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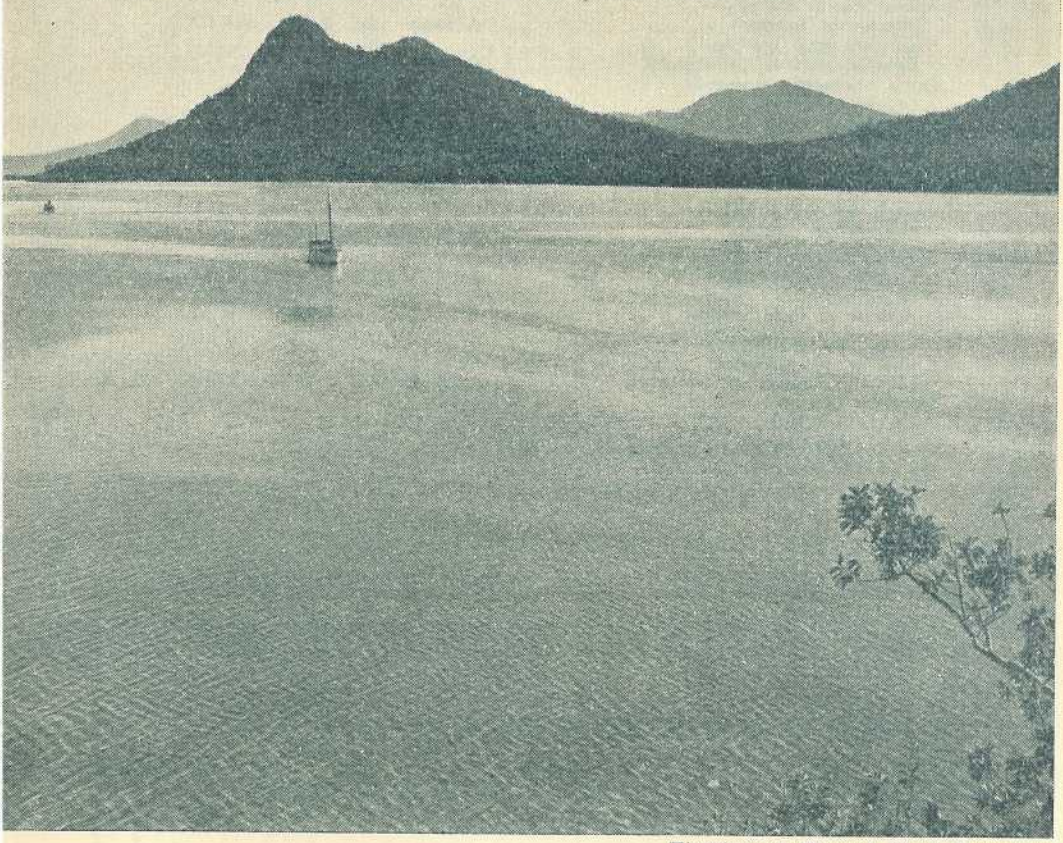
DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL



Hinchinbrook Channel, North Queensland.

LEADING FEATURES

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

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Contents

Cattle Drafting Yards.

R. H. BARTLAM, Cattle Husbandry Branch.

A SET of yards capable of handling the cattle on any property is essential and it is wise to give some thought to the problem before commencing to build.

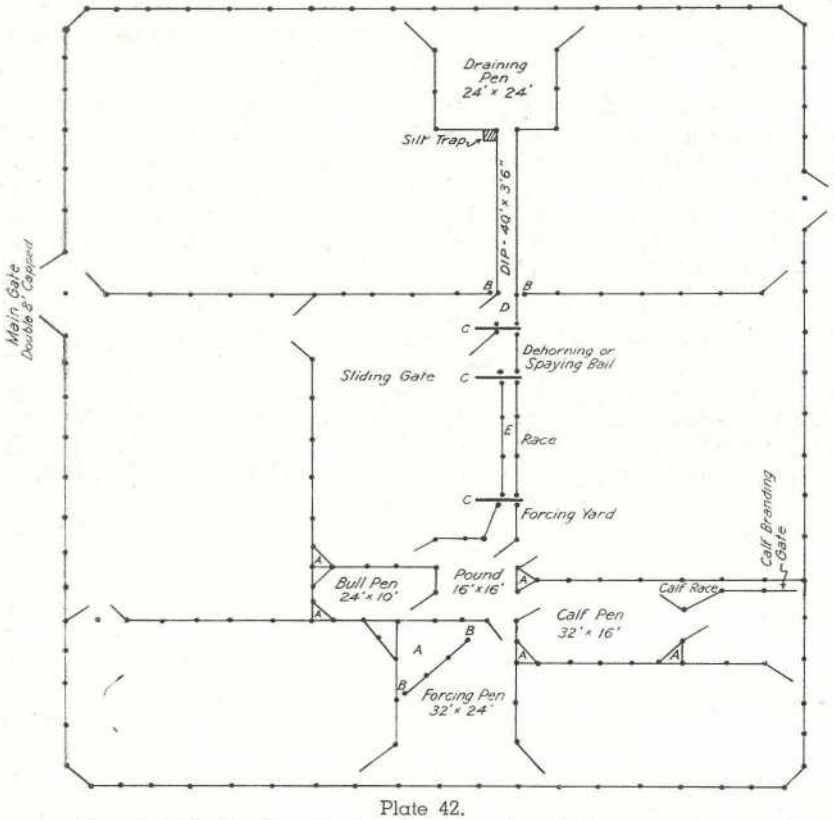

Plate 42.

Plan of Cattle Drafting Yards.—A, corners for shade trees; B, spaces for slipping through when working yard; C, slide gates; D, cemented apron; E, race or crush 22–24 in. wide. Panels are 8 ft. and 6 ft., as shown by the dots, which represent posts.

Drafting yards built in such a way as to enable all the work to be carried out with a minimum of effort must differ in some respects in individual cases, but a good basis on which to work is shown in Plate 42.

THE SITE.

The site is important and when choosing a spot for a cattle drafting yard care should be taken to avoid those things which make yarding of cattle and working them in the yard difficult. An obvious precaution is to see that the ground itself is firm and well drained. Some types of stony ridge are ideal, but areas with big stones embedded in scattered positions should be avoided. The earth soon works away from such stones with movement of cattle and the result is a loose stony surface.

Usually a yard, particularly one which is intended for dipping, is built near a creek or river so that water is easily available. Cattle react differently to river approaches and it would be wise to check carefully how the particular stock which will be using the yards behave when worked near the river. Most cattle baulk at "yarding into the river," particularly near sundown, so it may be better to have the main gates on the side nearest the river or creek, leaving plenty of room to check any tendency on the part of the cattle in hand to "ring up" as they are brought between watercourse and yard.

Shade is essential for cattle standing in the yard during the heat of the day and too much emphasis cannot be laid on the necessity for this during the summer months. It is not always possible to avoid handling cattle during hot weather; heated cattle do not work well and a few hours distress in a yard exposed to a blazing sun can mean loss of condition as well as actual danger of overheating. A few trees in appropriate places save a lot of planting later.

It will be readily understood that the constant working of stock is likely to cause erosion if the incline on which the yard is built is too steep, and anything beyond a very slight fall should be avoided. On the other hand, yards should not be placed in hollows. Dust in dry times becomes mud when it rains and any surface which cuts up under the hooves of the cattle is unsuitable. This applies to ant-hill country and some types of country covered with gum-topped box.

YARDS.

While there are changes which might be made in the plan submitted to suit individual requirements, there are several features which should be retained in any modification.

Firstly, there are two gateways shown in the outer fence of the yards—one for yarding up and one for letting go. The reason for this is that cattle using a yard regularly develop habits both good and bad, and the practice of working always in the one direction pays dividends even with the quietest of cattle and certainly with fresh bush cattle.

In the plan advocated the cattle work towards the letting-go gate and this makes for ease of future yarding up and working in the yard.

Secondly, it will be noticed that the plan provides for cattle, once they get to the forcing pen, to have one straight side to work up right through the pound, race and dip. Cattle working in such a way run better.

Thirdly, whenever possible the corners have been taken off, and the usual 8 feet panel reduced to 6 feet both to allow for the cut-off panel and to strengthen the corner. This makes it much easier for weaker cattle, particularly calves, which may get jammed in corners. Shade trees should be planted in the corners thus provided.

The calf pen, which opens from the pound, is provided with a small race and a branding "machine" is placed at the end.

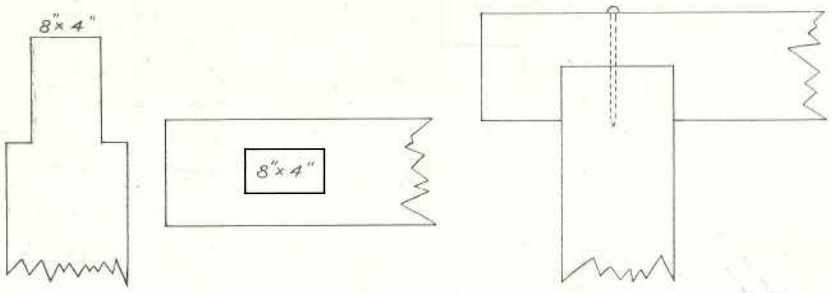

Plate 43.

Two Methods of Fitting Gatepost Caps.—Left, mortise and tenon; right, joggle fitting.

When planning for gates it is a good idea to provide overhead caps for the gateposts wherever possible and for the crush. Where yards are small, as in the pound, these could be omitted. The cap could be fitted in either of the ways shown in Plate 43, that on the left being the stronger job. That shown on the right is the quicker way and is done merely by cutting a joggle in the cap to fit the slightly squared end of the post and spiking from the top of the cap into the top of the post. The other method provides for a tenon, say 8 inches by 5 inches, in the top of the post and a corresponding mortise in the cap, pinning with an inch dowel or a half-inch bolt. Leave at least 18 inches of overhang in the cap.

The running posts should be at least three feet in the ground, and gate, crush and corner posts four feet. Where timber with some sap is used for posts, it is wise to trim off the sap from that part of the post which will be underground, and apply to this a good coat of hot coal tar. Apart from preserving the wood itself, this method eliminates the possibility of an inch or two thickness of sap rotting away early in the life of the yard and leaving posts which are loose in the ground. In heavy black soil which is inclined to "move" between the extremes of wet and dry seasons, it is a sensible precaution to have the holes dug six inches deeper and set the posts on six inches of sand as a buffer.

Gate and corner posts should be at least 14 inches in diameter at the small end, free of sap, and running posts 12 inches. To allow for sufficient head room the crush posts should be at least eight feet out of the ground and provided with a cap as support. The running

posts should be 5 ft. 6 in. out of the ground with the top rail lying flush with the top of the post. The gatepost should be sufficiently high, say nine feet, to allow a horseman to ride under the cap without having to do more than bend his neck.

Gates may be hung in several ways, and where bush timber is used for making gates the simplest form is to extend the gate upright to the cap as in Plate 44, passing the rounded end through a hole made for it. The base is also suitably rounded off, leaving plenty of shoulder in the gate upright and set into a block which is securely imbedded in the ground at the foot of the gatepost. This makes a very strong job but has the disadvantage that should the gatepost lean slightly no

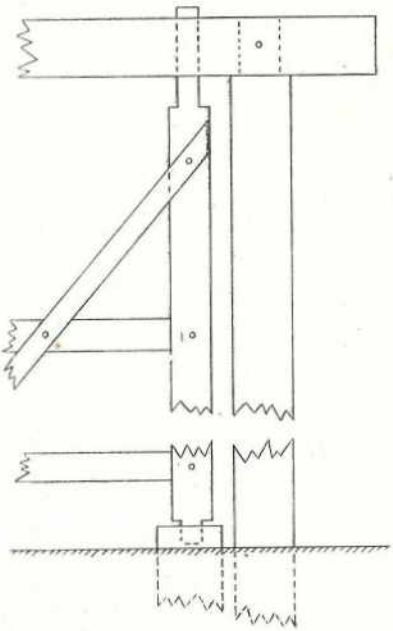

Plate 44.

A Method of Hanging a Gate.

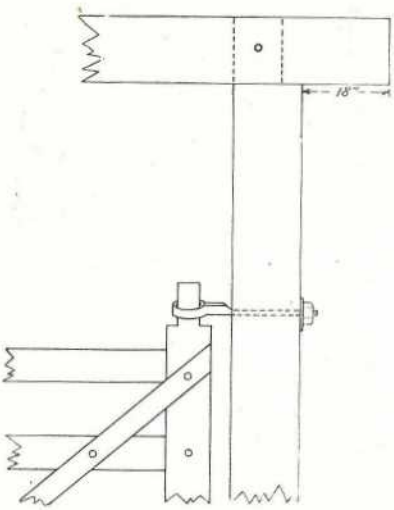

Plate 45.

Gate Swung From an Eyebolt.

adjustment can be made without straightening the post, which is often a fairly big job. A modification is shown in Plate 45. Here the gate upright, while set into a block as before, has the top cut off and set in an eye bolt which is used to secure the gate to the gate post. If the gate is not set too close to the gate post, an adjustment to the eye bolt will bring up the head of the gate should it drag through leaning of the gate post.

A simple hinge as shown in Plate 46 is sufficient where sawn timber is used for gates. Have chains secured to gate posts on all gates in such a way that the ends may be picked up to pass around the gate head with a minimum of trouble. Fumbling for chains accounts for a lot of wasted time in the work in a yard and makeshifts such as wire fastenings have a habit of coming apart under pressure at the most awkward times, causing boxing of drafts and subsequent redrafting with unnecessary handling of stock.

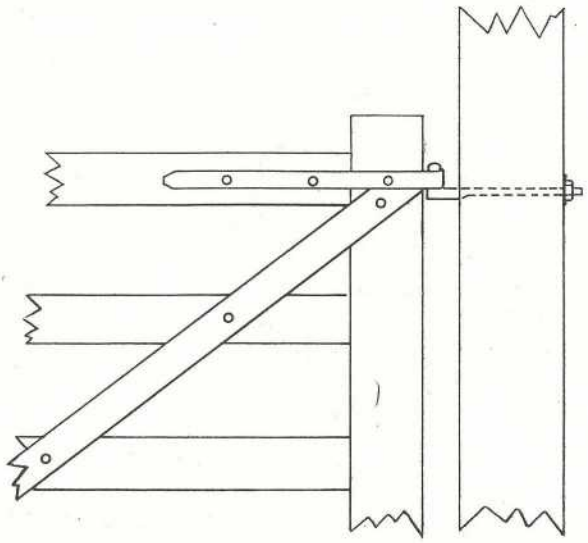

Plate 46.

Sawn Timber Gate Swung on a Simple Hinge.

Rails should not be less than four inches at the small end and free of sap. Where it is possible to get good 16-foot rails they could be used to straddle two panels at once. They should be arranged so that joins are staggered to avoid having two such rails meeting immediately above or below another. This method, shown in Plate 47, greatly strengthens a yard, but care should be taken that in the effort to get long rails, timber with too much sap at the thin end is not used. Sappy timber is the cause of much quick deterioration of yards.

The method of mortising the posts and letting the rails into them is a good one, but presents difficulties when replacements are necessary. Joggling of posts and letting the rails in flush with the inside of the posts makes a workmanlike job. The rails are tied on with double

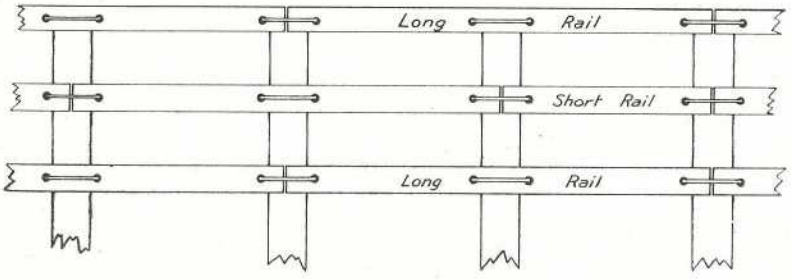

Plate 47.

Staggering of Rails to Strengthen the Yard.

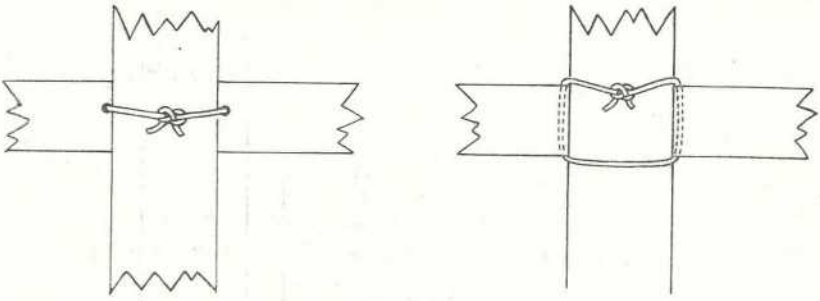

Plate 48.

Method of Tying Rails Let in Flush With the Inside Face of the Post.—Left, rail bored; right, rail not bored.

No. 8 wire and a "Cobb & Co." twitch at the back of the post (Plate 48, left). Where timbers such as lancewood and gidyea are used there is a tendency for them to split when the ends are bored for the wire, so a method which does not involve boring is employed. A longer piece of wire is needed and this, bent double, is brought from the back of the post, each end passing around an end of a rail from underneath and back to twitch at the rear of the post, as in Plate 48 (right).

