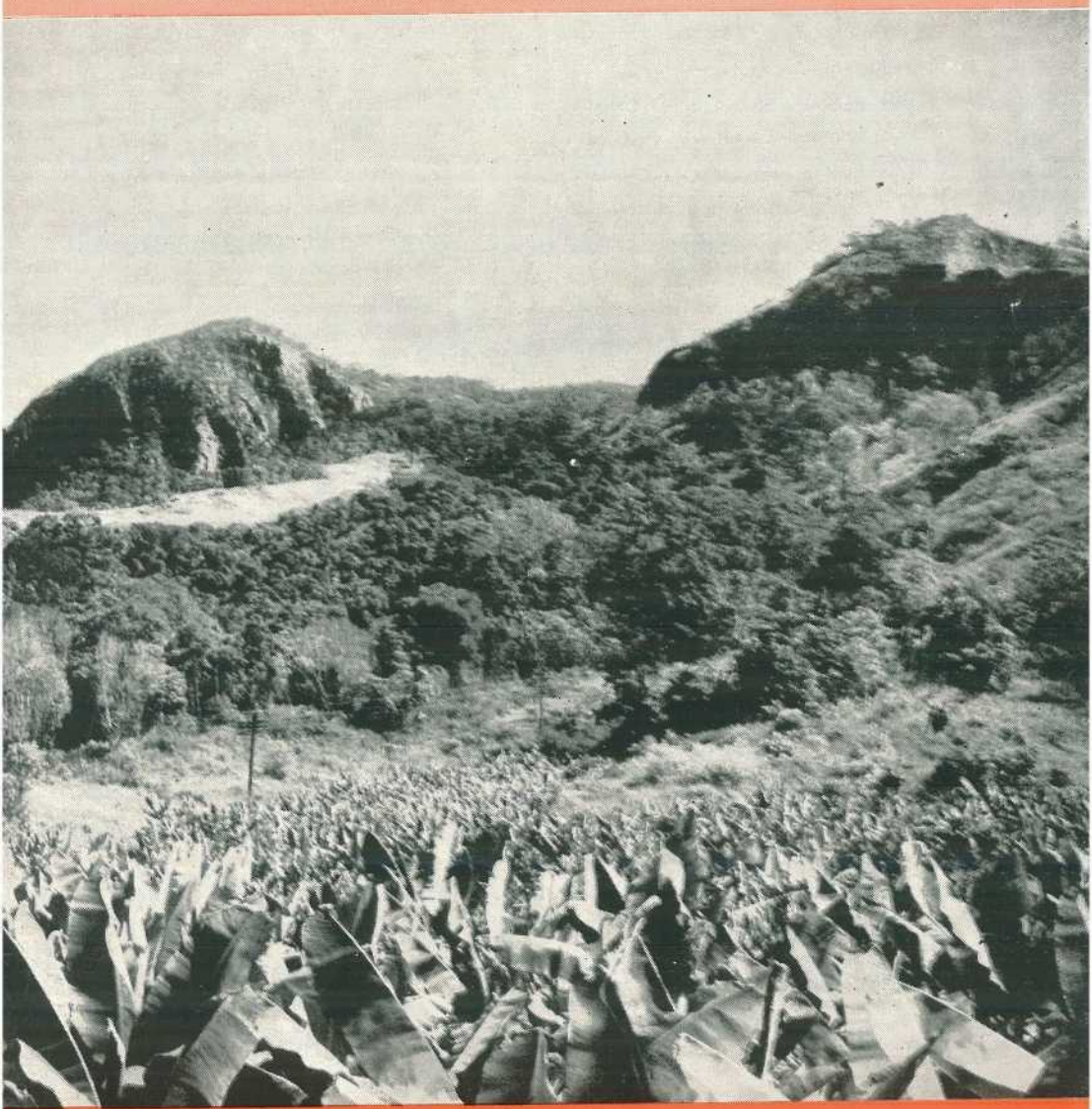
Queensland AGRICULTURAL JOURNAL



OVERLOOKING A BANANA PLANTATION IN THE CAIRNS DISTRICT.

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Editor: C. W. Winders, B.Sc.Agr.

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Berkshire.

A. P. and N. Beatty, "Deepdene," Barambah road, Nanango
S. Cochrane, "Stanroy" Stud, Felton
J. L. Handley, "Meadow Vale" Stud, Lockyer
O'Brien and Hickey, "Kildurham" Stud, Jandowae East
G. C. Traves, "Wynwood" Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
H.M. State Farm, "Palen" Stud, Palen Creek
A. R. Ludwig and Sons, "Beau View" Stud, Beaudesert
H. H. Sellars, "Tabooba" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
R. H. Crawley, "Rockthorpe" Stud, *via* Pittsworth
F. R. J. Cook, Middle Creek, Pomona
Mrs. I. M. James, "Kenmore" Stud, Cambooya
H. L. Stark, "Florida," Kalbar
J. H. N. Stoodley, "Stoodville," Ormiston
H.M. State Farm, Numinbah
N. F. Cooper, Maidenwell
M. G. and R. H. Atkins, "Diamond Valley" Stud, Mooloolah
E. J. Clarke, "Kaloon" Stud, Templin
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C. E. Edwards, "Spring Valley" Stud, Kingaroy
G. McLennan, "Murcott" Stud, Willowvale
H. M. Wyatte, "Cumberland Vale," Cooyar
C. F. W. and B. A. Shellback, "Redvilla" Stud, Kingaroy
J. C. Lees, "Bridge View" Stud, Yandina
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A. C. Fletcher, "Myola" Stud, Jimbour
Q.A.H.S. and College, Lawes
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The Marsden Home for Boys, Kallangur
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E. R. Kimber, Block 11, Mundubbera
A. J. Potter, "Woodlands," Inglewood
Regional Experiment Station, Hermitage
J. W. Bukowski, "Secreto" Stud, Oxley
R. Astbury, "Rangvilla," Pechey.

