plate 9. The Macadamia is an edible nut which can be eaten raw or processed. It is highly nutritious and contains between 70 and 80 per cent. of oil, equal in quality to the best olive oil.

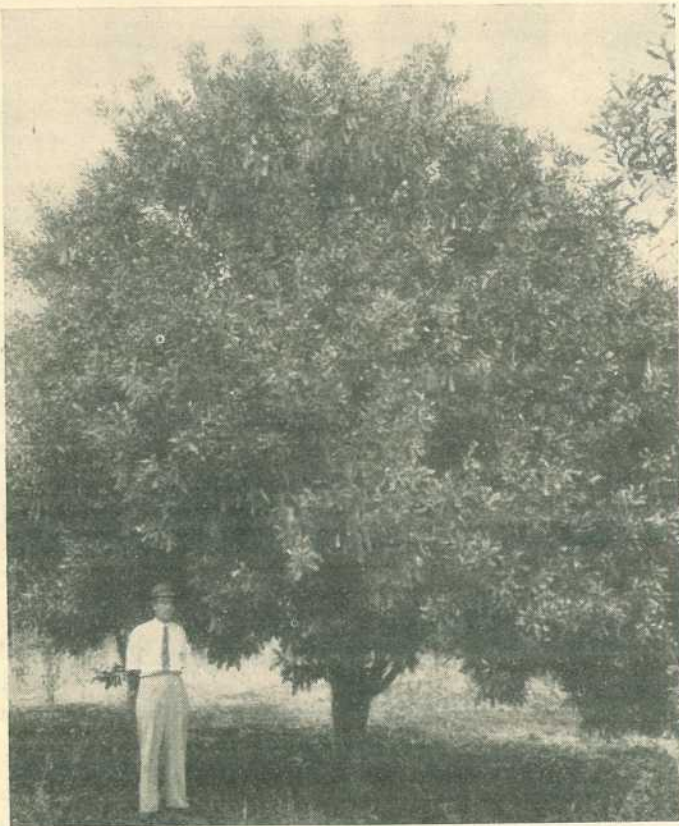


Plate 9.

Macadamia Nut Tree. Tree shape is variable, but good types have a dwarf habit of growth.

There are two recognised botanical varieties of *Macadamia*—namely, *ternifolia* and *ternifolia* var. *integrifolia*. While possessing several points in common, these show certain broad differences. The variety *ternifolia* has long, narrow, spiny leaves which are pink or red when young, and pink to light reddish-brown flowers. The leaves of *integrifolia*, on the other hand, are obovate, almost free of spines, and yellowish when young, while the flowers are creamy-yellow. There is a tendency for *integrifolia* to blossom from June through to March and some strains are almost over-bearing; *ternifolia* blossoms between August and October and produces one main crop. However, between these two distinct types there are numerous intermediate forms varying in spini-ness of leaves (Plate 10), colour of flower, size of nut and thickness of shell.

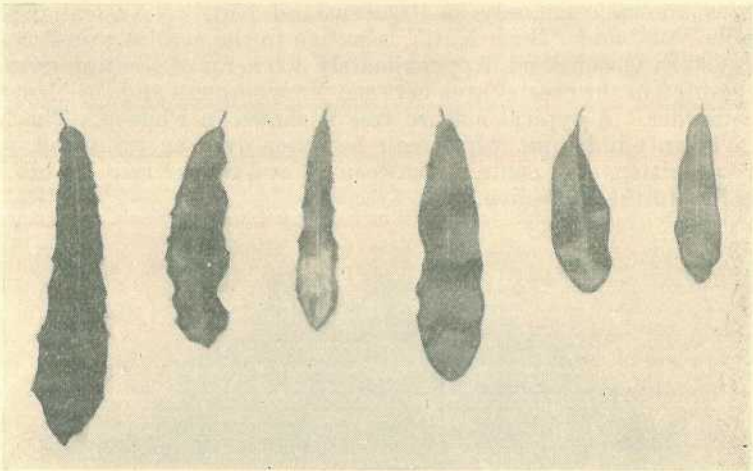


Plate 10.

Variations in Leaf Type in the Macadamia Nut. Note gradations from the large, spiny *ternifolia* (left) to the small, smooth *integrifolia* (right).

Strains selected for vegetative propagation can be grouped according to the type of nut as follows:—

- (a) Strains with thin-shelled nuts which are particularly suitable for table purposes when sold in the shell. These yield over 40 per cent. by weight of kernel and can be cracked fairly easily.
- (b) Strains with moderately-sized medium- to thick-shelled nuts (Plate 11), which can be used for both processing and table purposes. The kernel yield is more than 25 per cent. by weight.
- (c) Strains with a medium- to thick-shelled nut which is too large for processing but likely to meet the requirements of some consumers.

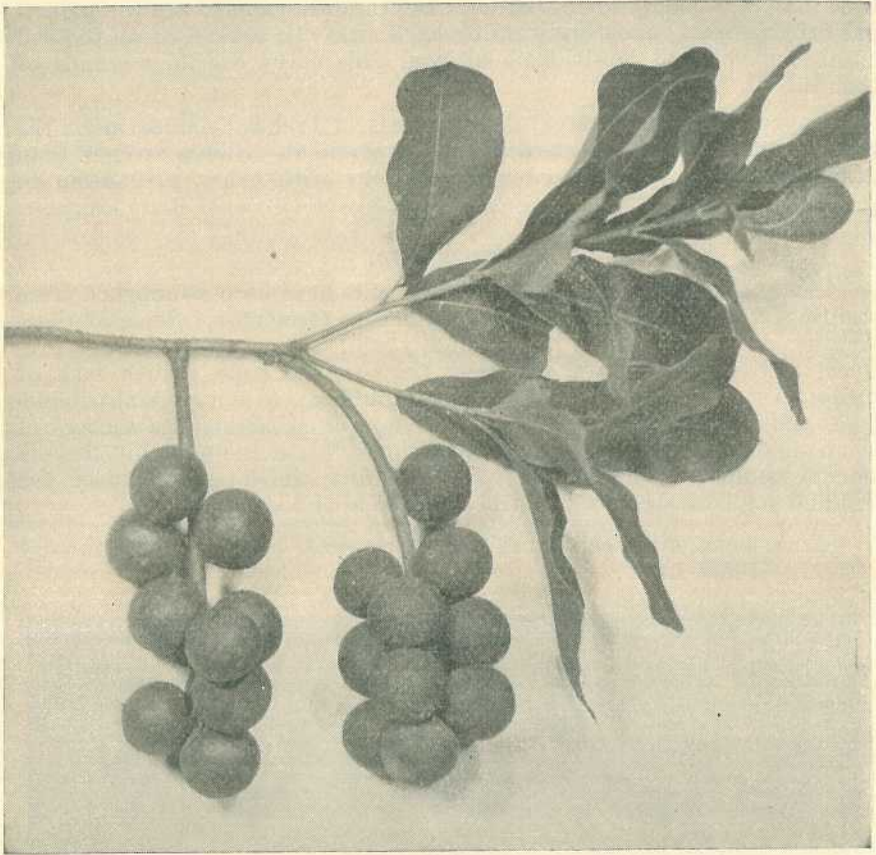


Plate 11.

Clusters of Macadamia Nuts. A medium-shelled strain commonly found in seedling orchards.

Climatic Requirements.

Being native to the rain-forest of southern Queensland, the Macadamia grows best along the coast under conditions of high humidity and comparatively heavy rainfall. It is, however, tolerant of adverse conditions and crops well from North Queensland to Sydney. In inland districts, the tree thrives in some locations but crops are usually lighter than they are near the coast. In general, the trees produce a deep tap-root and relatively few lateral roots; they may therefore need the protection of windbreaks in exposed situations. Under orchard conditions, the trees are shapely, robust and more heavily foliated than they are when growing in the rain-forest. Crop yields seem to be correlated with the spring rainfall.

Soil Requirements.

The Macadamia grows well on a wide range of soils but fails on infertile coastal sands, heavy clays and gravelly ridges. Like most other fruit trees, it yields particularly well on deep, well-drained soils

with a loam or sandy loam texture. Depth and drainage are the principal criteria used in selecting an orchard site. In coastal areas the red basaltic loams and sandy loam alluvial soils carry excellent stands of this nut.

In keeping with present-day methods of orchard management the land must be managed according to the gradient. Slopes steeper than 1 in 25 should be planted on the contour with every precaution to prevent soil erosion. Planting on excessively steep slopes is undesirable.

Propagation.

All existing orchards of *Macadamia* nuts have been established from seedlings and consequently include numerous tree types. Some of these trees bear up to 200 lb. of nuts annually while others of similar age produce only 10 lb. Many also bear thick-shelled nuts. Such lack of uniformity in plant material is a major handicap to commercial production, and superior types of trees have now been selected as sources of scion material for vegetative propagation. These include thin-shelled, smooth-round and mammoth types of nuts which should meet the demand for both dessert and processing quality kernels.

Rootstocks are readily raised from seed by ordinary nursery systems. (Plate 12.)



Plate 12.

Macadamia Nut Nursery. Both seedling and grafted trees may be raised in nursery rows. Only grafted trees of known parentage should be used for orchard plantings.

Grafting is more difficult in the *Macadamia* than in most fruit trees, owing to the hardness of the wood, and considerable practice is required before a high percentage of "takes" can be expected. The best results have been achieved when the seedling rootstocks are side wedge grafted with the selected scions. In the side wedge graft, the scion is sharpened to a V or wedge shape at the basal end and inserted into an oblique cut in the stock. The stock is prepared first by making a straight downward

cut into the trunk at an angle of about 30 degrees and approximately two inches above ground level. The cut should be $\frac{3}{4}$ to 1 inch in length and should not extend beyond the centre of the stock. After the scion is inserted, the graft is tightly bound with raffia and coated with melted paraffin wax. After-care of the graft is similar to that practised in other trees. Budding is usually much less satisfactory than grafting in the Macadamia nut.

Grafting should be carried out at a time when starch accumulation in the wood is at a peak. The starch content of a tree is highest after the fruit has been harvested and before blossoming, but starch accumulation may be induced in scion wood by girdling suitably sized branches three weeks before the scions are cut. When it can be arranged, early spring grafting is likely to produce better results than grafting in autumn.

Preparation of Land and Planting.

The methods of land preparation practised in any other orchard crops can be followed in the case of the Macadamia. Deep initial ploughing is essential.

Spacings adopted in existing orchards vary from 20 to 30 feet, but the widest spacing is the most satisfactory and 30 feet should be allowed between the trees wherever possible. In designing the orchard, varieties with similar characteristics should be kept together to facilitate harvesting, for it is an unwise practice to mix thin-shelled and mammoth nuts together in market consignments.

Spacing may be influenced somewhat by the common practice of growing inter-row crops when the trees are young. Papaws, pine-apples, bananas and most vegetables can be successfully raised between the Macadamia trees provided they are removed before they exert any serious competition for moisture and plant foods. These crops supply the farm income until the nuts come into bearing.

The most suitable time for transplanting young trees into the orchard is from February to April, when the natural rainfall is well distributed and ample soil moisture is available. The roots are particularly susceptible to exposure and care is required to avoid desiccation between lifting from the nursery and planting. In planting grafted trees, the union should be kept above ground level and the usual method of tree planting followed. Planting should be immediately followed by watering.

Pruning.

In its early stages the tree is trained to a squat habit with large spreading limbs. The Macadamia has the natural tendency to grow tall. Consequently when the young tree is about 2 ft. 6 in. high, the top should be pinched out to encourage branching; a few evenly spaced limbs are then allowed to develop into a strong, rounded, symmetrical tree.

Little pruning is required in bearing trees. Should the grove become densely over-grown, lateral growth may be reduced to admit light and induce the development of fruit-bearing spurs (Plate 13). Some leaders may also require shortening to prevent the trees from becoming too tall for normal cultural operations in the orchard. Pruning is done towards the end of winter after the crop is harvested.



Plate 13.

Macadamia Nut Tree in Bloom.

