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DEPARTMENT OF AGRICULTURE

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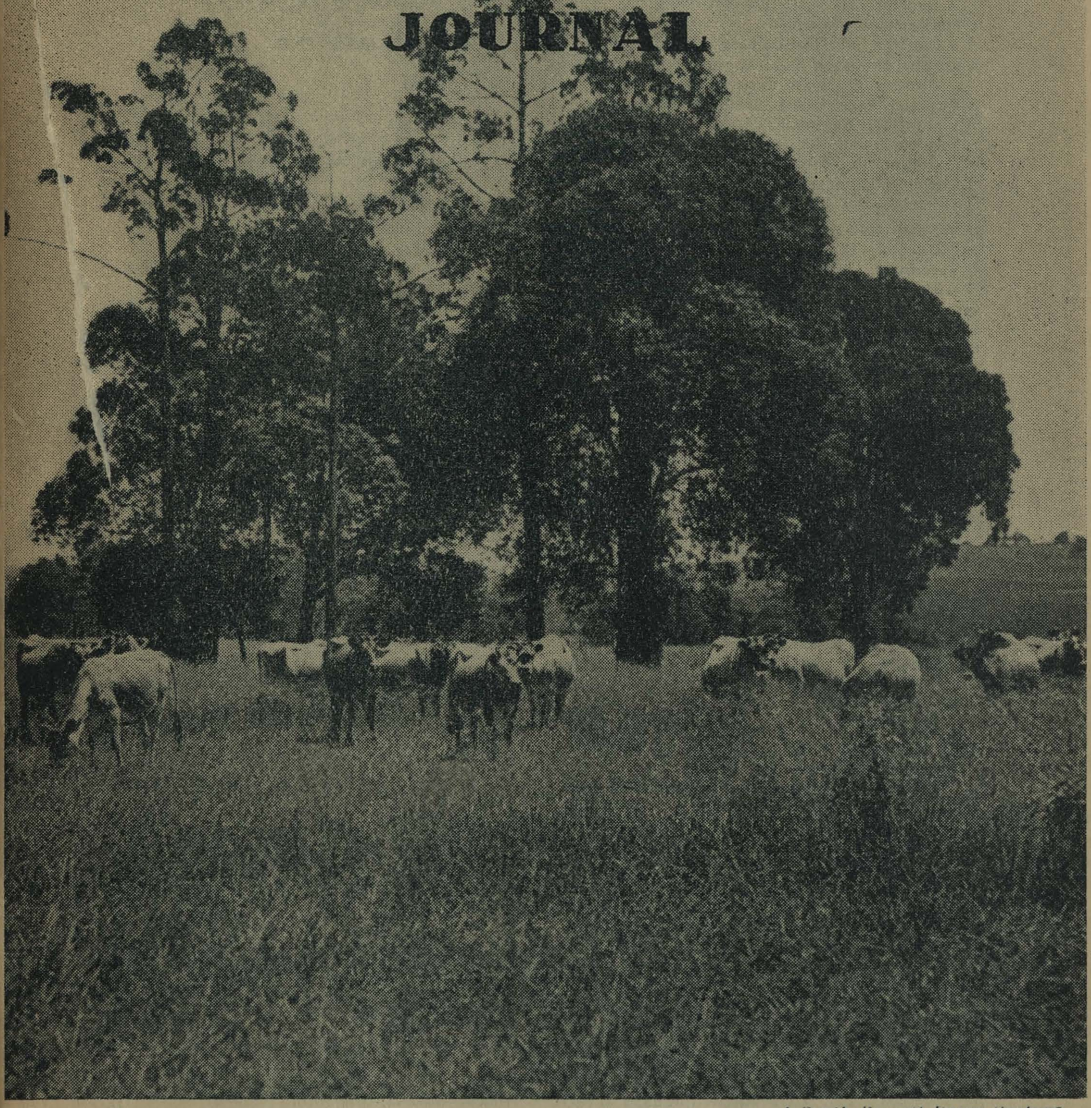

A South Burnett Dairy Pasture.

LEADING FEATURES

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Contents

Agriculture in the South Burnett.

J. A. KERR, Plant Breeder.

THE history of the development of the South Burnett commenced with the establishment of the big station properties a little over a hundred years ago. Prior to 1846, Haly Bros. occupied and developed Taabinga Station, with an area of approximately 305 square miles. Burrandowan, Nanango, Barambah, Wigton, Mondure, Tarong and other large stations also date from that period. Apparently, the first signs of closer settlement date back to 1883, and from that year until 1904 was the truly pioneering period of the South Burnett.

Farm produce, such as maize, had to be transported by German waggon to the nearest rail head—Kilkivan, Esk or Jondaryan—with consequent poor nett returns to the producer in many cases. The first cream was forwarded by road to Kilkivan and thence by rail to Maryborough in 1901.

A boom in timber accelerated land clearing from 1900 to 1910 and this was possibly the biggest single factor associated with the closer settlement of the district.

Extensions of the railway to Wondai in 1902 and to Kingaroy late in 1904 were landmarks in the history of the South Burnett. Later, branch lines were constructed from Murgon to Windera and Proston, and from Kingaroy to Tarong and Nanango.

Earliest development of the South Burnett was associated principally with sheep, but these were superseded by beef cattle, which are still of major importance in the district. Agricultural development led to the district being the most important maize producing centre in Queensland. The value of dairying to the district is reflected in the production of the five large butter factories. In the early twenties, a new era of prosperity commenced with the expansion of the peanut industry. The value of the 1947 peanut crop exceeded £1,000,000.

The boundaries of the South Burnett are approximately the Coast Range and Jimna Range on the north-east and east, the Blackbutt Range on the south, the Bunya Range on the south-west to west, and a

line up to and along latitude 26 degrees to rejoin the Coast Range. The area included exceeds 4,000 square miles, and is composed principally of undulating country, the greater portion of which has an altitude in excess of 1,000 feet.

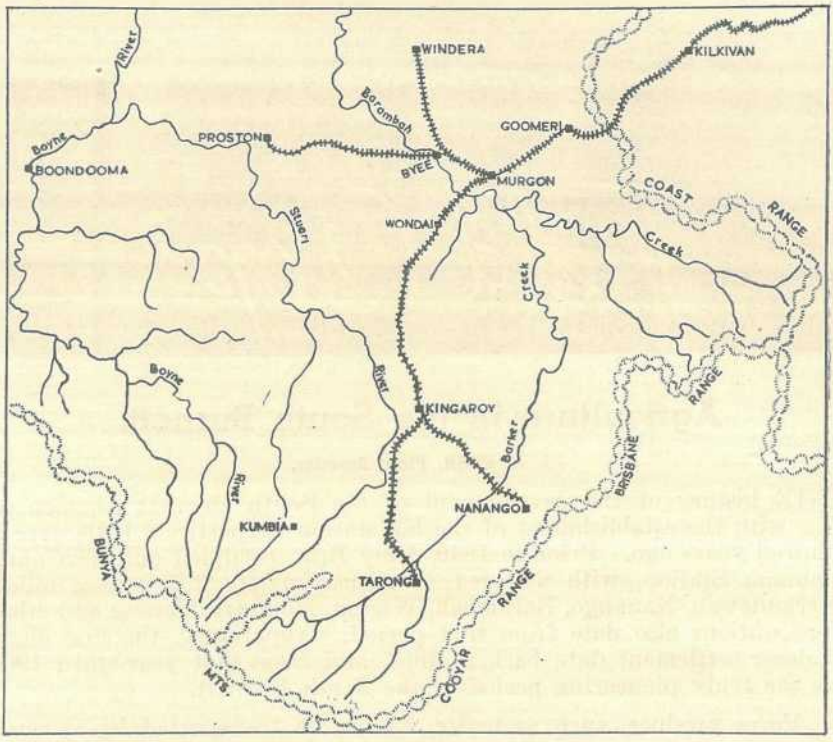


Plate 154.
Sketch Map of the South Burnett District.

By far the greater proportion of farm land in the South Burnett is freehold, only a small proportion being perpetual lease or other form of Crown lease.

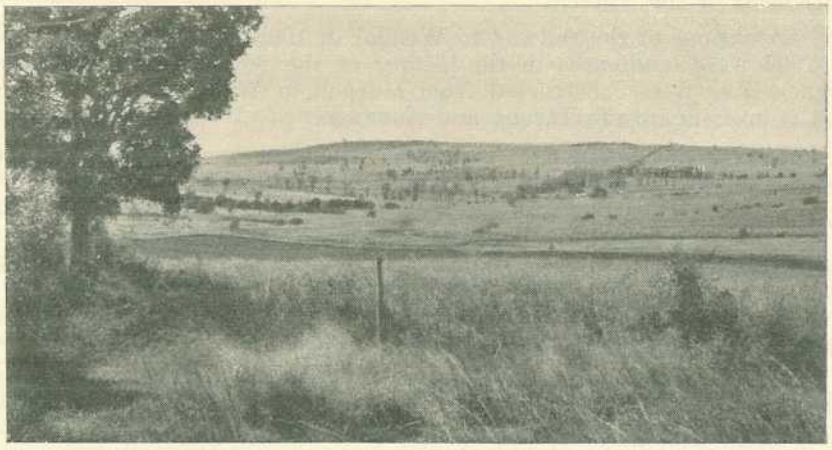


Plate 155.
Farmlands in the Coolabunia District, Near Kingaroy.

Centrally situated in the district is Kingaroy, in which the dominant feature is the group of peanut silos, symbolising the importance of the peanut growing industry to the town and district. Murgon, Nanango, Wondai, Goomeri, Proston, Yarraman and Kumbia are strategically situated to service the farming and grazing community.

The principal watercourses of the district are Barker's, Barambah and Boonara Creeks and the Boyne and Stuart Rivers, all of which have many tributaries. Although normally the streams run during the wetter portion of the year only, they are rarely completely dry.

VEGETATION.

With the exception of land held by the Forestry Sub-Department in the Yarraman district, practically all of the rich rain-forest land has been cleared to form the backbone of maize and peanut production combined with dairying and pig raising. This luxuriant rain forest was originally composed of a wide range of plant types and was similar to the rain forest found near the coast east of Gympie and on the highlands of the Blackall Range.

The adjacent open hardwood forest mainly consists of species of eucalypts associated with a wide range of native grasses. The better class forest country has also been closely settled, and there are few possibilities of expansion in these parts of the district.

In addition to the rain forest and open forest types of vegetation, an extensive area of brigalow and belah forest occurs in the Durong and Boondooma districts.

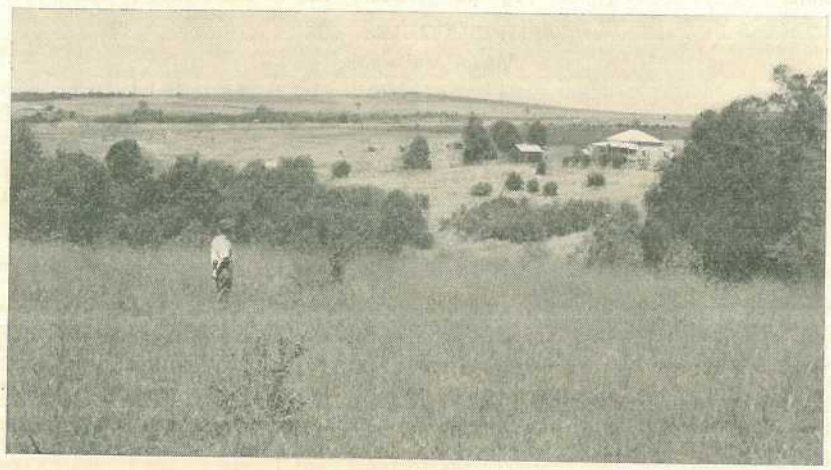


Plate 156.

Mixed Farming Country Near Coolabunia. The Rhodes grass in the foreground was sown on rain forest land.

Of the estimated 4,000 square miles in the area under consideration, probably little more than 500 square miles could be included in the total area suitable for cultivation, and this would include a very large area of second class country with limited agricultural possibilities. Large areas of this second class country are now being cleared by machinery and used for the production of peanuts and grain sorghum

and for dairying. Further expansion of agriculture in the South Burnett is restricted almost entirely to this class of country, and it appears that the balance of agriculture and grazing will change little in the future.

CLIMATE.

Fairly high temperatures are generally recorded throughout the summer months, with considerable variation in the relative humidity. Winter temperatures are generally low, with a high number of frosts during the period from May to mid-August, portion of the district enjoying the doubtful honour of closely following Stanthorpe's minimum recordings in this regard.

The district average rainfall varies from 25 to 30 inches. At Kingaroy the average is approximately 28·8 inches, of which 73·6 per cent. falls during the six months from November to April. This preponderance of summer rainfall automatically determines the range of crops grown in the district, and accordingly winter cereals are of minor importance in the South Burnett. However, while the summer rainfall

TABLE 1.

CLIMATIC DATA FOR SOUTH BURNETT CENTRES.

RAINFALL—(POINTS).

——	No. of Years.	Jan.	Feb.	Mar.	April.	May.	June.
Kingaroy	37	484	327	321	165	111	190
Murgon	33	522	364	272	189	137	214
Nanango	68	465	393	342	193	155	195
Wondai	34	516	330	264	170	122	211
TEMPERATURES—(°F.).							
Mean Maximum.							
Kingaroy	3	85·0	83·6	79·9	74·1	70·9	65·8
Nanango	22	85·1	83·9	81·2	77·3	71·4	66·6
Mean Minimum.							
Kingaroy	3	59·4	63·5	61·8	50·7	43·8	38·1
Nanango	22	62·6	62·0	58·5	50·5	42·5	38·4
RELATIVE HUMIDITY—(PER CENT.).							
Kingaroy 9 a.m.	3	62	74	80	74	74	78

RAINFALL—(POINTS).

——	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Kingaroy	140	92	152	201	291	408	2,882
Murgon	132	86	142	234	332	452	3,076
Nanango	165	129	291	219	286	386	3,099
Wondai	143	97	152	237	339	483	3,064
TEMPERATURES—(°F.).							
Mean Maximum.							
Kingaroy	66·3	69·1	72·7	79·4	82·5	84·3	76·1
Nanango	66·0	69·3	74·6	80·5	84·0	85·5	77·1
Mean Minimum.							
Kingaroy	35·1	38·8	44·9	52·6	56·6	63·9	50·7
Nanango	36·7	36·9	43·6	50·7	57·0	60·6	50·0
RELATIVE HUMIDITY—(PER CENT.).							
Kingaroy 9 a.m.	76	71	62	60	60	68	70

average would indicate satisfactory totals for production of most summer crops suited to this climate, the establishment of these crops is dependent on storm rains occurring from October to January. Storm rains, however, are most erratic and irregularly distributed, and frequently are only sufficient for planting in isolated portions of the district until late in the planting season; late planting entails the risk of destruction of the crop by frost before maturity.

Table 1 gives official rainfall averages for Kingaroy, Murgon, Nanango and Wondai and in addition temperature averages for Kingaroy and Nanango. No temperature records are available from Murgon or Wondai and those for Kingaroy are available for three years only. Local unofficial records, however, show a highest reading of 109 degrees and a lowest grass minimum of 8 degrees.

SOILS.

The most important agricultural belt coincides with volcanic flows, principally basaltic, which have formed an undulating topography. The slopes are gentle with broad ridges. The belt extends from Yarraman to Proston; it is approximately 70 miles long and varies in width from 3 to 15 miles. In addition to the main belt, there are several "islands" of basaltic origin, such as the Tablelands (near Murgon) and Dangore Mountain. The soils are classified as red loams, the general features of which are relatively great depth, with little or no evidence of differentiation into horizons in the profile. The red colour is due to the presence of free iron oxide formed in the weathering processes. Locally, the soils are divided into two classes and are described as scrub and forest. The former is associated with the rain forest vegetation and the latter with the open hardwood eucalypt forest.

Plate 157.

A Farm Residence in the South Burnett.

The scrub soils invariably occur on the more elevated areas of the undulating landscapes and the forest soils on the lower slopes. Scrub soils are slightly acid to neutral, mostly well supplied with plant foods, and are highly productive. The forest soils are mostly moderately acid

and though fairly fertile are not so highly productive as the scrub soils. There is a tendency for the formation of a subsoil of higher clay content in the forest soils.

The soils in the natural state all have a well developed granular crumb structure, are free working and friable, and though readily permeable to water have a fair moisture holding capacity. The structure of the forest soil is less stable than that of the scrub soil.

Up to 10,000 acres of rich alluvial soil are found along Barker's, Barambah and Boonara Creeks. The area of brigalow and belah scrub in the Durong and Boondooma districts is associated with a brown to dark grey clay to clay loam soil, occasionally with melon-hole formation. The balance of the district consists mainly of sandy loam to gravelly loam ridges of fair fertility, used principally for grazing. These areas usually contain a number of small but fertile alluvial flats.

SOIL EROSION.

Soil erosion has been a serious problem, especially in the red soil belt. These soils were reasonably resistant to erosion in their virgin state, largely because of their good structural development, but intensive cultivation and lack of suitable crop rotation have destroyed the soil structure. A large acreage of this soil is on slopes of from 5 to 8 per cent., and sheet and rill erosion have removed much of the top fertile soil.

First steps to control this erosion mechanically were taken in the 1939 season. They involved the use of contour banks and water diversion channels. The success of these early projects created considerable interest in the district and led to the adoption of similar methods of erosion control by many farmers.

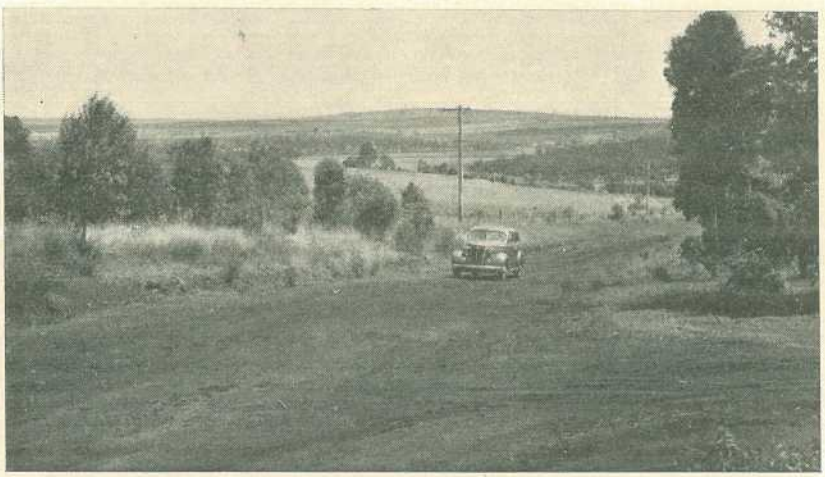


Plate 158.

View of Wooroolin Country from the Memerambi Road, Near Kingaroy.

The control of erosion, however, on these soils must always be dependent on satisfactory cropping practices. The suitability of Rhodes grass (*Chloris gayana*) for the scrub soil indicates a simple effective rotation. Broadly speaking, the suggestion is to plant 10 per cent. of

available cultivation with a perennial grass (preferably Rhodes grass) each year, leaving each area in grass for three years before returning to crop, and rotating the various cultivated crops within the remaining seven-year period. This rotation will do much to improve and maintain soil structure and fertility. Variations in cultivation methods designed to incorporate the maximum quantities of crop residues into the surface soil are also recommended. Where virgin sloping land is brought into cultivation, the immediate adoption of both mechanical control measures and crop rotation is recommended. Under any circumstances, of course, crop rotation is highly desirable.