Large White.

H. J. Franke and Sons, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, "Highfields," Murgon
K. B. Jones, "Cefn" Stud, Pilton
R. Postle, "Yarralla" Stud, Pittsworth
B. J. Jensen, "Bremerside" Stud, Rosevale, *via* Rosewood
E. J. Bell, "Dorne" Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, "Thistleton" Stud, Maleny
H.M. State Farm, Numinbah
V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
S. T. Fowler, "Kenstan" Stud, Pittsworth
W. Zahnow, Rosevale, *via* Rosewood
Regional Experiment Station, Biloela
G. J. Hutton, Woodford
H. L. Larsen, "Oakway," Kingaroy
G. I. Skyring, "Bellwood" Stud, *via* Pomona
O. B. Vidler, Manneum, Kingaroy
K. F. Stumer, French's Creek, Boonah
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R. S. Powell, "Kybong" Stud, Kybong, *via* Gympie
C. Wharton, "Central Burnett" Stud, Gayndah
S. Jensen, Rosevale, *via* Rosewood
V. V. Radel, Coalstoun Lakes
H. R. Stanton, Tansey, *via* Goomeri
L. Stewart, Mulgowie, *via* Laidley
D. T. Law, "Rossvill" Stud, Trouts road, Aspley

Tamworth.

D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
A. C. Fletcher, "Myola" Stud, Jimbour
Salvation Army Home for Boys, "Canaan" Stud, Riverview
A. J. Surman, "Namrus" Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
F. N. Hales, Kerry road, Beaudesert
T. A. Stephen, "Withcott," Helidon
W. F. Kajewski, "Glenroy" Stud, Glencoe
A. Herbst, "Hillbanside" Stud, Bahr Scrub, *via* Beenleigh
H.M. State Farm, Numinbah
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
H. J. Armstrong, "Alhambra," Crownthorpe, Murgon
R. H. Coller, Tallegalla, *via* Rosewood
A. J. Potter, "Woodlands," Inglewood
D. V. and P. V. Campbell, "Lawn Hill," Lamington
S. Kanowski, "Miecho" Stud, Pinelands
N. R. Potter, "Actonvale" Stud, Wellcamp

Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
C. R. Smith, "Belton Park" Stud, Nara
H. H. Sellars, "Tabooba" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
J. B. Dunlop, "Kurrawyn" Stud, Acacia road, Kuraby
R. A. Collings, "Rutholme" Stud, Waterford
M. Nielsen, "Cressbrook" Stud, Goomburra
G. J. Cooper, "Cedar Glen" Stud, Yarraman
"Wattledale Stud," 492 Beenleigh road, Sunnybank.
Kruger and Sons, "Greyhurst," Goombungee
A. Scott, "Wanstead" Stud, Grantham

British Large Black.

H. W. Naumann, "Parkdale" Stud, Kalbar

Tuberculosis-Free Cattle Herds.

The studs listed below have fulfilled the conditions of the Department's Tuberculosis-free Herd Scheme to 30th September, 1956.

Breed.	Owner's Name and Address.
A.I.S.	M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy
	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," Benair, *via* Kingaroy
	Sullivan Bros., "Valera" Stud, Pittsworth
	Reushle Bros., "Reubydale" Stud, Ravensbourne
	H. F. Marquardt, "Chelmer" Stud, Wondai
	A. C. and C. R. Marquardt, "Cedar Valley," Wondai
	A. H. Sokoll, "Sunny Crest" Stud, Wondai
	W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar
	C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman
	W. H. Thompson, "Alfa Vale," Nanango
	S. R. Moore, Sunnyside, West Wooroolin
	H.M. State Farm, Numinbah
	D. G. Neale, "Groveley," Greenmount
	Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
	A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah
	W. D. Davis, "Wamba" Stud, Chinchilla
	Queensland Agricultural High School and College, Lawes
	C. K. Roche, Freestone, Warwick
	Mrs. K. Henry, Greenmount
	D. B. Green, "Deloraine" Stud, Durong, Proston
	E. Evans, Wootha, Maleny
	T. L. and L. M. J. Cox, "Seafield Farm," Wallumbilla
	J. Crookey, "Arolla A.I.S. Stud" Fairview, Allora
	M. F. Power, "Barfield," Kapaldo
	A. H. Webster, "Millievale," Derrymore
	W. H. Sanderson, "Sunlit Farm," Mulgildie
	R. A. and N. K. Shelton, "Vuegon" A.I.S. Stud, Hivesville, via Murgon
	R. R. Radel & Sons, "Happy Valley," Coalstoun Lakes
Ayrshire	L. Holmes, "Benbecula," Yarranlea
	J. N. Scott, "Auchen Eden," Camp Mountain
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
	C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
	G. F. H. Zerner, "Pineville," Pie Creek, Box 5, P.O., Gympie
	T. F. Dunn, Alanbank, Gleneagle
Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
	D. J. Pender, "Camelot," Lytton road, Lindum
	S. E. G. Macdonald, "Freshfields," Marburg
Guernsey	C. D. Holmes, "Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, *via* Biggenden
	A. C. Swendson, Coolabunia, Box 26, Kingaroy
	C. Scott, "Coralgrae," Din Din road, Nanango
	R. J. Wissemann, "Robnea," Headington Hill, Clifton
	G. L. Johnson, "Old Cannindah," Monto
	A. Ruge & Sons, Woowoonga, *via* Biggenden
	G. Miller, Armagh Guernsey Stud, Armagh, M.S. 428 Grantham
Jersey	Queensland Agricultural High School and College, Lawes
	J. S. McCarthy, "Glen Erin" Jersey Stud, Greenmount
	J. F. Lau, "Rosallen" Jersey Stud, Goombungee
	G. Harley, Hopewell, M.S. 189, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line
	P. J. L. Bygrave, "The Craigan Farm," Aspley
	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
	L. E. Meier, "Ardath" Stud, Boonah
	A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood
	Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango
	F. W. Verrall, "Coleburn," Walloon
	C. Beckingham, Trouts road, Everton Park
	W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala
	G. H. Ralph, "Ryecombe," Ravensbourne
	Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy
	W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah
	Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman
	D. R. Hutton, "Bellgarth," Cunningham, *via* Warwick
	J. W. Carpenter, Flagstone Creek, Helidon
	H. G. Johnson, "Windsor" Jersey Stud, Beaudesert
	W. S. Kirby, Tinana, Maryborough
	S. A. Cramb, "Trecarne Stud," Lockyer
	G. & V. Beattie, "Beauvern," Antigua, Maryborough
	J. A. & E. E. Smith, "Heatherlea" Jersey Stud, Chinchilla
	W. C. M. Birt, "Pine Hill" Jersey Stud, Gundiah
	T. Nock, Dallarnil
	P. Fowler & Sons, "Northlea," Coalstoun Lakes
	F. Porter, Conondale
	H.M. State Farm, Palen Creek
Poll Hereford ..	W. Maller, "Boreview," Pickanjinnie
	J. H. Anderson, "Inverary," Yandilla
	D. R. and M. E. Hutton, "Bellgarth," Cunningham, *via* Warwick
	E. W. G. McCamley, Eulogie Park, Dululu
	Wilson and McDouall, Calliope Station, Calliope