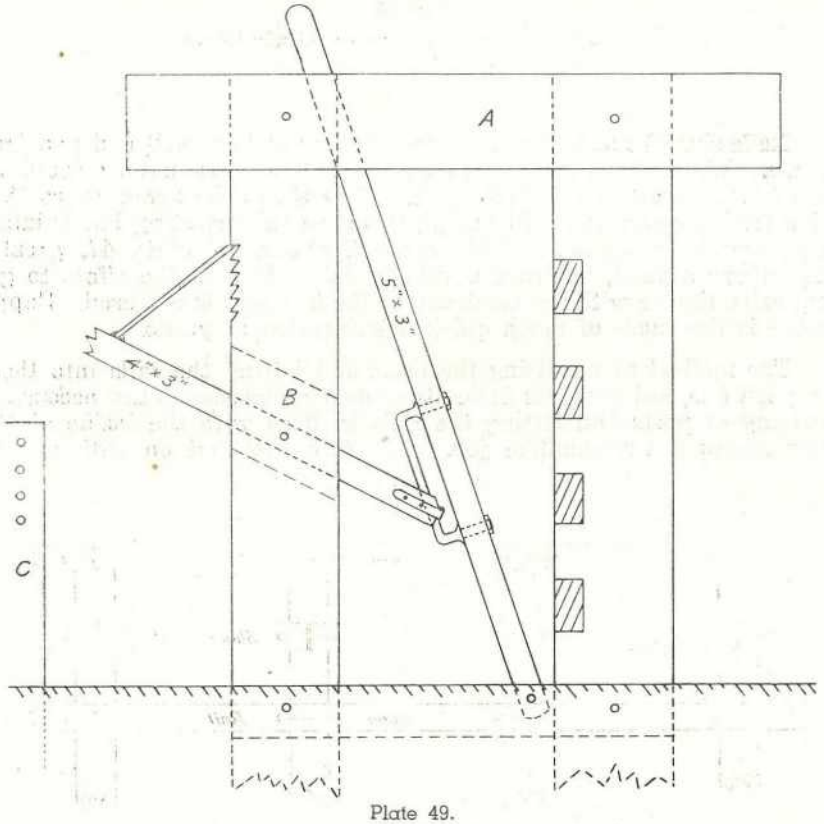

Plate 49.

Sketch of Dehorning or Speying Bail, Looking Through Race.—A, two 6 ft. long 8 in x 1¼ in. boards bolted to form a 3¼ in. channel for the sword; B, slot 18 in. x 3¼ in.; C, post to hold the handle rigid by means of a bolt.

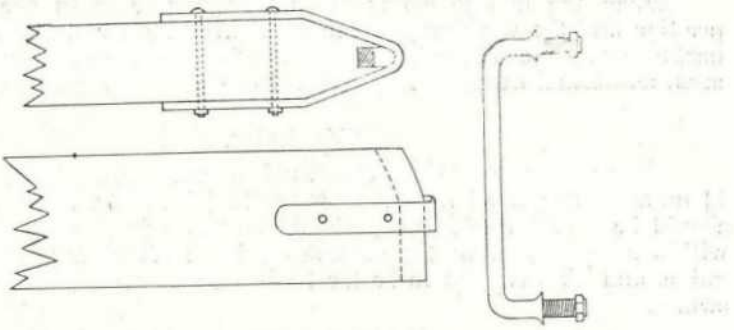

Plate 50.

Parts of the Dehorning Bail.—Top, looking down on top of handle of bail sword, showing the bevelled slot for sword slide; bottom left, side view of bail sword handle; right, slide for sword.

Dehorning and Speying Bail.

The dehorning and speying bail is placed about eight feet back from the dip to allow room to work in front. In Plate 49 the bail sword is seen to be fastened at its lowest end by a heavy bolt to crosspieces placed at ground level. This is to allow of the sword being withdrawn and cattle proceeding onwards as required to the dip.

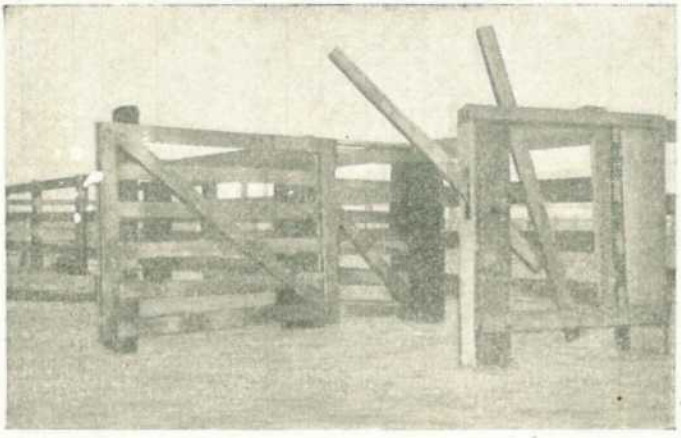

Plate 51.

A Dehorning Bail on a New South Wales Holding.

[Photograph by N.S.W. Dept. of Agriculture.

The sword handle, which works through a large slot cut in the bail post, is connected to the sword by the attachment shown in Plate 50. This handle has an inch wide slot cut vertically into its inner end to receive the slide, which is made of $\frac{3}{8}$ in. round iron. The slot is cut on the slant so that on the upper surface of the handle it is $2\frac{1}{2}$ inches deep, but on the lower surface only one inch. Having made the slot, the sides of the inner end of the handle are shaped to form a blunt triangle and the upper crosswise edge is made into a bevel of approximately $1\frac{1}{2}$ inches. Finally a length of 1 in. by $\frac{1}{4}$ in. flat iron is shaped to match the end of the handle and is bolted on so as to form in conjunction with the slot a firm socket for the slide. The latter should be kept well greased when in use. The outer or working end of the handle may be rounded to facilitate handling.

When the bail is closed the sword handle is in the horizontal position and the working end can be secured by a bolt through a short post specially placed for the purpose. The ratchet device on the handle is an additional safeguard against a beast forcing the bail open.

Slide Gates.

These slide gates (Plate 52), three in number, could be of 6 in. by $1\frac{1}{4}$ in. sawn hardwood timber, bolted with $\frac{1}{2}$ in. bolts, the nuts of which should be countersunk. They should be made just wide enough to fit within a few inches of the outside of the crush posts which are their guide, and high enough to be level with the top rail of the yard when swung.

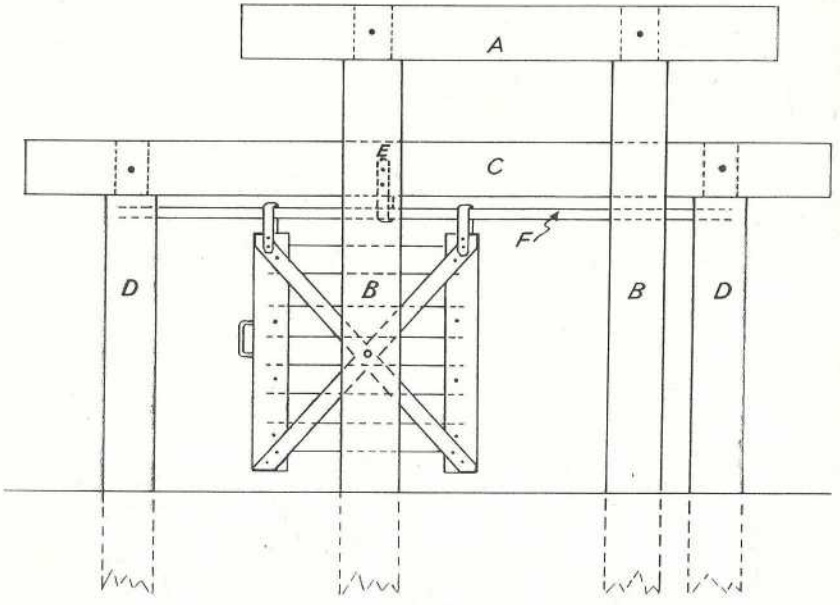

Plate 52.

Slide Gate in Half-open Position.—When the gate is closed it is prevented from swinging by the two sets of crush posts. A, crush cap; B, crush posts; C, sliding gate cap; D, sliding gate supports; E, centre support for slide rod, hidden by post; F, $1\frac{1}{4}$ in. mild steel rod or 2 in. galvanised piping.

The gates, which can be of two boards each as uprights with four boards set at even spaces within them, should be securely braced. This can be done with two $1\frac{1}{2}$ in. by $\frac{1}{4}$ in. iron straps set crosswise from head to toe of the gate and bolted with the same bolts which fasten the boards. They are suspended by $1\frac{1}{2}$ in. by $\frac{1}{4}$ in. iron straps from either $1\frac{1}{4}$ in. mild steel rod or 2 in. piping which is held in position by two strong posts 3 ft. 6 in. in the ground and about seven feet apart, one close to the crush and the other, on the working side, set sufficiently far out to allow the gate to clear the race, but not so far as to swing clear of the post. No exact dimensions are given here, as they depend on the size of the posts used. These posts could be joined overhead by a cap which also supports the rod about its centre, where it will not interfere with the free running of the gate along its length. This rod is kept well greased when in use.

There are several gaps marked "B" in the plan (Plate 42), which are necessary for the smooth working of the yard and to facilitate easy handling of the dip. These are usually just wide enough to allow a normal person to squeeze through and so eliminate constant climbing through or over yard fences. In the forcing pen the larger of the two gaps shown is provided specially for the safety of the person using the drafting gate should it be needed suddenly.

Dip Construction.

The dip (Plate 53), which is 40 feet overall, with the main portion 32 feet at working level, would hold approximately 3,200 gallons of dipping fluid when in use. It is 3 ft. 6 in. wide.

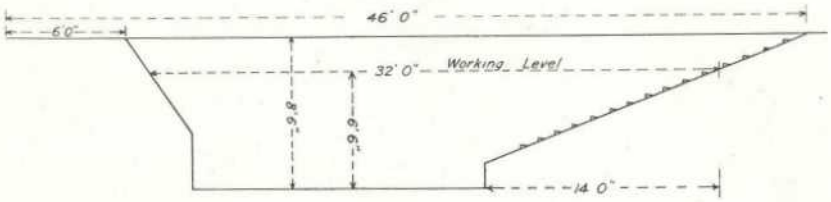

Plate 53.

Sketch of Concrete Dip With a Capacity of 3,200 Gallons.

A straight plunge-in is advocated at the entrance rather than a slide-in as ensuring complete immersion in the dipping fluid, and a walk-out incline suitably barred with steps at the exit. The lip at the entrance to the dip is concreted back for six feet to eliminate as much as possible the kicking of dirt into the bath. This lip, which is left roughened to avoid unnecessary slipping, has not been included in the overall length of 40 feet mentioned above. The lip or apron thus formed makes the floor of the crush between the last slide gate in the crush and the dip itself. All concrete work should be reinforced and for floors of this nature old barbed wire and wire netting help to strengthen it. Where heavy black soil cannot be avoided, a buffer of sand and gravel at bottom and sides of dip is a distinct advantage. This applies also to the concreted floor of the draining yard and wherever cement is used in the construction.

Splashboards are required along the side of each dip guard rail and these are usually three feet high and may be either 1 in. hardwood boards or galvanised iron, tarred. The dip should be roofed to avoid excessive evaporation. The plan shown allows for a single draining pen, and in practice where mobs of 300-400 are being dipped this is sufficient. However, a dual type pen may be added where thought necessary with little alteration to the plan, and may be an advantage where bigger mobs are being handled and where time is important.

The floor of the draining pen should be strongly constructed and reinforced. Cracked draining pen floors are a common fault which becomes progressively worse as moisture seeps through to the foundations.

The silt trap is on the working side of the dip so that a watchful eye may be kept upon it for choking and overflowing.

TUBERCULOSIS-FREE CATTLE HERDS.

(AS AT 10th JULY, 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 A. C. and C. R. Marquardt, "Cedar Valley," Wondai A. H. Sokoll, "Chelmsford," 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 E. A. Matthews, "Yarradale," Yarraman A. L. Semgreen, "Tecoma," Coolabunia G. & V. Beattie, "Beauvern," Antigua, Maryborough
Gurensey	C. D. Holmes, "Springview," Yarraman

Horticultural Districts of Queensland.

7. Central Queensland.

K. KING, Senior Adviser in Horticulture.

CENTRAL Queensland figures in the annals of early Australian history, for it was at Round Hill Head, the southern point of Bustard Bay, that Captain Cook landed on 24th May, 1770.

In the year 1854, the township of Gladstone was founded, and Sir Maurice O'Connell was appointed as the first Government representative. A year later, William Archer settled at Gracemere, six miles from Rockhampton, and in 1856 Mr. W. K. Wiseman, then Commissioner for Lands, and Charles Archer chose the site on which the city of Rockhampton now stands. The Canoona gold rush in 1858, although a tragedy in some ways, laid the foundation for the development of both Rockhampton and the surrounding districts. In 1860, John Mackay and party set out from Rockhampton and eventually established themselves in the fertile valley of the Pioneer River on which the city of Mackay is situated. Thus, in a comparatively short period of six years, the pioneers of those early days laid the foundation of what is today Central Queensland.

GEOGRAPHICAL.

Central Queensland, for the purpose of this article, comprises a coastal belt of country extending approximately 450 miles from Rosedale in the south to Bloomsbury in the north and stretching westward to the South Australian and Northern Territory borders. The eastern portion is shown in Plate 54. The area is divided in four regions—namely Capricornia, Pioneer, Central Highlands and Western Plains—and contains in all 32 local authorities. Of the four regions, however, only Capricornia and Pioneer produce horticultural crops in quantity and production there is chiefly confined to a comparatively narrow coastal strip where the rainfall is relatively heavy and dependable.

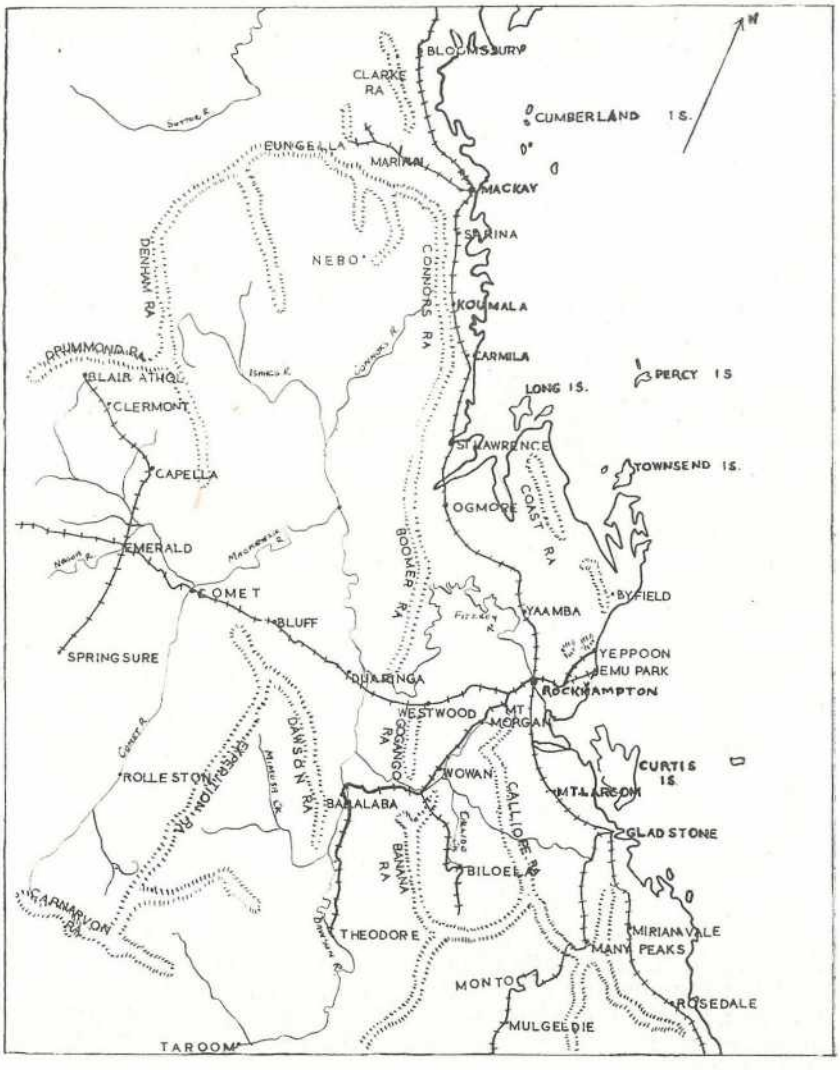

Plate 54.

Sketch Map Embracing the Main Horticultural Districts of Central Queensland.

The district is served by the Central Railway and various branch lines which link Rockhampton to Longreach and other western towns, and by the Sunshine Route railway which runs from Cairns and Brisbane. There are approximately 1,713 miles of railway within the Central Queensland district, which is also well served by various airlines and numerous all-weather highways. Shipping facilities are available in the three main towns—namely, Gladstone, Rockhampton and Mackay. Gladstone is the point of departure for tourists travelling to the Capricorn and Bunker group of islands which form the southern portion of the Great Barrier Reef, and Mackay for the Cumberland and Whitsunday islands.

CLIMATE.

The climate is chiefly tropical in character, but temperatures in horticultural areas are seldom very high owing to the daily land and sea breezes. The winters are invariably short and mild, and only low-lying parts experience frosts, which are light. Along the coast the annual rainfall varies from 39.5 inches at Rockhampton to 66.6 inches at Mackay. Approximately two-thirds of the annual rainfall is registered from November to April, with peak monthly means between January and April, when monsoonal conditions occur. Most of the horticultural areas lie in the cyclonic belt and heavy blows accompanied by torrential rain are not uncommon during late summer. Winter rains are somewhat erratic and frequently insufficient to fully satisfy crop requirements.

SOILS.

As might be expected in such a large district as the one under review, many soil types are encountered.

The podsols and the sandy loams which form a large part of the coastal region are mainly utilized for grazing and contribute little to existing horticultural production. The red-brown loams, on the other hand, are used extensively for horticultural crops (Plate 55). These loams occur around Rosedale, parts of Yarwun, Mt. Larcom, Ambrose, Tanby, Yeppoon, Byfield, The Caves and St. Lawrence, and along the many foothills of the Coast Range from Carmila north to Sarina, Mackay and Bloomsbury. This soil type is reasonably fertile in its virgin state. It is well drained, comparatively easy to work and responds well to fertilizer. It occurs mainly on hill slopes where protection against erosion during heavy storm rains is essential. Very little trouble is encountered with deficiencies of trace elements such

Plate 55.