WATER FACILITIES.

While the portion of the South Burnett devoted primarily to grazing is fairly well watered by creeks, the main dairying and agricultural belt is dependent on underground water supplies for stock purposes. Generally little difficulty is encountered in locating satisfactory underground supplies.

A large number of irrigation plants are found along Barker's and Barambah Creeks. A plan to weir Barambah Creek has been prepared and on completion should increase production in these areas.

PASTURES.

The native pastures are composed of a wide range of species, including the following:—Queensland blue grass (*Dichanthium sericeum*), pitted blue grass (*Bothriochloa decipiens*), forest blue grass (*Bothriochloa intermedia*), kangaroo grass (*Themeda australis*), love grasses (species of *Eragrostis*), burr grass (*Cenchrus*), spear grasses (species of *Stipa* and *Aristida*) and reed grass (*Arundinella*).

There is also a large range of native legumes growing in the native pastures, of which the commonest are *Glycine tabacina* and *Rhynchosia minima*. These legumes, however, do not form any considerable proportion of the total ground cover.

The carrying capacity varies considerably in accordance with the percentage of better grasses, and may range from one beast to five acres to one to twelve acres. Frequent burning appears to have destroyed many of the finer native grasses.

Sown pastures are limited principally to the scrub soils, and Rhodes grass is practically the only introduced grass found in these areas. Kikuyu grass provides feed on small portions of the more fertile scrub land and is a favoured pasture in pig runs.

Rhodes grass is established either in scrub burns or planted in specially prepared cultivated land. The risk of destruction of the young seedlings by exposure to excessive heat is minimised by planting either in the early summer with a light stand of Sudan grass or in late summer among row crop maize or grain sorghum, just prior to the last cultivation.

A strain of Guinea grass, locally known as green panic, shows promise for the area.

WEED PROBLEMS.

A large range of noxious weeds have been introduced accidentally into the district, often as contamination in uncertified seed. The more troublesome of these include several species of Datura, Noogoora burr (*Xanthium pungens*), Bathurst burr (*Xanthium spinosum*), saffron thistle (*Carthamus lanatus*), star burr (*Acanthospermum hispidum*), wild verbena (*Verbena venosa*), spiny emex (*Emex australis*), galvanised burr (*Bassia birchii*), wild turnip (*Rapistrum rugosum*), wild radish (*Raphanus raphanistrum*), and mint weed (*Salvia reflexa*).

The mint weed has been controlled by Rhodes grass pasture on areas that have not been subjected to overgrazing, but has become a troublesome weed in some cultivation areas.

Urochloa grass (*Urochloa panicoides*) is regarded as a weed in cultivation, particularly in peanuts.

Johnson grass (*Sorghum halepense*) has become established on many properties, though the use of sodium chlorate has been of considerable benefit where infestations were detected early.

An increasing interest is being shown in the control of many weeds by the use of hormone-type weed killers, and interested farmers are purchasing spraying equipment to facilitate the spraying of large areas.

AGRICULTURAL CROPS.

Climatic conditions and soil types in the South Burnett limit the major agricultural cropping programme to the summer months.

Peanuts.

Peanuts (Plates 159-161) rival maize as the most important crop of the area, 95 per cent. of the Queensland crop being planted within a radius of 40 miles of Kingaroy.

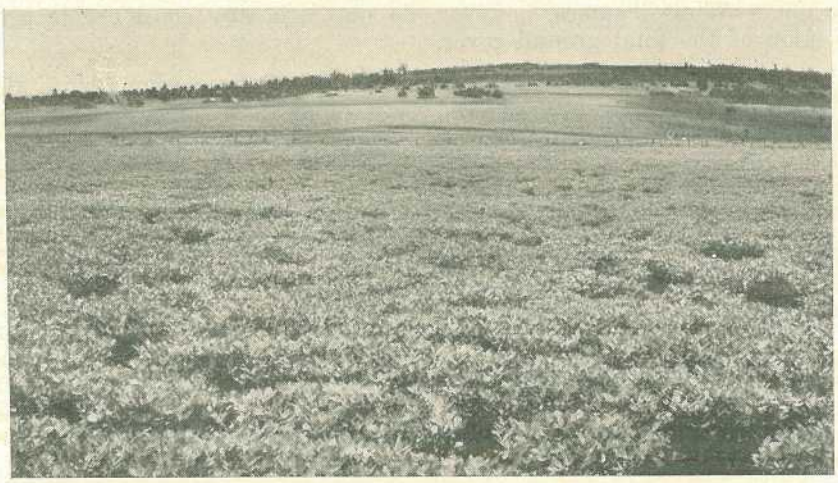


Plate 159.

Peanut Crops in the Kingaroy District.

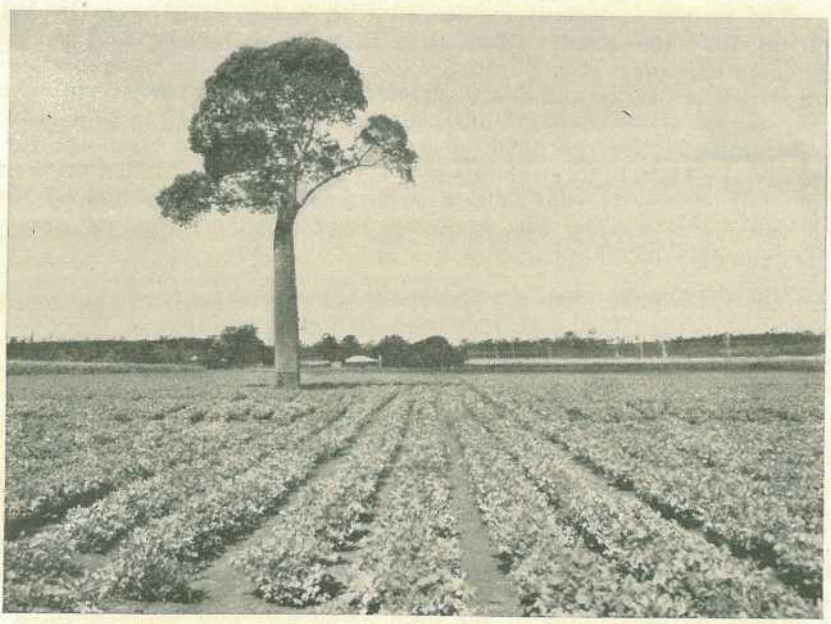


Plate 160.

A Peanut Crop in the Kingaroy District. The bottle tree is a remnant of the original scrub.

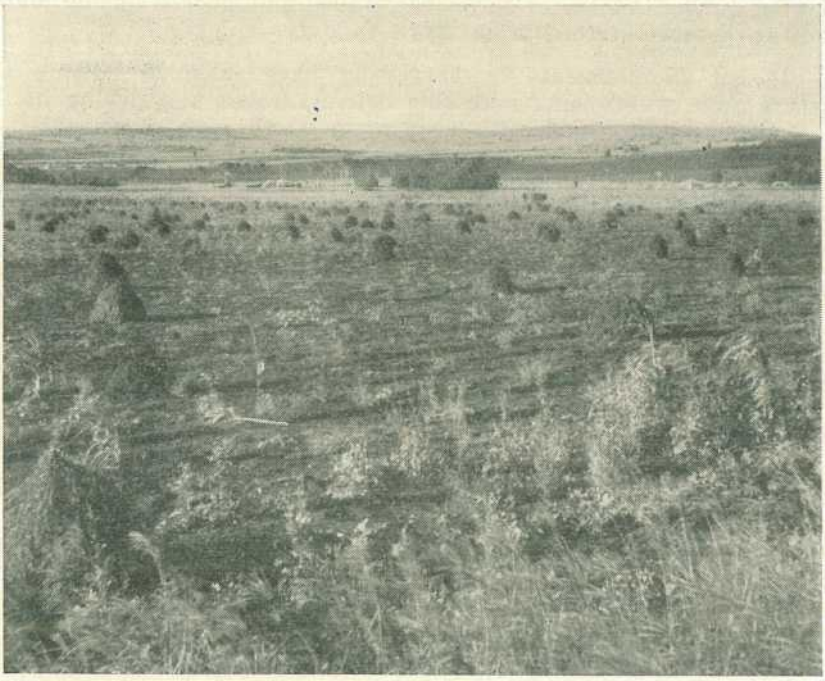


Plate 161.

A Field of Recently Stooked Peanuts at Crawford, Showing the Memerambi District in the Background.

The peanut industry commenced with a few small areas in 1919. During 1924 the Peanut Marketing Board was formed and in 1928 the Peanut Growers' Co-operative Association, operating in close association with the Marketing Board, erected a storage and treatment plant in Kingaroy. Droughts and marketing problems resulted in slow growth of the industry for the next ten years and it was not until the early years of the 1939-45 war that a rapid expansion in production occurred. Earlier protective legislation had encouraged the industry and by 1947 the value of the crop was in excess of £1,000,000 from an area of approximately 45,000 acres.

The Peanut Growers' Co-operative Association increased its storage capacity during 1938 and 1948 and though some silos were recently destroyed by fire, large crops can still be handled.

The crop is generally planted on both scrub and forest red loams, though increasing acreages are being planted in the lighter grey and brown sandy to clay loams associated with second-class forest country.

Only two varieties are used—Virginia Bunch and Red Spanish. The higher yield of the former variety results in a larger acreage being planted, though Red Spanish can yield fairly well under some conditions unfavourable to Virginia Bunch. Reduction of plant stand and yield due to crown rot is usually less with the Red Spanish and an increasing percentage of the total acreage is now being devoted to this variety. Yields of Virginia Bunch under favourable conditions may range from 1,500 to 2,000 lb. per acre, with exceptional yields up to 3,000 lb. per acre. Red Spanish yields may range from 1,000 lb., with exceptional yields up to 2,200 lb. per acre. The crop is usually planted during October or November, pulled and stooked during March and April and threshed from April to July.

Recent developments in harvesting have included cutting the mature crop, windrowing with side delivery rakes, sun drying in the windrows and threshing with headers to which pick-up attachments, special peg drums, sieves and elevators are fitted. Advantages of this method are the lower demand for farm labour and the beneficial return of trash to the soil.

Maize.

Maize production in the South Burnett exceeds that of any other district in Queensland and until recent years, maize was the most important crop in the district. The original high fertility of the scrub soils produced, under favourable conditions, yields exceeding 90 bushels per acre, though the district average has been considerably reduced in recent years by lowering of the original soil fertility and by heat waves at tasselling.

Scrub soils in some locations continuously cropped with maize for over forty years are still producing good yields, probably aided by the prolific growth of grass and weeds which develops after cultivation of the maize crop ceases. These weeds, supplemented and sometimes even smothered by the leguminous burr trefoil (*Medicago denticulata*), provide an abundant and valuable source of organic matter.

Although the principal maize areas (Plates 162-164) are associated with the scrub red loams, a large acreage is also planted on the better class forest soils. Grain sorghums, however, are usually more economic on the poorer forest soils.

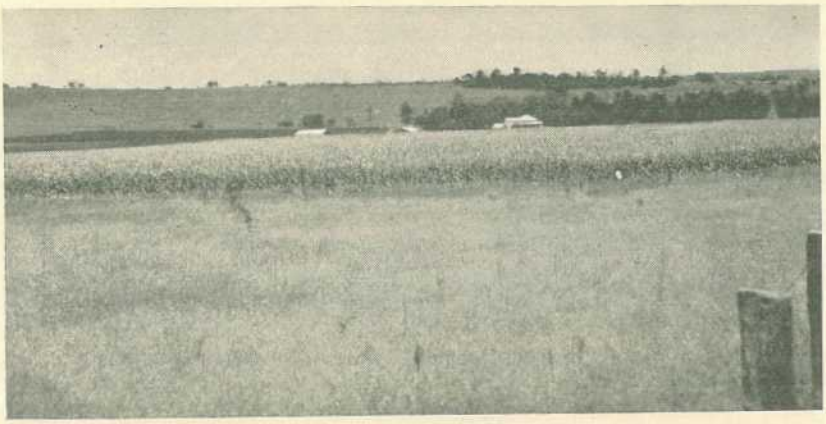


Plate 162.
A Maize Crop in the Wooroolin District.

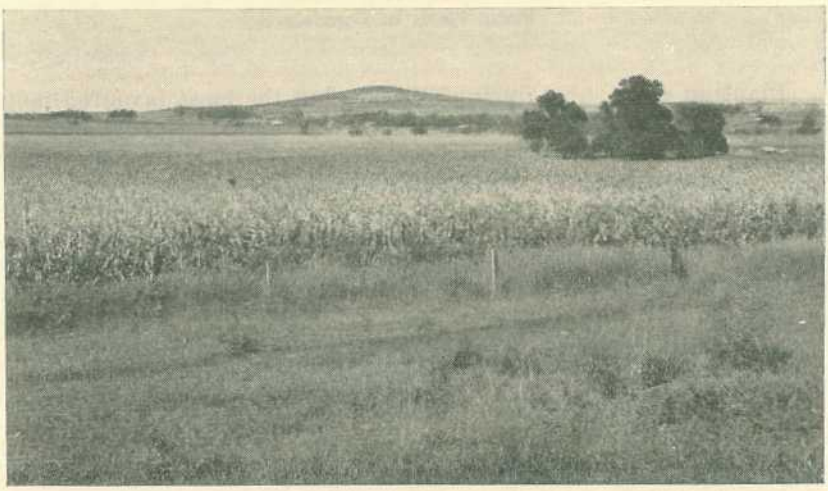


Plate 163.
Maize Crops at Crawford.

Until recently, yellow dent varieties, including Improved Yellow Dent, Fitzroy, Leaming and Lady's Finger, were used for approximately 80 per cent. of the crop, the balance being planted with white varieties such as Hickory King, Silvermine and Manning White. Hybrid maize, however, has proved to be superior in yield and in resistance to heat conditions and there is now a strong demand for hybrid maize seed. Yields in excess of 80 bushels per acre are frequently being obtained where the soil and seasonal conditions are satisfactory, and when sufficient seed is available there is little doubt that a large percentage of the district crop will be planted with hybrid maize strains.

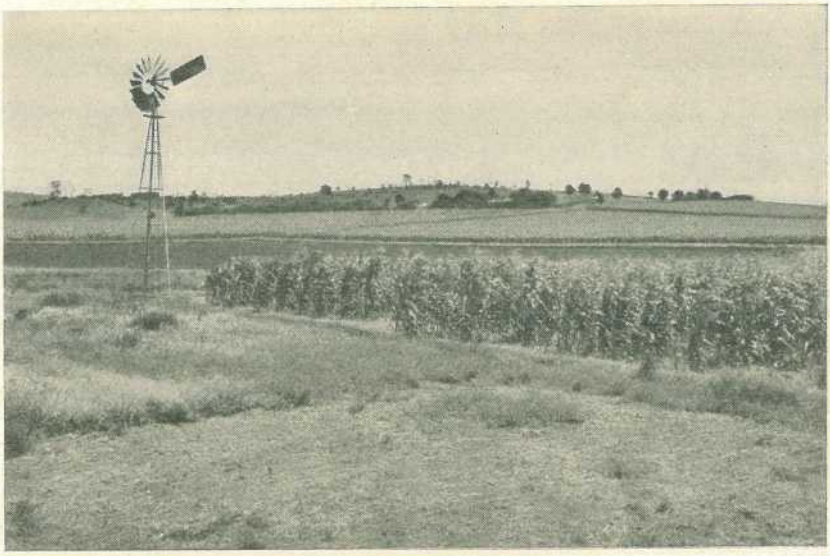


Plate 164.
Maize Fields at Corndale.

Planting commences during October, but the most favoured month is December, this later planting being more likely to avoid heat conditions at tasselling than earlier plantings. Highest yields are normally associated with the late November and December plantings.

Mechanical picking machines have been in the district for the past ten years, and during the past three years combined picking and threshing machinery has been favoured. Direct harvesting by means of header-harvesters, though still practised by a few farmers, is not popular and is not likely to increase.

Plate 165.
A Field of Wheatland Grain Sorghum, With Maize in the Background.

Grain Sorghum.

The cultivation of varieties suitable for direct harvesting commenced during 1939. Damage done by parrots on small areas retarded the spread of this crop for a few years, but the yields obtained on soils unfavourable for maize production later encouraged larger acreages. Best results are obtained on the more fertile of the forest soils.

Wheatland (Plate 165) is the most popular variety in the district, accounting for at least 90 per cent. of the acreage planted. Interest is now being shown in Caprock, Martin, and Alpha, and it is anticipated that much of the Wheatland acreage will be taken over by these new varieties.

December planting is generally favoured for two main reasons:—firstly, the sequence of suitable rainfall periods is usually more certain after late November; and, secondly, the grain should mature during the drier months. The average yield is about 35 bushels per acre, with exceptional yields up to 90 bushels.

Navy Beans.

Navy bean production commenced during the second World War and is now well established, particularly in the Kumbia (Plate 166) and Manneum districts. Michelite and Californian Small White are the only two varieties used, the former being the more popular at present.

Plate 166.
Navy Beans in the Kumbia District.

The crop is planted during late December and January and harvested with pick-up threshers during April and May.

Average yields are 12 to 15 bushels to the acre, with the highest recorded yield being 40 bushels per acre. The crop is marketed through the Navy Bean Marketing Board.

Poona Peas.

A large proportion of the Poona pea seed required for green manure crops by the cane industry is grown in the South Burnett. Planted in January, the crops are directly harvested by header-harvesters fitted with rubber concaves in the drum. Yields average about 8 to 12 bushels to the acre.

Sunflowers.

Until recently sunflowers were not grown extensively, but during the 1948-49 season several thousand acres were planted. However, they are not expected to become an important crop in the district on present indications.

Potatoes.

Potatoes are produced under irrigation in the Redgate, Murgon, and Byee districts, with yields from 3 to 8 tons per acre. Factor is the most popular variety for the autumn plant, though a fair proportion of Delaware is planted for the spring crop. Some interest is being shown in the varieties Bismark, Katahdin, Chippewa, and Sebago.

Onions.

Onion growing areas coincide with the main potato producing areas. Brown Spanish is the favoured variety and yields range from 5 to 12 tons per acre.

Lucerne.

The area planted with lucerne is not high and is principally associated with the alluvial flats adjacent to the main creeks (Plate 167). High yields of excellent quality lucerne are produced on the Boonara flats near Goomeri and at Redgate and Byee near Murgon. The scrub red loams can produce good crops and a larger acreage could be planted with advantage on this type of soil.

Plate 167.

Mowing a Lucerne Crop in the Kingaroy District.

Winter Crops.

Linseed growing is becoming of more importance in the district, and over a thousand acres were planted during 1950.

Wheat production is not extensive, but satisfactory yields of good quality grain are produced. The acreage available for this type of crop is not large enough for it to become of particular importance.

Oats are popular for grazing in the winter months and a small acreage of barley for grain is also grown.

CERTIFIED SEED.