Commonwealth and State Co-operation in Expanding Extension Services

By ROBERT VEITCH, Assistant Under Secretary (Technical).

As mentioned by the Under Secretary in the September issue, stress was again laid at the last meeting of the Australian Agricultural Council on the necessity for increasing the volume of primary production for both local and overseas consumption. The meeting also noted that very considerable progress had been made since pre-war days in achieving that objective.

In such an achievement, Departmental extension services have an important part to play in association with the farmer or grazier in stepping up yield per acre or per animal and in improving the quality of produce both for local consumption and for export on highly competitive world markets.

It is the recognised duty of extension officers to keep producers informed, as required, regarding worthwhile developments in primary production such as improved methods for dealing with plant and animal pests and diseases, more profitable feeding practices in animal husbandry, and the production of higher yielding or better quality varieties of field and horticultural crops.

This passing on of information to the producer has been an important function in the policy of the Department ever since its establishment, and with the still greater recognition of its importance in recent years, there has been an increase in the numerical strength of every Branch providing extension services. In some spheres the expansion has been particularly rapid—for example, in cattle husbandry and soil conservation.

While the Department of Agriculture and Stock has thus been aware of its responsibilities in developing extension work from its own financial resources, it has been enabled to augment the expansion of such work as a result of the Commonwealth Government's decision to financially assist State extension activities.

The Dairy Industry Extension Grant was first made available in 1948 and it now provides Queensland with an annual sum of £65,800 for herd recording; farm demonstrations; farm and herd surveys; demonstrations in supplementary feeding, calf feeding, mineral deficiencies correction, and milk and cream quality improvement; sterility surveys; and the proving of dairy bulls.

These demonstrations have been carried out on dairy farmers' own properties and the Department is well satisfied with the mutually beneficial co-operation achieved. It is believed that the demonstrations and the other projects have been or will be productive of much good to the dairying industry as a whole. For example, herd recording and the application of the data obtained in it is recognised as one of the best means whereby the economic status of the dairying industry may be enhanced, as is also the more recently introduced project on the proving of dairy bulls.

The State Government and dairy farmers make a substantial financial contribution to the work carried out under this Grant in that they at present provide £63,000 per annum, in equal proportions, towards the cost of the herd recording project.

The Extension Services Grant dates from 1952 and Queensland's share thereof is now £57,000 per annum. It has made financially practicable considerable additions to the staff of the Agriculture Branch, thus providing an agricultural extension service in districts in which the Branch was not previously represented. This Grant has also been used to devote increased attention to the control of contagious pleuropneumonia, to phosphorus deficiency elimination in, and to the early turn-off of, beef cattle. Sheep, pig and poultry extension work is assisted from this particular Grant, as are some cropping, fodder conservation and pasture projects.

Some money is also available from the Wool Industry Fund for extension work in the sheep industry, but this is not a fixed annual grant and is a comparatively small, variable amount.

Assistance has also been available for extension work in tobacco, originally through the Tobacco Leaf Production Grant, of which Queensland's share was £5,625 in recent years. This Grant differed from the other two larger Grants in that it was available for research as well as for extension activities.

Queensland's share, together with an equal contribution from the State, has now been amalgamated with the Tobacco Trust Account, which operates as from this year and is available for both research and extension. The new moneys paid into the Trust Account are received from the Commonwealth Government, tobacco growers and tobacco manufacturing firms. Queensland's share of these new moneys is £53,250 for 1956-57. It will be used during the current financial year largely for the development of the tobacco experiment stations at Parada, in the Mareeba-Dimbulah area, and at Inglewood, in the south, and for the appointment of additional officers to engage on extension and research work.

The general extension work of the Department is handled by several hundred permanent Departmental officers, who use all available channels, these including the press, radio, field days, farmers' and graziers' meetings, extension schools and personal visits to properties, as well as advice by correspondence.