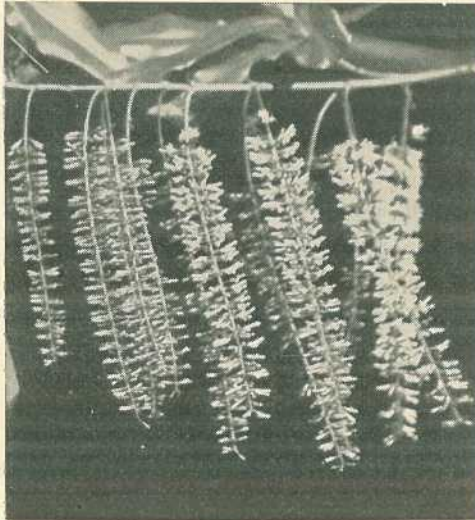


Plate 14.

Single Spray of Macadamia Blooms.

Nutrition.

The Macadamia grows best in soils well supplied with humus, and farmyard manure should be added to the soil if it is available; alternatively, green manure crops can be grown in summer, when they will not make too heavy a demand on soil moisture. Of the inorganic plant foods, nitrogen is usually deficient in the majority of soil types

near the coast, but phosphates and potash are present in reasonable amounts. Under orchard conditions, regular applications of fertilizer will be found advantageous. A complete fertilizer with an 8:10:5 or similar formula is satisfactory when used at the rate of 1 lb. per tree per year of age, with a maximum of 10 lb. The most satisfactory time to apply the fertilizer is in early spring just before the trees make new growth and commence to blossom.

In several orchards, zinc deficiency (Plate 15) has been reported, the symptoms being small, yellowish and sometimes slightly mottled leaves which are bunched fairly closely together. The affected trees crop poorly and shoot growth is retarded. The disorder can be corrected by the application of foliage sprays, mixed according to the following formula:—10 lb. zinc sulphate, $3\frac{3}{4}$ lb. soda ash (or 5 lb. hydrated lime), 100 gallons water. The spray is best applied in early spring after the first flush of new growth, but reasonably good results are obtained at practically any period of the year.

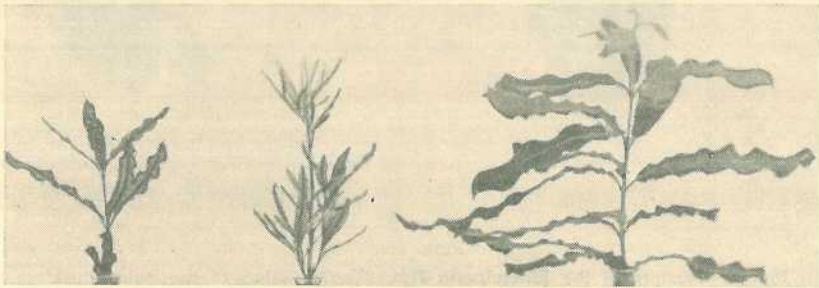


Plate 15.

Zinc Deficiency in the Macadamia Nut. Compare normal terminal (right) with affected terminals (left and centre).

Cultivation.

Many roots of mature trees are fairly close to the surface of the ground, and in the orchard, therefore, cultivation for weed control should be shallow. Weeds are kept down at all times. Cowpeas such as Poona pea make an excellent cover crop during the wet summer months, and an early autumn green manure such as New Zealand blue lupin is useful in irrigated areas. Harvesting takes place during late autumn and winter and the collection of the nuts from the ground is relatively easy if the orchard is kept clean during this period. In older groves, animals are sometimes grazed on volunteer grass and weeds, and this practice may possibly replace the usual method of soil management; it has the advantage of adding animal manure to the soil.

Harvesting.

The nuts mature (Plate 16) in six to seven months after blossoming and must be allowed to ripen on the tree, for immature kernels quickly become infected by moulds which make them inedible. On reaching full maturity the majority of nuts fall to the ground, but in some strains the nuts are more persistent and must be removed from the tree by means of a rake. After harvesting, the nuts are de-husked in machines of various types; a corn sheller can be improvised to perform this

operation with remarkably good results. The nuts are then washed to remove any discoloration caused by adhesions to the husk, thus leaving the shell an even brown colour after drying. At least a month should be allowed for the nuts to "harden off" before they are bagged and despatched to market.

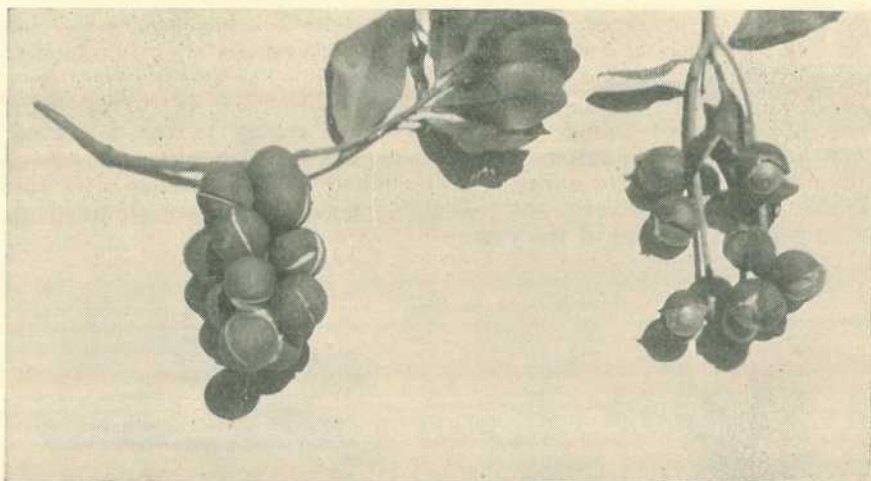


Plate 16.

Mature Clusters of the Macadamia Nut. The splitting of the outer husk indicates maturity.

Grading the nuts according to size gives the product a desirable appearance and also assists mechanical handling by processors. A simple, but effective, grader (Plate 17) for sizing the nuts into small, medium and large grades can be readily constructed from case timber. The nuts are rolled between the edges of two inclined boards which diverge from a spacing of $\frac{1}{2}$ inch where the nuts enter to $1\frac{1}{2}$ inches at the far end. Suitably sized boxes are placed beneath the slots to receive the nuts as they fall through. Spherical nuts grade more evenly than ovoid types and it is therefore advisable to separate the two types in the orchard when the crop is harvested.

Shelling.

The toughness of the shell in most of the nuts marketed at present limits sales for dessert purposes. However, several efficient hand-operated crackers are available which crack the shell with little effort and turn out the kernel undamaged. Machinery for cracking the shells has also been designed for processing purposes. During the cracking process, some kernels are unavoidably broken but these are used by confectioners.

Shelled kernels do not deteriorate to any appreciable extent if kept in sealed jars away from light and moisture, the flavour and oil content being maintained. As a roasted and lightly salted confection, they are in strong demand and this treatment enhances their natural good keeping qualities.

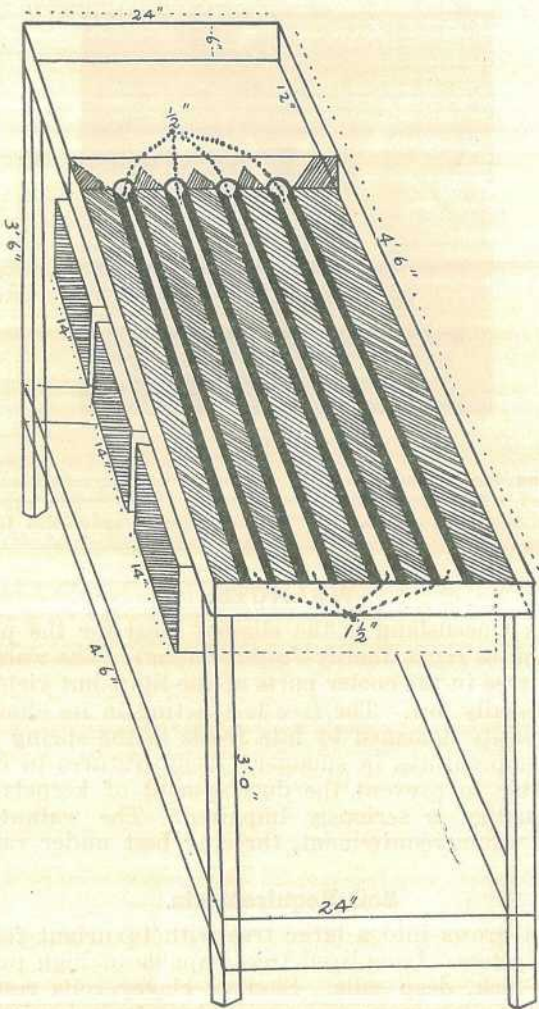


Plate 17.

Grader for Macadamia Nuts. The nuts should roll down the groove and fall into the appropriate box underneath.

Yields.

Under optimum conditions, seedling trees produce their first crop when six to seven years old, but in some strains cropping does not begin until the tenth or twelfth year. However, vegetatively propagated trees should commence bearing at an earlier average age.

Yield records based on seedling trees show wide variations due to strain characteristics and environmental effects. In favoured localities, yields of 300 lb. per tree have been obtained annually from mature trees over 14 years of age. The performance of grafted trees (Plate 18) has still to be determined.



Plate 18.

Top-working the Macadamia Nut. Vigorous but unprofitable trees may be bark grafted with scions from a better strain. Three scions are grafted to a sawn-off branch and waxed. A side wedge graft may also be used on small branches.

WALNUTS.

Nowhere in Queensland is the climate ideal for the production of the walnut (*Juglans regia*, family *Juglandaceae*). The walnut makes an excellent shade tree in the cooler parts of the State but yields of marketable nuts are usually low. The tree is exacting in its climatic requirements, as it is easily damaged by late frosts in the spring and will not tolerate high temperatures in summer. Temperatures in excess of 100 deg. F. are liable to prevent the development of kernels; if they do develop, the quality is seriously impaired. The walnut also has a relatively high water requirement, thriving best under rainfalls of 35 to 40 inches.

Soil Requirements.

The walnut grows into a large tree with luxuriant foliage and an extensive root system. Long-lived trees capable of high production are found only on rich, deep soils. Shallow clayey soils restrict growth, while deep sandy soils may require supplementary irrigation. Soils with a loamy texture offer the best prospects for the crop, but even these must have an open subsoil which drains freely to a depth of at least 10 feet. Walnuts are very susceptible to salt injury; consequently only a good grade of irrigation water should be used and care must be taken to prevent any rise in the water-table in irrigated orchards.

Propagation.

Most walnut groves in Australia are composed mainly of seedling trees of very variable quality. Trees worked on Northern Californian Black stock, which is readily raised from seed, are available, but few Australian nurserymen achieve a high percentage of "takes" and consequently vegetatively propagated trees are expensive. The most satisfactory results are obtained with patch budding, but nurserymen also graft the seedlings below ground, using the bark or wedge graft and heaping soil over the union. This operation is difficult and few growers attempt it.

Varieties.

Although most walnuts grown in Australia are seedling trees, commercial plantings should, as far as possible, be based on worked trees of varieties with a good reputation overseas. Varieties which have proved satisfactory in Australia are Franquette (a late flowering type) and Myrtleford Jewel (a Victorian seedling). Both are resistant to blight and produce a high quality nut. Other varieties of commercial interest are Concord, Eureka, Freshford Gem, Payne, Placentia and Treyve Mayette.

Planting.

Walnut roots are very susceptible to drying and young trees must therefore be handled carefully when transferred from the nursery to the orchard. The usual system of tree planting is adopted, followed by regular watering.

Tree spacings are wide when compared with those of other fruit trees, because of the large size to which these trees develop. A spacing of 50 x 50 feet should prove satisfactory under most conditions and nothing less than 40 x 40 feet is practicable. Some groves are planted with 60 feet between the trees and even then adjacent trees touch. During the early life of the grove, inter-row crops can be grown to defray the high cost of bringing the nut trees into bearing.

Pruning.

Very little pruning is required in the walnut. The young trees are headed at five or six feet and thereafter training consists of removing side shoots from the main trunk and preventing the development of too many main leaders. All leaders should be maintained at approximately the same length to give the tree a symmetrical shape. Internal laterals which are unwanted or out of position should be removed in their early stages. When the tree has assumed its regular shape, pruning is limited to the removal of dead wood.

Soil Management.