South Burnett farmers have for many years been interested in the availability of good quality seed. Seed certification has thus met with a ready response from both seed producers and seed purchasers.

The aim of the seed certification scheme is to supervise the production of seed of crop varieties which will be true to type, free from contamination with other varieties or with weed seeds, free from seed-borne diseases, and of a high standard of germinability. The varieties chosen for seed certification are those which are well adapted and capable of high yields either in this or in neighbouring districts.

A wide range of sorghum varieties and Queensland maize hybrids is now produced and marketed annually within the district's boundaries. Under the control of the Seed Certification Committee of the Queensland Department of Agriculture and Stock, areas for the production of seeds of the following varieties were planted during the 1949-50 season:—

Hybrid Maize: Q23, Q431, Q629, Q692, Q739, Q658.
Grain Sorghum: Wheatland, Early Kalo.
Sweet Sorghum: Italian, Sugardrip, Honey.
Sudan Grass: Roma.
Beans: Brown Beauty.

HORTICULTURAL CROPS.

Horticultural crops are of practically no commercial importance in the district and are confined to small farm orchards, generally for private use only. However, excellent oranges and mandarins are produced on the rain forest areas and most vegetables can be readily grown throughout the district,

FORESTRY.

Valuable forestry reserves and re-afforestation areas are concentrated in the southern and eastern fringes of the district, including portions of the Bunya, Cooyar, Blackbutt, Brisbane and Coast Ranges.

State forest reserves include 172,677 acres, timber reserves 28,539 acres, and national park reserves 9,605 acres. Approximately 13,000 acres of forest reserves have been replanted with hoop pine (*Araucaria cunninghamii*), *Pinus patula,* and *Pinus caribaea.* Some flooded gum and ironbark are also included. Five nurseries provide the young trees for the annually increasing re-afforestation areas.

DAIRYING AND PIG PRODUCTION.

The majority of farmers in the South Burnett combine dairying with the production of crops, and approximately one-seventh of the Queensland butter yield is produced in this district.

The size of properties varies from 160 to 320 acres in the closely settled portions of the district and from 320 to over 1,000 acres in the more outlying areas such as Durong. While pastures of natural grasses and Rhodes grass are of importance, most farmers depend principally on fodder crops.

Many thousands of acres of Sudan grass (Plate 168) are planted each year, and although the risk of poisoning cattle is well known in the district, the crop is grazed in all stages and under a wide range of seasonal conditions with very few losses. The risk of the introduction of Johnson grass in Sudan grass seed is of great importance and for this reason the supply of certified seed has been welcomed.

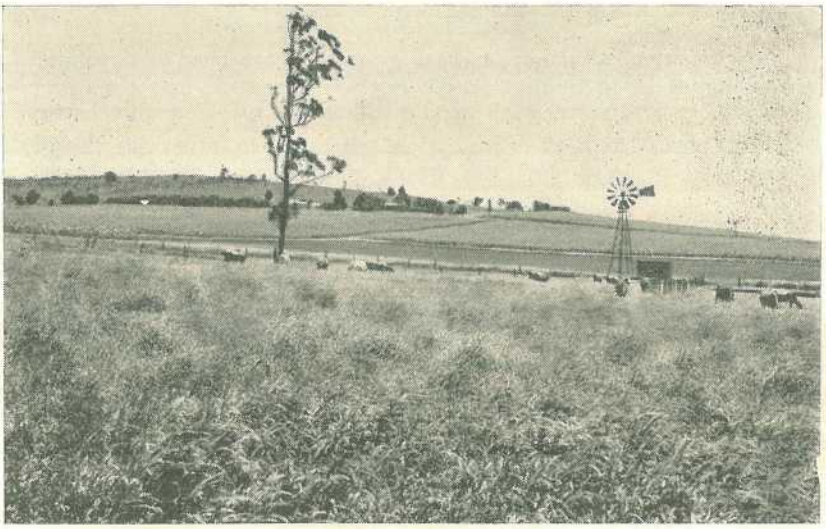


Plate 168.

A Dairy Herd Grazing on Sudan Grass at Corndale. The slopes in the background are under maize.

Winter and spring feed is provided from two sources, namely, crop residues, including peanut trash, and oats for grazing. The most important oat varieties planted are Victoria x Richland and Algerian, but increased acreages of Klein will be planted when seed supplies are more readily available. Until recently the readily available supplies of peanut trash made the storage of summer crops in the form of ensilage of minor importance. However, increased interest is now being shown in silos, particularly by stud breeders.

Both Jersey and A.I.S. breeds are well represented in the pure herds of the district, with many Queensland champions being produced by local breeders. Probably 60 per cent. of the dairy cows in the district are of the A.I.S. breed. The majority of the smaller herds are Jersey. The bulk of milk produced in the district is used for butter-making, and an indication of the output can be gained from the production figures for 1949-50:—

Factory.	Butter Production. lb.
Kingaroy	4,141,635
Nanango	2,935,155
Wondai	2,865,808
Murgon	2,761,250
Proston	1,548,000

Cheese production is carried on in two factories, while the Murgon factory produces pasteurised milk for distribution over the whole of the South Burnett.

Pig raising is of considerable importance in the district, and more than 100,000 pigs are railed each year to Brisbane and Toowoomba. Stud piggeries representing Tamworth, Canadian Berkshires, and Large Whites produce high-class pigs, but the majority of farmers rely on crossbred sows with purebred boars.

THE GRAZING INDUSTRY.

Beef cattle production is an important industry in the district. There are a number of stud herds, mostly Hereford, but including Aberdeen Angus, Shorthorn, and Polled Herefords. However, probably 90 per cent. of the holdings are used for fattening, breeding being of lesser importance.

The size of the holdings varies from 2,000 to 15,000 acres. The majority are completely dependent on native pastures, though some holdings contain a fair percentage of Rhodes grass. Stud properties usually supplement their pastures by green feed on cultivated areas.

Many farmers who concentrate on the production of peanuts, maize, and grain sorghum, without dairying, purchase stores and fatten them on crop residues and grass paddocks. This practice is to be commended, as the increased farm income will usually be associated with an improved cropping sequence resulting in better maintenance of soil fertility.

Root Crop Vegetables.

C. N. MORGAN, Senior Adviser in Horticulture.

THE carrot, beetroot, parsnip, turnip, swede turnip, radish, and salsify, although representative of four quite distinct plant families, have very similar cultural requirements. It is therefore usual for the specialist grower to handle two or more of these plants in his cropping programme each year. Some are grown extensively on a commercial scale, but others such as radish and salsify are better adapted to the home garden.

CARROT.

The carrot (*Daucus carota*) is said to have originated in Europe and Asia, but much of its early development from the wild state to the cultivated vegetable of to-day took place in France. The crop has increased in importance and popularity over the last few years and is now rated highly because of its vitamin A content.

Cool conditions are required for carrot growing but good crops are harvested during most of the year in some part or other of Queensland. In the far north the carrot is essentially a winter crop, in south-eastern Queensland the growing season extends from early autumn to late spring, and in the temperate climate of the Granite Belt the crop is grown during the summer months.

Soils and Preparation.

Carrots do well on most soil types providing the drainage is good, and payable crops have been grown on heavy, medium and sandy loams. Ground which sets hard after rain is not suitable as growth is restricted and the roots may be misshapen. Preference should be given to a sandy loam.

Thorough soil preparation is particularly desirable for carrots, which must be planted on finely prepared ground where the roots can penetrate deeply and quickly through the soil, as even a slight check is harmful.

When the crop is grown on raised beds, the land should be ploughed to a depth of not less than 8 inches, but a 10-inch ploughing is needed if the crop is to be grown without hilling. It is not difficult to prepare a light sandy loam for the crop, but at least two ploughings are necessary on the heavier soils. Harrowing or discing between ploughings, followed by further working, brings the soil into seed-bed condition prior to planting.

Fertilizers and Manures.

On well-prepared and well-manured land (Plate 169) the carrot crop requires little feeding. At the addition of fresh manure to the soil just prior to planting may produce badly forked roots, carrots should preferably follow a well-manured crop. In this case, the carrots are topdressed when they reach the thinning stage approximately four weeks after seeding. A suitable topdressing is a 5–14–5 water-soluble fertilizer at 2 cwt. per acre.

In less fertile soils, a basal dressing of fertilizer is spread along the furrow in the crop row or broadcast over the whole area at least two weeks before sowing. Broadcasting is usual where the plants are grown on hills, as the fertilizer is worked into the soil when the hills are made. A fertilizer containing approximately 5 per cent. nitrogen, 13 per cent. phosphoric acid and 5 per cent. potash is satisfactory on most soils. If applied as a basal dressing the mixture should contain a fair proportion of blood and bone. The water-soluble form of the same mixture is preferred as a topdressing. Form 8 to 10 cwt. per acre, or 3 to 4 oz. to the square yard, should be sufficient for the crop.

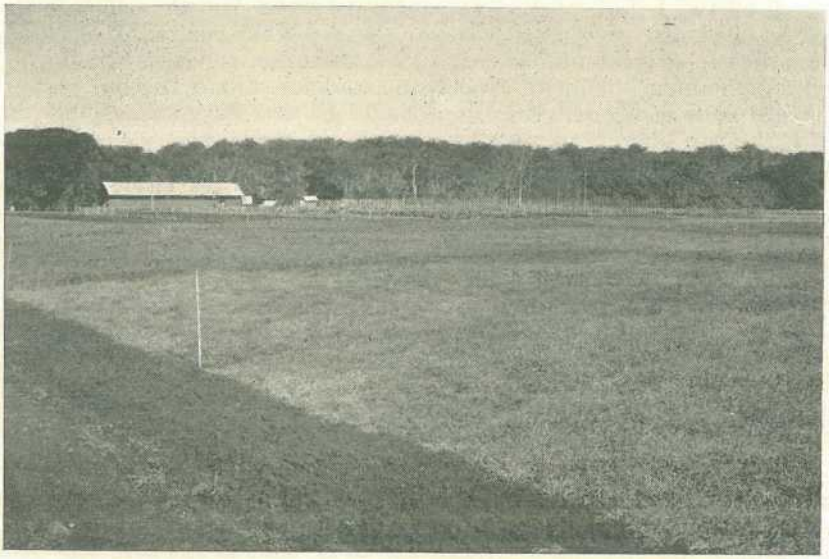


Plate 169.

A Typical Cover Crop in the Redlands District. Such crops should be ploughed in early so that the green matter can rot down before the root crop is sown.

Planting.

On shallow soils, the crop is planted on hills or raised beds four to five inches high and with a 20-24-inch wide flat surface. The distance between the centres of the hills is from 3 feet to 3½ feet if horse implements are used for cultivation, but may be much less where only hand tools are available. On the prepared hills, double rows are planted 12 inches apart. On flat sandy loams hilling is not necessary and the crop may be planted either in double or single rows. The double rows should be about one foot apart with three feet centres between adjacent pairs; single rows may be closer according to the implements in use. In the home and market garden, rows may be planted from nine to 12 inches apart.

Small hand-operated planters may be used for carrots, the seed being sown at the rate of about 4 lb. per acre at a depth of ½ to ¾ inch. The soil must be firm, level, free from dead grass or weeds and in good tilth if the planter is to work efficiently. For small plantings, a ½ to ¾ inch drill may be made with the hoe or rake handle, the seed dropped along it and the ground levelled. About ¼ oz. of seed is sufficient for 100 feet of drill. After planting, the ground must be well firmed. The rear wheel on the hand planter usually does this job reasonably well, but even so the hills should be lightly rolled after planting.

If possible, the ground should be irrigated immediately after planting and kept moist until the seed has germinated. Germination usually takes nine to 14 days. The crop is difficult to establish when the weather is hot and it is then advisable to increase the seeding rate to 5 lb. per acre. The small grower will find light shade an advantage for February-March plantings. The covering may be removed altogether after the second fern leaves are showing.

Cultivation.

Cultivation of the beds should start early, the beds being watered a week or two before seeding to encourage weed growth, which is then lightly hoed off. Weeding between the rows is comparatively easy; a flat hoe is a good implement. All cultivation must be shallow. A certain amount of hand weeding is unavoidable, but if the soil preparation has been good, little weeding should be necessary before thinning, when the two operations may be carried out conjointly. Weed control in the young crop can be achieved with a kerosene weedicide which, when used correctly, kills most weeds but does not hurt the young carrots. Treatment is, however, a specialised job requiring a great deal of care. Little cultivation will be necessary on the hills or near the rows after the first thorough weeding, as the tops rapidly shade and smother any new weed growth.

Over-crowding is undesirable and commercial growers thin carrots to about three inches between plants a month or so after planting. The home gardener may thin out gradually as the plants are growing and use the young roots as required. Thinning is done by hand when the soil is moist and the roots leave the soil quickly and freely.

Irrigation assists germination and is desirable when the plants are young and subject to the effect of heat. Irrigation must be thorough so that the water penetrates to the bottom of the root zone. When the carrots have reached maturity and are to be held in the soil, only sufficient water should be used to keep the plants bright and tender.

Harvesting and Marketing.

Small market gardens sell bunched roots from about 1 inch to 1¼ inches in diameter (Plate 170), but the commercial grower usually leaves the crop in the ground until the roots reach their full size about 3½ to 4½ months after planting. Large carrots in good condition (Plate 171) meet a ready market and when sold by weight give the greatest return per acre. The roots are harvested each week by hand and it is usual to go through the crop selecting only the larger carrots. The remainder continue to grow until they are removed at one or other of the harvesting periods.

In sandy loams, "pulling" is comparatively easy and causes no damage to the roots, but in heavier soils it may be necessary to first loosen the ground with a digging fork. For marketing in bunches, the

roots are washed, graded for size and tied in bunches of a dozen with the tops on. When marketed in bags, the tops are cut off about an inch above the crown.

Varieties.

Carrot varieties may be classified as follows:—

(*a*) Long rooted varieties, such as Intermediate and St. Valery.

(*b*) Half long varieties, such as Red-cored Chantenay, Chantenay, Danver's Half Long, Manchester Table, and Osborne Park.

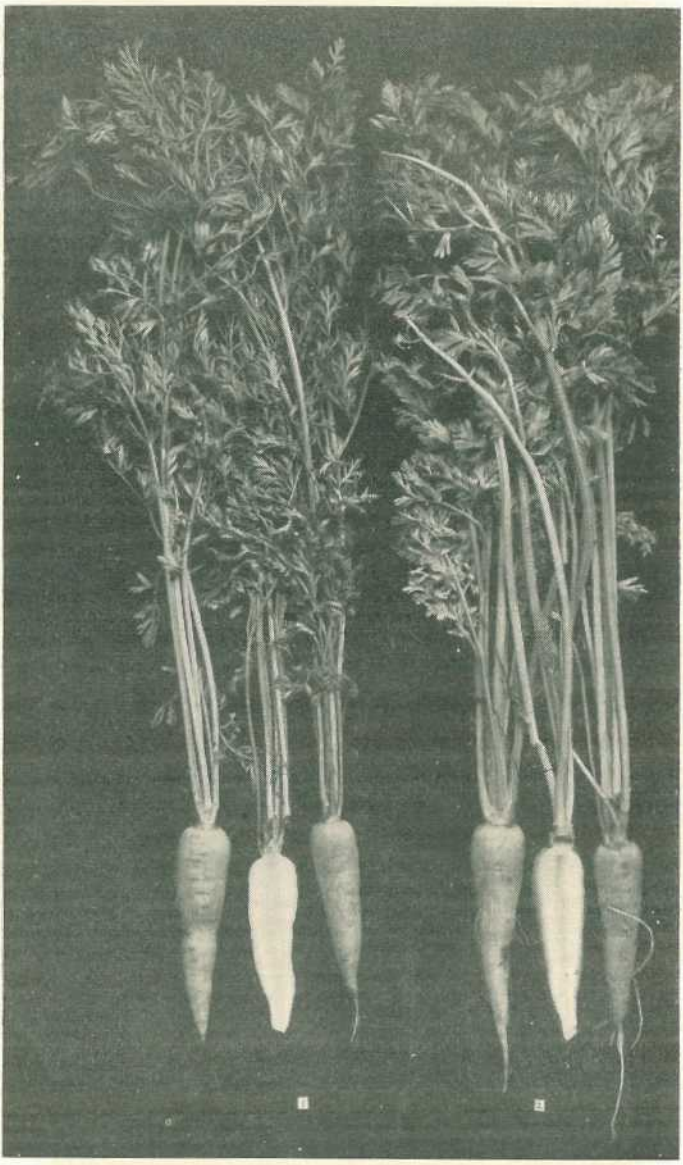


Plate 170.

Carrot Varieties: Chantenay (left) and Danvers (right). Both are half-long types grown for the bunch trade.

The Red-cored Chantenay is by far the most popular commercial variety and Danver's Half Long is next; both are an attractive colour and their strong leaves make them suitable for the bunched trade.

(*c*) Stump rooted varieties, such as Ox-heart (Guerande) and Early Horn.

The variety Early Horn is suitable for the home garden, being quick maturing with an attractive colour; it is perhaps the best for shallow soils.

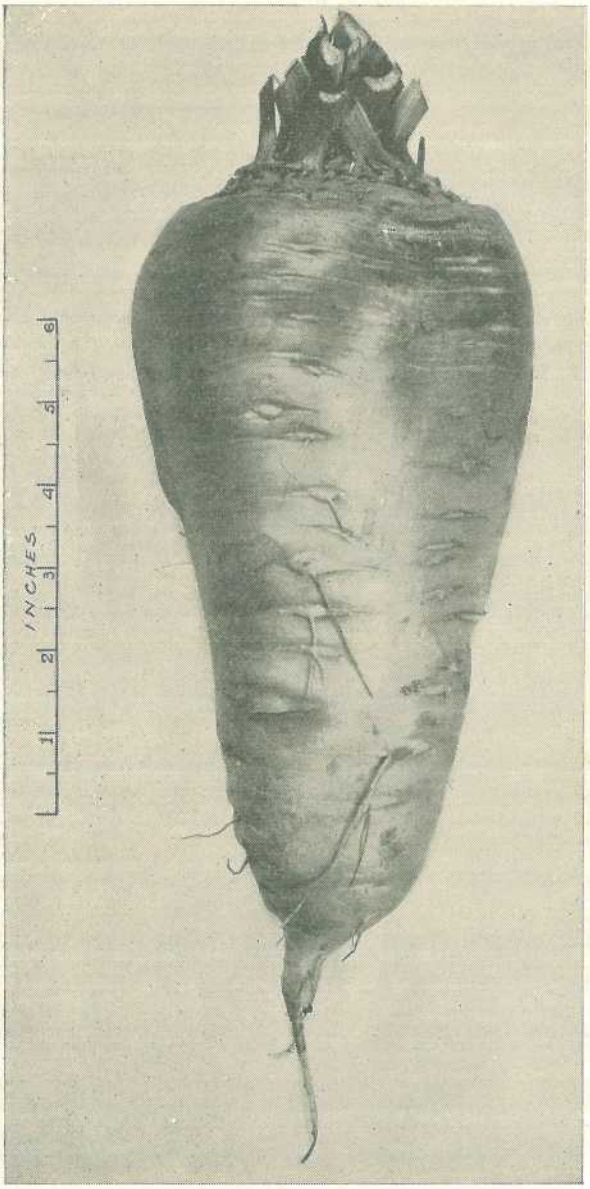


Plate 171.