The Commonwealth Grants have been a valuable supplement in that they have provided finance for additional demonstration and other work as well as making practicable the appointment of a considerable number of temporary employees.

DAIRY FARMERS' HANDBOOK.

Dairy farmers milking 10 cows or more who have not received or claimed a copy of the Queensland edition of "Dairy Farming in Australia", which was distributed in 1952 and subsequently, are advised to write for a free copy to the Department of Primary Industry, Commonwealth Offices, Adelaide Street, Brisbane. Other people may obtain a copy for 9s. 4d. post free.

Oats for Grazing

Results of Some Trials in South-Eastern Queensland

By Dr. L. G. MILES, Assistant Director of Agriculture.

WHO DID THE WORK AND WHERE?

Over the past six years, a number of grazing trials have been carried out on winter cereals in coastal dairying country of the Gympie and Brisbane districts. The purpose of this report is to give the main results of these trials and see what lessons we can learn from them.

This series of trials was started by Mr. A. Hegarty in 1950. Mr. Hegarty is now an Agrostologist (pasture worker) stationed at Brisbane, but was formerly Agricultural Adviser in the Gympie district. Since the begining of 1953 the Gympie series of trials has been carried on by Mr. G. J. Cassidy, who is the present Adviser in Agriculture at that centre. Mr. N. J. Douglas, Assistant Adviser at Gympie, has also helped in the work on the Gympie trials.

The Brisbane series of trials was begun by Mr. Hegarty in 1954.

Trials of this nature would be impossible without the willing co-operation of the owners of the farms on which the work was carried out. We are very much indebted to Mr. G. Beattie, of Lagoon Pocket, near Gympie, and Mr. E. Shield, of Moggill, Brisbane, for their enthusiastic help in this work. These two farmers not only provided land each year for the trials, but also grazed their herds according to a plan and kept very careful records of the actual grazing times.

IMPORTANCE AS A GRAZING CROP.

In Queensland as a whole, over 90 per cent. of the total area of oats is normally used for grazing. In coastal districts, such as we are considering here, the percentage would be nearly 100.

The first plantings of winter cereals for grazing are generally made as soon as possible after the late summer rains. These plantings provide grazing through the winter and often into the spring.

The crops thus give succulent green feed at a time when our native pastures are at their worst. Even in winters in which there is a great bulk of native pasture, this pasture will be over-mature and of low nutritive value. In such cases, an hour or two of grazing on the cereal crop each day provides a splendid supplement to the bulky low-protein feed of the pastures.

There are, of course, a number of winter-growing crops which can be used for this purpose. In addition to the grain crops (such as wheat, oats, barley, rye and canary seed) there are winter legumes such as field peas and vetches.

While all these crops can, and do, play some part in providing winter grazing for milking cows, oats has always been the favourite. The reasons generally given are that oats gives bulkier, leafier grazing than most other cereals, that it is well liked by cows, and that in favourable seasons it gives a long period of grazing.

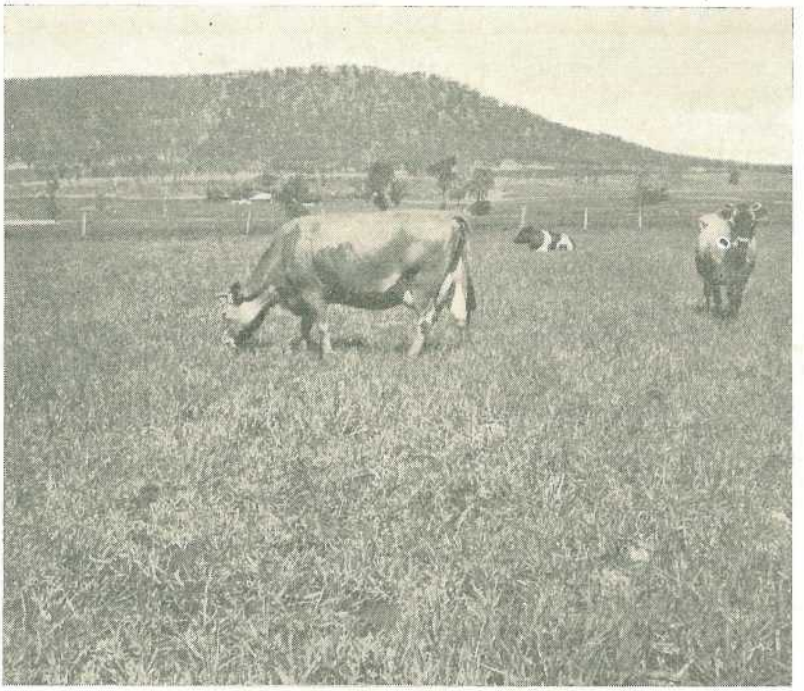


Plate 1.

Cattle Grazing on Algerian Oats. This area was planted in late February, 1954, and the picture was taken in September. At that time the cattle had grazed the oats intermittently over a period of five months.

WHY THE NEED FOR EXPERIMENTS?

In the first place, all of our earlier oat varieties came from southern States, and for a long time we were entirely dependent upon these States for our seed supplies. Some of these varieties are erect and grow up fairly fast. They generally also have very broad leaves. Examples are Mulga, Buddah and Orient. Others, like Algerian and Klein, are fairly slow growing, have a large number of finer leaves, and are much more "grassy" in appearance. One thing we wanted to find out was which of these types gave the most (and best) grazing in our coastal dairying districts.

Another important reason for these experiments was to find out whether oats or wheat gave the better grazing on these farms.