Pineapples on the Red-brown Loams Which Are Extensively Used for Horticultural Crops.

[Photograph by E. T. Wannup.

as boron, zinc and molybdenum. Some of these loams in the Yeppoon area, however, are rich in manganese, which is associated with an iron deficiency in certain crops in that area. As in the case of many other red loams, fertilizers are usually applied in bands to counteract the effect of phosphate fixation. Crops produced on the red-brown loams include pineapples, papaws, bananas, citrus, passion fruit, tomatoes, beans and melons.

Characteristically, the alluvial soils which are utilized for horticulture are situated near Rockhampton, at Gracemere, Nerimbera, Bouldercombe, Moore's Creek and Frenchville. They produce the bulk of the vegetables grown in the district, such as cabbages, cauliflowers, carrots, beetroot, lettuce, beans, peas, pumpkins and potatoes.

A sandy granite loam in the Yarwun-Targinnie area is also of horticultural interest. This soil is reasonably fertile, of considerable depth, well drained, and contrary to expectation, retains its moisture reasonably well. It is easily cultivated, but is rather subject to erosion. Large quantities of tomatoes are produced on this soil type as well as papaws of particularly high quality.

Many of the production areas in the Central District are comparatively new in comparison with those of southern Queensland. In the past as land became less productive more and more virgin soil was brought into use. However, the ever-increasing cost of preparing new land for cropping, together with the current scarcity of rural labour, has been responsible for bringing many old cultivated areas back into production. The application of modern methods of farming land management and the proper use of artificial fertilizers have made the re-establishment of these old areas possible.

Although the district has numerous large rivers and creeks, water facilities for irrigation are not good. The watercourses are either tidal or are far removed from existing production areas. Further, the underground water supplies are either inadequate or unsuitable for fruit and vegetable crops except in the basin of the Fitzroy River near Rockhampton. Hence fruit and to a lesser extent vegetable production is chiefly dependent on seasonal rains.

VEGETATION.

Open eucalyptus hardwood forests form by far the greatest portion of the vegetation, the chief species being blue gum, bloodwood, narrow-leaf ironbark, grey box and stringy bark. In swampy areas, tea tree and banksias predominate. Light softwood scrubs occur on some of the better soil types and are characteristic of the more highly developed farming areas. Dense rain forest is found in the heavier rainfall belt around Mackay and to a smaller extent at Byfield.

HORTICULTURAL USES.

With the exceptions of some fruit crops, horticultural production in Central Queensland reached its peak during World War 2 when large quantities of fruit and vegetables were required for the Services. Although production has since declined, a perusal of Table 1 will give some idea of its importance to the district.

TABLE 1.

HORTICULTURAL PRODUCTION—CENTRAL QUEENSLAND DISTRICT (1949–50).

FRUIT.

Crop.	Not Bearing.	Bearing.	Production.
	Trees.	Trees.	
Citrus—			
Navel oranges	994	1,789	2,033 bushels
Valencia oranges	5,988	7,055	7,035 bushels
Other oranges	2,784	54,52	5,414 bushels
Lemons	1,085	2,351	1,654 bushels
Mandarins	5,064	7,405	4,364 bushels
Custard apples	936	598	218 bushels
Mangoes	547	2,596	3,269 bushels
	Acres.	Acres.	
Table grapes	6	59	54,884 lb.
Bananas	122	309	15,422 1¼ bush. cases
Pineapples	101	406	238 tons (factory)
			50,384 1½ bush. cases
Papaws	136	225	30,980 bush. cases
Passion fruit	2	33	2,300 ½ bush. cases

VEGETABLES.

Crop.	Acres.	Production.
Potatoes—		
English	354	831 tons
Sweet	38	64 tons
Turnips	17	52 tons
Carrots	28	1,569 cwt.
Beetroot	7	244 cwt.
Onions	6	7 tons
Tomatoes	491	74,509 ½ bush. cases
French beans	118	7,500 bushels
Green peas	73	3,145 bushels
Cabbages	80	19,661 dozen
Cauliflowers	29	5,749 dozen
Lettuce	6	2,873 bushels
Melon—		
Water	104	270 tons
Rock	83	148 tons
Pumpkins	807	1,559 tons
Marrows and squashes	13	22 tons
Cucumbers	91	9,383 bushels
Other vegetables	31	..

Pineapples.

The main varieties of pineapple are the smooth-leaf Cayenne (Plate 56) and the rough-leaf Ripley and Alexander. Rough-leaf types have been grown for many years and enjoy a wide popularity as a fresh fruit on all Queensland markets. They are less popular on interstate markets, where the consumer demand is for the Smooth Cayenne. In recent years a notable expansion has taken place in the area under the Smooth Cayenne, which, besides being used as a fresh fruit, is also canned. The establishment of a growers' co-operative cannery at Northgate in southern Queensland has given a decided impetus to the pineapple industry in the Central District. Potentialities for further expansion are bright, as the tropical climate favours early maturation of the fruit,

particularly in the summer crop. The Yeppoon area, which embraces Tanby, Emu Park, Farnborough, Woodbury and Adelaide Park, is the main production centre. Other notable areas are Gracemere, St. Lawrence and Bucasia, which is near Mackay. Ample land is available for the expansion of the industry in most of these areas.

Plate 56.

Young Pineapple Crop near Rockhampton.—The crop may be grown either in single rows as illustrated or in double rows; the latter is more usual.

[*Photograph by E. T. Wannup.*

Bananas.

The banana industry has been established for many years (Plate 57). It reached the peak of its production about 1930, when rain forest soils at Yeppoon and Byfield and near Mackay were planted up extensively. Immediately afterwards, however, the industry in the whole of Queensland went through a very difficult period, characterised by low returns to the grower, and production rapidly declined. The banana area then remained fairly static, but a succession of droughts and occasional cyclonic winds have caused a further decline in the acreage under crop over the last few years. Although the soil and most climatic factors are suitable for banana production, the rainfall is so uncertain that the industry is unlikely to become as important as it is in southern Queensland. However, there is scope for expansion in the northern portion of the district from Carmila to Bloomsbury, where the rain is more dependable and large tracts of suitable land are still undeveloped.

The dwarf Cavendish is the main variety. Mons Mare is growing in importance but the lack of adequate supplies of planting material is retarding progress. Sugar bananas, which are well received on the market, are also grown to some extent.

Plate 57.

Banana Plantation of the Cavendish Variety.—Crops are grown on recently cleared forest country.

[Photograph by E. T. Wannup.

The district is free from bunchy top disease, but banana weevil borer and banana rust thrips are fairly prevalent. Panama disease is present in some of the areas where tall varieties are grown.

Papaws.

Papaws (Plate 58) are grown in most parts of the district, including Yarwun, Yeppoon, Ambrose, Bouldercombe, The Caves and around Mackay. Yarwun is the biggest production centre. Although the 1949 cyclone gave the industry a severe set-back, new plantings have made good these losses and production is now back to normal. That the soil and the tropical environment are ideally suited for papaw production is demonstrated by the excellent reputation of the fruit wherever it is marketed. Dioecious types are mainly grown, and although generally variable in shape and size, they nevertheless have reached some degree of uniformity in the Yarwun area, where a local strain has been selected and grown for many years.

The two new varieties, Bettina and Improved Petersen, released in southern Queensland are at present under trial at Yeppoon and Yarwun. Dieback is the most troublesome disease, particularly on the heavier loams around Yeppoon and The Caves.

Citrus.

The citrus industry ranks among the oldest in the district. Seedling citrus were first planted at Byfield over 50 years ago. Many of these trees are still in production and excellent crops of both oranges and mandarins are harvested annually. Byfield is the only place where

Plate 58.

Papaw Plant Bearing Its First Crop of Fruit.—Commercial plantations last from three to five years.

[Photograph by E. T. Wannup.

citrus is harvested in quantity. Production elsewhere is limited to scattered orchards throughout the district, including more inland areas such as Barcaldine, Bogantungan, Clermont, Yamala and Dingo. Because of the lack of adequate irrigation facilities, no immediate expansion of any consequence is visualised and production will be limited to local market requirements for some considerable time.

The main varieties are Late Valencia, Washington Navel, Joppa and seedling oranges, Emperor mandarin, Marsh grapefruit, and Lisbon, Villa Franca and Genoa lemons. Because of the prevalence of certain pests and diseases, spray programmes must be strictly observed.

Grapes.

Grapes (Plate 59) are grown chiefly around Rockhampton and Westwood. At Westwood a vineyard planted approximately 50 years ago is still producing excellent crops. Muscat Hamburg is the main variety. The fruit matures a week or so before Christmas and meets a very ready demand. Prospects for expansion are good, particularly if the possibilities of air-freighting to southern markets are exploited by growers.

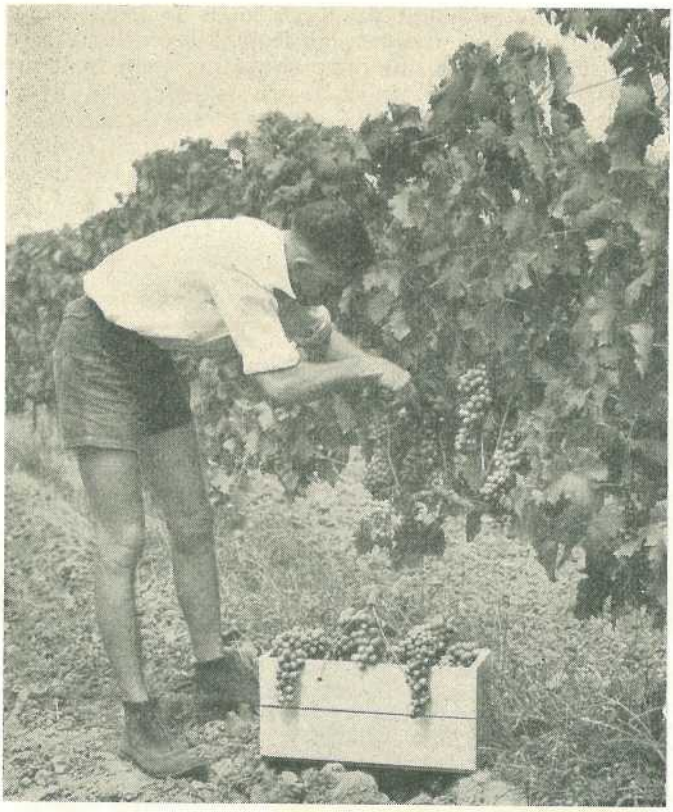

Plate 59.

Harvesting Muscat Hamburg Grapes Near Rockhampton.

[Photograph by E. T. Wannup.

Passion Fruit.

The inroads of diseases such as Fusarium wilt and woodiness have seriously affected the production of passion fruit in Central Queensland. Yeppoon, which for many years was a large production centre, is no longer interested in the crop, and only limited quantities are grown at Yarwun, Milman, St. Lawrence, and parts of Mackay. The main crop matures during the spring and early summer when dry weather is usual, and fruit shrivelling, accompanied by heavy losses, often occurs.

Custard Apples.

Production is mainly confined to seedling types. Compared with Pink's Mammoth, the principal variety in southern Queensland, the fruit is smaller and contains a much greater number of seeds. The tree, on the other hand, is very hardy and has the advantage of regularly producing crops. A few good trees of the Pink's Mammoth variety are also under cultivation but in general the cropping of this variety has been very disappointing.

Mangoes.

No really serious attempt has been made to grow the mango in Central Queensland on a commercial scale. Trees have been mainly planted for ornamental or shade purposes rather than fruit production. That mangoes can be successfully grown is evidenced by the many beautiful trees throughout the various parts of the district. At Bucasia, near Mackay, an attempt has been made to establish orchards of the better types such as the Kensington, and although the trees are still young the venture appears to have promise.

Plate 60.

Young Tomatoes Grown under the Trellis System.—The plants will be trained to two arms which grow up the V string looped over top and bottom wires.

[*Photograph by E. T. Wannup.*

Tomatoes.

Tomatoes are grown in practically all farming areas and play a very important part in the district's prosperity. Production is maintained throughout the greater part of the year. Planting commences at the beginning of February and continues until approximately September, but the largest acreage is set out during the May-June period to supply the southern markets during late winter and spring. Because irrigation facilities are limited, production is mainly dependent on

good seasonal rains. For the same reason, staking or trellising (Plate 60) is rarely practised and most crops are grown by the bush method. The most favoured varieties are Sioux, Grosse Lisse, Rutgers, Break o' Day and Pearson. Plant protection against pests and diseases is necessary.

The use of fertilizers, together with the choice of better varieties and a better appreciation of the importance of pest and disease control by farmers, has done much in recent years to bring about a considerable improvement in the average production per acre.

Vegetables.

Vegetable production for the greater part is confined to localities where suitable irrigation facilities are available. The best irrigable soils for vegetables are near Rockhampton, which is the district's largest market. Horticultural areas in Central Queensland are too far from the interstate markets to encourage large-scale production and growers are therefore usually concerned with supplying local requirements over the longest possible period during the year. Modern developments in plant protection and a careful selection of varieties have done much to prolong the cropping period. The vegetables grown include cabbages, cauliflowers, root crops, lettuce, cucurbit crops, beans and peas. Included in the cucurbit crops is a gourd commonly known as Guada bean, which is a popular vegetable on the local market and is an excellent substitute for greens during the hot summer months.

Lettuce, which were once solely produced by Chinese gardeners, are now grown commercially by Australians. During the summer months this crop is difficult to handle and calls for specialised management. The most popular variety is a local selection—a legacy from Chinese gardens—now commonly known as Chinese or Summer lettuce. It produces excellent heads during the hot summer months.

THE FUTURE.

The Central Queensland horticultural district is one of the largest in the State. It still contains vast areas of undeveloped or only partly developed land and thus has distinct potentialities for the future. At the moment, the acreage under pineapples, papaws and to a lesser extent tomatoes is expanding. Of these crops, the pineapple is by far the most stable, for the tropical conditions favour the production of high quality fruit for which there is a good payable outlet. The papaw is another fruit which, when handled with care, can be placed in good condition on southern markets, where Yarwun fruit already enjoys a reputation for excellent quality. Both crops withstand dry seasonal conditions particularly well. Tomatoes have been produced in quantity for many years, but the crop is almost entirely dependent on good seasons and the annual output is therefore variable. As the crop grows quickly and requires only a small capital outlay, it will always play an important part in the horticulture of the district.

Summing up, it appears that the future of horticulture in Central Queensland depends on specialisation in crops which (*a*) are best suited to the soil and climate; (*b*) may be placed on southern markets; and (*c*) are capable of being processed. Should the district's natural resources like Callide and Blair Athol coal be more fully exploited and industrial development follow, horticultural production could readily keep in step with the needs of an increased population and in so doing consolidate its own future.

Salmonellosis in Transported Rams.

G. R. MOULE and R. B. YOUNG, Sheep and Wool Branch.

IT is well known that bacteria can be identified according to their shape, the way they stain, the nutrients they require for normal growth and reproduction, the way they ferment certain sugars, and their requirements with regard to atmospheric conditions. A group of organisms which are of considerable importance because of the disease conditions they produce, and which can be identified by cultural methods, was named Salmonella after the eminent American bacteriologist Salmon.

Salmonellosis refers to the establishment in the animal's body of an infection by organisms of the Salmonella group. These organisms commonly affect the small intestines and as a result profuse scouring occurs. Heavy mortality commonly results from severe outbreaks of salmonellosis.

Until recently the disease had been reported only on a few occasions amongst sheep in Australia. Investigations carried out by officers of the Queensland Department of Agriculture and Stock into mortality occurring amongst Merino rams in transit from studs in New South Wales and South Australia to western Queensland have established that salmonellosis is quite common and that it may result in serious losses.

Ever since it became possible for rams to travel the whole journey from southern studs to western Queensland by rail, losses have been reported, though little trouble seems to have occurred in earlier days when animals were moved by boat from Sydney to a convenient port in Queensland for distribution to various properties. In some consignments by rail half the number of travelling rams have been affected, and on more than one occasion at least a quarter of the total draft has died within a few days of completing the journey. These losses are of considerable importance, as they may restrict the number of rams available for joining.

History of Affected Rams.

Enquiry has revealed that the majority of stud breeders like the sheep they sell to be in good condition when they are delivered, and to ensure this rams are commonly grazed on irrigated or improved pastures for a fortnight or so before they are consigned.

While in transit from South Australia or from the majority of studs in New South Wales the animals are subjected to prolonged periods of starvation, as they may travel several stages each of from 48 to 72 hours duration. These are broken by spells of about 24 hours during which the animals are offered cereal or lucerne hay.

Usually the first signs of trouble amongst the travelling rams are observed as they approach the New South Wales—Queensland border, and almost invariably some losses have occurred before the animals reach their destination. While it has not been possible to get detailed information about the feeding of all sheep en route, it has been established that in many instances the rations provided for the sheep at the spelling points are inadequate. There is also evidence that rams which have been starved for some time do not regain their appetite for a considerable time, and the comparatively short spelling periods may be insufficient to ensure a return of their normal appetite.

These facts are of importance because they probably pre-dispose travelling rams to attacks of salmonellosis. Apparently the establishment of severe infection is dependent partly upon the amount and nature of the food available to the sheep. The paunch of sheep which have been on succulent pastures soon empties when the animals are starved and these sheep regain their appetite slowly. The emptying of the paunch may facilitate the establishment of severe infections of bacteria belonging to the Salmonella family, and accordingly is to be avoided when rams are in transit.

Symptoms.

Persistent scouring is the most striking symptom exhibited by sheep suffering from salmonellosis. The faeces become so fluid that they are about the consistency of paint. They are usually greenish or yellowish in colour and are evil smelling.

The affected rams become dejected; they do not eat, but will drink small quantities of water frequently. Sometimes they stand with their backs arched and with their hind feet tucked up under their forefeet, in an effort to take weight off the floor of the belly.

The temperature of the sheep is raised and the blood vessels of the eyelids become inflamed.