Soil management consists chiefly in maintaining the texture of the soil by the regular addition of organic matter, taking precautions against soil erosion and supplementing natural rainfall with irrigation in dry times. Cultivation should aim at controlling weeds, especially during the early autumn when harvesting is in progress.

Fertilizers are seldom used on walnut trees, as the soils planted are usually deep and well supplied with plant foods. Young trees should, however, benefit from light applications of a complete fertilizer mixture which is relatively rich in nitrogen.

Harvesting.

When mature, the nuts separate from the hulls and fall to the ground, but when harvesting is in progress, it is customary to shake the trees by means of poles fitted with hooks to accelerate nut fall. Nuts should not be allowed to lie on the ground for long periods, as the shells lose their colour quickly and the kernel may become mouldy. At times, some nuts have a persistent hull and these are referred to as "sticktight"; they should be kept separate from the other nuts as they are inferior in quality and include many blanks, or contain mouldy and discoloured kernels. After collection, the nuts are washed to remove dirt and stains and then quickly dried in the sun on shallow trays with

frequent stirring to accelerate the process. A really first class product can be prepared by dipping the nuts for from 5 to 10 seconds in a bleaching solution containing 25 lb. chloride of lime, 18 lb. soda ash and 50 gallons water to which sulphuric acid has been added at the rate of 1 lb. to 340 gallons.

THE PECAN NUT.

The pecan nut (*Carya oliviformis*, family *Juglandaceae*) is closely related to the walnut. The present production in Queensland is small, but annual plantings are increasing.

Climatic Requirements.

The pecan nut (Plate 19) crops well only in regions with a reasonably cool temperature during the winter months, and does best on the tablelands of the interior and in some parts of southern coastal Queensland. Late spring frosts are, however, injurious to young trees and any necessary precautions must be taken to protect them during the first few winters after planting. Trees grow luxuriantly in warm climates, but their cropping capacity is relatively poor. Male and female flowers are borne on the same tree and pollen is air-borne from one to the other. Rain at blossoming may therefore interfere with pollination and result in a poor crop.



Plate 19.
Pecan Nut Tree.

Soil Requirements.

Pecan nuts grow on a wide range of soils. Clay loams and loams overlying a free draining subsoil support vigorous trees and these types should be given preference in selecting the orchard area. Cultural practices which maintain a high organic matter content in the soil are desirable. The tree prefers a slightly acid soil with a pH value of 5.5 to 6.0.

Propagation.

Vegetative propagation is necessary for the production of commercial trees, but simple methods of budding are not very successful. Ring and patch budding have proved reasonably satisfactory when carried out by skilled operators. Rootstocks are raised from the seed of vigorous, fruitful parent trees with some resistance to scab. Germination is improved by soaking the seed in water for 36 to 72 hours before planting. The seed is, however, sometimes stratified—that is, packed in bands between layers of sand which is kept moist by a covering of about eight inches of soil. When the seed shows signs of germinating, it is planted direct into nursery rows four feet apart with 9 to 12 inches between the seeds. The seedlings are budded in the second growing season at any time when they are in active growth.

Some years ago, grafting was commonly practised, but it requires a greater quantity of budwood than budding. The whip-tongue graft was used for small stocks and the cleft or side grafts for stocks one inch or more in diameter.

Nursery care of the worked tree is the same as for other fruit trees except that the pecan develops a very long taproot, which must be cut when the top reaches a height of about 12 inches.

Planting.

The fibrous roots of the young tree are very susceptible to exposure and should be carefully protected when the trees are transferred from the nursery to the field. The land should be thoroughly prepared for the trees, ploughed deeply and, if necessary, sub-soiled. The trees are transplanted when the top is a year old and has reached a height of four to six feet. Planting should be done during the winter as soon as dormancy sets in so that the root system will be re-established in readiness for the spring growth. In planting, the tree is placed at about the same depth as it was in the nursery and then watered immediately.

Pecans develop into large trees and require a 50 to 70 feet spacing. Inter-planting with some early maturing crop will offset part of the cost of establishing the orchard.

Varieties.

There are approximately 180 known varieties of the pecan nut, many of which produce high quality nuts. Scab has been a serious disease in American orchards and preference is now given to those varieties with some resistance to the disease or those in which spraying for its control is an economic proposition. The most popular resistant varieties are Stuart, Farley, Desirable and Curtis. More susceptible varieties previously held in high esteem are Schley, Frotscher, Van Deman, Moneymaker and Pabst. Little information is available on varietal behaviour in Queensland, but it would appear advisable to plant scab-resistant varieties on the coast and perhaps try the better quality but scab susceptible varieties in the drier inland areas.

Pruning.

No systematic pruning is necessary beyond removing dead wood and branches which are out of position. Nuts are borne on terminal wood and vigorous growth is associated with heavy crops. Young trees should be headed at a height of about four feet and trained into a spreading, symmetrical form with a limited number of leaders.

Soil Management.

The root system of the pecan nut is extensive but relatively shallow, and accordingly, deep cultivation is undesirable. Disc implements should always be used in preference to tyne implements. It is the usual practice to apply clean cultivation during the summer, especially when the crop is harvested, and to plant a winter-growing green manure crop, such as New Zealand blue lupin, towards the end of autumn. By this means, soil organic matter is maintained, the best use is made of soil moisture and a minimum of inconvenience is caused during harvesting of the nuts.

Yields of nuts are influenced considerably by fertilizing and an 8:10:8 or similar mixture at the rate of 2 lb. per tree per year of age up to 25 years should prove effective. This is best applied in two applications, one in early spring and a second when the nuts are about half-grown.

Rosette, which is an indication of zinc deficiency, frequently appears in pecans as a yellowing and mottling of the new leaves at the top of the tree combined with a shortening of the internodes. In severe cases, terminal twigs and branches die back and the trees become unproductive. Soil dressings of zinc sulphate, 1 to 2 lb. for each inch of trunk diameter, are an effective remedy in acid soils, but in neutral or alkaline soils the zinc-lime spray used for zinc deficiencies on citrus will be found satisfactory.

Harvesting.

The crop is harvested in the autumn from April to May. When the nuts mature, the hulls open and the nuts fall to the ground, but shaking or jarring the branches may be needed to dislodge the more persistent nuts. The nuts are gathered by hand or preferably collected on a canvas or burlap sheet spread under the tree. They should then be washed to remove foreign matter and rapidly dried before being stacked 6 to 8 inches deep on a well ventilated floor for curing. Shrinkage is complete in about a month and the nuts are then placed in sacks and marketed as whole nuts.

Yields.

The age at which a tree comes into bearing depends on the variety and the care given to the orchard. Under favourable conditions, some varieties bear within three years, but late types take up to six years. Worthwhile commercial crops should be produced in 8 to 12 years.

The average yield of mature trees is influenced by such things as climate, variety, soil type, fertilizer practices, insect pests and disease. About 100 lb. per tree is considered a very good crop, but recorded yields usually range from 25 to 80 lb. per tree.



Beekeeping Legislation.

"The Apiaries Act of 1947."

C. ROFF, Adviser in Apiculture.

LEGISLATION on beekeeping in Queensland dates from 1931, when the first Apiaries Act was passed. Primarily it gave power to deal promptly and adequately with outbreaks of diseases of bees. A natural adjunct to this was a system of approval and registration of apiary sites so that inspections for disease would be facilitated. It was also required under the Act that any bees or beekeeping materials introduced into the State should be certified as free from disease. These basic principles were maintained in "*The Apiaries Act of 1938*," and in addition, a certain degree of control of the industry was introduced to prevent overstocking of localities or encroachment between apiaries in south-eastern Queensland, where the greater proportion of the apiaries of the State were located.

The degree of protection against encroachment, under the Act of 1938, proved to be excessive, as relatively small apiaries could hold territory that was capable of carrying a greater number of hives and, consequently, of yielding a much larger crop of honey. New apiaries could be established only at distances further apart or further from existing apiaries than is now considered necessary. There was also a tendency to limit the increasing number of migratory beekeepers from utilising potentially profitable areas. This was substantiated by instances where beekeepers, by mutual consent, as was allowed under the Act, positioned large apiaries at short distances without detrimental effects.

To correct shortcomings of the 1938 Act, "*The Apiaries Act of 1947*" was passed. This Act came into force on 31st March, 1948, and the following explanation should enable all beekeepers to become conversant with its requirements. The Act is divided into parts, but for convenience, it will be discussed under headings relating to requirements in declared districts, to the control of disease in the State as a whole, to the prevention of the introduction of disease and also to some general provisions.

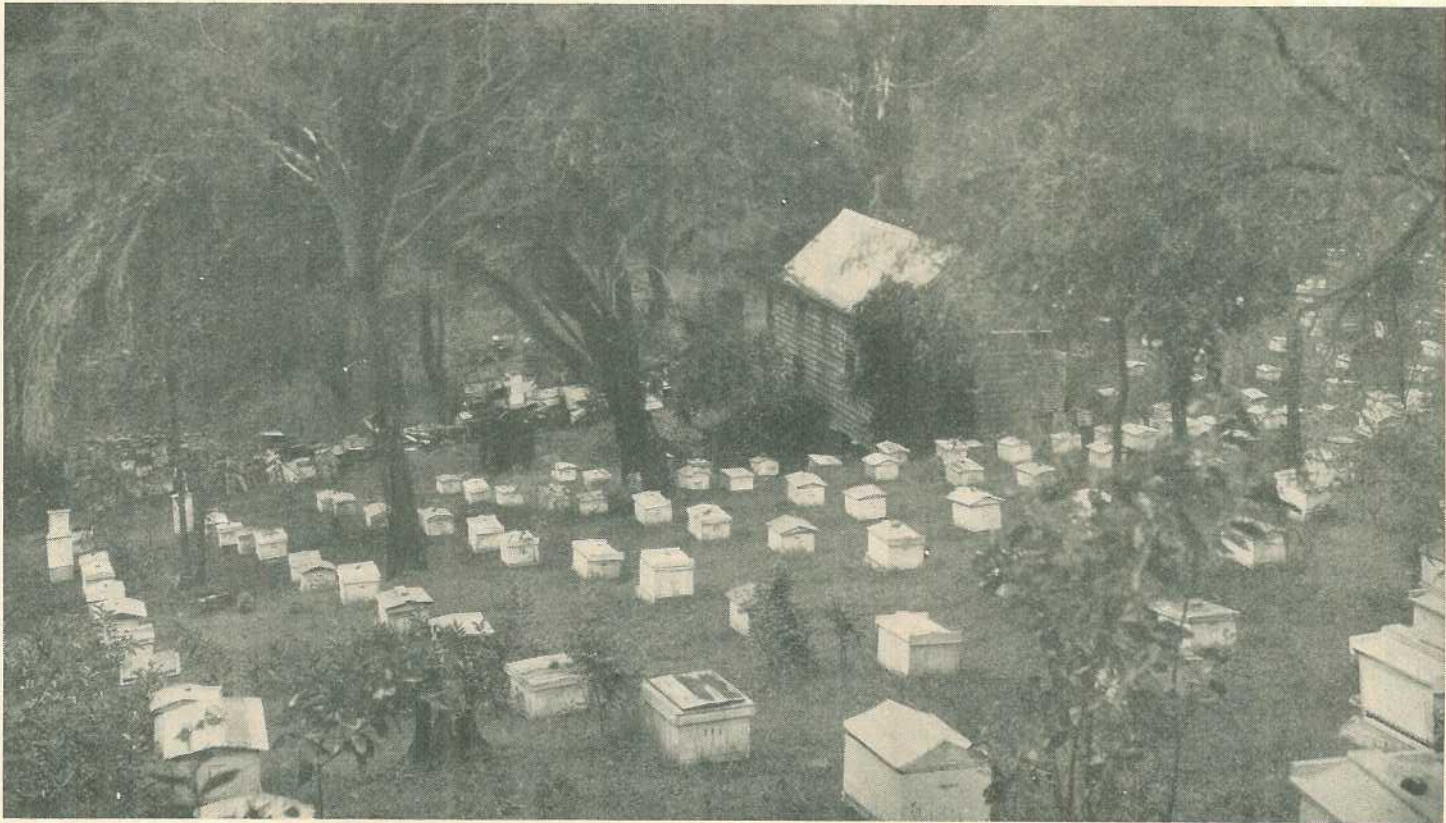


Plate 20.
A Queen-rearing Apiary in Southern Queensland.