Chantenay Carrot at the Stage of Harvesting for the Bagged Trade.

BEETROOT.

The beetroot (*Beta vulgaris*) originated in Europe and has been developed from an original long-rooted ancestor to the popular globe types of the present day.

The plant thrives under cool conditions and is grown successfully from North Queensland to the New South Wales border. In the coastal areas of south-eastern Queensland where the climate is fairly equable good marketable crops are grown under irrigation throughout the year, with the exception of the hot summer months.

Soil Preparation.

In common with most other root crops, the beet prefers a loose loamy soil which is fairly deep and well drained. It does particularly well in sandy loams. However, providing land preparation is thorough, the crop can be grown on many other soil types. Heavy clay loams which set hard after rain or irrigation are the least suitable.

Land preparation should ensure a depth of eight to 10 inches of loose friable soil for the crop. Early preparation is desirable so that weeds can be controlled before planting. The heavier loams are usually hilled to promote rapid root-penetration and quick growth. A fine tilth assists seeding.

Fertilizers.

Beets do best following a well-manured crop. The use of fresh manure is undesirable but a well-balanced fertilizer is required on most soils.

The fertilizer may be applied during the final stages of soil preparation or as a topdressing three or four weeks after planting. On a soil of low fertility, it is as well to apply the fertilizer prior to seeding. A fertilizer containing roughly 5 per cent, nitrogen, 13 per cent. phosphoric acid and 5 per cent. potash is sufficiently well balanced for beet requirements in Queensland soils, and 7 to 10 cwt. per acre should be ample for the crop. If applied as a basal dressing, the mixture may contain a fair proportion of blood and bone, but if used as a topdressing, it should be in a water-soluble form. If the beet is planted in single rows, the topdressing is applied in a band along the side of the row and about three to four inches from the plants. With double rows on hills, the fertilizer may be distributed in the double row. Where irrigation is available, it is unnecessary to work a topdressing into the ground, as watering takes the fertilizer down to the roots.

It may be necessary on some soils to apply a small amount of borax to correct deficiency troubles such as girdling and multiple crowns (Plate 172).

Planting.

In most commercial beet areas, the seed is planted in the field, by either hand or planting machine. On light sandy loams, the seed is sown on the flat in single rows 2 to 2½ feet apart, depending on the types of implements available and the method of cultivation used. On the heavier ground, the crop is sown in double rows approximately 12 inches apart on hills, with 3½ feet between the centres of the hills. Single-row planting is preferred for rain-grown crops, but with irrigation the closer double row plantings are the best. Four to six pounds of seed should be sufficient to plant an acre. Owing to the relatively large size of the seed, planting may be done easily by hand; a machine planter works well only with graded seed.

Planting should be shallow—from $\frac{1}{2}$ to $\frac{3}{4}$ inch—at least in irrigated crops. On non-irrigated soils, the seed may be planted slightly deeper. Germination may be erratic unless the seed is sown under very favourable conditions. Uneven germination can be overcome, to a certain extent, by soaking the seed overnight in water prior to planting.

Plate 172.

Girdling and Multiple Crown on Beetroot. These are symptoms of boron deficiency.

Cultivation.

When the beet plants are about two to three inches high, they are thinned to single plants three to four inches apart. Failure to thin results in numerous small and often malformed roots. Any misses in the row may be filled in with plants taken out at thinning.

Following adequate soil preparation and early weed control, little cultivation should be necessary. The first cultivation often coincides with thinning, and if the plants are growing rapidly, no further treatment is required. Shallow-working implements are essential, and a small hand cultivator with attachments such as a flat hoe which does not dig deeply into the soil, is suitable. Between hills or wide rows, horse or machine cultivation is practicable.

Irrigation ensures an even strike and the production of high-quality beet which are characteristic of a quickly-grown crop. Any cessation of growth makes the roots fibrous and unattractive. The soil should be kept moist to plough depth and an irrigation before harvesting makes "pulling" easy.

Marketing.

In the warm autumn and spring months, some beet should be ready to harvest about eight weeks after planting (Plate 173). Regular "pulling" during the next few weeks is necessary, for beet left in the field rapidly increase in size and become too large for the market. During the winter months, harvesting may be prolonged to some extent without marked deterioration in quality. The first beet are usually ready for harvest in 10 to 11 weeks at this time of the year. Root sizes ranging from 2½ to 3 inches in diameter suit the Queensland market; large beet are not popular as they are often coarse and unattractive.

Plate 173.

Early Wonder Beet at the Stage of Harvesting for the Bunch Trade.

Beet are sold chiefly in bunches of a dozen with tops on. Immediately after harvesting they should be washed, the dead and discoloured leaves removed, and the beet bunched and stacked under shade. Wilting of the tops occurs quickly when beet are exposed to the sun. The tops are removed about an inch above the crown if the roots are sold in bags.

Varieties.

Of the numerous varieties available, the following are suitable for Queensland conditions:—

Early Wonder or Rapid Red.—Quick maturing, globe shaped, fairly free from zoning during most of the year (Plate 174); has a large top which makes it attractive for the bunch trade; colour is deep red.

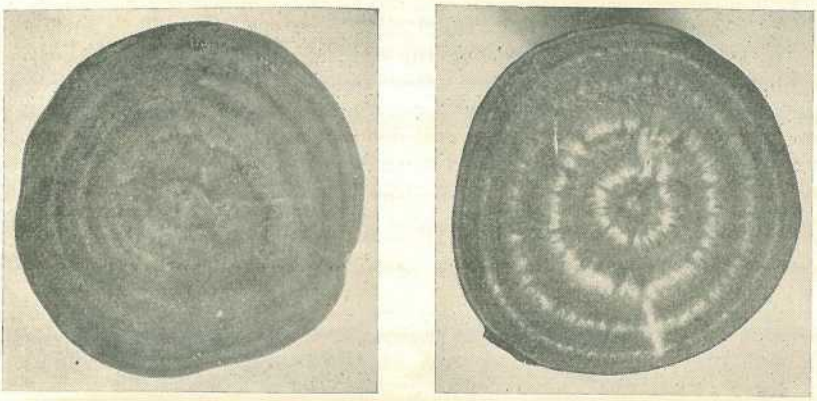


Plate 174.

Zoning in Beet. Cross section of a normal beet (left) and a beet with typical zoning. Zoning is a defect in some varieties at certain times of the year.

Derwent Globe.—Probably more free from zoning than Early Wonder; colour is dark red; suitable for bunch trade.

Crimson Globe.—Early maturing; colour is deep red.

Detroit Dark Red.—An attractive beet, extremely dark red in colour; tops are small and the crop is usually bagged.

Egyptian Turnip Rooted.—Extra early; flat shape; suitable for home gardens.

Obelisk.—Cylindrical shape, deep red and of good flavour; suitable for home gardens.

PARSNIP.

The parsnip (*Pastinaca sativa*) is a cool weather crop which came from the Mediterranean area. It has a distinctive flavour which limits the demand to a small but appreciative number of consumers. Although it is one of the hardest of the root crops to grow, the market could easily be over-supplied by a small increase in the present acreage. The crop is less tolerant of heat in the early stages than carrots.

The parsnip is grown mainly on deep sandy loams, which are more easily prepared for this crop than the red volcanic loams. The long tender roots of the parsnip cannot stand any check in their downward movement and fork badly under adverse soil conditions. Soil preparation and fertilizer practice follow closely those recommended for carrots and the greatest care must be taken to obtain a deep friable seed-bed.

Planting.

If the ground is fairly shallow the seed should be planted on hills similar to those required for carrots. Only fresh seed should be used, as germination is frequently low in batches more than one year old.

The soil should be firmed and the seed sown rather thickly to a depth of about $\frac{3}{4}$ inch. Immediately after seeding the soil should be rolled or tamped firmly. Five to six pounds of seed is required to plant an acre, or approximately $\frac{1}{2}$ oz. to every 100 feet of row. Distances between rows are the same as for carrots. March to May is the main planting period on the coast but early spring is the best for the cooler tablelands.

Cultivation.

Cultural methods applied to carrot crops are suitable for parsnips but thinning may be delayed as much as five weeks. It is inadvisable to thin out to more than four inches as the crop grows slowly and after the first harvest the roots left in the field will increase in size. There is little demand for large thick roots and wide thinning tends to encourage this condition.

Seed of the parsnip is slow to germinate and the plants may not come through ground with a hard crust on top. Early irrigation is therefore required to keep the ground moist enough for germination and loose enough for the small plants to push through. Subsequently, sufficient water should be applied to reach well down into the soil.

Harvesting and Marketing.

Parsnips are harvested and marketed in the same manner as beet or carrots, but the first pick does not take place until 4½ to 6 months after planting. Care is required in lifting the long roots, and unless the ground is a free moist sandy loam the use of a digging fork is necessary.

Varieties.

Good varieties are not plentiful. The most popular is Hollow Crown.

TURNIP.

The turnip (*Brassica rapa*) is a cool season crop which may be grown on practically all types of soils. It is much hardier and more rapid in its growth than the carrot or beet and soil preparation need not be so thorough. The plant thrives in any reasonably fertile soil, and does particularly well following another heavily manured crop. Should fertilizer be considered necessary, a dressing of from 3 to 4 cwt. per acre, or approximately 2 oz. to the square yard, of a 5–13–5 fertilizer should be sufficient. Borax may sometimes be necessary to correct boron deficiency, which results in multiple crowns and other undesirable features.

Planting.

Seed may be planted in drills and it is rarely necessary to go to the trouble of hilling. Single or double rows may be used, with distances similar to those recommended for beetroot. Two pounds of seed should be sufficient to plant an acre, or about ¼ oz. for 200 feet of drill. Plantings may be made from March to August on the coast and in spring on the tableland areas.

Cultivation.

The turnip germinates within a few days, grows rapidly and tends to smother many of the weeds in the rows. Some hand weeding will be necessary as well as cultivation between the rows. The crop is thinned a few weeks after germination to a spacing of from two to three inches between plants.

Harvesting and Marketing.

Turnips should be ready for harvesting in from eight to 10 weeks after sowing. The roots are pulled and sold in bundles of a dozen. Harvesting from one planting may continue for a few weeks but the turnips develop a strong objectionable flavour as they reach maturity and therefore should not be allowed to grow too big.

Varieties.

Purple Top White Globe.—A white globe turnip with an attractively coloured purple top; has strong foliage suitable for bunching.

White Stone.—A white, round turnip of good quality.

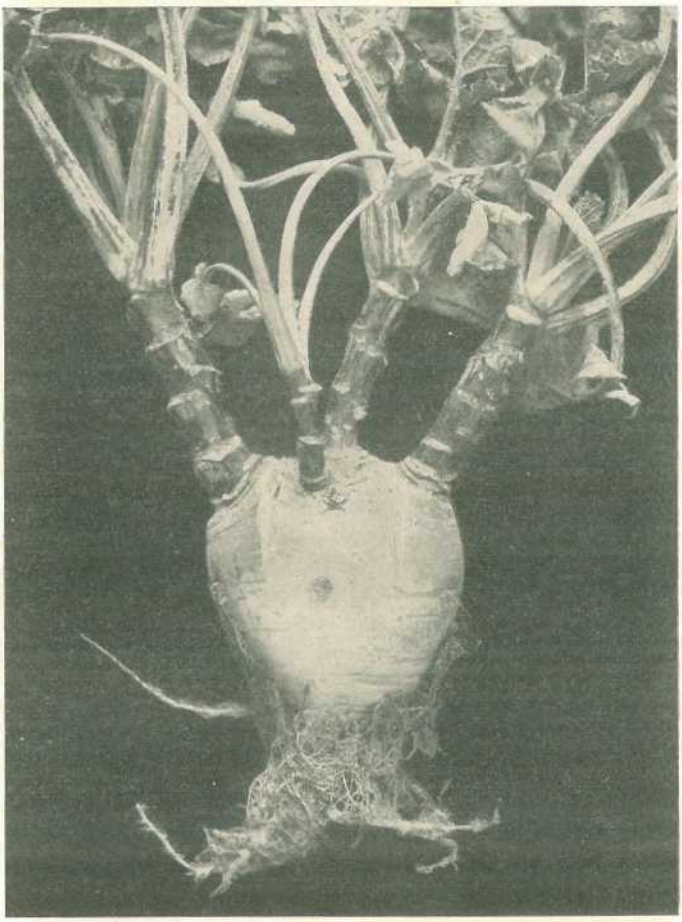


Plate 175.

Multiple Crowns on White Turnip, a Symptom of Boron Deficiency.

SWEDE TURNIP.

The Swede turnip (*Brassica napobrassica*) is grown mainly in agricultural rather than horticultural districts. It is a robust type of root crop which is adaptable to most soil types. Being less tolerant of heat than the ordinary white turnip, late plantings which carry the maturing crop into the hot weather should be avoided. Cultural conditions for the Swede turnip follow closely those applied to ordinary turnips but it may be necessary to thin out to at least five inches, as the roots are larger when mature.

The crop takes much longer to grow than the white turnip and in cold areas where frost is prevalent may occupy the ground for a period of four to five months. However, the roots should be fit for use much earlier where the weather is not so cold.

Bunching for market is satisfactory with reasonably small roots; the larger ones are topped and sold in bags. Old roots should not be harvested owing to their objectionable flavour.

Varieties.

The main variety is Purple Top, which is yellow fleshed, globe shaped and early maturing.

RADISH.

The radish (*Raphanus sativus*) is an easy vegetable to grow in its right season.

All types of soil appear to grow radishes well. Normal soil preparation to spade depth, which leaves the ground in a reasonable tilth, should be sufficient.

Fresh manure should not be used immediately before planting. Well-rotted manures, compost and any complete garden fertilizer with a fair amount of blood and bone are satisfactory. Unless they are grown quickly, radishes rapidly develop a strong flavour.

Planting.

Being hardy, the radish may be planted at almost any time of the year except during the hottest months. Seed should be sown fairly thickly in shallow drills about half an inch deep and about nine inches apart. About ½ oz. of seed is sufficient for every 100 feet of drill. Germination occurs in three to seven days according to weather conditions. It may be necessary to thin the seedlings to about 1½ inches apart.

The plants should be kept growing quickly by regular watering, and harvesting usually commences three to four weeks after seeding.

Varieties.

There are numerous varieties, but the following types grown in Queensland are the early maturing sorts:—

French Breakfast.—An oval-shaped radish, red in colour with a white tip.

White Icicle.—A long tender variety, mildly flavoured and pure white in colour.

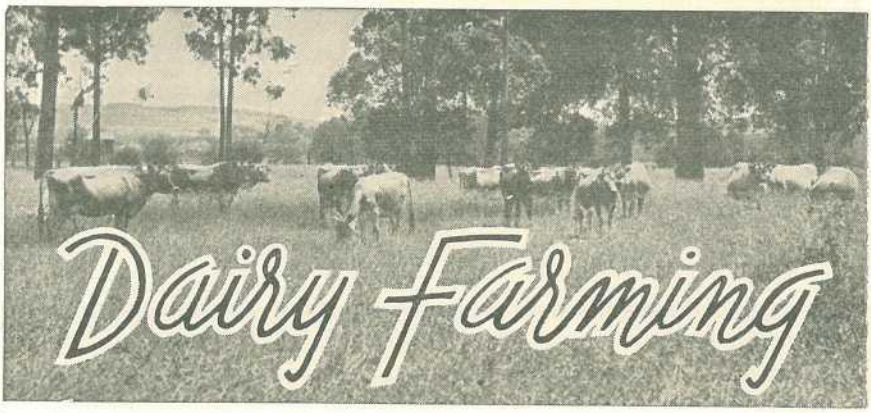
Long Scarlet.—Five to six inches in length, good flavour.

SALSIFY.

Salsify (*Tragopogon porrifolius*), a native of southern Europe, is not grown to the extent that its quality deserves. The white salsify is commonly known as the vegetable oyster because the flavour of the cooked vegetable has some resemblance to oysters.

The root is somewhat similar to but smaller than that of the parsnip. General soil preparation and planting may be done in the same way. The salsify has a longer growing season than the parsnip and should be planted to avoid maturing in the hot weather.

The main variety is Sandwich Island.



The Cleansing of Milking Machines.

THE DILUTE CAUSTIC SODA SOLUTION METHOD.

THE successful operation of a milking machine depends on the care and time given to it. Any neglect in keeping it clean will be reflected in the quality of the milk or cream supplied to the factory. The boiling water and caustic soda method has proved efficient for the cleansing of the milking machine, and in order that the method may be simply yet thoroughly applied the following are essentials:—

(1) An adequate supply of pure water.

(2) A steam sterilizer for boiling water and providing steam.

(3) Caustic soda. (Approved proprietary cleansers may be used in place of caustic soda.)

(4) A complete set of brushes for cleaning all parts of the machine.

To simplify this method, a routine system should be adopted, and the following has been found satisfactory in actual practice:—

Treatment Before Use.

Just before milking, give the machine (and all utensils) a cold water rinse to which a chlorine compound (used in accordance with instructions on the label) has been added (chlorine is not a cleanser, but a germicide). The used chlorine solution may be retained for washing udders, also floors, and for similar purposes.

Treatment After Use.

Milk System.

1. Immediately after each milking wash all dirt from the exterior of the rubbers and teat cups, using a vessel and brush kept exclusively for this purpose.

2. Draw 1 gallon of cold water through each set of teat cups; while doing this, withdraw the cups from the water several times, thereby causing a surging effect which flushes the pipes and rubbers more thoroughly, and ensures more effective removal of milk residues than a steady flow. Always start on the set of teat cups farthest away from, and work towards, the releaser.

3. Draw through each set of teat cups at least 1 gallon of hot dilute caustic soda solution, which is made by dissolving 1 level dessertspoonful of caustic soda in 4 gallons of hot water. (Proprietary cleansers may be used instead of caustic soda, and, if so, use them according to the instructions on the label of the package.) While drawing the hot caustic soda solution through the teat cups nearest the releaser, the torpedo brush supplied with the machine or a ball of horsehair is run through the milk pipe. The vacuum will carry this through with sufficient momentum to remove traces of milk from the interior of the pipe. If a torpedo brush is used the attached cord should be just long enough to enable the brush to travel the full length of the milk line, but not so long as to allow it to hit against and damage the metal of the releaser. Retain the caustic soda solution for using on the air line.

4. Next flush the whole of the milk system with clean, *boiling* water, using at least one gallon (preferably two) per unit, in order to remove all traces of the soda solution. This is important, for if the caustic soda solution is not rinsed off with plain water the tinning will gradually be removed from the milk pipes.

5. After this has been done, sterilize the entire milk system with steam, but it should always be remembered that the efficiency of steam sterilization depends on the effectiveness of the prior cleansing operations. If steam is applied to the machine before thorough cleansing, the heat will bake the milk remnants on to the interior of the pipes. This residue forms a hard deposit, known as milkstone, which makes cleansing and near sterilization difficult.

Air System.

Cleanse the air line at least once daily by flushing with hot soda solution, followed by clean, hot water. (The soda solution and hot water previously used for the milk lines may be used.) Because of the differences in the way of cleaning the airline of different machines, the manufacturer's instructions should be carefully followed. In the event of a farmer not knowing how to clean the airline of his machine, he is advised to contact the manufacturer or the local Dairy Officer.