As the disease progresses the sheep rapidly lose condition, become weaker, and finally collapse and die. They may be sick for from three to five days before death supervenes, but not all affected sheep die. Recovery is usually protracted and it may be two weeks before scouring ceases. Six to eight weeks may elapse before recovered rams regain their condition.

Post-mortem Findings.

The post-mortem findings are not very spectacular, although they are characteristic of the disease. There is slight engorgement of the blood vessels under the skin and the muscles may be dark.

The small intestines are usually empty and their lining is inflamed. Sometimes these changes extend up to the fourth stomach and down to the lower bowel, which may show patchy areas of ulceration. The lymph glands of the small intestines are slightly enlarged and the gall bladder is distended and sometimes inflamed.

There may be an aggregation of fluid in the heart sac and a few dark haemorrhages on the heart muscle.

Treatment.

The drug sulphamezathine is useful for administration to sheep suffering from salmonellosis. It is available as white tablets, each weighing half a gram, or as a 33 per cent. sodium solution.

The tablets can be administered by mouth at the rate of 1 gram (that is, two tablets each of half a gram) per 10 lb. liveweight for the initial dose, followed by half a gram (one tablet) per 10 lb. liveweight a day thereafter.

The sodium solution can be injected into the jugular vein or into the abdominal cavity. The dose rate is 3 c.c. per 20 lb. liveweight, followed by 1½ c.c. per 20 lb. liveweight each day until recovery.

Great care is necessary in making these injections. Treatment should be commenced early and affected rams should be withdrawn from the rest of the flock.

Preventive Measures.

The main preventive measures to consider are as follows:—

(1) Feed rams an adequate ration of fibrous fodder, such as cereal or lucerne chaff and oats, for a fortnight or three weeks before they commence their rail journey.

(2) Keep them off irrigated or succulent pastures or overgrazed areas.

(3) Ensure that travelling rams are spelled frequently and that they eat well. They should be fed bulky rations, consisting mainly of roughage, while in transit.

(4) Pay particular attention to cleanliness in feeding rams in transit. The feed should be offered in clean troughs, and not dumped on ground heavily soiled with faeces. Clean water troughs carefully.

(5) If a ram commences to scour, remove him from the draft. The organism which causes the disease is passed in the faeces. An affected sheep could contaminate the feed or water and be responsible for spreading the complaint to the remainder of the draft.

The Cultivation of Some Salad Vegetables.

K. M. WARD, Senior Horticulturist, and C. N. MORGAN, Senior Adviser in Horticulture.

THE term salad vegetables refers to a group of plants which are valued in the diet for their mineral and vitamin content and used most commonly during the warm months of the year. They are always eaten in the fresh state with or without cold meats, cheese and other foods. The tomato and the lettuce are basic ingredients in most salads, but many others, such as celery, parsley, cress and spring onions, are used when available. The cultivation of three important salad vegetables—tomato, lettuce and shallot—is described in this article.

TOMATO.

The tomato (*Lycopersicum esculentum*) is native to tropical America and though known in Europe prior to 1600 it was not grown for culinary purposes until after 1750. Since then great strides have been made in the development of the crop. The tomato belongs to the botanical family Solanaceæ, which contains a number of important species, including potato, tobacco, egg plant and cape gooseberry. The plant is grown as an annual and its fruit is technically described as a berry.

Climatic and Soil Requirements.

Though the tomato is a warm-climate plant, it is grown in both temperate and tropical countries on a wide range of soil types. The plant will not withstand frosts and grows most rapidly at temperatures between 75 deg. F. and 88 deg. F. Hot winds cause blossom drop while cold winds seriously damage the foliage and interfere with fruit setting. The plant thrives under irrigation where atmospheric conditions are dry. It is grown as a summer crop at Stanthorpe on the southern tablelands of the Great Dividing Range, and as an autumn, winter and spring crop in coastal Queensland.

The tomato is produced on a variety of soil types, including sands, red volcanic loams, and clay loams. The plant grows more quickly on light than on heavy soils and the former are preferable where earliness is desired. However, loamy soils are likely to give greater yields. Good drainage is essential and a plentiful supply of organic matter is most beneficial.

The Seed-bed.

Climatic conditions in Queensland permit the use of open-air seed-beds and only occasionally is it necessary to protect the plants against late frosts. It is worth while taking the trouble to raise sturdy, healthy

plants. The seed-bed should therefore be dug deeply, brought to a fine tilth and preferably raised four to six inches above ground level. The fertility of the bed is increased by adding a small amount of fertilizer and well rotted manure to the soil a week or more before sowing. The seeds should be sown a quarter of an inch deep in rows four to six inches apart and five or six to the inch. After covering the seed, the soil should be firmed gently with a flat board and lightly watered.

Though the seed-bed will require watering, care must be taken not to over-water and thus encourage damping-off disease in the seedlings. In warm weather, one watering each morning is usually needed, but in cool weather two waterings a week may suffice. A fine spray should be used. In warm districts the seedlings will be ready for planting out in four to six weeks, but in the tablelands the seed-bed period may be as much as eight weeks.

There are about 10,000 seeds per ounce and it is advisable to sow about 1½ ounces of seed for each acre of the crop to be established in the field.

Fertilizers.

In addition to organic manures, which should be incorporated with the soil during the preparation of the land, artificial fertilizers serve a useful purpose. In Queensland, the tomato plant responds to fertilizer mixtures containing approximately three parts of phosphoric acid to one part of nitrogen. Suitable mixtures on the market contain nitrogen, phosphoric acid and potash in the following proportions—5:13:5; 5:14:5; 5:13.5:4 and 4:12:6. Some of these mixtures contain a proportion of blood and bone.

The rate of application varies with cultural conditions, soil fertility and the spacing of plants. On moderately fertile soils, a suitable pre-planting application would be 8 cwt. per acre of a 5:13:5 or similar fertilizer mixture. This is equivalent to 5½ lb. to each chain of row if the rows of plants are four feet apart. A typical fertilizing schedule for a ground crop is as follows:—

Basal dressing applied in the furrows before planting—5:13:5 (containing blood and bone) at 8 cwt. per acre;

Side dressing at early flowering—5:13:5 (a quick-acting water-soluble) at 4 cwt. per acre.

Cluster types of tomatoes grown on trellises or stakes during cool weather benefit from light side dressings of sulphate of ammonia or quick-acting complete fertilizers applied at regular intervals during the growth of the crop.

Field Planting.

Soil preparation for tomatoes includes at least one deep cultivation. When organic matter is used, it should be incorporated in the soil about three to six weeks before field planting to allow sufficient time for its decomposition and the settling of the soil.

Before transplanting, the seedlings may be hardened off in the seed-bed for a few days by withholding water, but just before lifting the plants the seed-bed should be well watered. As the plants are taken out, most of the older leaves are removed but the growing tip is left intact. Only sturdy plants not more than eight inches high should be used (Plate 61). When setting out, the plants should be placed at least three inches deeper in the soil than they were in the seed-bed, and it is good practice to spread the roots before filling in the hole. Water should then be applied to each plant to settle the soil around the roots.

Plate 61.

Tomato Seedlings.—The leaves will be trimmed to reduce transpiration when the plants are set out in the field.

Plate 62.

Ground Tomatoes.—A crop of Rutgers in the Stanthorpe district. Strains of this variety are widely grown in southern Queensland.

Planting distances depend on the variety grown. Dwarf types planted as ground crops (Plates 62 and 63) are set out about 30 inches between plants and four to five feet between rows. Normally, ground crops grown in coastal districts are planted with a 3-feet spacing between plants and a 6-feet spacing between rows (equivalent to about 2,000 plants per acre), though in home gardens closer planting may be adopted. If the crop is staked, the plants may be set out 18 inches apart in rows with a 4 ft. 6 in. spacing, thus allowing up to 7,000 plants per acre. Trellised plants are also planted closely. Cradled plants are usually planted a little closer than ground crops, so there are about 3,000 plants per acre.

Plate 63.

Gound Tomatoes.—A well grown crop of Rutgers in the Redlands district.

Crop Management.

Shallow cultivation is necessary to control weeds. However, all cultivation of ground crops must cease once the plants have covered the soil in order to avoid damage to both the vines and the fruit clusters.

Training and pruning is essential for staked and trellised plants (Plate 64). The plants are trained to a single or double stem by pinching out all lateral shoot growths from the axils of the large leaves. Single stems are tied to stakes with strips of rag or soft thick twine (Plate 66) or twisted round the trellis string. The growing point is pinched out when the plant reaches the required height. Cradled crops do not require pruning but the plants are trained on to wires (Plate 65). Unpruned plants will generally give better individual yields than those that are pruned.

Tomatoes require a moist soil for best growth but excessively wet conditions lead to the production of inferior quality fruit. Heavy but infrequent applications of water are preferable to many light waterings. The quantity of water applied in dry weather should not exceed that necessary to penetrate the root zone, and where there is a clay band near

Plate 64.

Trellised Tomatoes.—Trellising is a standard method of growing tomatoes in the Brisbane district during the cooler months of the year.

Plate 65.

Cradled Tomatoes.—The plants are trained on to wires in the form of a cradle.

the surface only sufficient water should be applied to reach this band. Over-watering not only lowers the quality of the fruit but also tends to wash soluble fertilizers down below the root zone.

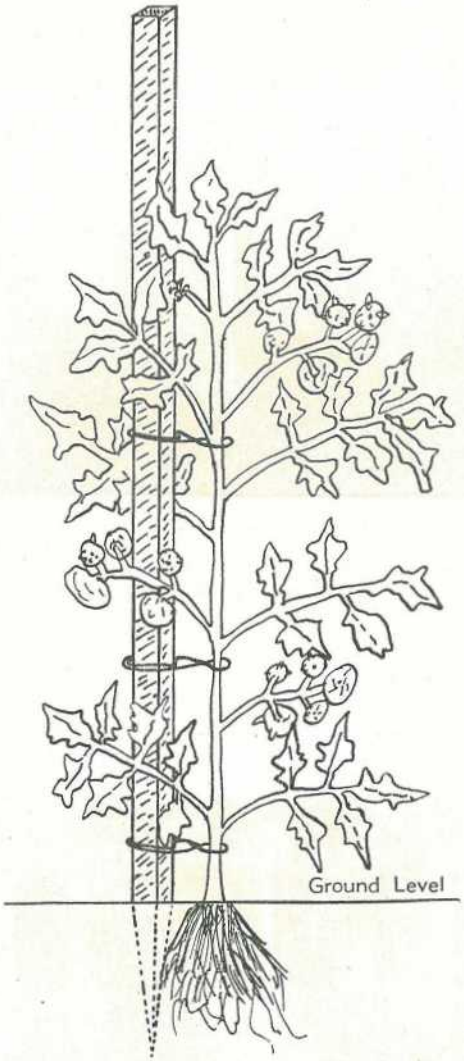

Plate 66.

Staked Tomatoes.—The diagram shows the method of tying the plant to the stake.

Varieties.

Broadly speaking. there are two groups of tomato varieties grown in Queensland. One group is suitable for ground crops; the other is preferred for off-the-ground crops which are normally staked or trellised. Varieties in the latter group, often referred to as cluster types, tolerate cool conditions and are pruned to increase the size of the fruit; they require both training and forcing.

Varieties recommended for planting at different times of the year are:—

For Coastal or Warm Climate Districts.

Time of Planting Out.	Varieties Recommended.
February to March (ground crops)	Q1 or Sioux, Q2 or Grosse Lisse, Q4 or Rutgers, Red Cloud and Break o' Day.
April to May (off-the-ground crops)	Salads Special, Potentate and Geraldton Smooth Skin.
June to August (ground crops)	Q1 or Sioux, Red Cloud and Break o' Day.

For Cool Tablelands.

Time of Planting Out.	Varieties Recommended.
October to February (ground crops)	First choice: Q1 or Sioux, Q2 or Grosse Lisse, Q3 or Valiant, Q4 or Rutgers. Second Choice: Among others, good varieties are Break o' Day and Pearson.

LETTUCE.

Lettuce (*Lactuca sativa*) is grown most successfully during the cooler months of the year. In summer the plants seldom produce a good heart and although the heads are large they would be classed as loose-leaved. Provided it is supplied with adequate moisture and plant food, almost any well-drained soil will grow good lettuce.

Manures and Fertilizers.

Without ample supplies of farmyard manure, lettuce growing is difficult. Unfortunately, this manure is not available to all growers and fertilizer applications are therefore heavy. The main fertilizer used is blood and bone, which is broadcast a week or so prior to planting. The amounts used vary from 10 cwt. to 15 cwt. per acre. Topdressings are often necessary on the growing crop and nitrogenous fertilizers such as sulphate of ammonia, nitrate of soda and dried blood are all used. The first topdressing may be made soon after thinning and the second when the plants are nearly half grown. The topdressing should not exceed 400 lb. per acre and each application should be followed by an irrigation.

Soil Preparation.

All land for lettuce must be thoroughly prepared. At least two ploughings are necessary, followed by harrowing and cultivating until the soil is in a fine state of tilth. When sowing lettuce direct into the field, it is essential to have the land reasonably level and free from lumps.

Planting and Thinning.

Two methods of planting are usually adopted. The first is to plant on raised beds (Plate 67) sufficiently wide to take four rows approximately 12-15 inches apart. The method of making the beds is to throw in two furrows approximately six feet apart by means of a single furrow plough or a hiller attached to a cultivator. The bed may then be levelled. Raised beds are used on heavy or shallow soils to improve the drainage. The second system is to plant direct in the field without hilling (Plate 68). Rows are made about 15 inches apart to allow the use of a hand cultivator. Where horse cultivation is practised, rows will have to be two feet apart.

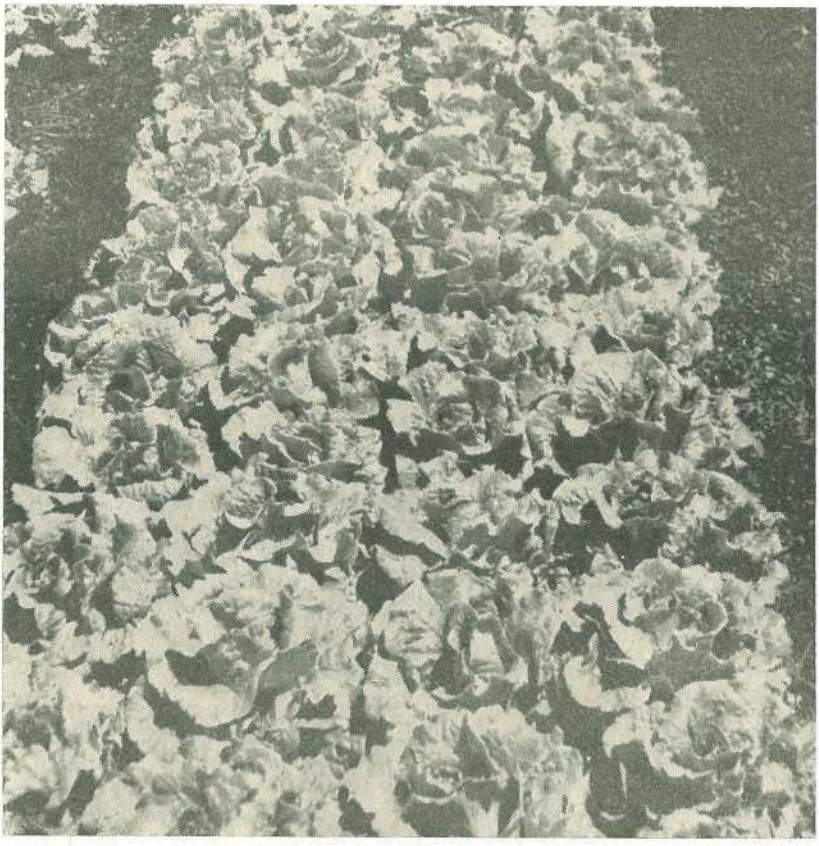

Plate 67.

Bedded Lettuce.—The crop has been grown on raised beds with four rows to the bed.

With both methods, the seed is drilled along the the row and sown shallow. Thick seeding should be avoided, as the work involved in thinning is laborious and expensive. From 1 to 1½ lb. of seed should be sufficient to plant an acre when using a planter but more is required for hand planting. Lettuce usually take from eight to 10 weeks from sowing to reach market condition.

Approximately three to five weeks after sowing, the plants should be thinned to about 10 inches apart.

Plate 68.

Lettuce on the Flat.—The crop is about half grown and has been planted to permit inter-row cultivation.

Cultivation.

Cultivation should be shallow and fairly frequent, for lettuce is a shallow-rooted plant and weed competition is harmful. Small hand cultivators may be used to keep down weeds between the rows, but in the rows hand chipping is necessary. A topdressing may be applied before cultivation, as the fertilizer is then immediately worked into the soil.

Irrigation.

Practically all lettuce are irrigated by overhead sprays. The crop requires a plentiful supply of water, particularly during the warmer months. Lack of moisture results in stunting, slow growth, bitter flavour and an increased tendency to bolt in warm weather.

During the winter months, irrigation is done sparingly and normally no great effort is required to keep an even supply of moisture in the soil during this period. In the summer, however, the full use of irrigation facilities is essential during dry weather. On well-drained sandy and volcanic soils, it will commonly be necessary to apply water every second or third day at this time of the year. Light waterings in between the main irrigations keep the soil cool and prevent wilting in the middle of the day.

Overhead watering should be done early in the morning or in the late afternoon. Should a grower find his irrigation supply below requirements, the available water should be used on half-grown plants rather than on those which are nearly mature.

Harvesting.

Lettuce should be harvested as soon as they have reached maturity. Winter lettuce are mature when the hearts are firm. Summer lettuce, being loose-leaved, may be cut when they reach reasonable market size. Cutting is done either late in the afternoon of the previous day or early in the morning of the day of marketing. The former practice is quite satisfactory in winter while the latter is more desirable in summer.

Varieties.