Plate 21.

A Migratory Beekeeper's Honey Extracting Plant at Inglewood.

Requirements in Declared Districts.

Districts.—The pastoral districts of Moreton, Darling Downs, Wide Bay and Burnett have been declared as Districts for the purposes of Part II. of the *Apiaries Act*. Within this area of south-eastern Queensland a system of registration is provided which is somewhat different from that under the previous Act.

Registration.—On 31st March in each year, every beekeeper, irrespective of the number of hives, must apply for registration and in doing so must supply certain information on a prescribed form regarding his apiary or apiaries. At a later date, he receives his certificate of registration for the period up to 31st March in the following year. No person is permitted to keep bees unless he is a registered beekeeper. No fees are charged under the Act.

Classification of Apiaries and Distance Limitations.—Unless an inspector decides that a locality has become excessively stocked, no restrictions are imposed on the placing of apiaries consisting of less than forty hives, and for convenience these apiaries are known as Apiaries Class A. Apiaries Class B are those consisting of forty hives or more. *The minimum distance between apiaries of this class is set down as half a mile.*

An Apiary Class C is one consisting of at least forty hives in which queen bees are bred for sale. A certificate indicating that an apiary is an Apiary Class C is issued only after the inspector has certified that the apiary is suitable for the purpose. *The benefit derived from this particular classification is that no other beekeeper is allowed to commence a new apiary within a radius of one mile of an Apiary Class C.* This restriction is provided to help the commercial queen-breeder to maintain the purity of his strain, but it may be noted that any apiary already established within the prescribed limits will not be affected.

The holder of a certificate for an Apiary Class C may, however, give consent for any person to establish an apiary within the one-mile radius, subject always to Department approval.

Certain apiaries consisting of forty hives or more may be classified as Apiaries Class D. The site of such an apiary is intended to be available as a protected site in the event of the beekeeper desiring from time to time to leave it to follow a honey flow. Before a certificate will be issued, the beekeeper concerned must possess a total of at least one hundred and fifty hives, and in effect the site must be one that an inspector considers to be a suitable and convenient centre for that beekeeper's activities. *The owner of an Apiary Class D may remove any or all of his bees from that site to any other site without loss of rights, and in the period between this action and the re-occupancy of this site it is an offence for another beekeeper to establish an Apiary Class B within the half mile radius.* However, in any certificate issued in connection with an Apiary Class D, conditions may be imposed to ensure that such a site is properly "worked" and that other beekeepers are not being unnecessarily restricted in that area. Certificates may be revoked at any time and the number of Apiaries Class D allotted to any beekeeper is determined by the Department.

A beekeeper having either an Apiary Class B or an Apiary Class D may give his written consent for any other beekeeper to establish an Apiary Class B or D at a distance of less than half a mile. If an inspector, after considering the local situation, is of the opinion that the establishment of a new Apiary Class B or D would not prejudice an already established Apiary Class B or D, then permission may be granted for the new apiary to be established and maintained for some determined period.

Sales and Removals.—If a beekeeper sells, establishes or removes an apiary, he must advise the Department of his action within fourteen days. Forms are available for this purpose.

Prohibited Apiary Sites.—The keeping of bees on a site may be prohibited if any provision of the Act is being contravened or not complied with, or if the site has become unsuitable for beekeeping, or if the keeping of bees there is detrimental to public interest. Such a site then becomes known as a prohibited apiary site. If any person establishes or maintains an apiary upon such a prohibited apiary site he is guilty of an offence under the Act.

Registered Brands.—It is necessary for each beekeeper to mark at least one hive in every fifty or part thereof with his registered brand number. This brand number is supplied to each registered beekeeper on his certificate of registration. The marking must be in block letters and figures not less than two inches high and must always be maintained in a legible condition. The marking is to be placed on the front of the hive, and at least one of the hives marked shall be situated in the front row of hives.

Control of Disease throughout Queensland.

The part dealing with the control and restriction of diseases and pests affecting bees is by far the most important portion of the Act and it is in force throughout the whole State.

Frame Hives.—Linked with inspectional work is the necessity to have good facilities for examining hives, and therefore beekeepers are required to keep their bees in frame hives maintained in good condition. A badly constructed or neglected frame hive makes effective examination for the presence of disease very difficult.

Disease Notification.—In the event of a beekeeper noticing a disease in his apiary, he must notify the Department immediately; further, he must not sell or in any way dispose of any bees or materials while they are affected with or liable to spread disease.

Destruction of Diseased Material.—Under the Act power is given to the Minister to order the destruction of any diseased bees or disease-affected material. However, such action will follow only if an inspector has certified that in his opinion the diseased apiary is a source of danger to other bees and ought to be destroyed and the certificate is counter-signed by the Director, Division of Plant Industry.

Quarantine.—Particular areas or buildings may be declared quarantine areas for the purpose of disease control. Until a quarantine is lifted, no person is allowed to remove bees or beekeeping material into, within or out of the area.

Disease Control Powers.—In connection with disease control, samples may be taken by an inspector for investigation, vehicles stopped and inspected, consignments directed to a quarantine area for investigation, instructions given regarding methods of treatment to be carried out and generally any other action may be taken or ordered that may be necessary to effect efficient control.

Queensland has been comparatively free from diseases in bees in the past and every endeavour must be made to keep it so in the future. The requirements relating to diseases were designed with this in mind, and normally they involve very little inconvenience to beekeepers.

Prevention of the Introduction of Disease.

Places of Entry.—In coastal Queensland and along the southern border, certain towns are listed as places of entry. All bees, bee combs, beeswax, hives, honey and appliances coming into this State must come through one of these listed places. By "appliances" is meant gear or apparatus that has been used in beekeeping but it does not refer to new goods. The places of entry are Bowen, Brisbane, Bundaberg, Cairns, Clapham Junction, Coolangatta, Gladstone, Goondiwindi, Killarney, Mackay, Maryborough, Mungindi, Rathdowney, Rockhampton, Texas, Townsville, Wallangarra.

Restriction on Introductions into Queensland.—A consignment coming into Queensland must be accompanied by a declaration completed by the consignee and a certificate must be completed and signed by an approved officer in a Department in the State or country of origin corresponding to the Department of Agriculture and Stock in Queensland to the effect that the consignment comes from a disease-free district. A duplicate copy of this declaration and certificate shall, prior to the introduction, be forwarded to the Department of Agriculture and Stock, Brisbane.

Power to Quarantine Consignments.—Upon arrival at a place of entry the consignment may be directed to a quarantine area for examination, and if found to be affected by disease, it may be detained in quarantine and treated in accordance with instructions.

Power to Return or Destroy Consignments.—A consignment coming into this State without the necessary declaration and certificate shall be either returned to the sender or destroyed in quarantine.

Normally, any consignment coming to the State through a place of entry and accompanied by a properly completed certificate of freedom from disease will not be delayed.

General Provisions.

Beekeeper to Supply Information.—A beekeeper may be required to furnish information regarding queen bees supplied by him or such statistics pertaining to beekeeping as an officer appointed under the Act may reasonably require of him.

Abandoned and Neglected Hives.—In the event of an inspector being satisfied that any bees, hives or appliances have been abandoned and are neglected, he may take possession of them and dispose of them in a prescribed manner or in accordance with instructions from the Under Secretary. This provision may sometimes be very necessary, for an abandoned apiary can easily become a source of nuisance or danger to beekeepers in the locality.

Honorary Field Men.—Honorary field men may be appointed and when required to do so may inquire and report on registration of beekeepers, location of apiaries, classification of apiaries, keeping of bees in frame hives, contraventions of the Act or such other matters as may be thought necessary by the Under Secretary. Honorary field men must be registered beekeepers and appointment will automatically lapse if beekeeping is relinquished by them.

Summary.

The main provisions of the Act may be briefly summarized as follows:—

1. Beekeepers throughout Queensland must keep their bees free from disease and in frame hives to permit of effective examination.
2. Beekeepers in the declared districts must register, provide descriptions of their apiaries, maintain a distance of at least one-half mile between apiaries of forty hives or more, and display their brand number on their hives.
3. All introductions of bees, honey, &c., must be certified as having come from an area free from disease.

Diagnosis of Bee Diseases.

When notifying an outbreak of disease in his apiary, the beekeeper will assist himself, the industry and the Department by sending samples of brood comb for examination by Departmental officers. The piece of comb should measure at least 4 inches by 5 inches and contain as much of the discoloured or dead brood as possible. No honey should be present, and the comb should not be crushed. A wooden or strong cardboard box only should be used for packing the sample, which should be accompanied by an explanatory letter.

ANIMAL HEALTH

Birdsville Disease of Horses.

Prepared by Officers of the Animal Health Station, Yeerongpilly.

FOR very many years a rather unusual disease of horses has been known to occur in parts of western Queensland, being most common in the south-western part of the State, where it was called Birdsville disease after a small township in the area. It is now known to occur in districts as far north as Cloncurry and some years ago cases were seen west and south of Winton in Central-Western Queensland. It is also found in certain parts of the Northern Territory and occasionally in the northern parts of Western Australia.

Recent experimental work has shown this disease to be due to the eating of the plant *Indigofera enneaphylla* (Plate 22).

Symptoms of the Disease.

Grazing horses of all ages are affected. One of the most common signs first seen is a dull sleepy attitude often associated with an uncertain gait. The animal takes little notice of its surroundings and when it moves it often has difficulty in controlling the placement of its hind legs. It easily loses its balance and may lurch a little when walking and sway from side to side. Apparently there is also some difficulty in raising the hind feet from the ground and as a result there is dragging of the foot which in time rounds off the horn of the toe of the hind hooves. This wearing of the horn of the toe is often the only sign noted in many station horses and it indicates a mild chronic form of the disease.

The disease can progress quite rapidly from the time the first symptoms are noted. The dull sleepy attitude is aggravated, the wobbling becomes worse and the animal soon becomes recumbent, often struggling for hours before death.

Some animals appear to recover to a degree and stock-owners have said that the same horse may be affected for two or three years running, appearing to recover partly, if not wholly, after each attack.

Some of these "recovered" cases are quite deceptive. If such horses, which may otherwise be in prime condition and look at first sight to be quite healthy, are galloped they move off smartly at a rapid pace and with a free action. Before half a mile has been covered they start to lose balance and pull up to prevent themselves from falling. If approached they show the greatest distress. They lurch and sway and may fall violently to the ground. On the ground they may show violent tetanic spasms for several seconds while stretched out on their side. Immediately these spasms pass off the affected beast rises at once and

the lurching and swaying commences once again. Such an animal may exhibit great difficulty in respiration. The mouth may be wide open, the nostrils widely dilated, and the air movements in and out through the trachea cause a "roaring" sound. The exact part of the respiratory tract at which this roar occurs has not been determined. Bleeding from the nose has been noted in some of these cases by competent observers.



Plate 22.

A Plant of *Indigofera enneaphylla*.

Stock-owners state that if one wishes to determine whether any horses of a mob are affected all that is necessary is to gallop them for half a mile, when the affected ones will drop out.

Many station workers show a distinct aversion to riding horses which have been known to have had an attack of the disease because of their tendency to show respiratory distress and uncertain gait if ridden hard after cattle.

On post-mortem examination, no lesions are found in the carcase. This is one of the features of the disease.

The Indigofera Plant.

This legume has no common name. It is generally an annual or biennial with a strong central taproot. It is usually prostrate and in good seasons may have a spread of 2 to 3 feet. Its flowers are bright red and the pods very small, usually with two small seeds.

It is a common tropical weed and occurs outside Australia (for example, in southern Asia and the East Indies). Mostly found in Australia in the tropics and subtropics, it is very scattered in the coastal areas but more abundant in the south-western corner of the State and in the area south and west of Cloncurry. It is very common around the bases of the sandhills in the area west of Windorah, especially after good rains. Here it often forms a fairly high percentage of the available grazing and hence it is here the disease is most common.

It is also common in parts of Central Australia and in places in the north of Western Australia.

All observers state that the plant is palatable and readily consumed by horses.

Control of the Disease.