A third and most important reason was to see which varieties were resistant to the common diseases of oats and to find out what effects these diseases had upon the grazing value of the crop. The disease which was commonest and best known to farmers was a rust (crown rust). This was so serious in some seasons that farmers were being forced to try any crop except oats, although oats was definitely their favourite winter grazing crop. Another disease, which first appeared during the period of these experiments, was Victoria blight.

WHAT IS CROWN RUST?

Most farmers know perfectly well what is meant by "rust" on crops. Most also know that a serious rust attack can ruin a crop whether it be intended for grazing or for grain. What is not always known is that the

disease is caused by a living fungus inside the plant, and that the "rust" itself is only the patches of spores (or tiny "seeds") which carry the disease from one plant to another.

Another most important point is that there are many different types of rust. In oats there are two quite distinctive types—crown rust and stem rust. A lack of appreciation of this fact has led to many contradictory reports in past years.

Crown rust is by far the most important disease of grazing oats in Queensland. This rust can appear very early in the growth of a crop, even before the period of first grazing. Stem rust, on the other hand, generally comes in late and usually reaches its heaviest development at about heading time. It can easily be seen, then, that while stem rust can be of the greatest importance in affecting grain yields, crown rust is the one which does the damage in the grazing crop.

The two rusts are easily distinguished when seen side by side. The crown rust pustules or spots are usually small, oval and a light orange in colour. Stem rust pustules, on the other hand, are large, a darker brown in colour, and with ragged edges; when stem rust is really bad the pustules join together and form continuous "rusty" patches.

Crown rust then is the lighter coloured "spotty" rust which comes in early on the leaf blades and seriously affects the quality and the quantity of the green crop. It has been reported that crown rust has in wet winters actually killed oat crops before any effective grazing could be had.

Plate 2.

Cattle Grazing on an Erect Variety of Oats of Bovah Type. This paddock, planted in early June, is providing a large bulk of feed in September.

WHAT IS VICTORIA BLIGHT?

Victoria blight is another disease which has appeared in coastal districts, but only in odd seasons. This is a leaf blight disease which can, in a bad season, entirely destroy the leaf of a grazing crop. Where the disease occurs early, the crop may receive a serious temporary setback but recover afterwards and provide a good late grazing.

Fortunately, as far as we know, this disease occurs only on the variety Victoria or on varieties with Victoria parentage. Varieties of this parentage which have been grown in Queensland are Vicland, Fultex, Acacia and the so-called "Bligh" oats. Before the introduction of these oats to Queensland, Victoria blight had never been found here.

Even where these susceptible varieties have been grown, the disease has only been serious in one season—that was the wet winter of 1952.

HOW ARE THE TRIALS CARRIED OUT?

On each of the trial farms, the varieties are sown in plots of about half an acre to one acre in area. These plots are all in the one large paddock, and they are arranged so that each one can later be enclosed at will using an electric fence.

Grazing of the plots commences when the quicker growing varieties have reached a stage at which they can be safely fed off. If the plots are grazed too early, a lot of the plants will be pulled out because they are not properly rooted. If grazing is left

Plate 3.

Portion of an Oats Trial Showing Two Types of Growth. The variety in the foreground is Klein, a slow-maturing, leafy variety; that in the background is Vicland, an erect, quicker growing type.

too late, the quick-maturing varieties will have advanced too far. This means that they will not be as palatable as they were earlier, and, in addition, they will not recover properly after the grazing.

Each plot is grazed as it requires it, and is then spelled while the cows go on to another plot. Grazing may be for only an hour or two each day, depending on the overall farm feeding programme and, of course, on the amount of oats relative to the number of cows. A chart is kept by the farmer and on it he enters each day the number of cows that went on to a particular plot and the number of hours they were left on the plot.

In this way each variety is grazed down and then spelled, re-grazed, and spelled again. This rotational grazing carries on until each plot can provide no more feed. In some seasons each plot may be grazed 4 or 5 times, while in more favourable years up to 8 grazing cycles have been possible.

At the end of the season the farmer has a complete record of the number of hours each plot has been grazed and the number of cows grazed each time. From these figures we can work out the number of *cow grazing hours per acre* that each plot has given. This we take as our rough measuring-stick of the actual grazing value of each variety during that season.

In addition to the actual grazing records, notes are taken from time to time on the general appearance of the plots, their recovery after each grazing, and the occurrence of crown rust or Victoria blight. Other notes are sometimes obtainable on the cow's grazing preferences and on such things as damage to the crop by trampling or loss of crop by pulling out of poorly rooted plants.

WHAT RESULTS HAVE WE FOUND?

In Table 1, a summary of the main results of the seven trials up to the 1955 season is given. In 1951 there was no good planting rain at Gympie, and no trial could be planted. In 1954 and 1955 there were trials at both Gympie and Brisbane (Moggill).

TABLE 1.

RELATIVE GRAZING VALUES FOR SOME OATS AND WHEAT VARIETIES IN THE GYMPIE AND BRISBANE DISTRICTS.

Variety.	Gympie 1950.	Gympie 1952.	Gympie 1953.	Gympie 1954.	Brisbane 1954.	Gympie 1955.	Brisbane 1955.
Oats—							
Vicland ..	127	40	127	84	56	100	62
Fultex ..	132	77	142	..	..	89	..
Klein	115	121	145	124	..	102	..
Mixture ..	141	101	142	127	..	..	..
Algerian ..	100	100	100	100	100	100	100
Bligh No. 1 ..	..	72	..	..	..	..	..
Bligh No. 3 ..	..	59	..	..	..	..	..
Bovah	122	93	139	132	103	118	107
Benton ..	..	..	..	..	..	..	122
Acacia ..	..	..	..	..	..	63	79
Wheat—							
Lawrence ..	76	52	97	..	..	60	..
Hybrid 1 ..	93	82	77	99	..	..	..
Hybrid 2 ..	87	81	103	110	..	74	..
Other varieties	..	52	..	91	..	..	..
Average Grazing	High	High	Low	Medium	High	Low	Medium

In this table, Algerian has been used as our standard variety, because it is an old and well-tried grazing oat in Queensland. In order to simplify matters, the cow-hours per acre for Algerian have been called 100 each year, and the values for the other varieties have been reduced proportionately.