The most popular types of lettuce are those known as the crisp varieties, which have crisp, curly leaves and develop a large, solid head. Cos and other loose leaf varieties are not often grown commercially but are common in the home garden. The principal crisp varieties grown in Queensland are—

Imperial 847	Grown all the year round.
Imperial 44, Seedless and Great Lakes	Preferred for summer growing.
Imperial 615 and New York	Preferred for winter growing.
Mignonette	A small, home garden variety, suitable for planting the year round.

SHALLOT.

The shallot (*Allium ascalonicum*) is a perennial and seldom seeds but the bulb as planted divides into numerous bulbils or cloves which remain attached at the base. The crop is used mainly as a salad green but sometimes the dry bulbs are used for seasoning or as a mild substitute for onions.

Propagation is by means of cloves which are separated from the dry bulb and planted out singly in early spring or autumn. The cloves should be set out in rows 9-12 inches apart in rich, well-prepared soil. When grown for use in the green state, planting to a depth of at least three inches is recommended so that long, well-balanced and succulent tops may be obtained. Under suitable conditions, plant growth and multiplication of cloves are rapid and the crop can be pulled or dug three or four months from planting out. At this stage, the bulbs are still soft and the earthed portion of the stalk is white; the aerial portion is, however, quite green.

When the crop is grown for the dry bulbs, shallow planting is practised and the soil is from time to time drawn away from the plants during their growing period until as they approach maturity they are practically sitting on top of the earth. This treatment encourages the filling out and hardening of the bulbs. Under this method of growing, the bulbs are not harvested until the tops have begun to wither, and after drying out they are divided and stored in a cool place.

Progress in Tea Trials.

For some time past, tea growing experiments have been proceeding at the Department's Bureau of Tropical Agriculture at South Johnstone, on the northern coastal plain. It has been demonstrated that tea of good quality can be grown on the lowlands of the north, and it is now proposed to make plantings at higher altitudes in order to test the suitability of the crop for various conditions.

A mechanical tea cropper has recently been tested at South Johnstone with promising results. Trials with the cropper will be continued, and studies of the type of bush most satisfactory for mechanical harvesting will be made.

The Relationship of Crops to Dry Farming Practice in Queensland.*

L. G. MILES, Senior Plant Breeder, Agriculture Branch.

THE areas with which I propose to deal under the heading of dry farming in Queensland are those in which crops are grown under natural rainfall whose average is less than 30 inches per annum. In actual fact such areas lie mainly between the 25 inch and 30 inch isohyets and include such important districts as the Darling Downs, portion of the South, Central and Upper Burnett districts and the Callide and Dawson Valleys.

While such rainfalls may appear bountiful to southern Australian farmers, they are characterised by two important factors:—(i.) their unreliability, and (ii.) their major incidence during periods of high temperature, coupled with high evaporation and high transpiration. These factors are responsible for frequent seasonal shortages and make necessary some form of moisture conservation if farming is to be successfully pursued. Typical rainfall data are those for Pittsworth, Dalby, Monto and Biloela.

—	Mean Annual Rainfall.	Percentage Oct.–Mar.	Evaporation.
	In.		In.
Pittsworth	27	66	53·0
Dalby	26	66	58·0
Monto	29	70	54·6
Biloela	28	72	77·25

Winter versus Summer Crops.

Under these conditions of predominantly summer-autumn rainfall it may at first sight seem paradoxical that the major agricultural crop in this region is wheat, whose growing period covers the winter and

* This paper was presented to the Agriculture and Forestry Section of the Brisbane Meeting of the Australian and New Zealand Association for the Advancement of Science.

spring months. One reason for this is of course economic, being related to relative requirements of farm products and the prices offering for them. Another important reason is, however, that in much of this country winter cropping is regarded as more reliable than summer cropping. This refers particularly to the heavier fertile clay soils of high moisture holding capacity which are eminently suited for moisture conservation by fallowing.

While the bulk of the rainfall occurs during the warmer months of the year, such rains occur erratically, frequently in torrential bursts, and usually interspered with heatwave periods of variable severity and duration. Thus a summer of better than average rainfall could well prove to be a mediocre or poor season for crop production on account of the uneven distribution and severe inter-rainfall periods. With successful fallowing practice, however, much of this summer incidence can be retained within the soil, irrespective of its actual distribution, and thus become available for the use of winter crops. The major crop requirement is then a suitable planting rain in the May-July period, and rainfall records show that while the average rainfall for these months is not high, the expectation of such rains is quite reliable.

It has been shown at Biloela, which is only one degree south of the Tropic of Capricorn, that a wheat crop averaging 38 bushels per acre could be grown on a nil effective rainfall subsequent to planting, when moisture had been conserved to a depth of four feet during the previous wet season.

Wheat.

Wheat is grown as the major annual crop on most of the large grain farms in the open plains and adjoining country of the Darling Downs. In other districts in which dairying and mixed farming predominate, the crop is grown in rotation with both winter and summer fodder and grain crops. Many years of continuous cultivation have shown that on flat land the practice of an annual crop of wheat following a short summer-autumn fallow has proved economically sound and has not been attended by any noticeable falling off in yields. Many Darling Downs farmers will alternate wheat only occasionally with another winter crop such as oats, linseed or canary seed, and switch to summer cropping for a few seasons only when winter weeds have become a major problem.

The old established practice has been to burn stubbles and to cultivate the land as soon as possible thereafter to allow of the maximum possible penetration of summer rains. This practice has already proved disastrous on much of the sloping land on the eastern and southern Downs, where heavy soil losses have occurred during recent years. In such areas soil conservation practices, including the greater use of summer cropping and the retention of winter crop stubbles, are being increasingly adopted. Stubble mulching is not, however, widely practised as yet, and much investigation into the practicability and the long-term effects of such methods will be necessary before they can be confidently recommended in the extensive grain producing areas of the relatively flat plain country.

Fallowing techniques made possible by modern power farming have definitely proved themselves insofar as yield is concerned, in spite of continuous use of the land under virtual monoculture. While commercial fertilizers as yet give no measurable response on most of the State's wheat lands, there is some indication (in the prevalence of mottling in normally vitreous grain) that the system in use is responsible for some

Plate 69.
Wheatfields at Charlton, near Toowoomba.

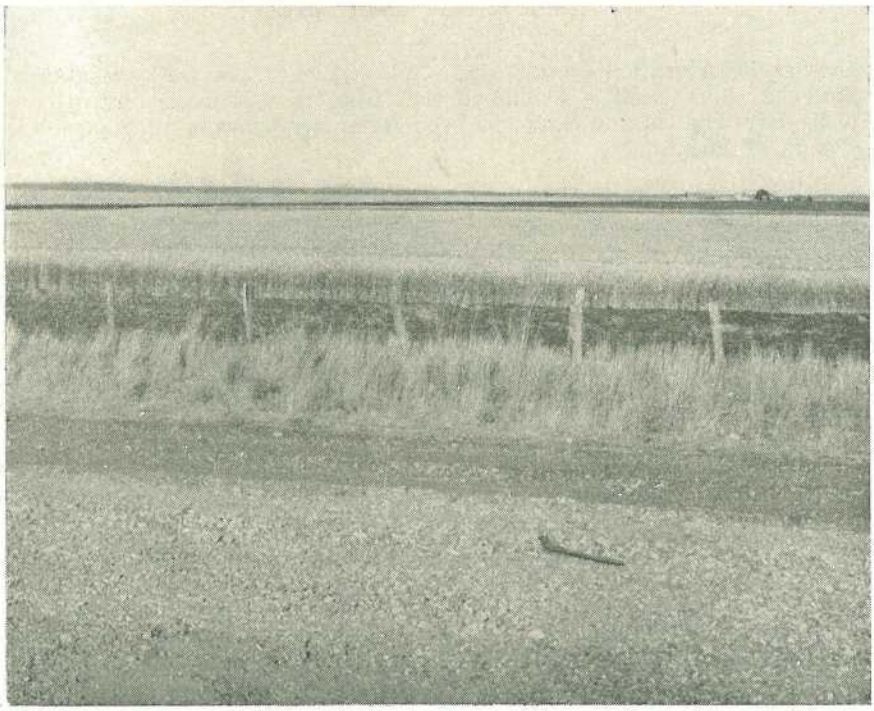

Plate 70.
Wheat on the North-western Portion of the Darling Downs.

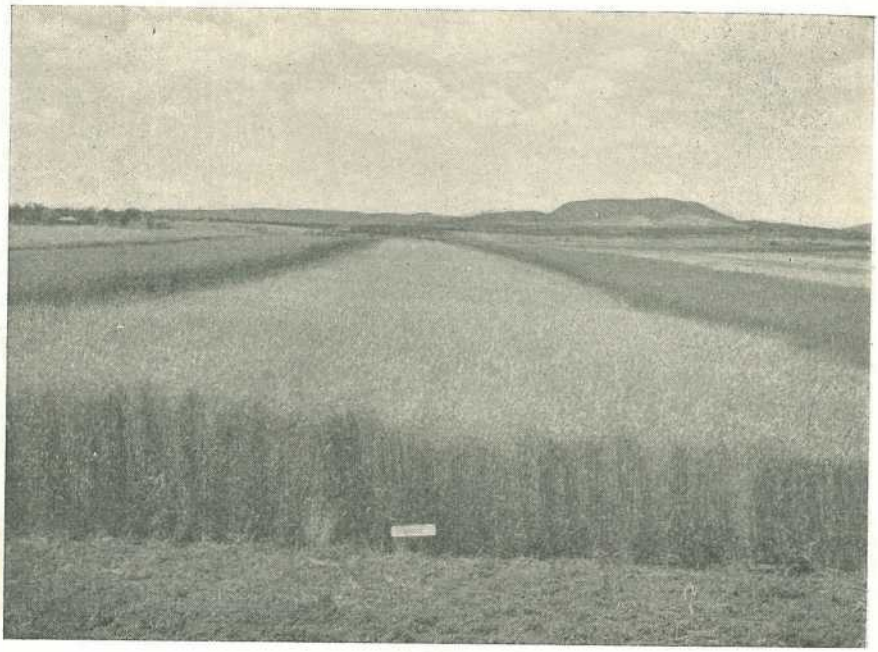

Plate 71.

Trial Blocks of Wheat at the Department's Hermitage Regional Experiment Station, Southern Darling Downs.

general deterioration in quality. While yields are well maintained, however, there is little likelihood that farmers will make any attempt to modify what is now, and has been for many years, a very profitable system of farming.

Wheat varieties in common use are mainly those bred in Queensland or in the northern districts of New South Wales. Varieties from the southern States are not in general well adapted to Queensland conditions, being unreliable, particularly in the drier seasons. The State's wheat breeding programme was initiated before the close of last century by Mr. R. E. Soutter and carried on by him for fifty years before his retirement. The major characteristics of his varieties have been drought resistance (coupled with early maturity and light foliage development), high gluten quality, and more recently, resistance to both stem rust and leaf rust.

Recent modifications in the breeding programme have been necessitated by (i.) a change in the baker's flour quality requirements and (ii.) alterations in the stem rust flora.

With regard to quality, Queensland has in the past produced a high proportion of grain of high gluten strength but somewhat harsh character. Present demand is for a flour of lower gluten strength but better elasticity and general balance. Qualities of this type are being aimed at in future releases.

Changes in the stem rust flora have also complicated the breeding programme. During past years farmers have escaped heavy rust damage by the use of local rust-escaping wheats, and more recently by

the use of rust resistant varieties, a number of which originated in northern New South Wales. The recent occurrence of new biotypes of stem rust, coupled with an exceptionally wet season in 1950, showed most of the hitherto resistant varieties to be highly susceptible, and focussed attention on the necessity for new varieties resistant to the new rust biotypes. In each of the major changes in the rust flora during the last decade, it has been physiological resistance such as possessed by the Kenya varieties which has broken down in the presence of a more virulent rust biotype. Mature plant resistance of the Hope type has remained unaffected. Fortunately there has recently been liberated a new variety carrying the Hope type of resistance, and a second is ready for release during the current season. These varieties, in company with a number of unnamed hybrid selections, proved markedly superior to all other varieties under test during the trying conditions of the 1950 season.

While Queensland's wheat area has only in recent years been sufficient to supply the State's requirements, it has expanded considerably since World War II. and is capable of considerable further expansion, even within the existing wheat districts. Maximum annual production of 14,317,422 bushels was achieved in 1948 from an area of 607,750 acres at a mean yield of 23.6 bushels per acre. The State's mean yield per acre over the five-year period up to 1948-49 season was 20 bushels per acre, which is in excess of that for any other Australian State.

Other Winter Cereals.

In the districts under consideration, other winter cereals are of minor importance compared with wheat. Oats are grown mainly as a grazing crop for dairy stock, and to a lesser extent for hay and grain. This crop is therefore to be seen more frequently in the dairying districts of the eastern Downs and the Burnett and Callide Valleys than in the main grain districts of the central and northern Downs. The industry is based largely on varieties from southern States, but during recent years the development of crown rust resistant varieties has been given considerable attention. A little barley is grown, mainly for feed purposes, as local soil and climatic conditions are not conducive to the production of a high quality malting grain.

Linseed.

Linseed has been successfully introduced into the wheat growing districts, largely under the stimulus of commercial enterprise, and is grown under very similar conditions to those applied to wheat. The crop depends largely upon stored moisture for its growth requirements and is handled completely by regular wheat farm machinery. Under comparable conditions, yields are approximately two-fifths to one-third of those expected for wheat, but with existing world prices for the crop, returns compare more than favourably with those from wheat. While only one variety, Walsh, is as yet being grown commercially, it is possible that plant introduction and selection may provide additional varieties better suited to Queensland conditions. The main present establishment of the crop is on the Darling Downs, but successful crops have also been produced as far north as the Callide Valley.

Plate 72.

A Linseed Variety Trial at Hermitage Regional Experiment Station on the Darling Downs.

The Sorghum Group.

The principal summer crops associated with dry farming conditions in Queensland are those within the sorghum group—comprising grain sorghums, sweet sorghums, Sudan grass, and to a much smaller extent, broom millet.

Grain sorghums have occupied a major place in the dry farming scene since dwarf and double-dwarf varieties became available in quantity 12 years ago. A large number of varieties were introduced into Queensland during 1933 and carefully tested during the next few years. The best of the dwarf varieties were then liberated to farmers and a rapid annual increase in area took place until the peak year of 1946-47.

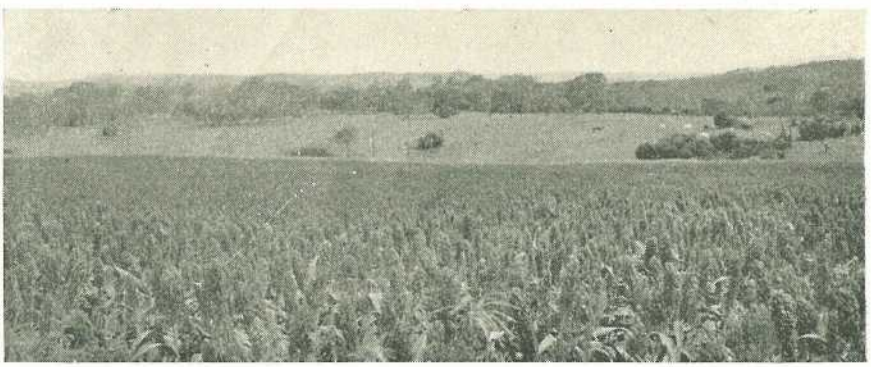

Plate 73.

A Crop of Dwarf Grain Sorghum.

Expansion of this crop was largely at the expense of maize in the drier dairying and mixed farming districts. Its two main advantages over maize were (i.) its greater drought resistance and (ii.) its ability to be harvested readily by existing (and widely distributed) wheat harvesting machinery.

While grain sorghum has been proven time and again to be a more reliable grain crop than maize in areas of irregular or marginal summer rainfall, it is by no means a certain grain crop even within the 25-30 inch rainfall belt (which provides a mean growing season rainfall of some 14-18 inches.) Crop failures within this zone have been quite frequent, particularly as one proceeds towards the present northern and western limits of cultivation. It has, however, been the invariable practice of dairy farmers to treat this crop as a dual purpose crop, harvesting the grain for the feeding of farm stock (mainly pigs) and using the stubble for grazing by dairy cows. This secondary utilisation of the crop has in fact frequently been regarded as of equal or greater value than that of grain production. Thus even crop failures may be turned to good account and may be the means of saving the lives of stock during periods of serious drought.

For this reason the yield of grain per acre by no means tells the whole story. While yields of 30 bushels per acre are normally expected under reasonable farming conditions, and 60 bushels per acre is often exceeded on good soils during favourable seasons, the State's average over a period of years is only a little in excess of 20 bushels per acre.

While the rainfall requirement of a reasonable sorghum crop has often been assessed at some 15 inches during the growing season, the figures will vary greatly from district to district and season to season, depending on such factors as evaporation, regularity of incidence, and degree of penetration into the soil.

Tabulated below are the rainfall records (December to April) for some ten seasons at Biloela Regional Experiment Station, together with general notings on the value of the season for sorghum production. It will readily be seen that growing season rainfall alone is not a good indication of crop success, without due cognizance of other factors.

BILOELA RAINFALL (POINTS).

Season.	Dec.	Jan.	Feb.	Mar.	Apr.	Dec.-Apr.	Crop response.
1941–42 ..	127	497	1,195	239	261	2,319	Good
1942–43 ..	467	280	477	105	57	1,386	Fair
1943–44 ..	447	235	804	47	73	1,606	Fair
1944–45 ..	299	506	198	130	80	1,213	Poor–Fair
1945–46 ..	350	699	49	96	5	1,199	Very poor
1946–47 ..	247	209	970	440	79	1,945	Poor
1947–48 ..	280	135	331	678	164	1,588	Poor
1948–49 ..	236	129	887	561	181	1,994	Good
1949–50 ..	103	347	814	266	252	1,782	Fairly good
1950–51 ..	119	643	271	48	16	1,097	Very good

The crop is generally sown by means of standard wheat drills with certain grain runs blocked to allow of row spacings of 14, 21 or 28 inches. In other districts maize planters may be preferred, in which case row

spacings are increased to 3 ft. or 3ft. 6 in. Where the wider row spacings are used, inter-row cultivation is necessary, but in closely spaced crops the operation is not required. Closely spaced crops run a greater risk of crop failure during stress periods than do those with wider row spacings, but may provide very heavy yields during seasons of ample and well distributed rainfall. Grain harvesting is carried out by means of standard harvesters with but minor adjustments to comb, drum, blast and riddles.