It is difficult to control or prevent the disease except by moving animals right off the affected pastures. Observation has shown that the distribution of the plant varies very much and on some properties it is possible to fence in areas where it is absent or only present to a limited degree. This has already been done in some places. Where possible, drovers with stock should camp in areas where the plant is absent or forms only a small percentage of the pasture and thus keep the amount likely to be eaten by the grazing horses to a minimum. This is often quite practicable.

When cattle are being mustered on stations, camping places should be selected where there is little Indigofera plant which can be grazed. In addition, hand-feeding of the station horses should be practised where practicable.

Admittedly these are only suggestions and cannot always be applied, but much can be undoubtedly done to minimise losses now that the cause of the disease is known.

CHANGE OF ADDRESS.

Journal subscribers notifying change of address should state their full Christian names and surname as well as their full former and new addresses.

Address all communications to the Under Secretary,
Department of Agriculture and Stock, Brisbane.

TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 12th JUNE, 1952.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, "Bingegang," Dingo
A.I.S... ..	F. B. Sullivan, "Fermanagh," Pittsworth D. Sullivan, "Bantry" Stud, Rossvale, <i>via</i> Pittsworth W. Henschell, "Yarranvale," Yarranlea Con. O'Sullivan, "Navillus Stud," Greenmount H. V. Littleton, "Wongalea Stud," Hillview, Crow's Nest J. Phillips and Sons, "Sunny View," Benair, <i>via</i> Kingaroy Sullivan Bros. "Valera" Stud, Pittsworth Reushle Bros., "Reubydale" Stud, Ravensbourne H. F. Marquardt, "Chelmsford" Stud, Wondai W. G. Marquardt, "Springlands," Wondai A. C. and C. R. Marquardt, "Cedar Valley," Wondai A. H. Sokoll, "Chelmsford," Wondai W. and A. G. Scott, "Welena," A.I.S. Stud, Blackbutt G. Sperling, "Kooravale" Stud, Kooralgin, <i>via</i> Cooyar
Ayrshire	L. Holmes, "Benbecula," Yarranlea J. N. Scott, "Auchen Eden," Camp Mountain "St. Christopher's and Iona" Studs, Brookfield Road, Brisbane
Friesian	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny C. H. Naumann, "Yarrabine Stud," Yarraman J. F. Dudley, "Pasadena," Maleny
Guernsey	C. D. Holmes, "Springview," Yarraman
Jersey	W. E. O. Meier, "Kingsford Stud," Rosevale, <i>via</i> Rosewood J. S. McCarthy, "Glen Erin Jersey Stud," Greenmount J. F. Lau, "Rosallen Jersey Stud," Goombungee G. Harley, Hopewell, Childers Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, "The Craigan Farm," Aspley A. Verrall and Sons, "Coleburn Stud," Walloon R. J. Crawford, "Inverlaw Jersey Stud," Inverlaw, Kingaroy P. H. F. Gregory, "Carlton," Rosevale, <i>via</i> Rosewood E. A. Matthews, "Yarradale," Yarraman A. L. Semgreen, "Tecoma," Coolabunia G. & V. Beattie, "Beauvern," Antigua, Maryborough L. E. Meier, "Ardath" Stud, Boonah A. M. and L. J. Noone, "Winbirra," Stud, Mt. Esk Pocket, Esk W. S. Conochie and Sons, "Brookland" Stud, Sherwood Road, Sherwood

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The Importance of the Animal Protein Factor in Rations for Growing Pigs.

K. J. HUTCHINSON, Assistant Husbandry Officer, Pig Branch.

PIG producers have realised for many years that young growing pigs need some feeding-stuff of animal origin as part of their ration if good growth is to be obtained. It has only been of recent years, however, that a vital clue in the explanation of this situation has been found, this being the discovery of vitamin B12, or, to use a broader term, the Animal Protein Factor.

It would appear that although the Animal Protein Factor (A.P.F.) is probably a complex, and not one simple substance, vitamin B12 is by far the most important single constituent. It should be pointed out that all our animal protein concentrates (for example, milk and milk by-products, fishmeal, and meatmeal) are comparatively good sources of A.P.F. or vitamin B12, and that without exception feeding-stuffs of vegetable origin (for example, grains, linseed meal, peanut meal, and lucerne) contain little if any. The presence or absence of A.P.F. does much to explain observed differences in growth potential between these two classes of feedstuffs and why growing pigs need some source of animal protein in their rations if they are to make satisfactory gains.

TYPES OF A.P.F. SUPPLEMENTS.

Since the discovery of the Animal Protein Factor there has been a rapid development overseas of various A.P.F. supplements. These contain a large concentration of A.P.F. and overseas have proved useful in supplementing all-vegetable rations and thereby improving growth (Plate 23).

A.P.F. supplements may be broadly grouped into two main types. Firstly, there are those which are in reality concentrated animal by-products, such as condensed fish solubles and condensed whale solubles. The second group would be better classed as vitamin B12 supplements, since they are not manufactured from any animal source but are the commercial products of fermentation processes using suitable micro-organisms. It should be mentioned that certain strains of these micro-organisms provide very efficient means whereby vitamin B12 can be manufactured commercially for use as a supplement.

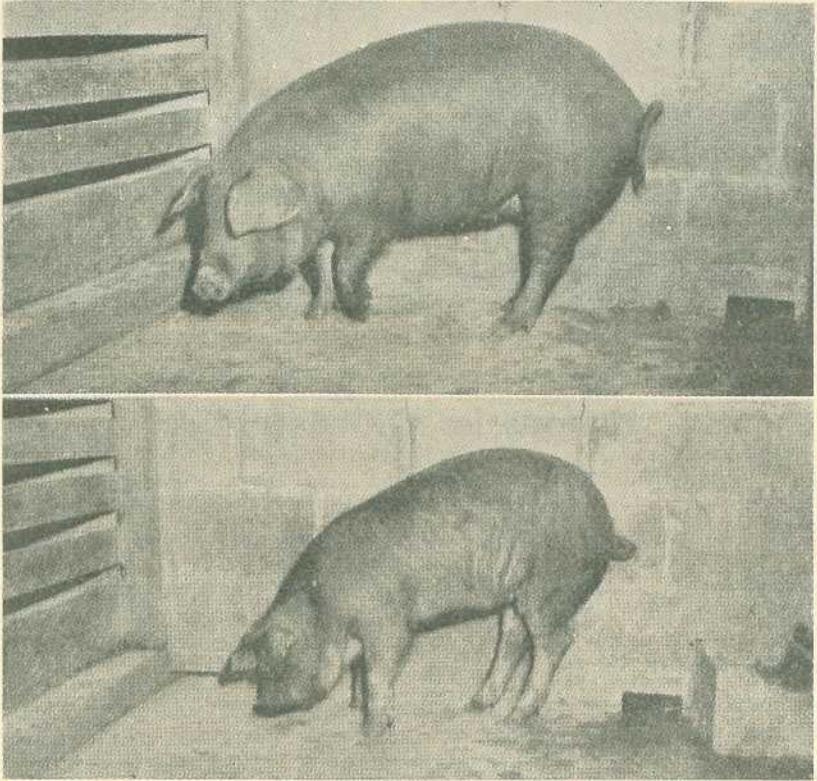


Plate 23.

Value of Animal Protein Factor.—Both pigs received the same all-vegetable meal ration, but the one at the top was fed an animal protein factor supplement as well.

[Photo. from Florida Agricultural Experiment Station Circular S. 13.]

THE VALUE OF A.P.F. SUPPLEMENTS.

It has already been pointed out that the addition of an A.P.F. supplement to an all-vegetable ration will yield better growth. However, the final response to such supplementation will depend on two things:—

- (1) the efficiency of the supplement in providing the needs of the animal for A.P.F.;
- (2) the basic quality of the ration which is to be supplemented.

The second point is an important one. A.P.F. is only one of the many essential factors which determine the growth potential of a ration, and comparative failure from an A.P.F. supplemented ration does not necessarily reflect on the quality of the supplement.

CONDENSED WHALE SOLUBLES AS A SOURCE OF A.P.F.

Recently the Pig Branch of the Department carried out an investigation into the possible A.P.F. supplementary value of a by-product of the Australian whaling industry known as condensed whale solubles (C.W.S.).

C.W.S. is a dark-brown, viscous fluid of similar consistency to molasses. It has a high moisture content (about 50 per cent.); the remainder is largely protein. To test its A.P.F. value, growth figures from three experimental rations were compared. Briefly, the rations and results obtained were as follows.

Experimental Rations.

Group 1.—An unsupplemented grain sorghum-peanut meal and linseed meal ration, devoid of A.P.F.

Group 2.—A grain sorghum-peanut meal and linseed meal ration incorporating 8 per cent. condensed whale solubles as a source of A.P.F. to be studied.

Group 3.—A grain sorghum-meatmeal ration. This ration would supply the dietary needs of young growing pigs for A.P.F. and was included for comparative purposes.

Conclusions.

With Grain Sorghum-Peanut Meal and Linseed Meal Rations:—The addition of 8 per cent. condensed whale solubles to this all-vegetable protein ration provided a growth increase of 27 per cent.

The pigs on the unsupplemented ration were obviously unthrifty, and their A.P.F. deficient diet led to a decreased appetite and a loss of bloom. The absence of these symptoms and the increased growth rate in Group 2 provide evidence that condensed whale solubles contains the Animal Protein Factor.

Comparison of C.W.S. Supplemented Ration (2) with the Grain Sorghum-Meatmeal Ration (3):—As shown hereunder, and in Plate 24, the grain sorghum-meatmeal ration proved vastly superior to the C.W.S. supplemented ration in terms of both growth rate and economy of feed consumption.

Ration.	Growth. (Liveweight Gain in Pounds per Day.)	Economy of Gain. (Pounds Consumed per lb. Liveweight Gain.)	Feeding Cost per lb. Liveweight Gain. (Approx. 1951 Figures.)
Grain sorghum—Peanut meal and Linseed meal with 8% C.W.S. . . . .	.80	4.12	10.35
Grain sorghum—Meatmeal	1.04	3.57	8.27

These differences may be explainable in terms of inferiority in the basic quality of the basic ration which was supplemented with condensed whale solubles. It does not necessarily reflect the inability of an 8 per cent. C.W.S. supplement to provide an adequate dietary source of A.P.F. for young growing pigs.

SUMMARY.

To obtain efficient growth, growing pigs need some source of the Animal Protein Factor in their diet.

Consequently, rations based entirely on feeding stuffs of vegetable origin are unsatisfactory.

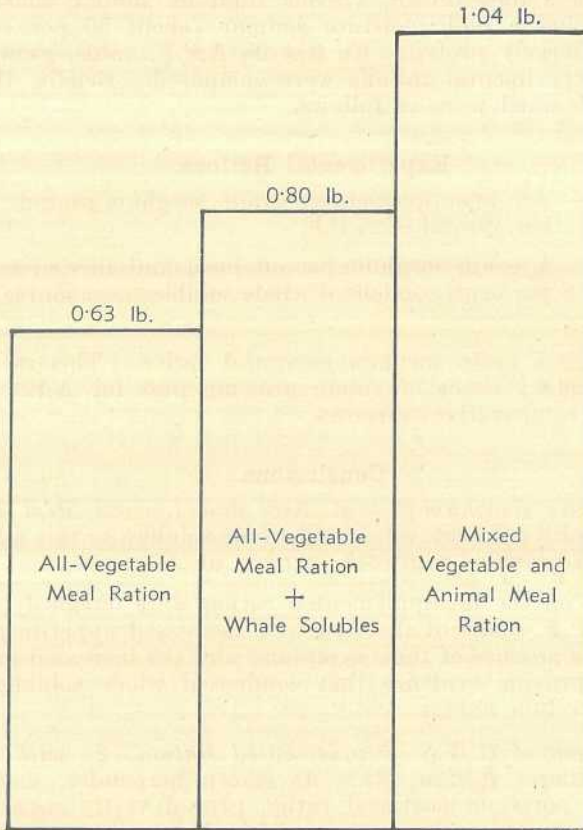


Plate 24.

Diagram Showing the Relative Daily Liveweight Gains of Pigs fed on Various Rations.