Note: It is important to thoroughly cleanse at each milking the rubber tube between the outer chamber of the releaser and the releaser pulsator.

Sundries.

After all operations have been completed, dismantle the releaser, thoroughly cleanse, and sterilize with steam. Then remove the vacuum tank, cleanse, sterilize, and store both it and the releaser in some dust-free position.

Take the teat cup assembly and long rubbers off the down drops, and hang in a cool place. Remove all rubber plugs, or throw open flaps.

After each milking, remove the glass observation bowls and rubber washers under them and place in a position to dry.

Weekly Dismantling of Machine.

At least once a week completely dismantle and clean the machine. Take down the observation bowls, rubber washers, teat cups, claws, air and milk droppers and top rubbers; in fact, every part of the plant that will come asunder, and thoroughly wash inside and out with hot soda solution, then boiling water, and finally sterilize with steam.

At least once a week place all rubberware in a clean hessian bag, suspend in water to which has been added one level tablespoonful of caustic soda for each 4 gallons, and boil for ten minutes. This prolongs the life of rubberware.

Summary.

Summarised, the procedure in the cleaning of machines by the dilute caustic soda solution method is:

(1) Just before each milking flush the milk system with clean, cold water containing a chlorine compound in the proportion indicated by the manufacturer.

(2) After use, rinse each unit with at least 1 gallon of cold water.

(3) Run through the milk system a hot, dilute caustic soda solution (1 level dessertspoonful of caustic soda to 4 gallons of hot water), using 1 gallon of the solution to each set of teat cups.

(4) Run plain *boiling* water through each set of teat cups, using at least 1 gallon (preferably 2) of boiling water for each unit.

(5) Sterilize the milk system with steam.

(6) Once daily thoroughly cleanse the air lines.

(7) Remove and dismantle the releaser and vacuum tank, wash each thoroughly, sterilize with steam and store in a dust-free place.

(8) Disconnect teat cups and all rubbers. Open up all flaps or remove rubber plugs on the machine.

(9) At least once a week completely dismantle the machine and thoroughly cleanse and sterilize it.

THE BUSH BOOK CLUB.

Country people who live beyond the reach of libraries are invited by the Queensland Bush Book Club to take advantage of the service offered by the Club in providing reading matter on loan.

A small annual membership fee is charged, but carriage on parcels to the nearest railway station is free.

Books are sent in parcels of ten, together with magazines. These last the average reader about three months, but faster readers may obtain more than four lots a year if desired.

In addition to general reading, the Club will provide information on such subjects as simple dressmaking and domestic science.

The Club's library is provided by Brisbane people and other well-wishers, and the Club's activities are a tribute of friendship to the people of the country from the women of the city.

To join the Club just write to the Queensland Bush Book Club, Victory Chambers, Adelaide street, Brisbane, or, if you live in the North, to Queensland Bush Book Club, Kellock's Building, Townsville.

The Sheep Blowfly Problem in Queensland.

3. The Attractiveness of Sheep to Blowflies.

4. Seasonal Conditions in Relation to Blowfly Strike.

G. R. MOULE, Director of Sheep Husbandry.

3. The Attractiveness of Sheep to Blowflies.

BLOWFLY strike in sheep is characterised by the development of maggots on or under the skin. As the result of their presence the skin becomes inflamed and bloodstained fluid may exude through the damaged parts. The presence of maggots on or under the skin can be very irritating and affected sheep may bite at the struck area. Later they may become fevered and extremely sick and may die.

The word "strike" connotes these changes. It includes the deposition of the eggs by adult flies, the hatching and development of the maggots, and the feverish reaction shown so commonly by struck sheep.

In most cases sheep are not struck by chance. It is well known that some animals suffer frequent strikes, while others remain unaffected during severe waves. This is because of differences in the attractiveness of some sheep to blowfly strike, and it is important to understand their nature.

FACTORS WHICH INFLUENCE ATTRACTIVENESS TO BLOWFLIES.

When considering the attractiveness of sheep to blowflies two things have to be examined:—

(1) The conditions which *predispose* sheep to strike.

(2) The conditions which render sheep *susceptible* to strike.

Sheep which are predisposed to strike will only be struck provided they become susceptible to strike. Sheep which are not predisposed to strike do not, in most circumstances, become susceptible.

Conditions which Predispose Sheep to Strike.

(a) The General Attractiveness of Sheep to Blowflies.

It has been shown that most of the common species of blowflies are more or less attracted to and feed on soiled or wet fleece. In addition, the green blowfly (*Lucilia cuprina*) lays its eggs more readily on wet fleece than other species of flies. This general association between flies and sheep greatly increases the chances of strike and it is probably due to some particular smell associated with the tip of the wool. During investigations in New Zealand, it was found that blowflies were attracted mainly to the tip of the staple rather than the base, although no unusual differences could be observed between the two ends.

(b) The Conformation of the Sheep.

The conformation of the sheep can influence the development of areas which are highly attractive to blowflies and susceptible to strike. This is likely to be of importance in relation to crutch strike, tail strike and body strike. Considerable variation occurs in the size and shape of the bare area surrounding the vulva and anus. If this is small, the wool is readily soiled with urine and droppings and soon becomes attractive to flies.

Crutch Strike.—It is well known that wrinkly breeched sheep suffer more frequently from crutch strike than sheep which are plain breeched. An example of this is presented in the following table, which was compiled from observations made amongst a group of 73 Merino ewes which were kept under observation for three years.

BREECH STRIKES: AGED EWES, 1933–36.

Type of Breech.	Number.	Number. Struck.	Percentage Struck.	Number of Strikes.	Average Percentage of Strikes Per Annum.
Plain	23	10	43	24	35
Moderately wrinkly ..	35	31	89	132	126
Very wrinkly	15	15	100	105	233
Total	73	56	77	261	119

Tail Strike.—More recently it has been shown that the length and the method of cutting off the tail can predispose to, or protect sheep from, strike originating on the tail or crutch. For these reasons the tailing operation is of considerable importance.

If the tails are cut so that the bare skin from the under-surface is turned back over the severed stump, the sheep is not so likely to be affected by strike as it is if the tail is cut in a way which permits the wool-bearing skin to be drawn down to form a "woolly mop" on the end of the tail. This is likely to become soiled with urine and/or faeces, and in this way it can lead to the development of susceptibility to strike.

The length at which the tail is cut also influences predisposition to both crutch and tail strike. If the tails are too short or too long the sheep are likely to suffer from increased crutch and/or tail strike. The most suitable length at which to cut lambs' tails appears to be level with the tip of the vulva. Tails cut at this length grow proportionately

with the rest of the animal's body and confer a marked degree of protection from strike, as the following figures of degree of strike and tail length show:—

—	Covering Vulva.	Medium.	Short.
Number of sheep	74	69	81
Number of breech strikes	9	15	20
Number of breech and tail strikes	Nil	5	8
Number of tail strikes	1	2	7

More recently it has been observed that the amount of wool-growing skin on the top of the tail influences predisposition to strike. Sheep which have an extensive area of wool-growing skin on the upper surface of their tails are more likely to be struck than those which have only a small area of wool-growing skin on the top of their tails.

Body Strike.—Body strike refers to strike which commences on some part of the sheep other than on the breech, the head of rams or the pizzle. It occurs most commonly on the back or withers, on the point of the shoulder or on the rump.

Body strike is usually associated with continued wet weather which keeps the wool of the withers and back wet, or with heavy dews at a time when grass is long. This can keep the wool of the shoulders and apron wet and may result in body strike.

Pastoralists commonly state that blowflies will strike anything and they quote the occurrence of blowfly eggs or larvae on saddle cloths, but these are not the same species as those that strike sheep and body strike does not occur by accident. Sheep with misshapen withers and with devil's grip are particularly likely to suffer from body strike, because conformation of this type is likely to let moisture get down through the wool to the skin where it sets up bacterial activity which makes sheep susceptible to blowfly attack.

Head Strike of Rams.—Two factors can predispose rams to head strike. They are (1) fighting, and (2) the shape and set of the horns.

Suppurating sores may develop on the poll of the ram as the result of fighting and these soon predispose the animals to head strike. Horns which are set too closely to the head are usually considered to set up a degree of sweatiness around the poll of rams and this leads to bacterial activity which makes that part of the sheep attractive to blowflies.

Conditions which Render Sheep Susceptible to Strike.

Apart from the general attractiveness that all woolled sheep have for blowflies, and excluding wounds, certain conditions must occur on the skin of the sheep before they will be struck. The usual sequence is as follows:—

(1) Some part of the wool must be wet to the skin, and must remain wet.

(2) As the result of the moisture, bacteria on the skin multiply rapidly.

(3) An area of scald develops on the wet skin, and as a result the skin becomes red and sore.

(4) Blood serum exudes through the damaged skin surface and that provides more moisture which is enriched with nutriments on which bacteria thrive. This further hastens their multiplication and it is not long before the skin is severely damaged.

(5) As a result of these changes, a peculiar smell, which is attractive to blowflies, emanates from the scalded skin.

> Female flies alight on or near the moist area and lay eggs. On hatching, the maggots find conditions which are suitable to their particular requirements. There is ample food, protection and warmth, and as they grow bigger they attack the skin of the sheep and may tear their way right through it.

This sequence of events is followed almost irrespective of the location of the strike. Adequate moisture to soil the crutch and keep it constantly wet is provided by the urine voided by ewes. This is increased if the ewe has only a small area of bare skin surrounding the vulva and anus. If the bare skin is stretched and enlarged by the Mules operation, the crutch is not so likely to become urine soiled.

Similarly, any wool growing on the tip of the tail of ewes may become soiled with urine and thus susceptible to strike, and the wool around the pizzle of wethers can also be affected. As the result of heavy rain or consistently heavy dews on long grass, the withers, back or shoulders of sheep may be kept wet for a considerable period. As a result, fleece rot develops. This is an obvious manifestation of the bacterial changes which take place on the skin and amongst the wool of sheep which are continually wet. Fleece rot may occur as a yellow, green, brown, pink, purple or blue discoloration associated with matting of the wool. When fresh it has a peculiar musty odour and when dry it is friable and crumbly and in the majority of cases it renders sheep susceptible to body strike.

Most suppurating wounds are attractive to blowflies. If tails are cut short, the wounds are likely to become soiled with faeces and urine. In this way they become infected and may render recently marked lambs susceptible to fly strike. Similarly, rams may suffer from suppurating wounds on their heads as the result of fighting.

Wool growers often consider that ill health renders sheep susceptible to blowfly strike. It cannot be agreed that this is usually the case, although it is well known that heavy infestations of hair or nodule worm may lead to the passing of droppings which consist mainly of fluid or mucus. These may keep the sheep's crutch wet and in this way lead to the development of areas attractive to blowflies.

4. Seasonal Conditions in Relation to Blowfly Strike.

Two things are necessary for the development of a severe wave of blowfly strike:—

(1) Sheep which are susceptible to flies.

(2) A reasonably large fly population.

Plate 176.

Map Showing the Different Zones Which Have 66 per cent. or Greater Reliability of Effective Rains for Periods of Various Numbers of Months.

KEY TO PLATE.

Summer—				
Number of wet months	6	4	2	0
Symbol	A	B	C	D
Winter—				
Number of wet months	6	4	2	0
Symbol	a	b	c	d

Example—Area Bc has effective rainfall for four summer months or two winter months with a 66 per cent. reliability.

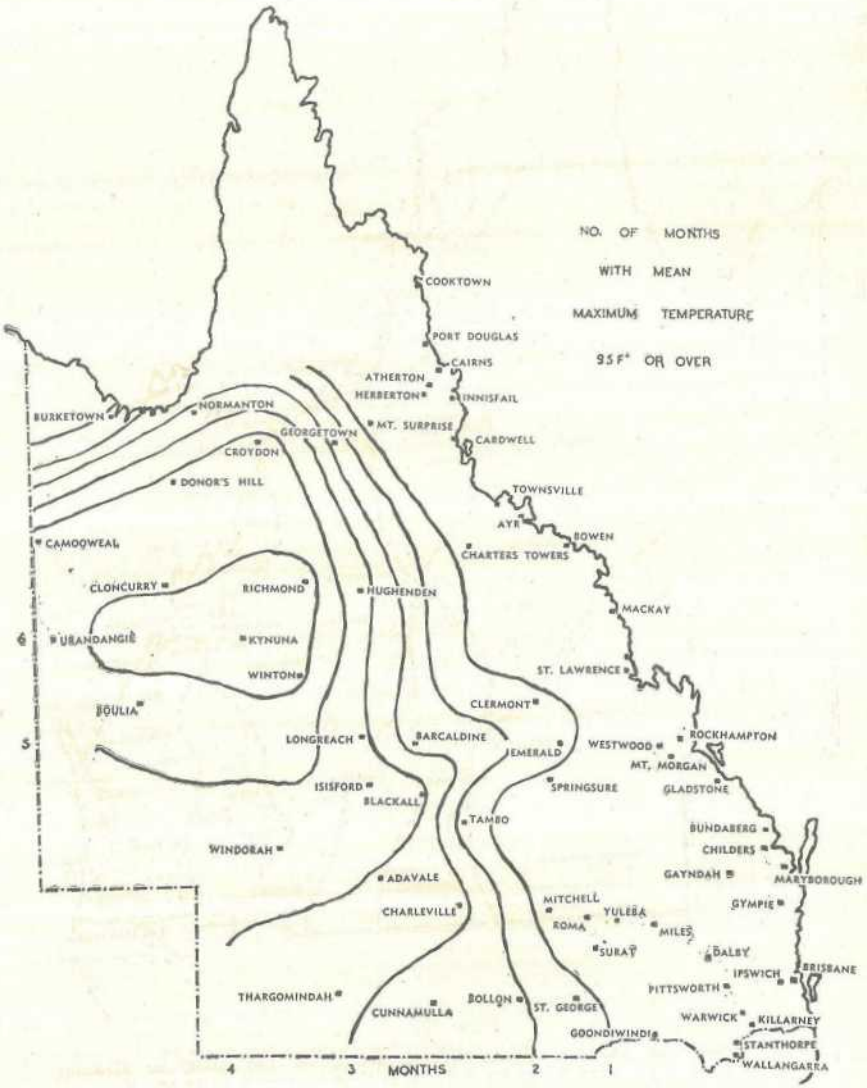


Plate 177.

Map Showing Number of Months With a Mean Maximum Temperature of 95°F. or Over.

Both of these are influenced by seasonal conditions. The main factors to consider are:—

(1) The distribution and intensity of the rainfall.

(2) The evaporation.

(3) The temperature of the air.

The distribution and reliability of the rainfall are important because they govern blowfly populations as well as the susceptibility of the sheep. An evenly distributed reliable rainfall ensures that a large number of blowfly maggots hatch out into adult flies. The intensity of the rainfall governs the amount of moisture in the fleece, and the evaporation and temperatures affect the rapidity with which the fleece dries. Temperature also influences the activity of any blowflies that are about and the rapidity with which their life cycle is completed.

A study has been made of rainfall in relation to evaporation in Queensland and of air temperatures. The results are presented in the maps in Plates 176 and 177. Plate 176 shows the number of months in which rains that equal a certain fraction of the total evaporation for the month occur. It is seen that the main Mitchell grass downs country of central and north-western Queensland have received their principal rains in two months of summer in 66 per cent. of the years for which records exist. In most years these rains have occurred during either January, February or March. The forest country, often referred to as the "desert," east of the open downs has received four months of summer rain in 66 per cent. of the years for which records exist, while the Clermont, Emerald and Springsure districts have received four months of summer rain or two months of winter rain in 66 per cent. of years.

Further south, the increasing importance of winter rain is apparent. In the Cunnamulla area, the winter rain is more reliable than the summer rain and to the east of this district occurs a long, wide zone which receives two months of rain in summer or two months in winter. In the Maranoa and Darling Downs the rainfall is more reliable and has a better distribution. Some districts receive four months of rain in summer or four months in winter.

The map (Plate 177) showing the number of months in which average monthly maximum temperatures exceed 95 degrees F. is of particular interest in relation to blowfly activity. In the north-west the long, hot summers tend to depress fly activity at that time. When this is considered in relation to the poorly distributed and unreliable rainfall in the north-west, it is not surprising that the blowfly problem is not as severe in that area as in the central-west and south-west. It is of interest that the cold weather experienced in the Maranoa in winter is sufficient to depress fly activity at that period.

Sterility in Cattle.

R. W. HEWETSON.

ONE of the most perplexing problems which has faced the livestock owner and the veterinarian during recent years is that of infertility in cattle in both dairy and beef herds.

In order to conduct a dairying or beef raising property successfully, particularly in these times of high operating and replacement costs, it is desirable that each female animal produce a live calf annually.

Diseases impairing reproduction strike at one of the fundamentals of animal production. Heifers and cows which are either temporarily or permanently infertile obviously fail to yield their maximum potential. Fewer calves mean fewer cows in milk and that of course means lower returns. Moreover, because there are more dry cows in the herd than normally, returns are still further reduced by reason of the cost of maintaining these additional non-productive animals.

This problem is particularly important to the wholemilk producer, who aims at calving his cows at certain periods of the year to maintain a constant production of milk for the city market.

Seasonal calving to utilize available seasonal flushes of pasture cannot be practised when sterility occurs in a herd as calving schedules are disrupted.

The stud-breeder who depends for a livelihood on the production of healthy calves for sale as future dairy or beef sires is also vitally affected by infertility in his breeding herd.

A herd wastage survey made of 122 Queensland dairy herds in 1949 showed an annual average culling rate of cows of 16·1 per cent. Of these, 4 per cent. were culled for permanent sterility and 7 per cent. for contagious abortion (brucellosis). This is an indication of the large annual economic loss from sterility which occurs each year in Queensland.

I. THE REPRODUCTIVE ORGANS.

In order to understand fully the problem of infertility in cattle, it is necessary to know something of the anatomy and functions of the reproductive organs of both sexes.