Breeding work in central Queensland has shown two main types of drought resistance—(*a*) that due to early maturity coupled with a low overall water requirement, and (*b*) that associated with later maturing varieties which may remain almost dormant during periods of stress, and recover well when the drought period is relieved. Varieties of type (*a*) do not possess the same powers of recovery as type (*b*) when effective rain falls following a dry heatwave period. In certain seasons, type (*a*) shows definite superiority while in others the situation is reversed. Since seasons cannot accurately be forecast, the farmers' best course is probably to rely upon two varieties of different maturity periods, or if a single variety is to be grown, to use an intermediate type such as Alpha.

The local breeding programme naturally has as a major aim the provision of varieties adaptable to the vagaries of the Queensland growing season. Other objectives have been (1) a uniform heading height suitable for mechanical harvesting; (2) more palatable and higher quality plant residues following harvesting; and (3) ability to escape damage by moth larvae in near-coastal districts. Not all of these attributes have been sought in the one variety as they are not all required for any one district. Some measure of success has been obtained, however, in all three aims by the development of (1) Alpha, a high yielding and uniform heading variety, (2) Capricorn, a grain variety with juicy (Kaffir-type) stems and leaf midribs, and (3) Coastland, whose very open panicles are unattractive to the yellow peach moth.

Among the sweet sorghums several good varieties which are capable of yielding 20-30 tons of green matter per acre are available. Such varieties may be used for cutting for either green feed or ensilage or may be grazed direct in the field. However, except where small subdivisions are used, direct grazing is particularly wasteful, and most efficient use is made of the crop by cutting and chaffing. On account of the higher labour requirement of this crop it is not grown to nearly the same extent as grain sorghum. Thus far more dairy cows in the drier districts of the State are fed on grain sorghum stubble than on sweet sorghum, in spite of the greater production per acre and higher palatability of the latter crop.

Sudan grass is widely grown as a summer and autumn grazing crop in the drier agricultural districts, and to a lesser extent for hay and ensilage. It provides a quick growing and very reliable grazing crop of one or two seasons' duration in such districts. While there is always a risk of prussic acid poisoning with the utilisation of this crop prior to the flowering stage, efficient grazing requires this risk to be taken. The risk becomes virtually negligible where (1) a reliable seed source free from Johnson grass and from sorghum hybrids is used, and (2) reasonable grazing precautions are taken. While HCN content

may vary widely with environmental conditions, definite evidence of the existence of low HCN strains has been obtained. A current breeding programme is now isolating and multiplying such strains with the aim of providing a variety which should be safe for grazing at all stages of growth.

Another group of summer crops which has been less widely used for grazing, hay and seed production is that known collectively as the millets. This group includes white panicum, Japanese millet, giant and dwarf Setaria and French millet. These crops, being of short duration, are useful and reliable dry district crops which might well find a greater use as cultivation is extended westward and northward.

Cotton.

Cotton is a crop which is in many ways well adapted to the dry-farmed districts of the State. The cotton plant is deeply rooted and possesses undoubted drought resistance. Under severe drought conditions, however, the plant survives at the expense of its crop, which is partially shed by the formation of abscission layers at the base of floral and fruiting pedicels. In spite of this the crop has played a major part in helping to establish farms in newly settled areas in central and sub-central Queensland. Cotton was frequently the initial cash crop planted on scrub burns and providing funds for the further improvement of farms and the purchase of dairy stock. With the establishment of stable dairying and mixed farming communities, however, cotton came to be relegated to the position of a subsidiary crop.

The peak season for cotton production in Queensland was 1938-39 when 12,447 bales of lint were produced from 41,112 acres. The serious decline which ensued has been variously attributed to the following causes:—(1) instability of the crop and frequent failures during dry seasons; (2) the susceptibility of the crop to insect pests; (3) the relatively higher and more stable returns obtainable from dairy products and pig meats; and (4) the dwindling away of the floating population previously available for cotton picking.

While (1) had some basis in actual experience, the fact remains that a few individual farmers did make comfortable incomes from cotton growing over a period of very indifferent seasons from 1941 onwards. Pest damage has been largely overcome by the use of power sprays and modern insecticides. The disparity in returns has been relieved to some extent by the provision of a much higher guaranteed price for local cotton. Finally, the introduction of mechanical harvesting has been attended with reasonable success, but as each harvester is capable of handling a limited crop each season, a considerable dollar expenditure would be entailed to provide sufficient machines even for the current annual crop of some 1,500 bales of lint.

Cotton could become a vital crop in the Australian economy; it has also been shown to be a useful crop in the individual farm economy, particularly in rotation with pasture leys. Its attainment of an important position must, however, rest upon its attractiveness to the farmer, and this in turn will depend upon (1) a possibly still higher price in comparison with competitive products, (2) greater use of mechanical harvesters and (3) the availability of cheap water for supplementary irrigation in suitable growing districts.

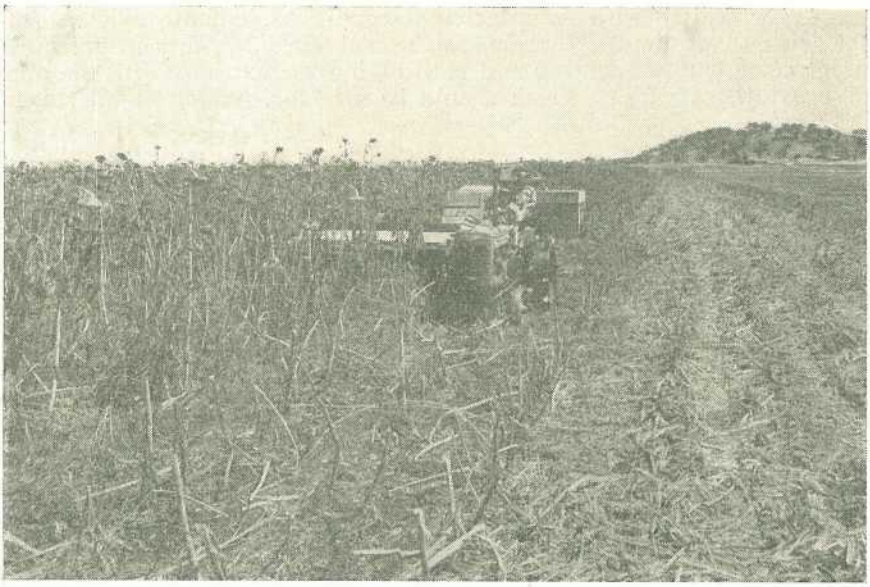

Plate 74.

A Modified Header Harvesting a Crop of Sunflowers on the Darling Downs.

Sunflowers.

Sunflowers grow well in the drier agricultural districts of Queensland, frequently providing yields of more than half a ton of seed per acre. The crop is comparable with grain sorghums in its water requirements, and recently gave promise of providing a useful additional source of oil for local industry. The growth of linseed production has probably had an adverse effect upon this crop, and recent market prices have not been sufficient to stimulate an increase in production. The crop may be sown either by maize planter or grain drill, and is harvested by means of headers equipped with shallow trays projecting in front of the comb to catch falling heads and seed. Both giant and dwarf varieties have been harvested satisfactorily by this means.

Legumes.

The major annual summer legume crop in the districts in question is the cowpea. While it is not used nearly as frequently as it might be as a green manure or grazing crop in rotation with cereals and pasture leys, recent high prices for the seed in sugarcane districts have stimulated its culture for seed production.

Soybeans have not been widely tried in these districts, mainly because of the absence in the past of an assured and profitable market. Suitable outlets for the crop are now more promising than at any previous period, and some development of the crop therefore seems assured. Considerable work has been entailed in sorting out introduced varieties and in selecting within the best of those available to develop strains suitable for direct harvesting under Queensland conditions.

Lucerne also has not been used to the fullest advantage. The districts in question are normally regarded by farmers as being too dry for satisfactory lucerne production except on alluvial flats where the

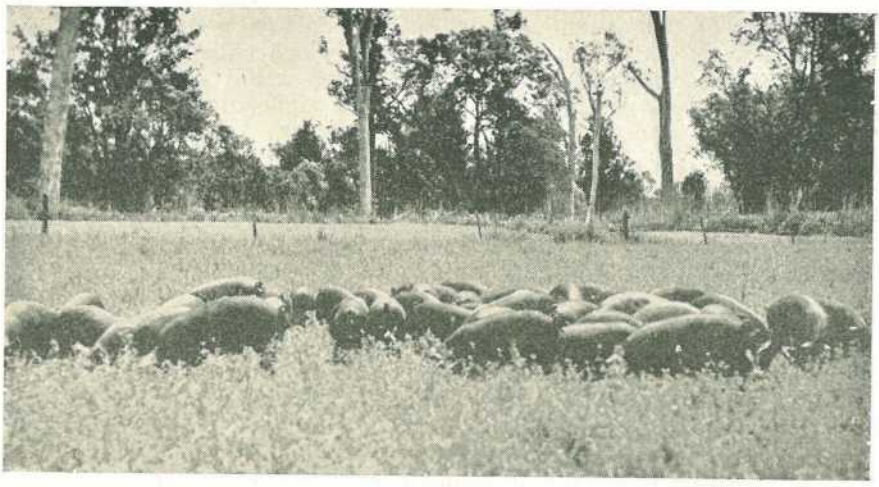

Plate 75.
A Lucerne Patch Used for Grazing Pigs.

water table it naturally high, or where irrigation is available. Much more of this country could and should grow lucerne as an integral phase in its cropping programme, particularly in association with dairying or with fat stock raising. Production would, of course, be mainly seasonal, where irrigation facilities are not available. Establishment would normally require a reasonable fallow period to build up subsoil moisture reserves and eliminate as many weeds as possible. Since lucerne effectively drains the moisture from a considerable depth of soil, old stands should preferably be ploughed out in the spring to enable adequate moisture replenishment before annual crops are reverted to. Lucerne could also be profitably used to a far greater extent than at present as a pasture component in these districts.

Future Developments.

Experience gained in the Callide and Dawson Valleys suggests that crop production alone could not be expected to be a profitable annual venture in any districts which are more marginal with respect to climate. Even in the Callide Valley, it is the animal industries (mainly dairying and pig raising) which have stabilised the local agriculture. Without livestock many farms in this district would have produced nothing of cash value during some of the semi-drought years between 1942 and 1948. With livestock, no grain or legume crops are total losses, since crop failures can be used as grazing crops during drought periods.

It would appear, therefore, on the basis of present knowledge, that any further agricultural developments in such areas should be regarded as subsidiary to animal production. Sudan grass could be used to a much greater extent both for grazing and for hay. Grain sorghums could also be grown annually to provide in good seasons both grain for storage and stubble for grazing, and in bad seasons crop grazing alone.

As one proceeds northwards and westwards between the 20-inch and 30-inch isohyets the rainfall of course becomes less effective on account of higher evaporation rates. This would be counteracted to some extent by the fact that the rainfall becomes still more seasonal until, in the Gulf country, it is restricted almost entirely to the summer monsoon periods. Where suitable arable soils exist, therefore, the opportunities appear good for large scale development of the sorghum and millet groups as useful adjuncts to the beef cattle industry.

At present, the Callide and Dawson Valleys would appear to approach the northern limits of successful wheat culture. The main limiting factors to further northward expansion would be (1) the more seasonal incidence of the rainfall, and (2) the higher day temperatures, causing higher evaporation and transpiration rates.

In the latitude of the Darling Downs, considerable westward expansion is possible for both summer and winter crops. For the latter, two main requirements would be (1) reasonably level country, and (2) soils which are retentive of moisture and therefore suitable for fallowing. The lighter soils would in general be better suited to summer cropping. Wheat has for many years been successfully produced in small pockets as far west as Roma, while sorghums and Sudan grass have also successfully invaded this area. In this direction, however, as well as in the north, best prospects of a stable agriculture would undoubtedly require crop production to be allied to animal production. Virtually all crops grown under such a system would then be regarded as triple purpose crops to be switched to seed production, hay production or grazing according to the requirements of the season.

Junior Farmers' Organisation.

New clubs have been formed during the past few weeks at Kingaroy, Childers, and Pomona. Club officials appointed were as follows:—

Kingaroy—Club Leader, Howard Goodger; Deputy Leader, R. Hetherington; Hon. Secretary, Hugh Goodger; Hon. Treasurer, W. Liesegang.

Childers—Club Leader, John Bunn; Deputy Leader, H. Bonnano; Hon. Secretary, Alf. Plath; Hon. Treasurer, Gordon Eastaughffe.

Pomona—Club Leader, John Hancox; Deputy Leader, Des. Hawken; Hon. Secretary and Treasurer, Miss June Napier.

Clubs in the Warwick, Chinchilla, Murgon, Wondai, Maryborough, Gayndah, Monto, and Callide-Dawson Valley areas again staged either competitive or non-competitive exhibits at local shows this year to date, winning many awards and highly complimentary references from judges and show visitors alike.

Their members also accepted positions as honorary assistant stewards in the various agricultural sections, such services being greatly appreciated by the various societies concerned.

In the North quite a number of clubs arranged junior farmer displays at the various shows—Bowen, Mackay, Ayr, Home Hill, Tully, Innisfail, Cairns, Malanda, and Atherton.

The societies in these areas include in their prize schedules judging contests covering dairy stock, fruit, tomatoes, cane, and vegetables, open to members of junior farmer clubs only. This is creating much interest among clubs generally and has attracted a large number of entries in most cases.

Three boys from the clubs in the Mackay district recently won an agricultural "quiz," conducted over the air from the Mackay broadcasting station, winning a fortnight's free tour of northern areas as far as Mossman and the Atherton Tableland, the various junior farmer clubs at the centres visited acting as "host" to them. The winners of this contest were T. Lawrie (Sarina club), D. Madden (Racecourse Mill), and Reg. Renton (North Eton).

Soil Factors Affecting Crop Production in Queensland.*

W. G. WELLS, Director of Regional Experiment Stations.

THIS somewhat vague title has been chosen to allow me to tell you something of the various soil problems which have been encountered in crop production in south-eastern and central Queensland. Although the investigations of these problems have been mainly associated with cotton, it is felt that the problems apply to most crops grown in the 25-40 inch rainfall districts of this State.

The investigations have been conducted at the experiment station which was established at Biloela in the Callide Valley in Central Queensland in 1924. This district, in which large areas had been resumed from cattle stations for closer settlement, had produced very satisfactory yields of cotton in exploratory plots conducted by the Department of Agriculture and Stock. Characterised by a rainfall of approximately 28 inches and soils of high fertility contained in a wide valley floor with long low slopes on each side, this district was considered likely to become the largest cotton growing district in the State. Accordingly investigations in cotton growing occupied an important place in the early programme of the station.

At first good yields were obtained on the newly cleared land and the cotton area in the district rapidly expanded to between 30,000 and 40,000 acres. With repeated cropping to cotton for several seasons, however, yields declined on nearly all types of soils unless exceptionally regular rainfall was experienced throughout the growing season.

On the experiment station, areas that produced up to 1,700 lb. seed cotton per acre in the first year of cultivation out of virgin grassland, after four or five years of successive cotton crops could not be relied upon to produce over 500 lb., and on certain soil types not over 300 lb., per acre.

As the usual laboratory analyses of these soils had shown them to be well supplied with the major plant foods it was realised that a normal type of nutrient deficiency was not contributing to these irregular results. Accordingly the nitrate-nitrogen† content of the soils was systematically studied in cultivations of various ages. It was found that, whereas in a new cultivation out of virgin grassland the top six inches of soil seldom contained more than 15 parts per million during the growing period of the cotton, old cultivations contained regularly up to 40 or 50 p.p.m. at a period when the cotton plants were in the transitional period of development from the vegetative phase to the fruiting phase. Some of the most fertile soils contained as much as 90 p.p.m. at this stage in the plants' development.

The effect on the type of plant produced on soils with such a difference in nitrate-nitrogen content is most interesting. Usually in the first season of cultivation after virgin grassland the plants develop an open type of structure which is characterised by a reddish-brown main stalk, light yellowish-green leaves of tough texture, and usually a good crop of bolls if ample soil moisture is available at critical periods.

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* This paper was presented to the Agriculture and Forestry Section at the Brisbane Meeting of the Australian and New Zealand Association for the Advancement of Science.

† This is nitrogen available to growing plants and results mainly from the breaking down of organic matter by soil micro-organisms.

The plants on the same soil after three or four repeated croppings to cotton become increasingly more vegetative in structure, with a coarser main stalk characterised by a dark greenish-brown colour and much axillary leafage and large dark-green main leaves of a thin texture. Obtaining good yields from such plants depends on very favourable conditions being experienced.

The first year crop does not appear to be very attractive to the major pests which attack cotton in this State, but if some of the flower buds or fruit are destroyed the plants continue to set a crop efficiently. The plants on the older cultivations, however, delay the setting of the first flower buds and if these are lost early in their development very rank growth of the plant usually develops under conditions of ample moisture. Such plants are very sensitive to irregular climatic conditions and with their high rate of transpiration react very quickly to even short periods of high temperature, thereby causing further shedding of young flower buds.

With the loss of a boll crop to utilise most of the uptake of nutrients the plants are in a very vulnerable condition. Owing to the high potential rate of nitrification in old cultivations, wet periods favour the development of such a supply of nitrate-nitrogen that the plant's uptake is sufficient to promote a rank growth which approximates a prolongation of the vegetative phase rather than the fruiting phase. Consequently in some seasons little or no crop is developed until late in the season when a combination of reduction in temperatures and hardening of plant growth may promote the formation of a late top crop under favourable moisture conditions.