It is possible to increase the efficiency of all vegetable rations by adding a satisfactory A.P.F. or vitamin B12 supplement. However, such supplemented rations will yield results comparable to proven rations (for example, one based on meatmeal) only if the basic quality of the unsupplemented ration is satisfactory.

At present, the most satisfactory way of supplying the dietary needs of young growing pigs for A.P.F. is to use an adequate amount of some feeding stuff of animal origin. Such feeding stuffs which contain A.P.F. include milk and milk by-products, meatmeal, fishmeal and whale meatmeal.



Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

A herd listed by the Department as "brucellosis tested" is one in which all such animals as may be determined by the Director of the Department's Division of Animal Industry have been subjected to two successive tests for brucellosis, at intervals determined by him, without any positive reactors being found.

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

TESTED HERDS. (AS AT 12th JUNE, 1952.)

Breed.	Owner's Name and Address of Stud.
Berkshire	S. S. Ashton, "Scotia" Stud, Pittsworth J. J. Bailey, "Lucydale" Stud, East Greenmount S. Cochrane, "Stanroy" Stud, Felton Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield G. Handley, "Handleigh" Stud, Murphy's Creek J. L. Handley, "Meadow Vale" Stud, Lockyer R. G. Koplick, "Melan Terez" Stud, Rochedale H. V. Littleton, "Wongalea" Stud, Crow's Nest O'Brien and Hickey, "Kildurham" Stud, Jandowae East E. Pukallus, "Plainby" Stud, Crow's Nest G. C. Traves, "Wynwood" Stud, Oakey E. Tumbridge, "Bidwell" Stud, Oakey Westbrook Farm Home for Boys, Westbrook H. W. Wyatte, Rocky Creek, Yarraman H.M. State Farm, "Palen Creek," Palen Creek A. R. Ludwig and Sons, "Cryna" Stud, Beaudesert H. H. Sellars, "Tabooba" Stud, Beaudesert F. Thomas, "Rosevale" Stud, Beaudesert Bowkett and Meacle, "Myola Vale" Stud Piggery, Burra Burri, Jandowae D. T. Law, Trouts Road, Aspley R. J. McCullough, "Maxholm" Berkshire Stud, Gatton C. F. W. and B. A. Schellback, "Redvilla" Stud, Kingaroy R. H. Crawley, "Rockthorpe" Stud, via Pittsworth F. R. J. Cook, "Alstonvilla," Woolvi, via Gympie D. E. and E. C. Apelt, "Thelmur," Oakey Mrs. I. M. James, "Kenmore" Stud, Cambooya H. L. Stark, "Florida," Kalbar
Large White	H. J. Franke and Sons, "Delvue" Stud, Cawdor Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield F. L. Hayward, "Curyo," Jandowae J. A. Heading, "Highfields," Murgon K. B. Jones, "Cefn" Stud, Pilton R. G. Koplick, "Melan Terez" Stud, Rochedale R. Postle, "Yarralla" Stud, Pittsworth E. C. Smith, "Smithfield" Stud, Coomera E. J. Bell, "Dorne" Stud, Chinchilla A. G. Fry, "Birubi" Stud, Dalby N. E. Meyers, Halpine Plantation, Kallangur L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, via Rosewood J. H. G. Blakeney, "Talgai" Stud, Clifton

TESTED HERDS—continued.

Breed.	Owners Name and Address of Stud.
Large White— <i>continued</i>	V. P. McGoldrick, "Fairymeadow" Stud, Cooroy N. Woltmann and Sons, Wooroolin R. S. Powell, Kybong, via Gympie E. B. Horne, "Kalringal," Wooroolin S. T. Fowler, "Kenstan" Stud, Pittsworth J. A. and J. McNicol, "Camden," Canning Vale, Warwick
Tamworth	S. Kanowski, "Miecho" Stud, Pinelands N. R. Potter, "Actonvale" Stud, Wellcamp D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun A. C. Fletcher, "Myola" Stud, Jimbour L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, via Rosewood Salvation Army Home for Boys, Riverview F. Thomas, "Rosevale" Stud, Beaudesert A. J. Surman, Noble Road, Goodna P. V. McKewin, "Wattle Glen" Stud, Goombungee Department of Agriculture and Stock, Regional Experiment Station, Kairi P. V. Campbell, Lawn Hill, Lamington E. C. Phillips, "Sunny View," M.S. 90, Kingaroy T. A. Stephen, "Withcott," Helidon W. F. Kajewski, "Glenroy" Stud, Glencoe
Wessex Saddleback ..	W. S. Douglas, "Greylight" Stud, Goombungee K. Day and P. Hunting, "Kazan" Stud, Goodna E. Sirrett, "Iona Vale" Stud, Kuraby C. R. Smith, "Belton Park" Stud, Nara H. H. Sellars, "Tabooba" Stud, Beaudesert H. Thomas, "Eurara" Stud, Beaudesert D. T. Law, Trouts Road, Aspley G. J. Wilson, "Glenbella" Stud, Silverleigh G. J. Cooper, "Cedar Glen", Yarraman J. B. Dunlop, Acacia Road, Kuraby

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Sample of seed
 Drawn from bags
 Representing a total of
 Purchased from
 Name and Address of Sender
 Date.....

SIZE OF SAMPLE

Barley - 8 oz. Oats - 8 oz.
 Beans - 8 oz. Peas - 8 oz.
 Grasses 2 oz. Sorghum 4 oz.
 Lucerne 4 oz. Sudan - 4 oz.
 Millets 4 oz. Wheat - 8 oz.
 Vegetable Seeds - $\frac{1}{2}$ oz.

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 DEPARTMENT OF AGRICULTURE AND STOCK, BRISBANE.

Milch Goats.

G. I. ALEXANDER, Cattle Husbandry Branch.

(Continued from June issue.)

GOAT'S MILK.

Goat's milk is almost pure white in colour and is comparatively rich, with a fat content of about 5 per cent. The fat globules are small in size and, being in a more perfect state of emulsion than in cow's milk, do not come to the surface of the milk on standing as readily as those of cow's milk. The curd of goat's milk forms into very small flakes which, being soluble, are readily digestible. These features allied with the goat's freedom from tuberculosis make it valuable for infants and invalids. Goat's milk has been used in cases of infantile eczema and pink disease.

Its composition varies considerably between animals. The following table gives a comparison between an average sample of goat's milk with other milks of average quality.

	Goat.	Ewe.	Cow.	Human.
	Per cent.	Per cent.	Per cent.	Per cent.
Protein	4.06	5.37	3.3	.98
Butterfat	5.14	3.65	4.0	4.4
Sugar	5.28	5.46	5.0	6.9
Salts	0.58	0.79	0.60	0.45
Total Solids	15.06	15.27	13.18	12.02
Water	84.94	84.73	86.82	87.98

Good goats can give over a gallon a day and some goats produce far beyond this. The average goat kept under good conditions should yield about two quarts of milk daily over a period of seven to 10 months. Three pints a day is considered fair production. A study of the official test records compiled under the British Official Pure-Bred Milch Goat Production Recording Scheme shows that, over a lactation period of 273 days, the average goat under test gave a total of about 2,000 lb. of milk and about 80 lb. butterfat. This means a daily average of about six pints of milk. These are purebred goats and grade animals may not achieve such high production figures. For the householder a good goat is one which will give 800-1,000 lb. (400 quarts) in one lactation.

FEEDING OF MILCH GOATS.

Milch goats require good feed and management, as do other types of farm animals. They are selective feeders and require good quality feed for maximum growth and production.

The most economical feed is good quality pasture. A good pasture is a young leafy growth of grass and legume. As pasture matures, its feeding value decreases and when fed alone it provides a ration of low food value. If goats are not fed supplementary food while pastures are deficient, they will drop in production, lose condition, and ultimately dry off prematurely. Then even when the pasture does improve, it may be a matter of weeks before the does respond, if at all, to the improved feed. Supplementary feeding is therefore essential to maintain milk production.

Constituents of Feed.

Protein.—The protein content of rations is of supreme importance. Proteins are complex chemical groups containing a number of substances known as amino-acids. The proteins fed in the diet are broken down by the digestive processes and by the action of bacteria in the rumen. In the process they are reduced to their component amino-acids and these are then converted into other amino-acids and proteins which go to build up body tissues and muscle and produce milk.

Milking goats and growing kids require more protein in their diet than do bucks and dry stock.

Carbohydrates and Fats.—Carbohydrates and fats form the bulk of the food. They are the energy-producing constituents; they supply energy for movement and maintenance of body heat, and form body fats. They are also responsible for the butterfat and milk sugar (lactose) in the milk of the milch goat.

Fats yield about twice as much energy as carbohydrates. This accounts for the high energy value of foodstuffs, such as peanut meal and linseed meal, which contain relatively high proportions of fat. There is a minimum requirement of fat in the diet below which milk production will fall even though the energy requirements of the animal are met.

Fibre.—This is the coarse less digestible part of the plant, the percentage of which increases as the plant matures. Young green plants are low in fibre while old mature and dry plants contain a high percentage. Fibre has the important function of adding bulk to the diet. The normal processes of digestion in the animal are hindered if there is insufficient fibre. Some fibre is broken down in the rumen or paunch to supply a small part of the energy requirements of the goat.

Minerals.—Minerals are essential for normal growth and development. They are needed for the formation of bone, blood and other body tissues. Many minerals are essential to the goat but only a few are of general importance. These are phosphates, lime, and salt. Many soils, especially in the coastal areas, are deficient in phosphates, and so a deficiency of phosphate may occur in the stock on these areas. Salt and lime deficiencies may occur in hand-fed goats and it may be necessary to add supplements of salt and finely ground limestone or bonemeal.

High producing goats secrete more minerals in the milk at the peak of their production than they are able to absorb from the feed. During the later part of their lactation and in the dry period, the depleted mineral resources are replenished. Good feeding must be continued during the dry period to make available minerals to replenish body stores depleted during the previous lactation.

Vitamins.—Goats, being ruminants, are less likely to suffer from vitamin deficiency than many other animals. Vitamin A is essential to goats and a deficiency may occur in kids if they are deprived of the colostrum or first milk from their dam. Adults rarely suffer a vitamin A deficiency as they can store enough of the vitamin to tide them over any period of the year when it may be deficient or low in their diet. This is the only vitamin likely to be deficient under Queensland conditions.

Classification of Fodders.

Fodders are broadly classified into roughages and concentrates. Roughages are those foods, such as silage, hay, and mature pastures, which contain a relatively low percentage of energy food. There is no sharp dividing line between roughages and concentrates. Important fodders such as mill offals and feeds such as young green crops and pasture occupy intermediate positions between the two. However, when rationing, it is convenient to consider fodders as either roughages or concentrates.

Roughages.

Pasture.—Good pasture is the cheapest and best feed for goats. Paspalum is of higher food value than most Australian summer species, but, as it is affected by frosts, is particularly deficient during winter. Winter-growing species such as the rye-grasses, Toowoomba canary grass (*Phalaris tuberosa*), cocksfoot and white clover are suited for winter grazing. Grasses are constantly changing in chemical composition and so in food value. Young leafy grasses have a much higher food value than those with much stem and those which have commenced to flower or seed.

Lucerne hay.—Lucerne hay varies enormously in food value. As the main protein content of the feed is in the leaves, the amount of leaf is a good indication of the protein content. Good green colour also is an indication of high vitamin A content.

Pasture hay.—This varies widely in food value. First-class hay is obtained from young leafy stands containing a high proportion of clovers and in which the grasses have not fully flowered or seeded.

Oaten and wheaten hay.—These are low in protein when cut at the usual haying stage of "early milk" for wheat and "late dough" for oats, but are equal to lucerne hay in energy value.

Concentrates.

Maize.—Although goats are capable of grinding maize grain, it is better to feed it crushed. Yellow maize is high in vitamin A and fat.

Sorghum.—Sorghum grain is equal to maize in feeding value. It is rich in carbohydrate and relatively low in fibre. The seed is small and hard and should be fed crushed or cracked.

Oats.—With fewer food units per 100 lb. than wheat, maize, barley, or sorghum, bulkiness is the great advantage of oats and crushed oats help to make the concentrate mixture more "open" and attractive to the animal.

Wheat.—Wheat should be fed coarsely ground or crushed. It should be fed mixed with other grains as excessive quantities without other grains may cause bloat or scouring.