If we wish to assess the value of a variety in any one of these experiments (for example, Bovah at Gympie in 1954) we look up its figure in the table. This figure, 132, means that Bovah provided 32 per cent. more grazing than Algerian in that experiment, or nearly a third as much again. Similarly, Acacia at Gympie in 1955 gave less than two-thirds of the grazing that Algerian did.

A few selected wheat varieties were included in the Gympie trials for comparison with the oats. These results are also included in the table.

While the grazing value for Algerian has been reduced to 100 for each experiment, this does not mean that Algerian provided the same amount of grazing each year. In the most favourable seasons (Gympie 1952 and Brisbane 1954) it gave over 600 cow grazing hours per acre. In a dry season such as 1953 Algerian's figure was only 209, and in a late-planting season (Gympie 1955) it was 243. At the bottom of the table is a line showing whether the grazing results for each experiment were generally high, medium or low.

OATS VERSUS WHEAT FOR GRAZING.

Wheats were included with the oats in the Gympie trials because there were at the time a number of rust-resistant wheats to hand. It was felt that a rust-resistant wheat might well prove a better grazing proposition than a rust-susceptible oat.

The wheat varieties used were chosen because they were highly resistant to the two wheat rusts (leaf rust and stem rust), and because they were rather late in heading and could provide a good bulk of green material. In addition, these varieties had all proved themselves to be very well suited for "feeding off" by sheep on the Darling Downs.

A glance at the table shows that under coastal conditions, and when grazed by dairy cows, these wheats were generally much inferior to the oats in carrying capacity. In two instances one unnamed crossbred wheat gave slightly more grazing than Algerian oats, but in both cases it could not compare with the better oat varieties.

The cows apparently found the oats more palatable than the wheats. They usually grazed the oats on a face, cropping everything to a fairly even height before they passed on. In the wheat plots they tended to pick here and there, and considerable damage was done to the crop by trampling.

As a result of these experiments, therefore, we cannot recommend wheat in place of oats for grazing by cows in coastal districts. At the present time, barley and canary seed are also being tried in comparison with oats, to see whether they fare any better than wheat.

SLOW-MATURING VERSUS QUICK-MATURING OATS.

In these trials, only two slow-maturing or long-season oats were used—Algerian and Klein. Both these varieties stool heavily during the early part of the season and produce an abundance of fine grassy leaf. They do not shoot up into head until the season is well advanced.

All the other oat varieties would be regarded more as hay or grain types. They tend to keep on growing upwards from the start, and do not normally stool so freely or produce as many

leaves as the Algerian types. Compared with Algerian, they would be classed as early-maturing or mid-season.

As the Algerian type of oat had generally been regarded as the ideal grazing oat, we were very interested to see how the faster-growing and more upright varieties would compare with it. In actual fact, these trials showed that erect-growing varieties such as Vicland and Bovah could be grazed just as effectively as Algerian or Klein; but, and this is important, *they must be managed properly.*

Algerian may be left a long time ungrazed without any harmful effect. The quicker variety, on the other hand,

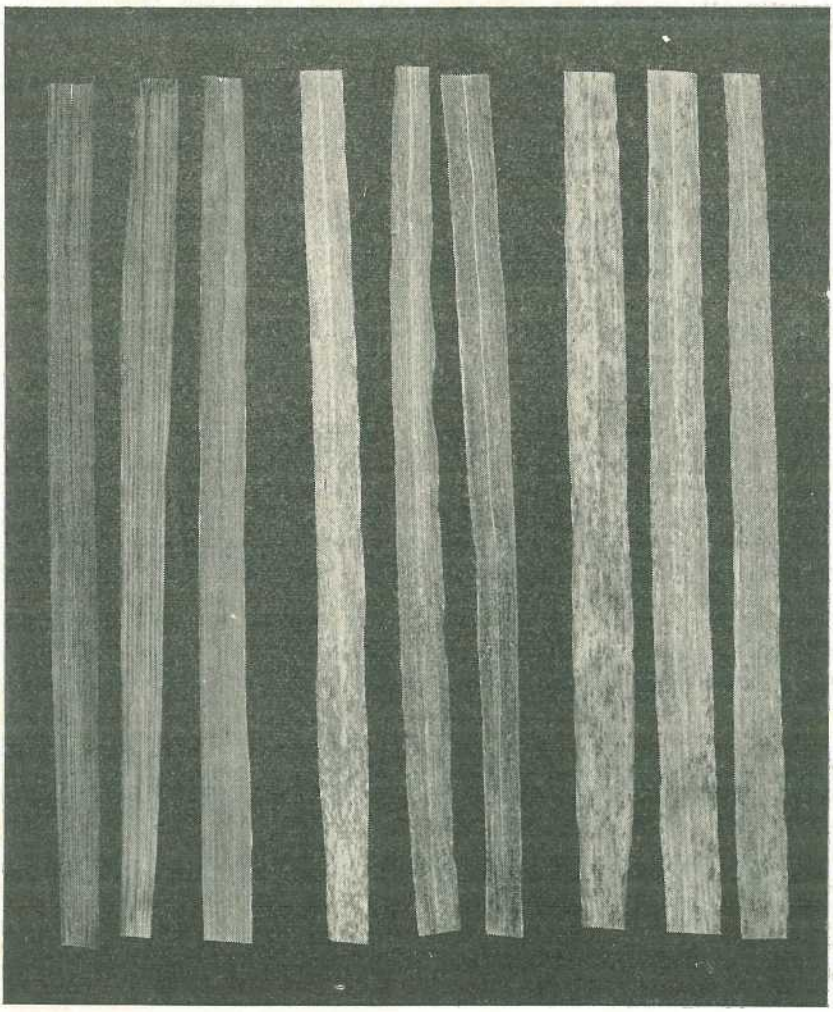


Plate 4.