Value of Grassland Rotation.

It became obvious, therefore, that a reduction in the nitrate-nitrogen content of the top soil during the critical stages of growth of the cotton plants was necessary if good yields of cotton were to be regularly obtained. Various crop rotations embracing combinations of cotton and crops requiring considerable nitrogen, such as grain sorghum, sweet

Plate 76.

Rhodes Grass Deterioration After Six Years.—The pasture was laid down on soil of moderate fertility. The outside of the pasture block, adjoining cultivated areas, shows green and tall growth. Away from the edges production is very low.

Plate 77.

Rhodes Grass in its Second Year of Establishment after Three Years of Cotton Cultivation.

sorghum, wheat, oats, maize and Sudan grass, were tried without obtaining any results that promised a solution of the problem. It was then decided to put the cultivations back into grassland to see if the original satisfactory conditions could be duplicated. Rhodes grass, which was performing satisfactorily in the district on newly burnt-off scrub country, was selected for the trial and proved to be highly suitable.

After two years of establishment of a pasture of this species it was found that the following cotton crop developed a structure comparable to that obtained in the first year after virgin grassland and that the nitrate-nitrogen content of the soil under this crop was very satisfactory for cotton production. Much work has since been done to elaborate the use of the cotton-grassland rotation and it is now recommended that for most soils the Rhodes grass pasture be established for four years followed by four annual croppings in this order—cotton, grain sorghum, cotton, and in the fourth year cotton if the previous crop has indicated that the nitrate-nitrogen moisture balance is satisfactory. If not, cowpea is used for repeated grazing during the fourth season and Rhodes grass is then resown in the following early summer.

Importance of Subsoil Moisture for Cotton.

In the course of the investigations it was noticed that two factors appeared to have a very important effect on the type of plant and crop produced when cotton was grown on old fertile cultivation. Plantings in late September and October in time-of-planting experiments consistently outyielded November and December plantings. Also, in seasons experiencing above-normal rainfall either during the late winter or in the early stages of the growth of the crop, plant development tended to resemble the desirable fruiting type produced following pasture. Systematic samplings indicated that in both the early plantings and under early wet conditions the nitrate-nitrogen content of the soil during the vegetative phase of the development of the plants was so low as to promote only a slow tough type of growth which quickly changed over to the fruiting phase. The early setting of a crop of flower buds resulted in the utilising of the uptake of nitrogen sufficiently to maintain a favourable carbon-nitrogen ratio in the plants for the rapid formation of further flowers and bolls, provided ample moisture was available.

The investigations in the nitrate-nitrogen content of the soils were co-ordinated with the soil moisture studies and the results indicated clearly the value of having ample subsoil moisture at planting time in the Station's immature alluvial soils with moisture equivalents ranging from 22 to 38 per cent. for the top 12-18 inches of soil. During the first two seasons out of virgin grassland the permeability of this zone of soil was suitable for obtaining penetration of most types of rain, but from then on the deterioration of the structure of the surface soil brought about by ploughing and the maintenance of clean inter-tilled row crops progressively reduced the ability of these soils to absorb satisfactorily, after they were compacted with the season's cultivations, any but steady soaking rains. Determination of the percentages of water-stable aggregates of various sizes confirmed this loss of structure in the surface soils. Comparisons of adjacent virgin grassland and aged cultivations indicated that in 19 years of continuous row-tilled cropping the percentage by weight of water-stable aggregates greater than seven-tenths of a millimetre declined from 48 to 25 per cent. Dry sievings of the surface soils at the end of the cotton crop also showed how this loss of suitable crumb structure contributed to a consolidation of the surface layers, and in some seasons following early storm rains the top caked half-inch of soil after row cultivation ceased obviously prevented the penetration of much of the first part of each storm rain experienced.

This loss of permeability in the top layer of the soil is of the utmost importance in Central Queensland. Approximately 50 per cent. of the year's rain occurs in the period December to March. This summer rainfall is characterised by mostly storm type of precipitation in which the first part of the storm is featured by hard driving large drops which churn the surface of row-tilled and clean fallowed areas into a thin paste which clogs up the pores of soils of poor structure.

The 12-year means of rainfall records of the experiment station indicate that during October to January inclusive over 41 per cent. of the rainfall for each of these months occurred at the rate of ·75 inch or more per hour, and that in all rainfall exceeding ·10 inch per hour 50-75 per cent. of the total rain of the average storm of this type occurred in the first third of the individual storm time. Runoff must therefore be excessive on all but flat land if the structure of the surface layer is poor, and actually a 4½-inch intense thunderstorm failed to penetrate more than four inches in the top soil under a cotton crop on a slight slope of an old cultivation.

When it became apparent that with the deterioration of the structure of the surface soils greater emphasis should be placed on conserving the subsoil moisture resulting from the penetration of the main wet season rains, cropping rotations were tested with this objective. An annual summer hay crop which could be mowed in time to prevent the crop using the subsoil moisture, followed by ploughing and leaving the land fallow until spring for cotton, seemed the most likely rotation. This cropping provided ample subsoil moisture but the bare fallow increased nitrification and gains in cotton yields were obtained in only very dry years, with appreciable losses in seasons which were favourable for a high rate of nitrification.

In devising the 8-year cotton-grassland rotation provision was therefore made for ploughing out of the grassland at the end of the wet season before the grass had used the lower subsoil moisture and for

including grain sorghum as the crop in the second cultivation to enable ploughing to be done before the late autumn and winter rains. The main weakness of this rotation is that if cotton follows cotton in the fourth year after a dry winter insufficient subsoil moisture may be encountered to carry a big crop through an irregular season.

Improving the Soil Structure.

The use of Rhodes grass pasture not only provides a suitable nitrate-nitrogen environment for the following cotton crop but materially restores the soil structure, as evidenced by the following sievings of water-stable aggregates of a size greater than $\frac{1}{4}$ mm.:—

Continuous cotton—0–6-inch zone, 28 per cent.; 7–12-inch zone, 58 per cent.

After 3 years Rhodes grass—0–6-inch zone, 41 per cent.; 7–12-inch zone, 66 per cent.

This partial restoration to the normal 48-50 per cent. of water-stable aggregates in the top six inches of soil in the virgin grassland of the experiment station increases the penetration of storm rains. An inch of rain will not penetrate more than six inches of the station soils in the first year of cultivation when the moisture content is at wilting point and not over five inches in old cultivations under row-tilled crops after they have been compacted following the planting operations. Consequently, even with rains approximating 2 to $2\frac{1}{2}$ inches, frequently only 35 per cent. of the rainfall is trapped in old cultivations under cotton compared with upwards of 70 per cent. for cotton on first or second year cultivation after grassland.

This deterioration of soil structure is not confined solely to continuous cotton cultivation. In one investigation over a 15-year period, in which wheat for hay was planted repeatedly on the same site in rotation with a summer green manure crop of annual grasses or cowpeas, the loss of organic matter and soil structure eventually resulted in the surface soils setting so hard, if storm rains occurred before the cowpea seedlings were well established, as to prevent the satisfactory growth of the cowpea. Yields declined also in the wheat crops, though comparisons of analyses of these soils and adjacent virgin grassland did not show any significant differences in their nutrient status. Likewise a rotation of annual cropping embracing cotton alternating with first grain sorghum and then wheat for grain failed to maintain the soil structure satisfactorily in a soil with a moisture equivalent of approximately 26 per cent., as evidenced by the following wet sieving results:—

Virgin grassland—0–6-inch zone, 50 per cent. aggregates $\frac{1}{4}$ mm. and larger.

Cotton, grain sorghum, cotton, wheat, &c.—27 per cent.

Cotton continuously for 9 years—14·5 per cent.

Cotton on Dairy Farms.

The use of pasture leyland in the cropping programme fits in well in the economy of the average farm in the 25–40-inch rainfall belt of this State. On most farms some form of animal husbandry is practised, with pastures often occupying a large proportion of the farm, particularly in the drier districts in which dairying is extensively practised.

Undoubtedly the productivity of these pastures can be markedly improved by ploughing them out and cultivating the land for suitable annual cropping for at least four years prior to re-establishing the pastures. The cultural operations associated with the annual cropping will assist in the decomposition of the roots and stubble of the grasses, thereby releasing nutrients which will materially increase both yields and quality of the following pastures. At Biloela the decline in a single-species pasture, such as Rhodes grass pasture, is most pronounced, yields falling from 3 to 2½ tons of air-dried hay in the first or second year to as low as 6 cwt. in the sixth year of establishment. During this period the crude protein content at correct hay stage may range from 12 to 8 per cent. in the first or second year to as low as 4 to 3½ per cent. in the sixth year. It is necessary, however, not only to maintain the cultivation of annual crops long enough to restore a satisfactory nutrient status for the new pasture, but also in the last year before re-establishing the pasture to grow a crop that will not retard the processes of nitrification.

This is evidenced by the results obtained in an investigation into the merits of row cultivated Rhodes grass conducted at Biloela. The basal layout of the experiment was a series of pairs of plots in which on one plot of each pair three successive crops of cotton had been grown while the companionate plot had been left in virgin grassland.

After a good seed-bed had been prepared over the whole area following ploughing and short fallowing of the grassland plots, a comparison of row cultivated and broadcast Rhodes grass was sown in each plot. Yields at hay stage and analyses of samples of the hay indicated that for five years starting in 1939 the plots following cotton outyielded each season those following virgin grassland, and the strip cultivated plots except in one wet season outyielded the broadcast plots.

Subsoil Moisture for Cereals.

The investigations conducted on the experiment station have also shown that it is advisable to have ample subsoil moisture at planting time of both grain sorghum and wheat. Table 1 presents the yields obtained in a grain sorghum varietal trial conducted over three seasons.

TABLE 1.

GRAIN SORGHUM VARIETAL TRIALS.

Variety.	Bushels per Acre.			——	Rainfall (inches.)		
	1949.	1950.	1951.		1949.	1950.	1951.
Alpha ..	39·5	30·7	82·4	Planting to flowering ..	1·39	4·47	9·06
Wheatland ..	40	28·4	81·4	Flowering to maturity ..	14.48	10·80	1·75
Ajax.. ..	46	32·5	75·7	Depth of wet soil at			
Capricorn ..	39	33·6	74·9	planting	54	30	45
Caprock ..	46·7	37·1	73·2				
Kalo.. ..	40·5	33·2	71·1				
Early Kalo ..	42·1	30·2	68·6				
Means ..	42	32·2	75·3				

Comparing the means of 1949 and 1950, it will be noted that in spite of the low rainfall in 1949 during the period from planting to flowering, all varieties produced a satisfactory average yield.

In contrast, in 1950, with only 30 inches of wet soil at planting the same varieties, experiencing over twice as much rain to flowering and good rain after that to maturity, produced only 76 per cent. as much grain on the average. The value of the combination of good depth of wet soil at planting and ample well distributed rainfall to the flowering period is well illustrated by the high average yield obtained in 1951 under conditions of very low rainfall from flowering to maturity.

In contrast to these illustrations of the need for both good subsoil moisture at planting and timely rainfall during the period of flowering of a summer crop like grain sorghum, Table 2 is presented to indicate how a winter grown crop like wheat can produce satisfactorily under a small amount of rainfall during the growing period provided ample soil moisture is available at planting.

TABLE 2.

WHEAT VARIETAL TRIALS.

Variety.	Bushels per Acre.			——	Rainfall (inches.)		
	1948.	1949.	1950.		1948.	1949.	1950.
Gabo ..	37·4	39·7	40·0	February to planting ..	18·54	17·97	15·58
Puno ..	42·1	37·5	34·2	Date planted	30–6	6–6	2–6
Pusa 4 ..	38·8	34·3	41·2	June rain after planting	Nil	·10	2·12
Seafoam ..	34·2	33·4	31·8	July rain	1·62	·64	2·82
Puora ..	38·1	33·0	34·8	August rain	Nil	·08	1·32
Charter ..	39·7	31·9	35·1	September rain	·41	·96	1·09
Means ..	38·4	34·7	36·2	Depth wet soil at planting	48	42-48	40
				Average height	33·6	31·5	50·7

Comparing the mean yields of 1948 and 1949, it can be seen that the combination of 48 inches of wet soil and two inches of rain during the growing period supplies about the minimum amount of moisture required to produce good yields. Comparing these two years with 1950 indicates clearly, however, that plant type plays an important part in the water requirements of wheat under Queensland conditions. Although 7·35 inches of rainfall was well distributed during most of the growth of the crop, the markedly larger and more vegetative plants reacted sufficiently to dry conditions during the latter half of September to prevent four out of six of the varieties equalling their yields of 1948.

Summary.

Summarising briefly, the findings of the investigations conducted at Biloela indicate that in the 20-40 inch rainfall districts of south-eastern and central Queensland, rotations should be practised embracing:—

(1.) Short-term pasture leylands to conserve the soil, to maintain its structure and fertility and to provide grazing and fodder for live stock.

(2.) Cropping programmes which maintain a suitable plant food-moisture relationship for pastures and annual crops. The inclusion of a short fallow at periods which will allow of the conservation of sufficient soil moisture to provide a "season" in the ground at planting, to supplement the rainfall during the growth of each crop, should be a routine feature of such programmes.

ANIMAL HEALTH

Grass Tetany or Oat Tetany.

D. W. LAVERS, Assistant Veterinary Officer.

GRASS tetany, also known as lactation tetany, oat tetany and grass staggers, is a highly fatal disease of cattle and cattle owners are advised to be on the alert for its appearance and prepared to carry out treatment should it occur. The disease usually makes its appearance in winter or spring when seasonal conditions are favourable for rapid growth of fodder crops, particularly oats, and winter pastures.

Most cases occur two weeks after stock have been turned on to lush new grazing but some cases have been seen on average natural pasture.

The stock affected are usually well-conditioned milking cows calved one to six weeks, but the disease may occur later in lactation. Other types of cattle, including dry cows, calves, steers and bulls of both dairy and beef breeds, are occasionally affected.

How Cattle become Affected.

Although the disease frequently occurs with the first flush of spring growth, its cause is not known. It is known, however, to be non-infectious. A marked fall in the magnesium content of the blood occurs and this is often accompanied by a fall in the calcium content.

Of the theories advanced so far, none has been adequately proven. It has been suggested that a deficiency of magnesium in the young grass might be important in causing the condition, but this seems unlikely in view of the fact that animals may become affected when the diet is adequate in magnesium.

Symptoms.

The main feature of the disease is nervousness and excitability. This may take the form of an unsteady gait, rolling of the eye, an anxious or wild appearance, frothing at the mouth, salivation, twitching of the muscles and sometimes aimless or excited charging regardless of any obstacles in the path. Affected animals after a time stagger and frequently fall to the ground. In the more acute cases convulsions are seen, the animals showing periods of stiff extension of the limbs (tetany) for approximately half a minute followed by bouts of paddling movements lasting about a minute. Death may occur at the end of an hour, or the animal may lapse into a coma lasting several days and ending in either death or complete recovery. In very acute cases, the animal may be found dead without any previous symptoms having been seen.

In all except the mildest cases, the milk yield is decreased and the animal is disinclined to eat. The temperature may be raised to 104 or 105 deg. as a result of any unusual exertion.

Occasionally the symptoms shown are similar to those of milk fever, leading to some confusion of the two conditions. It should be remembered, however, that milk fever usually occurs within four days after calving while grass tetany seldom appears before the second week after calving. In milk fever dullness and prostration are the characteristic features, whereas in grass tetany nervous excitement is the rule.

On post-mortem examination very careful observation is required to detect any departure from normal. In some cases dark patches beneath the skin and in the muscles along the back and over the shoulders, suggestive of blackleg, may be seen, but there are no bubbles of gas present. There is usually mild inflammation of the fourth stomach and small intestine and there may be small haemorrhages in the spleen and heart muscle.

Treatment.

Since a marked fall in the magnesium and often the calcium content of the blood occurs in this disease, the aim in treatment is to counteract this fall by providing the animal with magnesium and calcium, thus returning the blood levels to normal. The dose is 1 oz. of Epsom salts (magnesium sulphate) dissolved in three to four fluid ounces of water, which is then filtered through a thin mat of cottonwool placed in a funnel, boiled and allowed to cool to blood heat. This may be injected under the skin behind each shoulder, a portion at each of three or four different points. A more efficient method is to inject the solution directly into the blood stream by way of the jugular or mammary vein, but this operation is of course more difficult to perform. Drenching with 1 oz. of Epsom salts in one quart of water, with 2-3 lb. molasses added, is useful in the absence of an injection, but is dangerous to use in the more severe cases, as drenching may bring on a convulsive attack, allowing the solution to enter the lungs and cause pneumonia. For this reason drenching must be carried out with the greatest care at all times.

If the beast fails to respond to the Epsom salts treatment, calcium borogluconate should be given in the same manner as in the treatment of milk fever. Sufficient water is added to 2½ oz. of calcium borogluconate to make 12 fluid ounces of solution, which is then boiled, cooled to blood heat and injected either under the skin or into the blood stream as before.

When an outbreak occurs a change of crop or pasture should be effected immediately if possible; otherwise handfeeding should be adopted, using hay or silage, until the outbreak has ended.

Prevention.

Outbreaks of this disease may be avoided if care is taken in the management of the pastures or grazing crops during the period of the year when they are likely to cause trouble. If possible, do not graze young cereal crops until the period of rapid growth is over. If young, rapidly growing crops must be fed, bring cattle on to them gradually and provide some other feed of a more fibrous nature. Handfeed with hay or graze the animals in an old grass paddock (or harvested corn paddock if available) in the early part of the day and turn them on to the crop in the later part of the day when the sun has been out for some time.

Although grass tetany is not regarded as a deficiency disease caused by lack of magnesium in the diet, there is some evidence that outbreaks may be prevented by increasing the intake of magnesium. Dolomite (a mineral containing both calcium and magnesium) may be used as a pasture topdressing, or it may be given in the feed at the rate of about 2 oz. per week for each cow or added to a hay, silage or concentrate mixture at the rate of 3-5 lb. per ton.