Peanut meal.—Peanut meal is high in protein and fairly high in fat and minerals. It is a very useful concentrate. In addition, its palatability makes it a very useful ingredient of a concentrate mixture.

Linseed meal.—Linseed meal is rich in fat and high in protein content. It may be used up to 25 per cent. of the concentrate mixture. It should be fed dry to prevent prussic acid formation.

Cottonseed meal.—This meal is rich in fat, protein, and food units and is highly palatable. It has a similar protein content to peanut meal.

Coconut meal.—High in fat, and moderately high in protein, coconut meal is another very palatable meal.

Meatmeal and blood meal.—These high-protein feeds can be very satisfactory but their lack of palatability presents a problem, especially with some brands of meatmeal. If the goats can be induced to eat them, they are a very useful source of the protein necessary for milk production.

Pollard.—Pollard is about one and a-half times as rich in protein as grain, but the food unit value is slightly lower. A palatable concentrate, it is quite satisfactory in mixtures or alone.

Bran.—Bran has about the same protein content as pollard, but is slightly lower in food units. The advantages of bran are its palatability, its beneficial "leavening" effect on the texture of the concentrate mixtures in which it is used, and its laxative effect.

Molasses.—This feed is fairly high in food unit value, being a concentrated solution of sugars, but has no digestible protein. It is of value in increasing the palatability of feed and may be used to render rather unpalatable mixtures more acceptable to the animal.

FODDER VALUES OF COMMONLY USED FODDERS.

	Food Units (Starch Equivalent).		Digestible Crude Protein.	
	Per 100 lb.		Per 100 lb.	
Hay—				
Lucerne	35		12.0	
Cereal	35		2.0	
Protein-rich Concentrates—				
Blood Meal	60—70		65—70	
Meatmeal	75—80		50—60	
Peanut Meal	75—80		40	
Cottonseed Meal	65—70		40	
Linseed Meal	65—70		30	
Coconut Meal	75		16	
Carbohydrate-rich Concentrates—				
Maize Grain	75		10	
Wheat Grain	70		10	
Oat Grain	60		10	
Sorghum Grain	75		10	
Bran	55		12	
Pollard	65		14	
Molasses	50		..	

Roughage Feeding.

The first essential in feeding the goat is to make sure that it gets adequate roughage. This means that it should have access to all the pasture it can eat. If the pasture is insufficient, other roughages should be allowed. Hay may be used; good quality legume hay is best, but cereal hays are quite suitable if supplemented by the right type of

concentrate. If available, silage is an excellent roughage feed. Free access to hay is probably the easiest way of giving the goat adequate roughage.

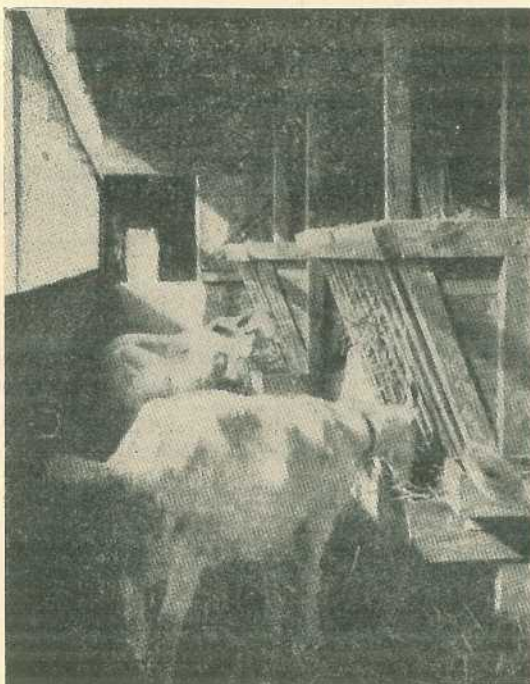


Plate 25.

Goats Feeding from Lucerne Hay Racks in a Barn.

[Photo. by "New Zealand Farmer."]

The usual amount of dry roughage supplied is about 3-6 lb. daily, but an increased weight is required when feeding silage or green crops because of the water content of these feeds.

Concentrate Feeding.

When the roughage requirement of the milking goat has been satisfied, the concentrates to be fed must be considered. The type of concentrate to be fed is determined by a number of factors, of which the three important ones are—kind and quality of roughage; milk production of each goat; and cost of the various concentrate feeds.

The type of roughage fed governs the protein content of the concentrate mixture. If the roughage is good quality lucerne hay, lucerne chaff, young crops or young pasture, the concentrate mixture need only have 10-12 per cent. protein. This may be provided by grain alone or grain plus mill offals (bran and pollard). When the roughage is mixed with legume and cereal hay, mature green crops or good pasture, the concentrate mixture must have 14-16 per cent. protein. If the pasture is mature or cereal hay is provided, from 20-24 per cent. protein is required.

A mixture containing 10-12 per cent. protein is—

Crushed grain	..	..	1 part
Pollard or bran	..	..	3 parts

A mixture containing 14-16 per cent. protein is—

Crushed grain	..	..	3 parts
Pollard	..	..	1 part
Bran	..	..	1 part
Linseed meal	..	..	1 part

A mixture containing 20-24 per cent. protein is—

Crushed grain	3 parts
Bran	2 parts
Linseed meal	4 parts

or—

Meatmeal	2 parts
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In full hand-feeding is being carried out, the matter is simplified. Lucerne hay or chaff requires grain alone or grain plus mill offals. Cereal hay or chaff requires the mixture containing 20 per cent. protein.

Alternative rations are—

(a) For lucerne hay or chaff—

(i.)	Crushed grains	..	..	1 part
	Bran or pollard	..	..	3 parts
(ii.)	Crushed grain	..	..	4 parts
	Linseed meal	..	..	1 part
(iii.)	Crushed grain	..	..	9 parts
	Peanut meal	..	..	1 part

(b) For cereal hay or chaff (oaten or wheaten)—

(i.)	Crushed grain	..	..	3 parts
	Linseed meal	..	..	2 parts
(ii.)	Crushed grain	..	..	3 parts
	Peanut meal	..	..	1 part
(iii.)	Crushed grain	..	..	3 parts
	Bran	..	..	1 part
	Pollard	..	..	1 part
	Linseed meal	..	..	4 parts
(iv.)	Crushed grain	..	..	3 parts
	Meatmeal	..	..	1 part

The amount of concentrate to be fed to a milking doe depends on the amount of milk she produces. A pound of concentrate to each 4 lb. of milk produced is a good basis for feeding a milking goat. A close approximation of this is to feed 1 lb. of mixture per day for every three pints of milk produced. A minimum ration of 1 lb. of concentrate per head is desirable.

If good pasture is not available, dry and pregnant does may be fed about 1 to 1½ lb. daily of a ration such as—

Crushed grain	..	..	1 part
Crushed oats	..	..	1 part

or—

Cracked grain	..	..	1 part
Bran or pollard	..	..	1 part

They should be maintained in a thrifty condition and not allowed to become too fat or to fall away excessively. Pasture or good quality hay may make up all the diet of dry animals, with grain fed just prior to parturition in order to prepare the doe for the following lactation.

The buck may be maintained in good thrifty condition on adequate good quality pasture. If there is insufficient, up to a pound daily of a concentrate mixture may be fed. Suitable concentrate mixtures would be:—

Cracked grain	..	..	8 parts
Bran	..	..	2 parts
Linseed meal	..	..	1 part

or—

Cracked grain	..	..	7 parts
Pollard	..	..	3 parts

REARING THE KID.

If the full supply of goat's milk is not required, the kid may be reared on the goat, allowing the kid the milk in one side of the udder or slightly less, depending on the production of the goat.

If the maximum of milk is required, the kid should be left on the doe for the first two or three days only in order to obtain the colostrum. Alternatively, the kid may be removed from the doe at kidding and fed the warm colostrum four times daily for the first two or three days. This may be done with an infant's feeding bottle. The kid may then be reared on ordinary warmed milk by bottle and gradually taught to drink from a dish. The milk should be warmed to body temperature and fed four times daily for the first three or four weeks, after which the number of feedings may be cut down to twice daily.

If maximum growth is desired, the kid should be fed as much milk as it will consume until about three months of age. Kids may be reared satisfactorily on separated cows' milk after about a fortnight. The change-over from whole to skim milk should be made gradually over about a week. The amount of milk required by a kid is about $1\frac{1}{2}$ to 2 pints daily.

Kids should be encouraged to eat grain as early as possible and some whole grain or a mixture such as a calf meal should be made available after the first week to encourage the kid to nibble the grain. If the maximum amount of milk is required for domestic use, the kid may be weaned at about eight to 10 weeks provided it is fed some grain or meal. After about 3-4 months of age the feeding of the meal may be discontinued if good pasture is available.

MANAGEMENT OF THE BUCK.

The buck requires careful management. He should not be mated too soon or too frequently. With adequate feeding, a buck can be used at 10 months without fear of stunting his growth. The buck becomes sexually active at about six to seven months and should be segregated from the females before that age. A separate yard should be provided for the buck and the does in season should be brought in to him and removed after service.

Although the buck will not give very much trouble when running with the herd, this practice nevertheless has great disadvantages in

contamination of milk. The buck contaminates the doe with the odour associated with him at mating time and the milk may be tainted at milking time.

The yard in which the buck is run should be large enough to allow him plenty of exercise. If kept clean by fairly frequent washing, the buck will not have any objectionable odour. It is desirable that he be taught to lead and tie up so as to be handled easily.

MANAGEMENT OF THE DOE.

Goats may breed throughout the year but usually they come in season only during the period February-March to September. During this period they will come in season every two to three weeks if not mated. They usually stay in season for two to three days.

Goats will mate at six to seven months, but unless the young doe is well grown it is preferable not to mate it until 12-18 months of age. As the gestation period or duration of pregnancy is approximately 150 days, the doe will then be $1\frac{1}{2}$ -2 years old when her first kids are born.

When a doe comes in season, she becomes very restless and will go off her feed. She will bleat persistently and frequently shake her tail rapidly. Usually the vulva swells considerably and becomes reddened.

Although goats usually come in oestrus for two to three days, the period of oestrus may sometimes be quite short and last only a few hours, so careful attention must be paid to the doe when considering mating her.

The surest sign of pregnancy is absence of oestrus subsequent to service. If a doe is carefully watched for two to three weeks after mating and no sign of oestrus is seen, it may be assumed that she is pregnant.

The condition of the pregnant doe exerts a great influence on the weight of the kids at birth and also on the subsequent lactation. She should be fed well and allowed plenty of exercise.

The signs of approaching parturition are enlargement of the vulva, hollowing of the flanks, restlessness, and continual bleating. The udder usually hardens and springs before kidding.

At parturition there should be as little outside interference as possible. As goats are relatively free from trouble at kidding, assistance is seldom required.

The usual number of kids is two, but frequently there are three, and occasionally four kids.

After kidding, the doe immediately licks the kid dry and usually the kid will then begin to suckle the udder. The afterbirth usually comes away within one or two hours; should it be retained for more than 24 hours, a veterinary surgeon should be consulted.

The doe may be fed a bran mash after kidding. This has a laxative effect and to some extent assists the animal to clean. The bran mash may be prepared as follows:—To half a pound of bran and one teaspoonful of salt, add half a pint of boiling water. Cover the mixture with dry bran and then cover with a lid or cloth. The mash should be fed when cool. As mash sours readily, it should always be freshly prepared.

For the first three to five days after kidding, the milk, called colostrum or beastings, is unsuitable for human consumption. However, it is essential for the kids as it contains a high proportion of plasma proteins and vitamins which give the kids some measure of resistance to the diseases associated with young animals.

HERMAPHRODISM.

An hermaphrodite is an animal which has the genital organs of both sexes. This defect occurs in goats more than in any other domestic animal. The tendency to hermaphrodisism is hereditary and appears to be associated with polled or hornless animals, as horned animals are not affected. There is apparently some heritable linkage between the polled character and hermaphrodisism. This is more noticeable the more closely the animals are bred. If possible, one of the parents used in breeding goats should have (or have had) horns.

MILKING.

Milking may be done either from the side or from behind, depending on the milker's choice. However, it is preferable to milk from the side.