Crown Rust in Oats. The three leaves on the left (Bovah) are green and rust-free. The three on the right (Belar) are heavily spotted with crown rust which has caused the leaf to yellow badly. The three centre leaves are from Klein, which was less severely rusted than Belar.

cannot be left too long or it will become stemmy and tough. As a result, considerable wastage will occur and the recovery after grazing will be much poorer.

The answer to the problem of managing the quicker growing oats is of course strip-grazing, using a movable electric fence. Using this method in these trials, we have usually obtained just as many grazings from the faster oats as we have from the others. During the favourable winter of 1950, Vicland and Bovah each gave 8 separate grazings while Algerian and Klein gave only 7. These grazings ranged over a period from the middle of June to the second half of October.

Seeing then that equally effective use can be made of quick growers and slow growers, the maturity period is not of great importance in choosing a variety for this region. We shall see, a little later, that other considerations such as disease resistance are of much greater significance.

If we could choose from a large range of disease-resistant varieties, there would be good reasons for using both a late-maturing and an early-maturing variety, either in separate paddocks or even mixed together. In the table there is an entry shown as "Mixture." This was a mixture of equal weights of Vicland (quick-maturing), Fultex (midseason), and Klein (slow-maturing). At the time these trials were begun, both Vicland and Fultex were highly resistant to crown rust and Klein was partly resistant. This mixture was very successful, as the grazing figures show. The combination was given up in later years because Vicland and Fultex are no longer resistant to crown rust.

EFFECT OF CROWN RUST.

In some of the trials in this series, crown rust was of little or no importance. In some of the wetter seasons, however, its occurrence played a very big part in reducing the carrying capacity.

This is perhaps best illustrated by looking at the grazing results for Vicland. Let us forget about 1952 for a while, because that was the bad year for Victoria blight. We find that in 1950 and 1953, Vicland was completely free from crown rust, while Algerian was fairly heavily attacked. In those two years Vicland gave a much better grazing performance than Algerian.

In 1954, a change occurred, and Vicland suddenly became completely susceptible to this disease. From this stage onwards its performance dropped, and it is now much inferior to Algerian. It is clear from these experiments that it was Vicland's resistance to crown rust which gave it a big advantage in past years. At the present time, as a susceptible variety, it provides very poor grazing in a year of heavy crown rust.

A change in reaction like this is very puzzling and disturbing. Where has the change occurred—in the variety of oats or in the rust fungus? For very sound reasons, scientists know that this change has occurred *in the rust fungus*. Some of us may know of "sports" which have appeared in garden plants or even in crops. Well, something similar has occurred in the crown rust fungus, which is in itself living plant material. Unlike a sport in zinnias or sweet peas, this rust sport does not give us a different looking rust. The only way we can distinguish the new rust from the old is because it can attack varieties which were resistant to the old rust.

When this change occurred the Department issued a new oat called Bovah which was resistant to the new rust as well as to the old. Bovah's continued resistance to crown rust has made it a top performer since 1953 and has established it as firm favourite for coastal districts.

Benton is a newcomer to Queensland from the United States. It is like Bovah in showing good resistance to the new strain of crown rust. It is a vigorous, erect-growing oat like Bovah and may even be more productive. In its only trial so far (at Brisbane in 1955) it provided longer grazing than Bovah, and reports this year (1956) also indicate that it is doing very well.

EFFECT OF VICTORIA BLIGHT.

While Victoria blight has been noticed on more than one occasion, it has so far been serious in only one season—1952. In that year Vicland, Fultex and the two so-called "Bligh" oats were very badly hit during the first half of the season. They recovered later in the season, but their final grazing record tells its own story.

This disease might easily occur again in a favourable season. However, there is little cause for alarm. The four varieties which went down to Victoria blight all had one parent (Victoria) in common. The other varieties that year (Algerian, Klein and Bovah) were completely untouched by the disease.

Of the newer varieties tested within the last year or so, there are two (Acacia and Garry) which also have Victoria as one parent. While it has not yet been proved, these two could well be susceptible to Victoria blight and should not be grown under moist coastal conditions.

Plate 5.

The Effect of Victoria Blight in Oats. This was a good grazing stand until hit by Victoria blight at Gympie in 1952.

Plate 6.

Bovah Oats in Grazing Trial, Gympie District, 1952. This crop is vigorous, free from rust and Victoria blight, and in good condition for grazing.

All of the older Australian varieties, such as Belar, Mulga, Fulghum and Algerian, appear to be quite resistant to this blight. Of the two most promising crown-rust-resistant varieties at present, Bovah proved quite free from the blight attack in 1952; Benton was not under test in that year, but from its breeding it also should have no trouble from Victoria blight.

All you have to do, then, to insure yourself against loss from Victoria blight in the wetter districts is to avoid planting Vicland, Fultex, Acacia, Garry or the "Bligh" oats. The other varieties available to growers should all be safe.