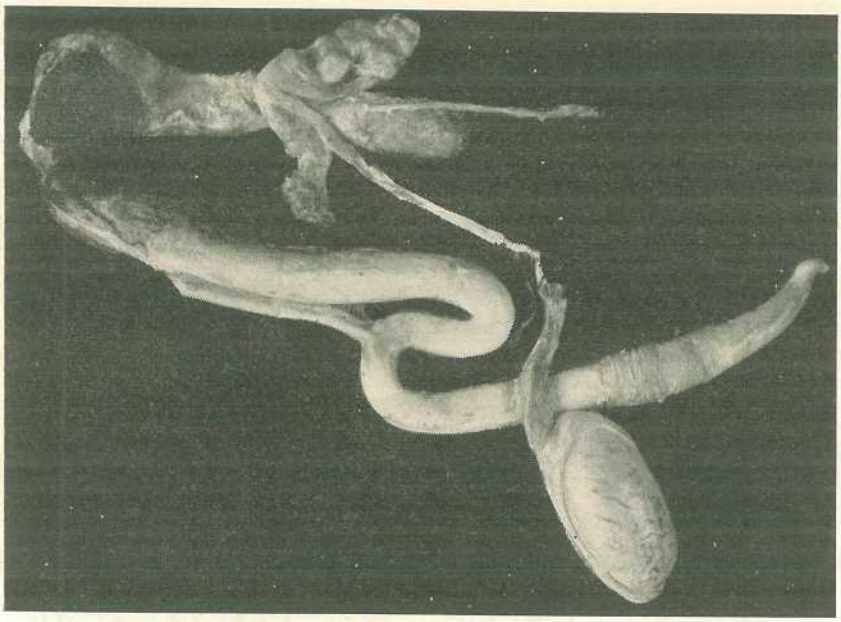
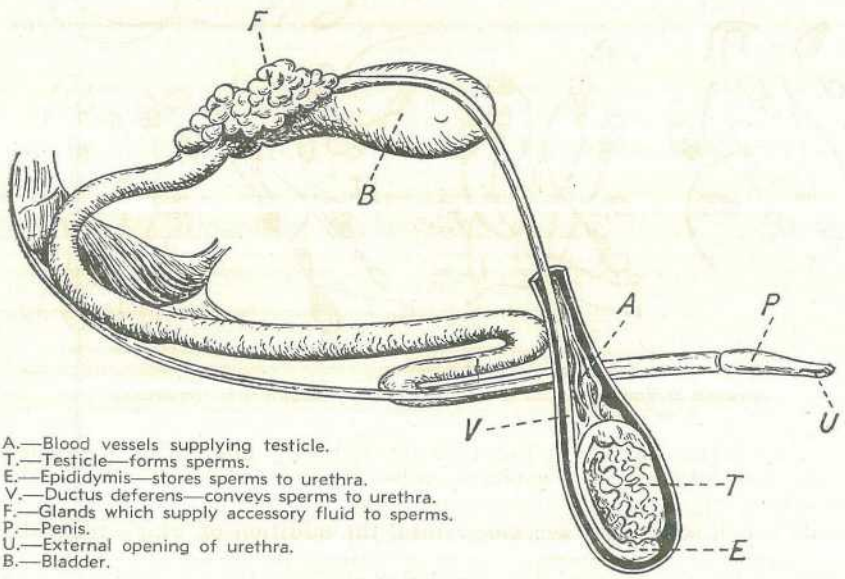


Plate 178.

Photograph of Reproductive Organs of the Bull. The parts are named in Plate 179.



A.—Blood vessels supplying testicle.
T.—Testicle—forms sperms.
E.—Epididymis—stores sperms to urethra.
V.—Ductus deferens—conveys sperms to urethra.
F.—Glands which supply accessory fluid to sperms.
P.—Penis.
U.—External opening of urethra.
B.—Bladder.

Plate 179.

Diagram of the Reproductive Organs of the Bull.

(Taken from Ministry of Agriculture and Fisheries Bulletin 39.)

1. The Bull.

In the bull, the reproductive organs (Plates 178 and 179) are composed of two testicles (testes) enclosed in a pendulous scrotum, a penis which is covered and protected by a sheath, and a number of accessory sex glands situated in the region of the bladder.

The sperm or male germ cells (Plate 180) are produced by the testes, in which they may remain fertile for 40 days and even as long as 60 days. It is often 60 days or more after sperm are formed in the testes that they are ejaculated in the act of mating. In artificial insemination centres, after a bull has had a long sexual rest it is necessary sometimes to discard one or two ejaculates because of the death of the sperm. This explains why the first few services of a bull which has been rested for some weeks may not result in conceptions.

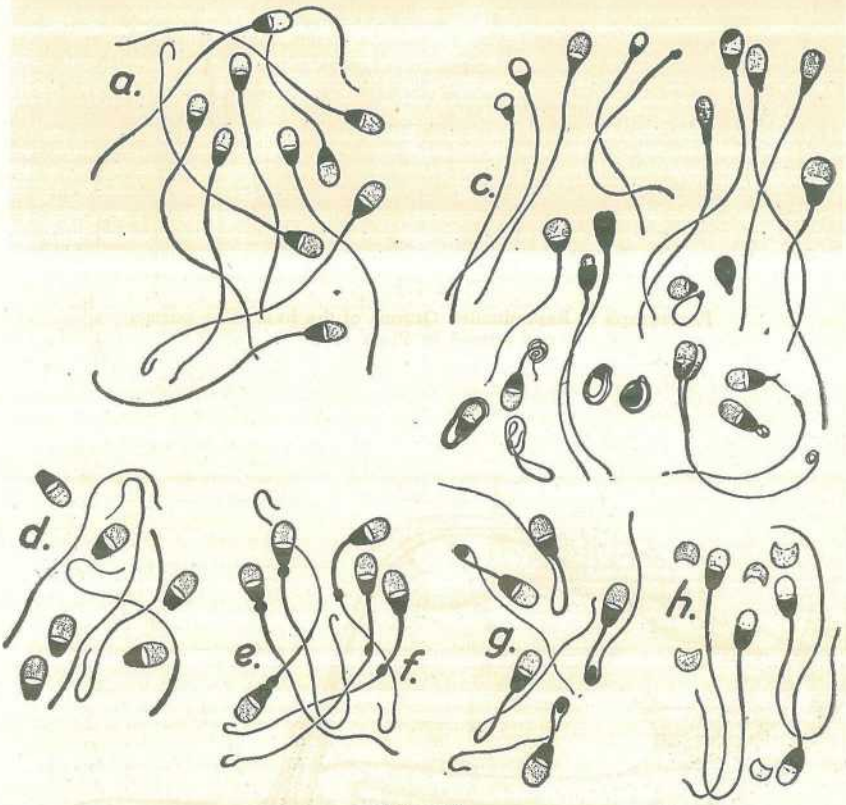


Plate 180.

Drawing of Various Types of Bull Sperms. a, normal; c-h, abnormal.

The sperms pass by a fine tube or excretory duct, which is called the ductus deferens, to a passage called the urethra. At or near the junction of the excretory duct with the urethra there are a number of glands which secrete an accessory fluid, the addition of which increases the volume of the semen. These glandular secretions activate the sperms so that they are able to ascend the female genital tract. At mating, the sperms pass down the urethra and are deposited in the female tract by the penis.

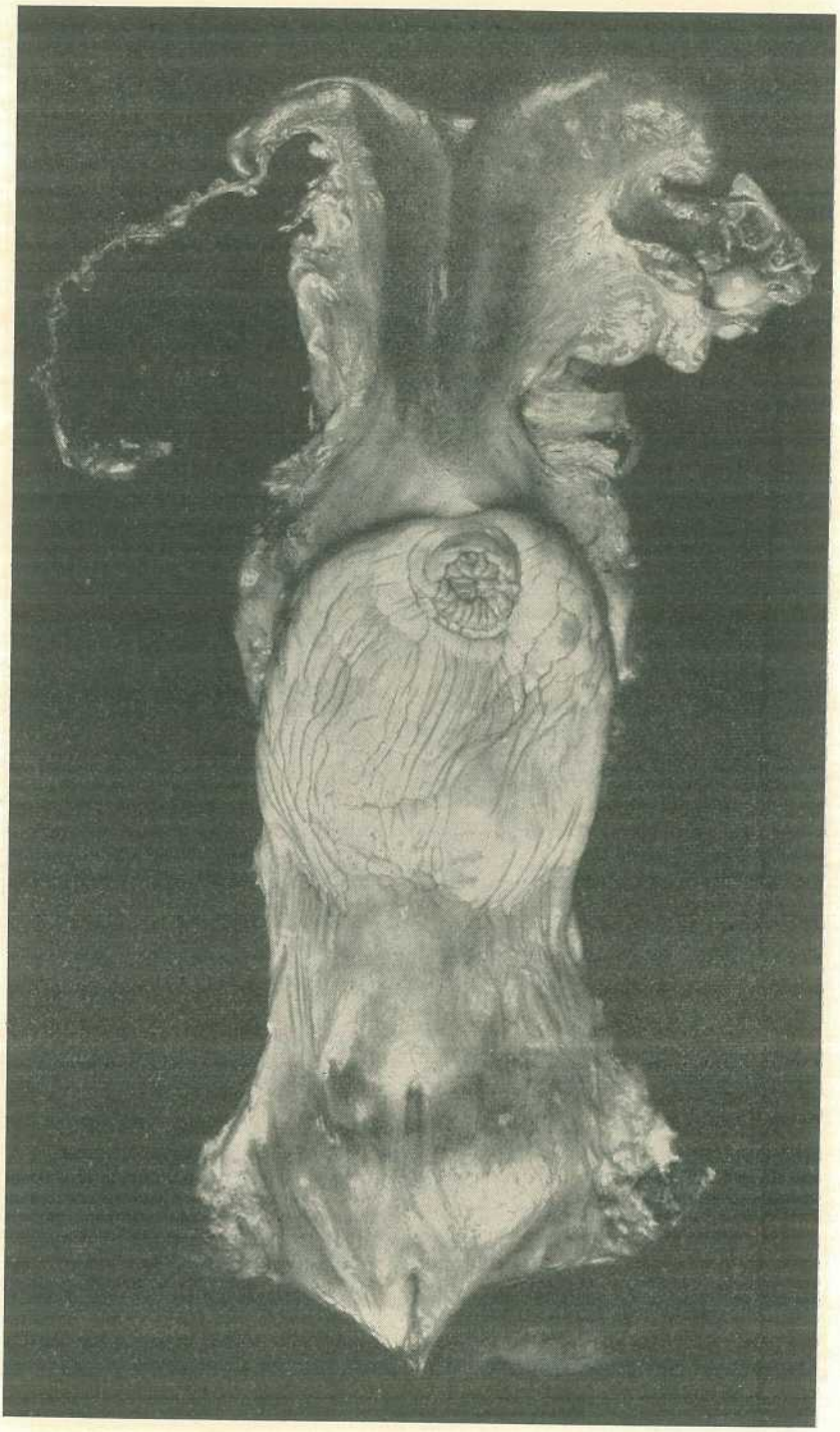


Plate 181.

Photograph of Reproductive Organs of the Cow, With Part of the Canal Cut Open. The parts are named in Plate 182.

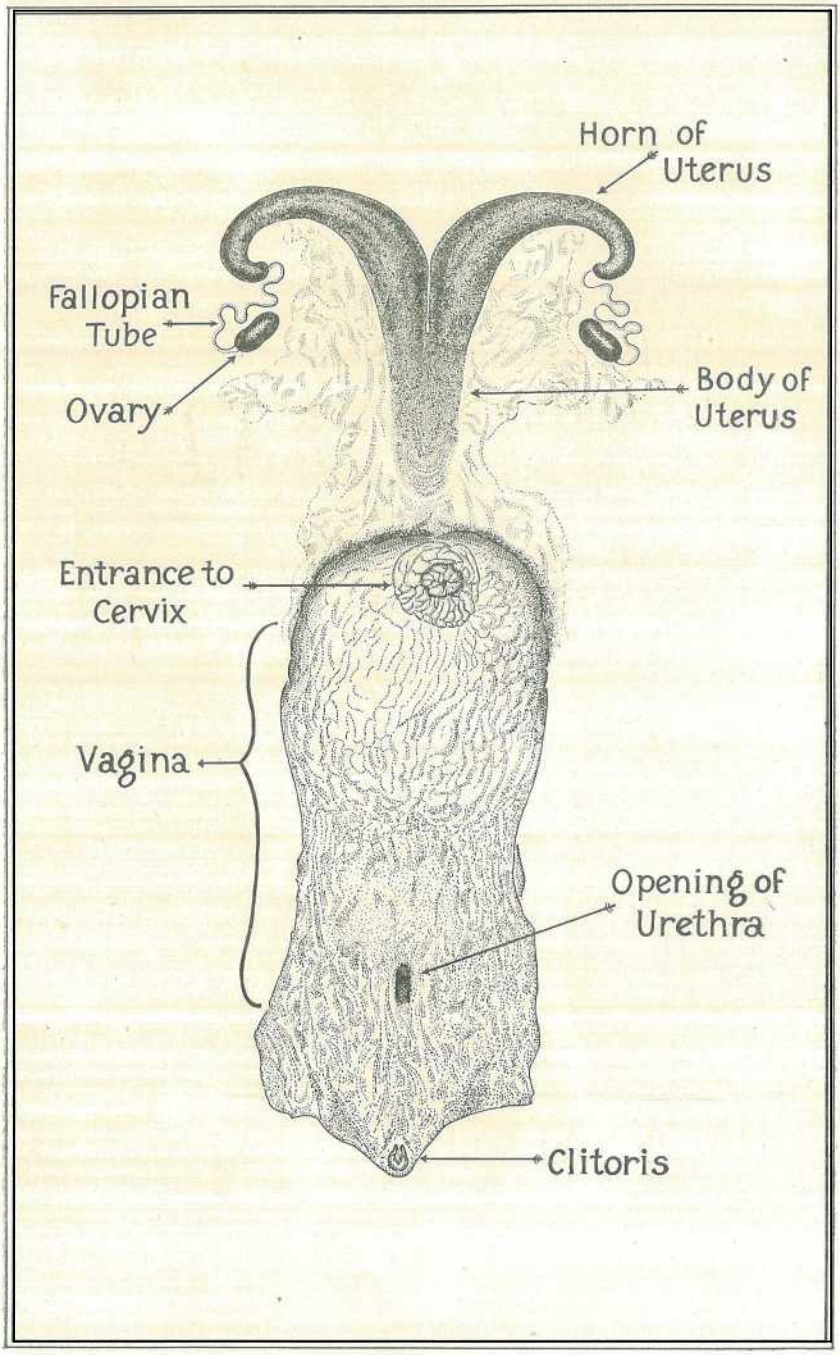


Plate 182.

Diagram of the Reproductive Organs of the Cow.

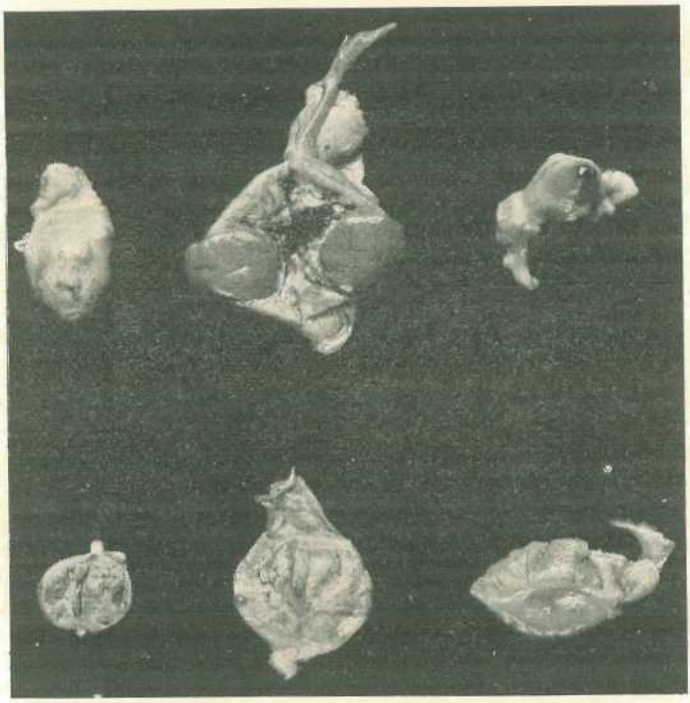


Plate 183.

Ovaries of the Cow. Left to right, top—Ovary showing corpus luteum; ovary cut to show the halves of the corpus luteum; mature follicle in ovary ready to ovulate. Left to right, bottom—Two ovaries sectioned to show immature follicles; normal quiescent ovary.

The male hormone controlling sexual behaviour is secreted by the testes. It is a chemical substance and is responsible for the desire and the power to mate. It must be recognised, however, that the mating power of a bull is no criterion of his ability to get cows in calf. It has been noticed that bulls of all degrees of fertility show considerable variation in their desire to mate and not uncommonly a completely sterile bull will be keener and more capable of service than a highly fertile one.

2. The Cow.

The production of ova, or female germ cells, in the cow is a function of the ovaries (Plates 181-183), which are roughened ovoid bodies, up to one inch long, situated in the pelvic cavity. Once the ovum (or egg) has ripened or matured in the ovary it is extruded and conveyed by the Fallopian tubes (or "webbing") to the corresponding horn of the uterus (or womb). If fertilised there, it develops into a calf.

The two horns of the uterus come together at one end to form a single compartment which is known as the body of the uterus. At its hindmost end the body is continuous with the cervix or neck of the womb. This portion of the uterus is thick-walled and has only a narrow and somewhat tortuous canal instead of the relatively large cavity which is present elsewhere. Except at calving time, the cervix is a substantial barrier to the uterus proper and can only be pentrated by way of the cervical canal which opens into the broad passage known as the vagina. In the floor of this passage is the opening of the urethra, which conveys urine from the bladder to the vagina and so to the exterior.

At service, the sperms are deposited by the male in the vagina of the cow and they then make their way through the cervix into the uterus to fertilize the egg.

II. OESTRUS AND THE SEXUAL CYCLE.

The female has a rhythmical sexual cycle, usually of 21 days, which can be divided into three stages:—

(i.) The ripening of the egg in the ovary and the preparation of the uterus to receive it;

(ii.) The release of the egg from the ovary. External signs of heat are shown by the female 13 to 15 hours before the egg is released;

(iii.) The attachment and commencement of development of the egg if mating results in conception, or in the event of non-conception the absorption of the egg and return of the uterus to normal.

The "yellow body" or corpus luteum develops in the follicle from which the egg has been released. While this yellow body persists in the ovary the cow will not come on heat. In a normal cycle the corpus luteum persists for 17 to 18 days. In the pregnant animal the yellow body persists throughout the gestation period, secreting a hormone which represses heat. Regression of the corpus luteum at calving time allows the production of other hormones necessary for normal calving.

It sometimes happens that regression of the corpus luteum does not occur during an ordinary cycle, and if this happens the normal cycle ceases and cows do not come on heat. This may occur secondarily to some infective process.

The whole cycle is controlled by a series of hormones produced by the pituitary body and the ovary. The pituitary body is a small gland situated at the base of the brain, and apart from producing hormones on its own account it initiates the production of other hormones by the ovaries. Oestrus or heat occurs on the average every 21 days, but there may be individual variations in the period ranging from 16 to 24 days.

The length of oestrus varies but is usually 13 or 14 hours. Heat may as be short as 8 hours or as long as 30 hours. Because of this fact, cows having short heat periods may be missed if they come on heat during the night.

Ovulation, or the bursting of the follicle to release the egg, occurs 13 to 15 hours after the end of the heat period.

Most farmers will recognise the symptoms of heat in the cow without difficulty, but the following points may assist:—

(1) Standing when mounted. Some cows remain standing whilst being mounted by other animals. Ruffled hairs over the tail head indicate that a cow has been mounted.

(2) Attempting to mount. Some cows attempt to mount other cows and generally behave like bulls.

(3) Bawling or bellowing and general restlessness. Some urinate frequently during this period.

(4) Discharge of mucus from the vulva. This mucus is transparent and has the consistency of egg-white during heat. Strings of mucus on the tail or hindquarters glisten and sparkle in the sun. There may be a bloody discharge, usually two days after the onset of heat.

(5) Swollen, flabby and wet vulval lips. The lips appear wider and thicker and mucus is smeared over them, giving a moist appearance.