Before milking, the udder and teats should be thoroughly cleaned with a damp cloth, and it is of advantage to give the animal a quick groom to prevent hairs from falling into the bucket and causing odours in the milk. When milked out the udder should be small and elastic with no appearance of flabbiness. A big disability with "town-bred" goats is the small size of the teats. This does not occur with Saanen goats. Frequent milking tends to increase the yield, but two milkings in 24 hours spaced as evenly as possible are sufficient for average goats. Regularity and completeness of milking are big factors in keeping up the milk flow. A long lactation period is more important than the amount produced per day, and in purchasing animals this point should be borne in mind.

Care is necessary in milking, as rough handling may predispose to mastitis.

Machines for milking goats are available and are particularly useful where a number are milked daily. Using machines, it takes about two minutes to milk each goat. The machines must be carefully cleaned and tended and should be looked after in the same manner as milking machines for cows.

DEHORNING OR DISBUDDING.

There are two common methods of dehorning kids, namely chemical and cautery or hot iron.

Chemical Dehorning.

Caustic Sticks.—Kids up to 10 days old can be treated with caustic soda or caustic potash. Caustic soda has a tendency to spread and cause injury to surrounding tissues, so caustic potash is preferred.

Each "button" or horn bud is clipped to the size of a one shilling piece and then petroleum jelly is smeared outside the horn bud to check the caustic from running into the kid's eyes. The caustic stick is moistened and rubbed over the horn bud with a circular motion until blood just starts to seep through the spot.

The caustic should only be applied to the area of skin covering the horn bud. Too much caustic may cause excessive burning and scarring of the head; too little rubbing will leave unsightly scars.

Care should be taken not to get any caustic on clothing or skin, as it is very injurious.

Afterwards the kid should be tied up for at least six hours in a place where it cannot get wet. This is to prevent scratching, rubbing or wetting, which may spread the caustic.

Antimony Trichloride.—This product has been incorporated in a solution of flexible collodion to form a very satisfactory dehorning agent.

The solution can be made up by a chemist according to the following formula:—

	per cent.
Antimony trichloride	28
Salicylic acid	7
Flexible collodion	65

The material is easy to apply and dries readily. There is much less pain associated with this than with caustic sticks and no danger of fluid running into the eyes. The solution is painted on after the area of application has been cleaned with methylated spirits. The animal need not be tied up or kept out of the rain.

Cautery or Hot Iron.

This method of dehorning is simple, efficient, safe and only slightly painful. A special debudding iron is used for the operation. The iron consists of a solid cylinder of iron or copper five-eighths of an inch in diameter, one end of which is hollowed to form a depression three-eighths of an inch in diameter and half an inch deep. This makes the end of the cylinder a metal ring one-eighth of an inch thick with five-eighths of an inch external diameter and three-eighths of an inch internal diameter. The iron is mounted in a wooden handle for convenient use. The iron may be made smaller if required as it is intended to give a snug fit over the horns to be removed. A soldering iron may be converted fairly readily into an efficient dehorning iron.

The iron is heated to a cherry-red colour and placed over the horn. It is then turned completely around several times until the base of the horn is completely covered by a copper-coloured ring. This indicates that the circulation of blood to the horn has been destroyed. The operation takes 10-30 seconds and the horns drop off by themselves three to six weeks later. There is no haemorrhage, as the vessels are sealed by heat, and the wound produced is dry and clean, heals quickly and completely and cannot burn the dam's udder as caustic may do.

An electric soldering iron with a copper tip containing a hollow cone point similar to that described for the ordinary iron may be used if desired.

Older goats may be dehorned with cup dehorning devices as used for cattle. This operation is described in a leaflet on dehorning of cattle issued by the Department.

[TO BE CONTINUED.]

ASTRONOMICAL DATA FOR QUEENSLAND.

AUGUST.

Supplied by W. J. NEWELL, Hon. Secretary of the Astronomical Society of Queensland.

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.30	5.18	Cairns ..	18	40	Longreach ..	30	40
6	6.27	5.21	Charleville ..	25	29	Quilpie ..	36	34
11	6.23	5.23	Cloncurry ..	42	58	Rockhampton ..	5	15
16	6.19	5.26	Cunnamulla ..	30	28	Roma ..	16	18
21	6.14	5.28	Dirranbandi ..	21	17	Townsville ..	16	34
26	6.10	5.31	Emerald ..	14	24	Winton ..	34	46
31	6.04	5.33	Hughenden ..	27	43	Warwick ..	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.			MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).							
			Charleville 27 ;		Cunnamulla 29 ;		Dirranbandi 19 ;			
			Quilpie 35 ;		Roma 17 ;		Warwick 4.			
At Brisbane.			MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).							
Day.	Rise.	Set.	Emerald.		Longreach.		Rockhampton.		Winton.	
	p.m.	a.m.	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	12.15	1.44	30	10	45	25	20	0	53	28
2	1.11	2.49	24	13	41	28	16	3	47	31
3	2.16	3.53	13	25	28	41	3	16	31	48
4	3.26	4.53	9	30	25	45	0	21	26	53
5	4.40	5.46	15	22	30	38	6	13	35	44
6	5.52	6.33	26	25	12	42	17	2	49	30
7	7.01	7.14	31	30	9	45	24	0	53	26
8	8.08	7.51								
9	9.12	8.26								
10	10.16	9.01								
11	11.19	9.36								
12		10.14								
13	a.m.									
14	12.21	10.56								
15	1.21	11.42								
16	2.18	12.33								
17	3.11	1.26								
18	3.59	2.22								
19	4.42	3.18								
20	5.19	4.13								
21	5.52	5.07								
22	6.22	6.00								
23	6.50	6.52								
24	7.18	7.44								
25	7.46	8.38								
26	8.15	9.34								
27	8.48	10.32								
28	9.25	11.33								
29	10.08									
30	10.59	12.35								
31	11.58	1.38								
	p.m.									
	1.05	2.38								

At Brisbane.			MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).							
Day.	Rise.	Set.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
			Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	5.4	5	67	34	51	20	44	6		
3	5.5	2	68	32	51	17	45	3		
5	4.7	7	63	35	47	21	39	8		
7	3.6	19	55	43	40	28	30	17		
9	2.4	31	46	52	31	37	21	27		
11	1.3	43	39	59	24	45	12	36		
13	8	52	36	65	21	50	8	44		
15	2	56	33	67	17	53	3	46		
17	5	52	35	65	19	50	5	44		
19	11	45	38	60	23	46	10	37		
21	20	36	43	55	28	40	17	31		
23	29	26	50	47	35	33	25	22		
25	40	15	57	41	42	26	33	14		
27	48	7	63	35	48	21	40	8		
29	55	4	68	33	51	19	45	5		
31	54	3	67	32	51	18	44	4		

Phases of the Moon.—Full Moon, 6th August, 5.40 a.m.; Last Quarter, 12th August, 11.27 p.m.; New Moon, 21st August, 1.20 a.m.; First Quarter, 28th August, 10.03 p.m.

On 15th August the sun will rise and set 15 degrees north of true east and true west respectively, and on the 8th and 23rd the moon will rise and set very close to true east and true west respectively.

Eclipses.—On 6th August there will be a partial eclipse of the moon, the moon entering the umbra of the earth's shadow at 4.33 a.m. and remaining within the umbra until after sunrise.

On 21st August, Eastern Australian Date, there will be an annular eclipse of the sun, but it will not be visible from Australia. The path of the annular phase is mostly over ocean, but portion passes over South America.

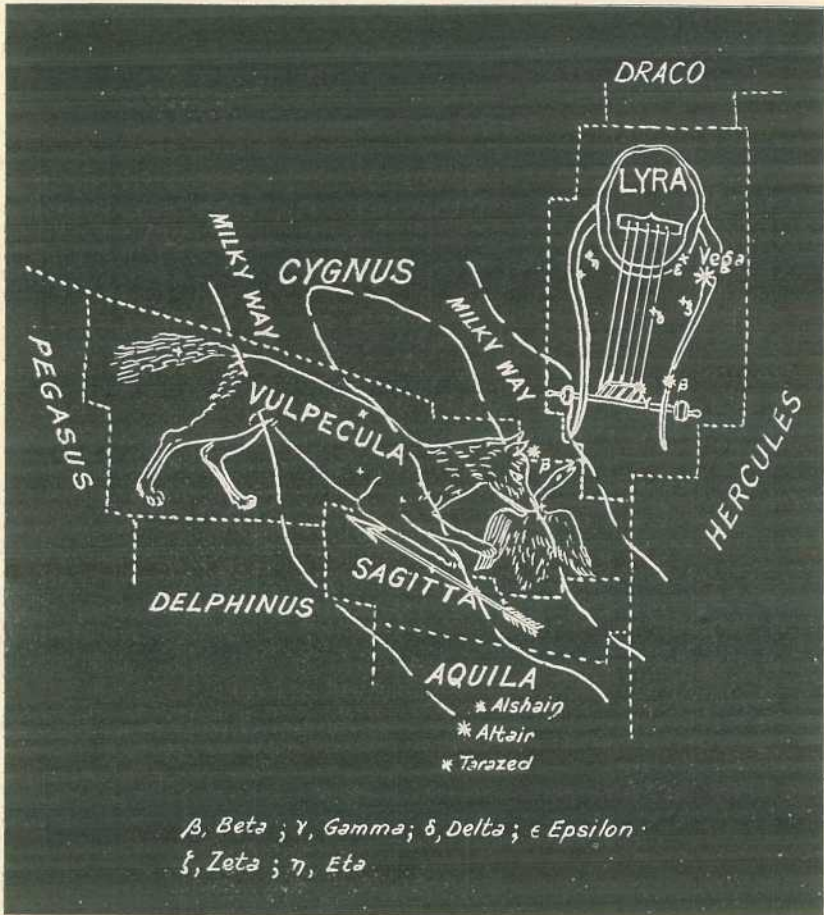
Mercury.—At the beginning of the month, in the constellation of Leo, will set about 1½ hours after the sun. By the 12th it will be in line with the sun, after which Mercury will pass into the morning sky, reaching greatest angle from the sun on the 30th, when it will rise about 1 hour before sunrise.

Venus.—Now a conspicuous object in the western evening sky. In the constellation of Leo, on the 1st it will set about ¾ hour after the sun, but by the end of the month, in the constellation of Virgo, it will set 1 hour 22 minutes after sunset. Venus will be near Mercury on the 4th and the moon will pass close to Venus on the 22nd.

Mars.—In the constellation of Libra, will set about midnight during this month. The moon will be close by on the 28th.

Jupiter.—In the constellation of Aries, will rise near midnight at the beginning of August and about 1 hour before midnight at the end of the month. The moon will pass Jupiter on the morning of the 12th.

Saturn.—At the beginning of the month, will set between 10 p.m. and 11.15 p.m., and at the end of the month will set between 8.15 p.m. and 9.30 p.m.



THE CONSTELLATIONS.

LYRA.

This constellation is said to represent the lyre that Hermes made from a tortoise shell and was given by Apollo to his son Orpheus, who played it to the Argonauts on their famous voyage. It is a small constellation directly to the west of Cygnus. Vega (Alpha) is the brightest star of the group and is an optical pair, the brighter component being 0.2 magnitude and the companion 10.5 magnitude separated by 56.4 seconds of arc. It is towards this part of the celestial sphere that our sun, with its "family" of planets, is moving with a velocity of about 13 miles per second. Beta Lyrae, about 6 degrees in the direction of Altair from Vega, is a well known eclipsing binary with a period of 12 days 22 hours. About 2 degrees from Vega in the direction of Alpha Cygni is the famous "double double," Epsilon Lyrae, one of the most striking objects in the sky. Acute eyesight will show this star as a double of about 4 and 5 magnitudes, but binoculars are needed to show them clearly. A small telescope, however, will show that both of these components are themselves double, one pair separated by 2.9 seconds of arc and the other pair by 2.3 seconds. Zeta, Delta and Eta are also doubles.

VULPECULA (THE FOX).

Situated to the east of Lyra and north of Delphinus and Sagitta, this constellation originally represented the Fox and the Goose. It is, however, a very inconspicuous group, consisting mostly of fifth magnitude stars. The famous Dumb-bell Nebula is situated in this constellation.