Since this disease is often rather difficult to diagnose accurately, and since treatment by an inexperienced person may lead to serious after-effects, a veterinary surgeon or Inspector of Stock should be contacted when grass tetany is suspected.

Contagious Vaginitis of Cattle.

D. N. SUTHERLAND, Divisional Veterinary Officer.

INFERTILITY in cattle or failure to reproduce at regular intervals is a cause of serious economic loss in many dairy herds in this State. There are numerous factors which may be responsible for infertility, important among these being infections of the reproductive organs, deficiencies in the diet and hereditary factors. Unfortunately, our knowledge of all the factors which may be responsible for infertility is as yet incomplete.

In the type of infertility encountered most commonly in dairy herds in Queensland, cows come on heat regularly but fail to conceive to repeated service by the bull. There is still a considerable difference of opinion amongst veterinarians as to the factors mainly responsible for sterility of this nature. Some hold the view that the majority of such cases are due to the effects of contagious or granular vaginitis, and in support of this view the argument is advanced that treatment for vaginitis will in many cases eliminate the trouble. Those who disagree with the theory that vaginitis is a serious cause of infertility contend that the value of treatments given in these cases is often greatly exaggerated, as infertility of this nature is generally only temporary in any case and recovery ensues in the majority of cases without treatment, especially if service is withheld for six to nine weeks.

The term vaginitis means inflammation of the vagina, which in the case of cattle is a passage approximately ten inches in length, separated at its forward end from the womb by the cervix and opening to the exterior behind through the vulva. In contagious or granular vaginitis the inflammation is present mainly just inside the vulva.

Cause and Spread.

The actual cause of contagious vaginitis has not been established yet, although it is almost certainly due to infection by a micro-organism. The disease can be reproduced artificially by transfer of material from the vulva of an infected cow to the vulva of a normal cow. In such cases the typical lesions of the disease generally appear in about five to ten days.

Under natural conditions the main method of spread appears to be from cow to bull and vice versa by service. In addition it may be spread by failure to observe proper precautions when examining or treating cows; for example, examining the vulva of a number of cows

without sterilizing the instruments. As lesions of the disease are also encountered in virgin heifers it must be assumed that the disease may also be spread by other means as yet unexplained.

Symptoms.

The lesions produced by this disease are quite characteristic and are readily recognised by opening the vulva with the fingers and examining the mucuous membrane. In the early, acute stages of the disease the mucous membrane is swollen and inflamed and studded with numerous dark red nodules approximately one-tenth of an inch in diameter. These nodules are generally confined to the lower portion of the vulva and vagina and they tend to be arranged in longitudinal rows. At this stage of the disease there is usually a clear mucous discharge which mats the tuft of hairs situated just below the vulva. In addition, the cow may show some uneasiness and pass water more frequently than usual. This stage of the disease generally lasts for about one month, after which time the inflammation subsides and the nodules become paler in colour although they persist for some months.

The inflammation of the vagina is generally aggravated by service and for some days after service the inflammation appears much more severe. When affected cows are withheld from service, or if they become pregnant, the inflammation generally subsides more quickly.

The disease may affect bulls as well as cows and in such cases lesions similar to those in the vulva and vagina are seen on the penis and in the sheath. The lesions in the bull are generally less severe than in cows.

Effect on Breeding.

The general effect of vaginitis in the herd is to prevent conception in a high proportion of the cows affected. As it spreads throughout the whole herd fairly rapidly, it can cause serious interference to the breeding programme for a period of some months. There is no evidence that vaginitis can cause abortion or interfere with the regularity of heat periods and if such symptoms occur in the herd it should be suspected that some other condition, such as brucellosis or malnutrition, is present. Infection with vaginitis does not have any marked effect on the fertility of the bull. However, if the infection is present in the herd for any length of time the bull would naturally be overworked and his fertility would tend to be lowered from this cause.

Preventive Measures.

In view of the serious interference to the fertility of the herd which this disease can cause, farmers should pay particular attention to means of preventing its introduction, and if it is introduced, to controlling its spread through the herd. Care should be taken when purchasing cows to examine them for the presence of vaginitis. The herd bull should be kept in a paddock on his own and cows brought to him for service rather than allow him to serve cows in the herd at random. In addition, precautions should be taken to prevent strange bulls from having access to the herd.

If the disease does become established in the herd all cows should be withheld from service for a period of at least three weeks. The whole herd, including the bull and heifers over six months of age, should be treated for the disease. If examinations of a number of cows

are made to determine whether the disease is present the hands should be washed in a suitable disinfectant solution before each cow is examined.

Treatment.

The condition generally responds fairly well to treatment and a large number of preparations have been used with a fair degree of success. It is of the utmost importance that when treatment is undertaken very strict precautions should be taken to prevent the spread of the disease or the introduction to the genital organs of other pathogenic bacteria on the instruments used in the treatment. The majority of treatments recommended involve the use of solutions for douching out the vagina, and for this purpose either a one-pint brass syringe or a funnel to which is attached a length of rubber tubing should be used. If a syringe is used at least two nozzles should be provided so that each nozzle can be placed in a suitable disinfectant solution between cows. Similarly, if a funnel is used several lengths of rubber tubing should be provided.

Satisfactory results have also been reported from the use of various dusting powders and where these are used a rubber bowl to which is attached a solid nozzle is used for blowing the powder into the vagina. A number of short lengths of rubber tubing should also be provided in these cases so that a freshly disinfected one can be used on each cow. In addition to taking precautions to sterilize instruments, the area surrounding the external genital organs and the tail should be thoroughly washed with a disinfectant solution before treatment is given.

The treatment which has been generally recommended for this condition in Queensland and found to be satisfactory is douching of the vagina every second day for three weeks with approximately 1½ pints of a 0·3 per cent. solution of zinc sulphate. To make up this solution one ounce of zinc sulphate should be dissolved in two gallons of water. For ease of handling a stock solution of 10 ounces of zinc sulphate in one quart of water can be made up and then one fluid ounce of this solution added to half-a-gallon of water to make up the solution required for treatment.

In addition to the zinc sulphate treatment satisfactory results have been reported from the use of the following preparations:—

(1) Zinc sulphocarbolate 0·1 per cent. solution—douche with 1½ pints twice a week for three weeks.

(2) Lugol's iodine and glycerine, equal parts—syringe out with one ounce twice a week for three weeks.

(3) Silver picrate 1 per cent. in kaolin, as dusting powder—5 gm. three times weekly for three weeks.

(4) Acriflavine 1:1500 solution—syringe out with about one-third of a pint twice a week for three weeks.

It must be recognised that these treatments are effective only against vaginitis and of no use in cases of infertility due to other causes. Should infertility persist after treatment has been given the advice of a veterinary surgeon or Inspector of Stock should be sought without delay.

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 10th JULY, 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
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, " Rosevale " Stud, Beaudesert
	Bowkett and Meacle, " Myola Vale " Stud Piggery, Burra Burri, Jandowae
	D. T. Law, Trouts Road, Aspley
	R. J. McCullough, " Maxholm " Berkshire Stud, Gatton
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. C. Smith, " Smithfield " Stud, Coomera
	E. J. Bell, " Dorne " Stud, Chinchilla
	A. G. Fry, " Birubi " Stud, Dalby
	M. E. Myers, Halpine Plantation, Kallangur
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, via Rosewood
	J. H. G. Blakeney, " Talgai " Stud, Clifton
	V. P. McGoldrick, " Fairymeadow " Stud, Cooroy

TESTED HERDS—continued.

Breed.	Owners Name and Address of Stud.'
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands N. R. Potter, " Actonvale " Stud, Wellcamp D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun A. C. Fletcher, " Myola " Stud, Jimbour L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, via Rosewood P. V. Campbell, Lawn Hill, Lamington Salvation Army Home for Boys, Riverview F. Thomas, " Rosevale " Stud, Beaudesert A. J. Surman, Noble Road, Goodna
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee K. Day and P. Hunting, " Kazan " Stud, Goodna E. Sirrett, " Iona Vale " Stud, Kuraby C. R. Smith, " Belton Park " Stud, Nara H. H. Sellars, " Tabooba " Stud, Beaudesert H. Thomas, " Eurara " Stud, Beaudesert D. T. Law, Trouts Road, Aspley G. J. Wilson, " Glenbella " Stud, Silverleigh

NEW DAIRY FARM COMPETITIONS.

Changed conditions and an increase in prize money to £2,420 are features of the Queensland Dairy Farm Competitions for 1951-52 to be conducted by the Department of Agriculture and Stock.

The important changes made should create greater interest in the competitions, which are financed from the Commonwealth Dairy Industry Efficiency Grant. One of the main changes is that this time, in addition to the whole farm competition in each zone, there will be six sectional zone prizes. The whole farm competition prizes remain at: 1st, £50 and trophy; 2nd, £30 and pennant; 3rd, £20 and certificate. The sectional prizes in each zone are: 1st, £15 and pennant; 2nd, £5 and certificate, and will be awarded for each of the following aspects:—Efficiency of land usage, farm buildings (farm layout and machinery), dairy buildings (layout and equipment), herd management, farm economy, and animal feeding.

To be eligible for a sectional prize the farm must be entered in the whole farm competition, and if a farm is of sufficiently high merit it will be possible for it to carry off all first prizes in the zone, totalling £140.

Another important change is that the number of zones has been reduced from 16 (as in previous competitions) to 11. This re-arrangement of boundaries of dairying districts should provide keener competition for the increased prize money.

Times of judging of the farms in the competition have been reversed. The first judging will now take place in the late spring or early summer, and the second (final) judging in the late summer or early autumn. This change has been made to fit in with seasonal conditions. It will mean that field days, at which the benefits of the competitions can be passed on to farmers generally, can be held within about a month of the final judging instead of four or five months later as in the past.

Entries, which are free, will close with the local officer of the Department on 31st August. The competitions are open to all dairy farmers except those who are co-operating with the Department in the demonstrations financed from the Commonwealth Grant. Farms conducted by Government institutions or subsidiaries are also ineligible. Competitors who gain prizes in the 1950-51 competition, still to be decided, will be handicapped.

ASTRONOMICAL DATA FOR QUEENSLAND.

SEPTEMBER.

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	6·03	5·33	Cairns	27	31	Longreach ..	34	36
6	5·58	5·36	Charleville	27	27	Quilpie	35	35
11	5·52	5·38	Cloncurry	48	52	Rockhampton ..	9	11
16	5·46	5·40	Cunnamulla ..	29	29	Roma	17	17
21	5·40	5·42	Dirranbandi ..	19	19	Townsville ..	22	27
26	5·35	5·45	Emerald	18	20	Winton	38	42
30	5·30	5·46	Hughenden ..	33	37	Warwick	3	4

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
	a.m.	p.m.
1	5·46	5·17
2	6·16	6·13
3	6·46	7·10
4	7·16	8·09
5	7·47	9·10
6	8·23	10·13
7	9·03	11·20
8	9·51	..
		a.m.
9	10·46	12·27
10	11·49	1·31
	p.m.	
11	12·57	2·31
12	2·07	3·23
13	3·15	4·08
14	4·21	4·48
15	5·24	5·23
16	6·25	5·55
17	7·25	6·26
18	8·25	6·59
19	9·25	7·33
20	10·24	8·10
21	11·22	8·50
22	..	9·36
	a.m.	
23	12·17	10·26
24	1·08	11·19
	p.m.	
25	1·54	12·15
26	2·35	1·12
27	3·12	2·09
28	3·45	3·06
29	4·15	4·03
30	4·46	5·00

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	23	30	39	5	14	34	45
6	26	12	42	27	17	2	49	30
11	30	9	45	24	20	0	53	26
16	18	19	34	35	9	10	38	40
21	9	30	35	44	0	20	26	53
26	11	28	26	43	0	19	28	51
30	18	19	34	35	9	10	38	40

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	18	38	42	56	27	41	16	33
3	28	26	50	47	34	33	24	22
5	40	15	57	41	42	26	33	14
7	51	5	65	34	49	20	42	6
9	56	2	68	32	52	17	46	3
11	54	3	67	32	51	18	44	4
13	44	11	61	38	45	23	37	11
15	33	23	52	45	37	30	27	20
17	20	34	44	54	29	39	18	29
19	10	45	37	60	22	46	9	37
21	3	53	34	66	18	51	4	44
23	2	56	33	67	17	53	3	46
25	5	52	35	65	19	50	5	44
27	11	45	38	60	23	46	10	37
29	21	34	44	54	29	39	18	29
30	27	29	48	50	33	35	22	25

Phases of the Moon.—New Moon, Sept. 1st, 10.49 p.m.; First Quarter, Sept. 9th, 4.16 a.m.; Full Moon, Sept. 15th, 10.38 p.m.; Last Quarter, Sept. 23rd, 2.13 p.m.

Equinox.—On Sept. 24th at 7 a.m., the sun will cross the Equator on its apparent journey from north to south and on this day the sun will rise and set at true east and true west respectively. On the 16th and 30th the moon will rise and set at true east and true west approximately.

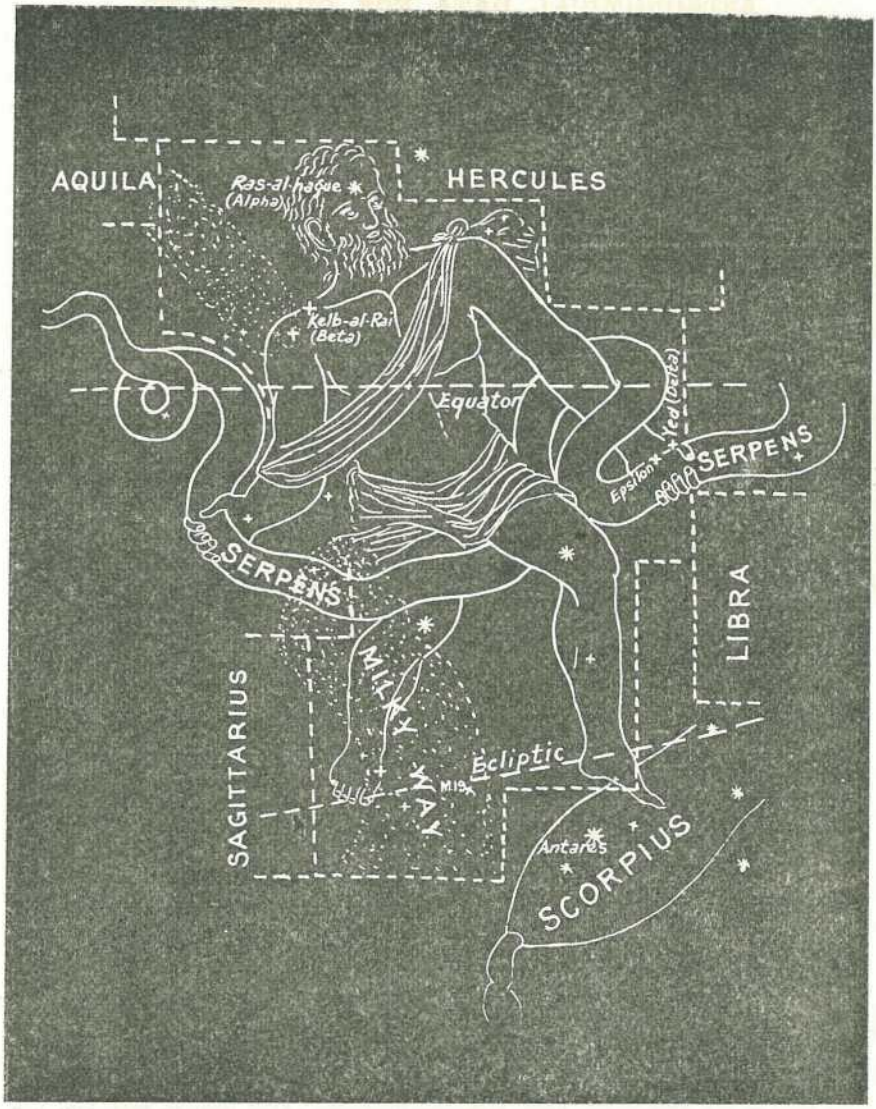
Mercury.—Will be a morning object all this month. On the 1st, in the constellation of Leo, will rise about 15 minutes before the sun and on the 16th will reach greatest angle west of the sun when it will rise ¾ hour before sunrise. By the end of the month it will rise 23 minutes before the sun.

Venus.—Also in the constellation of Leo. At the beginning of the month will be too close in line with the sun for observation but by the end of the month it will rise 2 hours before sunrise. However, it should not be confused with Mercury and Mars, which are both much fainter than Venus.

Mars.—In the constellation of Cancer at the beginning of the month but by the end of the month will be in the consetellation of Leo, close to Venus. It is, however, much fainter and redder than Venus.

Jupiter.—Favourably placed for observation almost throughout the whole night, in the constellation of Pisces. On the 1st it will rise between 8 p.m. and 9.15 p.m. and at the end of the month will rise just before sunset.

Saturn.—May be observed low in the west near sunset at the beginning of the month but by the end of Sept. it will be too close in line with the sun to be seen.



THE CONSTELLATIONS.

OPHIUCHUS.

Adjoining Scorpius, on the north-east is the constellation of Ophiuchus, one of the largest groups in the sky, part being north of the Celestial Equator and part south. Though it is not listed as one of the Zodiacal constellations, the sun and planets pass through quite a large portion of Ophiuchus between the constellations of Scorpius and Sagittarius. In fact, there is a far larger portion of the Zodiac in Ophiuchus than in Scorpio.

The group is said to represent the mythological God of Healing, Aesculapis, and on old star maps the god is shown with one foot on the Scorpion (Scorpius) and holding a large serpent in his hands. The constellation Serpens is curiously mixed up with Ophiuchus, and appears both east and west of it.

Though Ophiuchus is a large constellation it is not easily defined and contains no very bright stars, but a branch of the Milky Way extends into the southern portion of it and there are some very fine objects to be seen with optical aid, including double stars, clusters, &c.