(6) Pink glistening vulval walls. The increased flow of blood through the fine network of blood vessels gives a pink colour to the walls. In addition, some animals show a reduced milk production whilst on heat, which is generally conceded to be due to a "hold up" of milk.

Some cows have quiet heats and do little mounting; they are often missed unless close observations are made for ruffled hairs and mucus discharge.

III. MANAGEMENT OF THE BULL.

On many farms management of the bull is unsatisfactory. Controlled mating and hand service is the exception rather than the rule.

For most efficient utilisation of semen and highest conception rates, two services only are allowed a bull each week in artificial insemination centres, and the bull is kept well fed.

1. Feeding.

A considerable amount of sterility is due to defective sperm production by the bull. This is found particularly in young bulls which have been under-fed and over-worked, and in old bulls which have been over-fed and under-worked.

With notably few exceptions, the food requirements for reproduction, both in quality and quantity, do not exceed those for maintaining animals in good health. The exceptions are vitamin A and protein, both of which are abundantly supplied in young green grass and in first quality lucerne hay.

A deficiency of vitamin A, if sufficiently prolonged, causes wasting of the testes and damage to the mechanism of sperm production.

There should be ample protein available to supply normal maintenance requirements. *On the other hand, too high a protein intake may be responsible for infertility.* A number of people consider that some animal protein in conjunction with vegetable protein is desirable for the production of high-quality semen.

Starvation in early life before puberty retards or arrests sexual development, delays puberty and suppresses the production of sperms.

A word of warning is necessary on the practice of feeding large quantities of roughages, or, for that matter, any other practice leading to the production of "pot-bellies" in bulls. Overlarge abdomens will interfere with service, the "pot" belly acting as a mechanical obstruction to the insertion of the penis.

Bulls should be maintained in hard condition, which is produced by sufficient exercise to work off excess fat. An area of at least one acre is desirable for a bull paddock and this paddock should be provided with a shelter shed, feeding facilities and service yard.

A beast increasing in weight is more likely to be highly fertile than one losing weight.

With bulls, the time when a nutritional deficiency occurs is important. Sperm formed in the testes may not be ejaculated for as long as 9 weeks after formation. Bulls brought onto good feed after having been on short commons may take some 9 or 10 weeks to achieve the production of good quality semen.

Seasonal changes in semen production have been observed in bulls. Changes appear to be associated with, or are actually caused by, atmospheric temperatures and nutritional deficiencies, although some as yet unexplained factors may be involved.

It is therefore necessary to take a broad view of bull feeding and aim at providing a good ration. The ration should be well balanced and provide ample protein, carbohydrate, minerals and vitamins. Some animal protein may result in increased fertility. A supplementary mineral mixture may be necessary, its composition depending on local circumstances. Phosphorus, calcium, and perhaps copper, are the only minerals likely to be deficient in Queensland.

Green feed should be fed wherever possible. Lack of green material and hence of vitamins may be important in the prolonged dry seasons of the tropics and sub-tropics in lowering fertility in males. When the breeding season is restricted, full feeding should start some weeks before and continue throughout the period. Older bulls, especially those of beef breeds in fat condition, may become sluggish and it may be necessary to starve them for short periods to increase their vigour.

Drugs such as opium, strychnine, cantharides and yohimbine, which are sometimes used to promote sexual excitement, are not recommended unless used under veterinary supervision, as in the end they will lower rather than increase the breeding powers of the animal.

2. Care of the Young Bull.

Most young bulls reported sterile have been overworked. They serve cows efficiently but fail to get them in calf. They have usually been turned in with the cows at an early age. This has allowed the bull to serve each cow several times, so instead of being allowed to serve 10 or 15 cows once or twice, he has probably been allowed anything up to 100 services in his first year. The bull simply fails to stand up to such heavy services.

The following rules for the use of young bulls should be observed:—

(1) Do not use a bull before he is a year old—segregate male and female calves before they become sexually mature.

(2) Be sure the bull is not overworked. A yearling bull can serve 10 to 15 cows with safety during the first year of service, but services should be reasonably spaced.

(3) Never allow the bull to run with the cows. Careful hand service should be practised and services should be limited to a single leap.

(4) Feed a balanced ration which keeps the bull growing without making him fat.

(5) Carefully control roughage intake, paying particular attention to quality, to avoid "pot-bellies."

(6) Inspect the feet regularly and keep them trimmed.

(7) Provide the bull with sufficient exercise.

(8) Keep a close check on worm infestation. Young bulls should be dosed regularly with phenothiazine to keep down worm burdens and, where possible, pastures should be changed regularly.

3. Mating.

The common practice of allowing the bull to run with the herd is not good husbandry. Controlled mating with hand service is much to be preferred. If this latter practice is adopted, the bull can be used on more cows and kept in much better vigour. Instead of several services per cow when running with the herd, a bull whose services are controlled need only serve cows once, or at the most twice if it is desired that a second service be given towards the end of the heat period.

Bulls become used to the method of management at service and the environment of the service yard, and if these are altered, particularly by transfer to another farm, there may be at first a disinclination to mate.

Young bulls may play with a cow on heat without achieving results, but if persevered with, sexual desire is usually acquired.

Over-exertion, inability to serve, or pain felt every time the bull mounts the cow may cause reduction or loss of sexual desire.

Infections following injury may result in adhesions of the penis to the prepuce and inability to protrude the penis. Such injuries are often referred to as "broken pizzle." It is very difficult to remedy such cases.

Most observations indicate that mating behaviour and sperm production vary independently of each other. In the bull willingness and ability to mate are not an indication of his ability to get cows in calf.

It has been observed that a longer time getting ready to mount has had a beneficial effect on sperm production. The superiority of second over first service by the bull when carried out within a short time is probably associated to some extent with greater efficiency of service and the ejaculation of younger and more active sperms.

IV. MANAGEMENT OF THE COW.

Often a veterinarian is called in to investigate infertility in a herd only to find that the farmer has no records of service dates or heat periods and only a vague idea of when his cows will calve.

Records of heat periods and service dates are invaluable to the dairy farmer himself if he is to run the farm efficiently. A knowledge of when the cows are due to come in will help in a planned milking programme. Especially is this so if seasonal calving is planned to make the most use of the spring and summer flush of feed. There is some evidence to show that the withholding of service for 60-90 days after calving favours conception. A suggested form of record is:—

MATING RECORD.

Name or Number.	Date Last Calved, and if Normal.	Dates on Heat.	Served or Not Served.	Bull's Name.	Date Expected to Calve.
Mary	13/12/49	3/1/50	Not Served.	.. ..	.. ..
	Calf dead	24/1/50	Served.	Duke	5/11/50
		14/2/50	Served.	Prince	26/11/50

Records kept in the above manner are of untold value to the person investigating infertility in a herd and at the same time notify the farmer immediately if he is having trouble with the service programme.

1. Feeding.

Malnutrition may affect the reproductive system in a variety of ways, directly or indirectly, and may take a number of forms. Under practical conditions, cases of malnutrition are rarely due to the deficiency of one factor in the feed, but more commonly to a variety of factors.

Underfeeding may be accompanied by poor quality of feed. Thus an energy deficiency is often accompanied by a protein, phosphorus or vitamin A deficiency, and a protein deficiency by phosphorus deficiency.

Malnutrition usually results in lowered vitality, so it is reasonable to suggest that any form of malnutrition lessens resistance to disease.

Generally the young animal is more susceptible to deficiencies than the adult. Early malnutrition prevents the orderly growth of the reproductive organs as a fully developed system. When this occurs, it is difficult and sometimes impossible to initiate the correct balance for proper development as irreparable damage may have occurred. Reproduction having begun, the problem tends to be easier as it is then only a question of maintaining in smooth operation an organisation already established. Reserves have been accumulated in the mature animal giving it greater resistance than the growing animal which is still using all available food for growth. For this reason more attention should be paid to the growing animal. Prevention rather than cure should be the aim of all good husbandry men.

Specific dietary deficiencies rarely cause specific lesions in the reproductive tract. They usually produce general effects leading to infertility.

(a) General Starvation.

Calves badly fed are late in reaching sexual maturity. Heifers fed heavily experience their first heat much earlier than heifers fed lightly.

Cows which are underfed may not come on heat regularly. However, once conception takes place the calf is usually carried to full time.

(b) Minerals.

The mineral most likely to be deficient in Queensland is phosphorus. Phosphorus deficiency tends to occur where the diet is low in protein when the grass is dry. Soils low in phosphorus generally produce pasture deficient in this mineral.

Generally, reproduction does not suffer until cattle show clinical signs of phosphorus deficiency—that is, unthriftiness, rough coat, a depraved appetite and a reduced milk yield.

In phosphorus deficient areas there are reports of herds in which not more than half of the cows have a calf each year although there are no more than the usual number of abortions. It is usual in these areas for heifers not to come on heat until they are two years old.

The effect of phosphorus deficiency is more evident in the winter and spring months when pasture generally is lowest in phosphorus. Cows suffering from phosphorus deficiency may fail to come in season, but after the drain of milk production has ceased with drying off, heat periods return with normal chances of conception.

Phosphorus deficiencies may be overcome by feeding phosphorus supplements or by phosphorus topdressing of pastures and crops. Superphosphate topdressing, however, is not successful in all areas because of what is referred to as a "lock-up" of phosphorus in some soils.

Phosphorus supplementation is usually undertaken by feeding small quantities of bonemeal. This can be fed at the rate of 2 oz. a day per beast if hand feeding is practised or given as a lick with equal parts of salt.

Recently, it was found that the addition of superphosphate to drinking water at the rate of 2 lb. per 100 gallons of water would supply sufficient phosphorus. It is, however, necessary that the whole of the superphosphate be added to one gallon of water first and the undissolved deposit discarded, the clear separated fluid alone being used. This procedure disposes of most of the harmful fluoride present in superphosphate. Solutions prepared as above can be added to the feed at the rate of one-quarter of a pint per head daily if the herd is hand fed.

In addition to phosphorus deficiency, calcium deficiency has been thought to cause reproductive failures in cattle, but this is much less common. Although calcium deficiency may occur in cattle, it is not nearly so common as phosphorus deficiency.

Copper deficiency may occur in some of the coastal areas of Queensland. A lack of copper will cause a suppression of oestrus and the birth of weak calves.

(c) Vitamins.

Vitamin A deficiency has caused the birth of dead and weak calves, with the retention of the "cleanings" or foetal membranes.

It is not likely that a vitamin A deficiency will occur except in prolonged dry seasons, as cattle have the capacity to store vitamin A in the liver.

Extravagant claims have been made from time to time for the use of vitamin E. It is known that adequate amounts of this vitamin are necessary for normal attachment of the egg. However, there are reports of raising heifers on a vitamin E free ration with no calving abnormalities.

(d) Over-feeding.

It is generally accepted that over-fat cows have more difficulty in conceiving than do others. It may be argued that the tendency to fatten denotes an hereditary ovarian imbalance which would in itself impair fertility. Fat is laid down in the ovary as well as the body tissues generally, and the effect is to interfere with the ripening of the follicles.

In quick fattening beef breeds it is often noticeable that fatness is associated with infertility.

2. Mating.

The cow comes on heat for an average of 13 to 14 hours approximately every 21 days, and the egg is released 13 to 15 hours after the cessation of heat. Because of this fact it is very important that cows should, as far as possible, be mated towards the end of the heat period—and so a cow on heat in the morning if mated immediately and still on heat in the evening should be mated again. Cows coming in season in the evening should be mated once and, if still on heat next morning, mated again.

V. SOME PHYSIOLOGICAL ABNORMALITIES.

The experience of some veterinarians suggests that hormonal abnormalities are usually the result of disease factors which have upset the normal hormone balance. (There is a delicate balance between all

hormones of reproduction.) Primary hormone imbalance in cattle is rare and this leads to the belief that functional sterility is usually the result of disease or malnutrition.

There are a number of conditions which may be treated with hormone preparations, but the aid of a veterinarian should be sought before treatment is contemplated. They are:—

(1) *Infantile ovaries.*—The failure to develop ovaries past the infantile stages in some heifers may be due to:—

(*a*) Late development;

(*b*) Some genetic factor;

(*c*) Malnutrition in early life.

(2) *Shrunken ovaries.*—The condition of ovarian hypoplasia, or shrunken ovaries, in the adult has points of similarity to that of infantile ovaries but the condition found seems to be more variable. The cause of this condition is malnutrition.

(3) *Persistent "yellow body" or corpus luteum.*—The cause of this condition is not known, but it may occur secondarily to some infective condition.

(4) *Nymphomania.*—In this case cows come on heat at irregular intervals which may be as close as three or four days. The condition is due to production of follicular cysts in the ovary. It can be caused by inexpert use of certain drugs of the oestrogen group.

(5) *Seasonal infertility.*—Cows in which heat periods may be regular or irregular present a most important problem because they give the opportunity for breeding but much time is wasted in trying to get them into calf. From the absence of definite signs of abnormalities, it is difficult to know when to begin to treat them as sterile cases. A relatively infertile bull is not as successful with this class of cow as a highly fertile one. Service at the end of the heat period may be helpful.

VI. DISEASES OF THE REPRODUCTIVE ORGANS.

The ability to reproduce may be temporarily impaired during the course of any general condition associated with sickness or an increase in body temperature. In bulls the ability to produce sperm may be affected and the quantity and quality of semen markedly altered. Especially is this so in diseases such as tick fever in which there is a sudden rise in temperature followed by several days of fever.

Absolute sterility does not result from most genital infections. A few of short duration have no lasting effects, whilst others may cause permanent changes which make reproduction difficult or impossible in bulls. Damage to the testicles and accessory glands may result. In cows extensive adhesions around the ovaries, blocking of the tubes, and destruction of the walls of the womb may result along with enlargement and distortion of the cervix.

Chronic infections may persist, resulting in lowered fertility.

Still other infections interfere with the production of living young, the infection subsiding as resistance is acquired. Some diseases (such as brucellosis) cause death of the calf or interrupt pregnancies when established. A characteristic of these diseases is that they usually affect the uterus and foetal membranes.

Other infections cause pain at mating and prevent service. Diseases of the reproductive organs can be divided into specialised and unspecialised diseases.

(1) Unspecialised Diseases

Into this group go the infections causing disease in other parts of the body as well as the reproductive tract. They are either non-contagious or only slightly contagious, and are usually associated with the production of pus. The pus-forming infections may be transferred at mating, but are not venereal in nature and do not occur in outbreaks.

Metritis or infection of the womb in females.—Metritis is the term used to describe an inflammation of the womb. If there is pus formed it is termed pyometra. There may be other parts of the reproductive tract infected separately or in combination with the womb, and various terms are used to describe the resulting conditions. One which is most familiar is vaginitis, meaning inflammation of the vagina.

In cows lacerations may allow the entry of infections or the infection may be secondary to a condition such as contagious abortion.

Infection of the unborn calf with subsequent abortion and the formation of pus may occur as the result of metritis.

A common sequel to farmers washing out cows after calving is the setting up of an infection in the womb which will undoubtedly lead to infertility. Washing out should not as a general rule be undertaken because it is necessary to withdraw all fluid from the womb; a small amount left in the womb provides the means for the development of an infective process. If cows will not "clean" or have a persistent discharge, especially noticeable whilst on heat, veterinary assistance should be sought.

It is possible with the use of iodine preparations and hormones in skilled hands to clear up infections of this kind.

(2) Specialised Diseases.

These are contagious diseases caused by specific infections, characterised by the fact that they occur in certain species and always in the same organ. They have a more or less general pattern of involvement of, and definite predilection for, the genital system.

There are a number of diseases present in cattle which affect the uterus particularly.

(*i.*) *Brucellosis or contagious abortion.*—Among infectious diseases causing sterility, bovine brucellosis is still the most common. Great financial loss is suffered each year by farmers whose cows are infected with this desease as a result of abortion and the sterility which is often an aftermath. Cows which abort as a result of brucellosis often fail to clean properly because of infection of the womb and membranes.

Rational means of combating this disease are now available with the use of Strain 19 vaccine. For further information on brucellosis, farmers should consult the Departmental leaflet on the disease.

(*ii.*) *Bovine venereal trichomoniasis.*—This is a venereal disease; that is to say, it is transmitted during the act of mating. However, mechanical transfer may occur readily between females through use of instruments such as syringes or specula if care is not taken to sterilize them between cows.

Bulls once infected remain so for life and may spread the disease throughout the herd. The disease does not harm the bull himself but his transmission of the disease makes him unsuitable as a sire.

In affected herds the most conspicuous symptom is sterility. This is accompanied by early abortion at from two to four months. Most females return to service within three to five weeks.

Trichomonas infection continues for several months, during which time the females are infertile. Some females may abort very small calves or the calf may be mummified or reduced to pus. Pus in the womb may persist for up to a year and on rectal palpation the womb may feel similar to one in the early stages of normal pregnancy.

On recovery, most females are resistant to infection. However, the immunity is eventually lost and mating with an infected bull results in reinfection.

It is reasonable to suspect that the disease is more widespread in Queensland than present diagnosed cases indicate. There is some difficulty in the diagnosis of the disease because of the fact that the infective organism is not continuously present in the discharges. If an aborted calf, preferably with unruptured membranes, is sent to one of the Department's Animal Health Stations within a reasonably short period, diagnosis is easier.

The complete eradication of this disease from affected herds is the only effective means of handling this condition and is ultimately the most economical course to pursue.

Eradication of the disease involves the following steps:—

(*a*) Recognising infected bulls and withdrawing them from service. This involves veterinary assistance in obtaining suitable specimens for examination under the microscope.

(*b*) As cows usually throw off the infection on their own account within three or four months if not served, known infected or suspected infected cows should be withheld from service for that period and then put to a clean (non-infected) bull.

Treatment of infected bulls is still not satisfactory, but experiments in that direction are continuing.

(*iii.*) *Bovine vibrionic abortion.*—This disease has also been known to occur in Queensland although it has only been diagnosed in a few isolated herds.

The disease resembles brucellosis inasmuch as abortions occur at somewhat the same period of pregnancy. Pregnancies may be terminated at almost any stage, but most frequently during the fourth to sixth months.

The manner of spread is unknown. Abortion rates of up to 20 per cent. of a herd have been observed. A passing sterility is usually associated with this disease; cows come on heat, but do not go in calf.

To control the disease general procedures of animal hygiene are indicated. Abortions should be anticipated and animals isolated.

The disease appears to be self limiting and has usually disappeared from a herd within a period of 12 to 18 months.

Diagnosis is made by examining the aborted calf and membranes at a laboratory, for which purpose the calf should reach the Animal Health Station as soon as possible after being aborted.

(*iv.*) *Vaginitis.*—As its name implies, this disease is an inflammatory condition of the lining walls of the vagina. There are several kinds, but the so-called granular vaginitis is most common. In females the slightly raised nodules may be confined to just inside the lips of the vulva, or there may be a general distribution of nodules over the whole surface of the vagina, with fairly severe inflammation. In very severe cases there may be production of pus. Similar nodules may be found on the inside lining of the sheath, and on the penis of the bull, and this is often referred to as bull "burn."

Some animals exhibiting these nodules may be found in most herds of cattle, including some free from infertility trouble. Nodules may be found in immature virgin heifers and it is also not unusual to find nodules in females in all stages of pregnancy.

It is therefore difficult to be certain as to the role played by granular vaginitis in relation to infertility, but where the condition exists and infertility trouble is being experienced action should be taken for its control. Once it has been eliminated, the conception rate does improve in most herds. indicating some beneficial effect from treatment.

Vaginitis should not be confused with diseases causing abortion or with the many other conditions which cause sterility in cows. The term should be reserved to describe inflammation of the vagina and not sterility in general.

The most effective treatments are those consisting of some astringent agent incorporated either in liquid or powder form. Most of the chemicals used are relatively cheap and can be made up by the farmer himself.

VII. HEREDITARY DEFECTS.

Research investigation and large numbers of observations indicate that fertility is to some extent hereditary.

The nature of the hereditary factors involved is not known. In general, a reduction in fertility is thought to accompany reduction in size, and is sometimes associated with inbreeding. Infertility may be inherited in a similar manner to other unfavourable characters.

The following are conditions affecting fertility which are thought to be hereditary:—

White Heifer Disease.—This disease has been observed most commonly in white Shornhorn heifers, but isolated cases are reported as occurring in roan and red Shorthorns, Aberdeen Angus and Friesians.

It is characterised by the persistence in development of a membrane stretching across the vagina just in front of the entrance of the urethra. This is known as a closed or persistent hymen which prevents sperm entering the uterus. This may be associated with a general infantilism of the reproductive organs.

Freemartin.—This occurs only in twins of unlike sexes. In about 90 per cent. of all mixed twins the female is sterile. All attempts to treat this condition have failed. With such a small chance of the heifer's being fertile it is probably wise to cull all females of mixed twins.

Absence of ovaries.—Some heifers have virtually no ovaries and a small uterus, cervix and vagina.

Defective testicles.—A condition in which sperm are not produced because of lack of development of sperm-forming cells of the testes is sometimes found. The testicles are undersized and their substance is flabby. When this condition occurs in both testicles there may be normal or increased desire to mate, but no sperms are produced.

Inability to serve.—The bull may be unable to serve because of maldevelopment of the penis. The condition is hereditary and once it is seen in a herd all relatives should be culled rigorously.

Umbilical hernia.—In the male, hereditary umbilical hernia may constitute a barrier to service. It is therefore wise not to keep a sire from a cow or bull which has thrown offspring affected with hernias.

Intersex or hermaphrodism.—With this condition, bulls appear to develop masculine traits normally but examination reveals an absence of testes and the presence of fully developed portions of some of the female organs.

Semen quality.—It has been noticed that some bulls produce semen of poor keeping quality. Others have produced sperms with abnormal shape.

Cryptorchid.—One of the most common structural abnormalities of the male is the retention of the testes in the abdominal cavity. If both testes fail to descend the bull will be sterile. The testes cannot produce sperms unless they are in the scrotum. This is because they are very sensitive to normal body temperatures. A bull with one testicle in the scrotum and the other in the body cavity although often fertile should not be bred from as cryptorchidism is hereditary.

VIII. SUMMARY OF TREATMENT FOR INFERTILITY.

(1.) Keep a careful watch for heat periods and serve at the correct time. Accurate records will provide information as to when to expect the next heat and do much to help in diagnosis of breeding problems.

(2) Control matings and adopt hand service.

(3) Feed animals correctly—correct any mineral deficiencies.

(4) Look after the herd sire—see he has a balanced ration and has sufficient exercise.

(5) Use Strain 19 vaccination with heifers between 4 and 8 months in herds suspected to be infected with brucellosis or in herds in which infection is likely to occur.

(6) Breed from the middle to the end of the heat period.

(7) Be sure that cows are not in-calf before they are sold as sterile.

(8) Call in veterinary assistance if abortions are occurring in the herd or difficulty is being experienced in getting cows in-calf.

TUBERCULOSIS-FREE CATTLE HERDS.

(AS AT 20th APRIL, 1951.)

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, *via* 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," Kingaroy Sullivan Bros., " Valera " Stud, Pittsworth Reushle Bros., " Reubydale " Stud, Ravensbourne H. F. Marquardt, " Chelmer," Wondai W. G. Marquardt, " Springlands," Wondai
Ayrshire	L. Holmes, " Benbecula," Yarranlea J. N. Scott, " Auchen Eden," Camp Mountain
Friesian	C. H. Naumann, " Yarrabine Stud," Yarraman J. F. Dudley, " Pasadena," Maleny
Jersey	W. E. O. Meier, " Kingsford Stud," Rosevale, *via* 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, via Rosewood

1951 SHOW DATES.

June.

Boonah	1 and 2
Childers	4 and 5
Bundaberg	6 to 9
Mt. Morgan	7, 8 and 9
Lowood	8, 9 and 11
Gin Gin	11 and 12
Gladstone	14, 15 and 16
Toogoolawah	15 and 16
Rockhampton	20 to 23
Kilcoy	22 and 23
Mackay	26, 27 and 28
Esk	29 and 30
Proserpine	29 and 30
Home Hill	29 and 30

July.

Charters Towers	2, 3 and 4
Bowen	4 and 5
Nambour	5, 6 and 7
Rosewood	6 and 7
Ayr	6 and 7
Townsville	9 to 12
Laidley	13 and 14
Redlands	13 and 14
Tully	13 and 14
Ingham	13 and 14
Maleny	13 and 14
Cairns	17 to 20
Gatton	19, 20 and 21
Woodford	20 and 21
Atherton	23, 24 and 25
Innisfail	27 and 28
Pine Rivers	27 and 28

August.

Brisbane	3 to 11
Redcliffe	17 and 18
Cooroy	25

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.

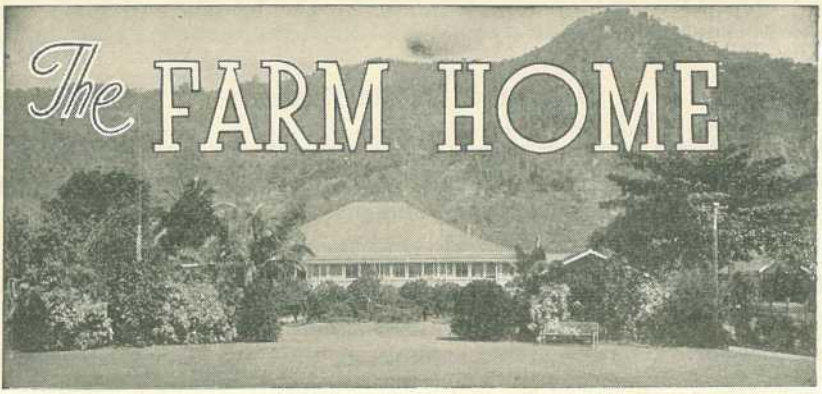
In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as 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 20th APRIL, 1951.)

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
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, " Yaralla " Stud, Pittsworth
	E. C. Smith, " Smithfield " Stud, Coomera
	E. J. Bell, " Dorne " Stud, Chinchilla
	A. G. Fry, " Birubi " Stud, Dalby
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
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee
	D. Kay and P. Hunting, " Kazan " Stud, Goodna
	E. Sirett, " Iona Vale " Stud, Kuraby
	C. R. Smith, " Belton Park " Stud, Nara



The Technique of Breast Feeding.

CONTRIBUTED BY THE DEPARTMENT OF HEALTH AND HOME AFFAIRS.

WE assume that your infant son or daughter has arrived safely and that he is beginning to take an interest in his food, which he hopes, and we hope, is going to be his mother's milk.

For your first ten days in hospital you won't have to worry much about his feeding, for the nursing staff will instruct you in the art and regulate it for you both.

However, it is unfortunate that most hospitals have a separate nursery for the babies, for it is most desirable that in the newborn period your baby should be close to you as much as practicable and not deposited in a nursery, except at certain fixed feeding times. It is too often the case that mothers return home without having had any real opportunity of getting to know their baby, or recognizing whether he is crying because he is hungry, or wet, or cold, or too hot, or troubled with wind, or requires his position changing, &c. The danger is that, when you get home and have to assume the responsibilities of housekeeping again, in addition to caring for your new baby, you will start worrying (often unnecessarily). You may get harassed and tired and unfortunately your milk supply may decrease for a time. But this temporary falling-off in your supply, if it should occur, may easily be overcome by judicially complementing some of baby's feeds, if he is short fed, until your supply increases again, which it assuredly will if the proper steps are taken.

Whatever you do, don't wean your baby in the mistaken assumption that your milk has gone for good. It is a mistake, also, to overcomplement the feeds. Complementary feeds, if given unnecessarily, are apt to reduce the baby's desire for the breast and so to reduce the emptying of the breast, which is the best stimulus to the further production of breast milk. You should always let baby empty one breast before putting him to the second breast, and if he does not empty it completely the remaining milk should be expressed by hand and given to baby in a spoon or bottle. Remember, too, to start the baby on alternate breasts at each feed. And, of course, if baby is not getting quite enough he should be on (approximately) 3-hourly feeding, that

is, six feeds in the day in preference to 4-hourly (five feeds in the day), for this provides extra stimulus to the breasts and gives baby more food in the twenty-four hours.

Subsequent Feeding Regime.

Once the initial period of adaptation and mutual education between your baby and yourself has been successfully accomplished, things should settle down into more or less easy routine. But one of the errors to be guarded against is the adoption of too rigid a regime.

One of the commonest causes of excessive crying is a rigid feeding schedule which takes no note of the individual baby. It is irrational to feed your baby strictly by the alarm clock. Such a method presupposes that babies are not individuals but are all alike. It presupposes that they have the same stomach emptying time, the same temperament, and the same degree of activity. This is not so; there is a considerable individual variation in the time in which the stomach empties and hunger pains occur in different babies, whilst emotional factors, sleep, activity, and temperature may influence their time of appearance in the same baby.

It is only reasonable, therefore, that you should use considerable elasticity in the feeding schedule and that you should adjust it as far as possible to the needs of your child. You should not have to waken your baby for a feed unless it is premature or weakling and not thriving. The smaller the baby the more often it is likely to want to be fed. You should not give unnecessary fluids between feeds because it is crying for food; instead, you should adjust the frequency of the feeds to the baby's requirements. It may be necessary to feed the baby in the night in the first month or two when he wants it. Refusal to do this is a potent cause of excessive crying and of loss of sleep to mother and father.

Rigidity in the duration of the feed is another cause of excessive crying; ten minutes at each breast is an average guide only. Those who advocate a fixed time on the breast presuppose that all babies suck at the same speed and that all breasts are the same. The duration of the feed is an individual matter and you will learn by experience how long your baby requires at the breast to satisfy his needs. A cardinal rule is never to force your baby to take the breast when he does not want it. A very common cause of wind and colic is leaving the baby to suck too long on the breast. When the breast is empty, suckling inevitably causes air swallowing. But on the whole your baby is the best judge of how much food it needs and when it wants it.

In the course of the first few weeks it will usually be found that the number of times that your baby sleeps for four hours between feeds gradually increases and that he can thus slide into a four-hourly programme rather than be forced into it. No hard and fast rule can be given as to when the night feed can be omitted, but a normal robust baby should soon learn to sleep right through the night, and it would then of course be folly to waken him for an extra feed. It is obviously a great advantage to the mother (not to mention the father) when she can get six or more hours undisturbed sleep.

For practical purposes, then, the feeding regime should be regarded as a compromise between the baby's demand to have the breast immediately available when it desires food or comfort, the baby's need of intervals between feeds for sleep, digestion and emptying of the stomach, and the mother's need for rest, exercise, and time for the secretion of a fresh milk supply by the breasts after nursing.

ASTRONOMICAL DATA FOR QUEENSLAND.

JUNE.

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	5·00	Cairns	8	50	Longreach ..	26	43
6	6·32	5·00	Charleville	25	29	Quilpie	37	33
11	6·34	4·59	Cloncurry	36	63	Rockhampton ..	1	19
16	6·36	5·00	Cunnamulla ..	31	27	Roma	15	19
21	6·38	5·00	Dirranbandi ..	22	16	Townsville ..	8	42
26	6·39	5·02	Emerald	11	28	Winton	29	52
30	6·39	5·03	Hughenden ..	21	49	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
	a.m.	p.m.
1	3·11	2·30
2	4·07	3·03
3	5·03	3·40
4	6·00	4·22
5	6·56	5·08
6	7·49	5·59
7	8·38	6·53
8	9·22	7·49
9	10·01	8·46
10	10·37	9·42
11	11·09	10·38
12	11·38	11·34
	p.m.	..
13	12·08	a.m.
14	12·39	12·31
15	1·11	1·31
16	1·49	2·34
17	2·33	3·42
18	3·26	4·54
19	4·28	6·06
20	5·38	7·15
21	6·50	8·17
22	8·02	9·08
23	9·10	9·51
24	10·13	10·28
25	11·12	11·01
26	..	11·31
	a.m.	p.m.
27	12·10	12·01
28	1·06	1·32
29	2·02	1·04
30	2·58	1·40

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

Charleville 27; Cunnamulla 29; Dirranbandi 19;
Quilpie 35; Roma 17; Warwick 4.

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	14	25	30	41	5	16	34	47
6	9	30	25	45	0	21	26	54
11	14	23	30	39	5	14	34	45
16	26	14	42	29	17	4	49	33
21	29	10	45	24	20	0	52	27
26	17	19	33	36	8	10	37	41
30	12	28	27	43	2	19	30	52

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	18	42	42	59	27	44	16	36
3	9	51	37	64	21	50	8	43
5	2	56	33	67	17	53	3	46
7	2	55	33	67	17	52	3	45
9	9	47	37	62	21	47	8	39
11	18	38	42	56	27	41	16	33
13	28	27	50	48	34	33	24	23
15	40	22	57	45	42	30	33	19
17	51	9	65	36	49	22	42	9
19	56	2	68	32	52	17	46	3
21	53	4	67	33	50	19	44	5
23	42	13	58	39	43	24	35	13
25	30	25	51	47	35	32	25	22
27	25	36	47	55	32	40	21	31
29	14	46	39	61	24	47	13	38
30	10	50	37	63	22	49	9	42

Phases of the Moon.—New Moon, 5th, 2.40 a.m.; First Quarter, 13th, 4.52 a.m.; Full Moon, 19th, 10.36 p.m.; Last Quarter, 26th, 4.21 p.m.

On June 22nd at 3 p.m. the sun will reach its greatest angle north of the equator. It will then rise and set approximately 25 degrees north of true east and true west respectively.

On the 13th and 26th the moon will rise and set very close to true east and true west respectively.

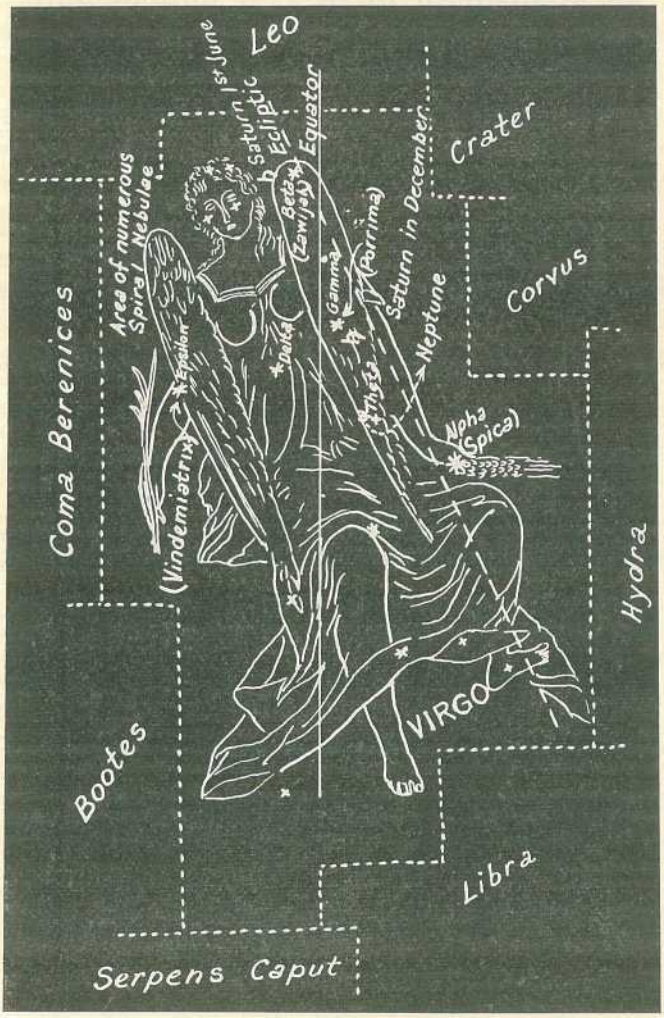
Mercury.—A morning object at the beginning of the month in the constellation of Aries, when it will rise about 1¾ hours before the sun. On the 25th it will be in line with the sun, after which it will become an evening object and at the end of the month, in the constellation of Gemini, will set 21 minutes after sunset.

Venus.—In the constellation of Gemini, near Castor and Pollux, at the beginning of the month, when it will set 3 hours after the sun. After passing through the constellation of Cancer, on the 25th in the Constellation of Leo it will reach its greatest angle east of the Sun and set 3½ hours after sunset.

Mars.—Still too close in line with the sun for observation.

Jupiter—In the constellation of Pisces, will rise between 1.45 a.m. and 3 a.m. at the beginning of June and between midnight and 1 a.m. at the end of the month.

Saturn.—In the constellation of Virgo, will be nearly overhead at nightfall, on the 1st setting soon after midnight and at the end of June setting just before midnight.



THE CONSTELLATIONS.

In the past few months the constellations close to the South Celestial Pole have been described and because they are above the horizon for such long periods they have been dealt with in a manner which readily shows their relationship to one another; no attempt has been made to publish the descriptions to coincide with the time of the constellations' most favourable appearance in the sky. As we move away from the Pole, however, the constellations have marked seasons for favourable observation and publication will agree with these periods.

With this object in view we leave the region of Orion, etc., and introduce Virgo—the large Zodiacal Constellation covering part of both the celestial equator and the ecliptic. It is said to represent Proserpine, the daughter of the Goddess Ceres, known as the Earth's mother. It is shown in old star maps as a virgin with a wheat-ear in her hand presiding over the harvest. It is also shown to represent the Goddess of Justice and Purity. The sun passes through the constellation from the end of September to the end of October and crosses the Celestial Equator about 23rd September. In June it rises during the afternoon daylight hours and is well up at nightfall, crossing the meridian soon after 7 p.m. Its brightest star is Spica (Alpha Virginis), a pure white 1st mag. star which is very hot. It is also a binary, the stars revolving about a common centre of gravity in about 4 days. Gamma is also a binary, with a period of 180 years, the stars being of 3rd magnitude and six seconds apart. A 4th magnitude star, Theta, has a 9th magnitude companion. The area round Epsilon, Delta, Gamma and Beta contains hundreds of spiral nebulae, but require the aid of a telescope to bring them to view. At the present time Saturn is in the constellation and will remain so throughout the year, passing from west to east of Beta and occupying a position near Gamma at the end of 1951. Venus and Mars will also enter Virgo during November. The position of Neptune, which is not visible to the naked eye and changes its position very little from year to year, is shown on the sketch.