CAN THE RESULTS BE APPLIED ELSEWHERE?

These trials have been carried out in relatively high rainfall districts close to the coast. The same results will apply generally in the Beaudesert district and other coastal areas of southern Queensland.

As we go further inland to districts such as the Darling Downs, the Central and Upper Burnett and the Callide Valley, we find that the growing season is usually much less humid. Under these conditions crown rust and Victoria blight are not likely to be nearly so serious as they are on the coast. There are some years in which

crown rust is common, but we never hear of it completely ruining a crop, as we do in the higher rainfall areas.

In most years, therefore, there is quite a range of varieties to choose from for inland districts. Naturally, for best possible insurance against crown rust, you should choose the best available resistant variety. At the present time this means Bovah, but Benton should also be well worth a trial as soon as seed becomes available. However, if these varieties are not available, Belar, Mulga, Algerian, Vicland and a number of others will still give good results in the drier areas.

WHERE DO WE GO FROM HERE?

One thing we must remember—that is, that Bovah and Benton will in time lose their crown rust resistance in the same way that Vicland did. We would only be fooling ourselves to think otherwise.

No one knows when that time will be. It may be this year or next year or not for five years or more. However, our Departmental Plant Breeding staff have got to try to make preparations for such a time.

When Vicland suddenly became a susceptible variety, we were fortunate in having Bovah to hand ready to take its place. When Bovah's turn comes to be beaten by a still newer form of crown rust, we hope to have something new to offer in its place.

This problem of developing crown-rust resistant varieties of oats for grazing is recognised as our highest priority job with this crop. For this

Plate 7.

"Bligh No. 1" Oats in the Same Trial as Bovah in Plate 6. "Bligh No. 1," like Vicland and Fultex, is a Victoria crossbred which is very susceptible to this blight.

Plate 8.

A Seed Crop of Oats on the Darling Downs. Queensland-bred oats are not available from southern States, and local seed production has to be arranged in areas like this.

reason a second cereal breeder, Mr. R. F. Moore, has been stationed at Warwick, and his main work will be the breeding of oats for crown rust resistance. We cannot expect new varieties to start rolling off the assembly line immediately, but some progress has already been made in the work.

In the meantime, with the continued help of our farm co-operators at Gympie and Moggill, the trials will be carried on, and any new information will be passed on to farmers as it comes to hand.

HANDBOOK OF PESTS AND DISEASES.

Sales of the Department's handbook on Insect Pests and Diseases of Plants have been very heavy and the stock remaining is not very large.

This handbook describes and illustrates most of the insect pests and diseases of crops in Queensland and gives a guide to control measures.

It is available to primary producers in Queensland only at the concession price of ten shillings a copy. The price to all others is £1 a copy.

Grain Sorghum Stover for Grazing

By R. B. BYGOTT, Assistant Experimentalist, Biloela Regional Experiment Station.

Grain sorghum is generally regarded as a dual-purpose crop, because after the grain is harvested the remaining stubble (or "stover") serves as a valuable grazing material for livestock (Plate 1). This secondary use of sorghum has frequently been considered to be of greater importance than grain production. Even if a crop fails to yield grain, often it can still be turned to good account by grazing the stover.

VALUE FOR LIVESTOCK.

In the course of investigations carried out at the Biloela Regional Experiment Station over the period 1951-1955, it was noted that the average protein content of grain sorghum stover varied considerably with season.

The protein content of stover is apparently determined by several factors, such as seasonal conditions, row spacing of the crop, amount of weathering received, and the nitrate-nitrogen status of the soil. It was found that in a season of insufficient rainfall resulting in a long growing period and poor grain yields, a stover of a high quality was produced. However, following a good season, the protein content of the stover was low.

Plate 1.

Harvesting Grain Sorghum at Biloela Regional Experiment Station. This crop yielded 70 bus. per acre and left a residue of valuable forage.

Assuming that a 5 per cent. level of protein meets the bodily needs of grown animals, sorghum stover should normally provide suitable grazing. Following a good season, however, when the protein content of the stover is generally low, supplementary feeding may be necessary to maintain production from dairy cows unless they have access to a high-protein pasture such as row-cultivated lucerne.

As the farmer may not require the stover for grazing immediately following harvesting, studies were carried out at Biloela to determine whether sorghum stover deteriorated in quality on standing in the field for several months.

It was found that the feeding quality of the stover did not decline appreciably during the months following harvesting, and on occasions it actually improved through crop regrowth. On the Queensland British Food Corporation properties at Peak Downs also, the feeding value of the crop residues was enhanced by the presence of second-growth grain, green shoots from the root crowns and a very rich admixture of native legumes and grasses.

One important consideration in grazing the stem and leaf portion of a sorghum crop is the potential danger of poisoning due to the high prussic acid content of the regrowth.

Regular weekly analyses at Biloela showed that, during the 1950-51 season, the prussic acid level was dangerous at the 10-12 in. stage of growth of seedlings. This stage was reached in late December. Good moisture conditions prevailed during the remainder of this particular growing season and there was a rapid decline in the prussic acid content. At no stage after the initial high reading was the prussic acid content above the danger level, which was assumed to be 20 mgm. HCN per 100 gm. of green matter.

The above results were in contrast to those obtained during the previous season, when only scattered rain fell during January and temperatures were high. The plants were under a definite moisture stress approaching the flowering period and many varieties were still potentially dangerous for 2-4 weeks after flowering.

Results at Biloela and elsewhere have shown that the prussic acid content of sorghum plants may reach dangerous levels for cattle during periods of wilting and regrowth, but not usually when plant growth is normal. Good husbandry technique has been found to obviate most of the danger of grazing sorghum stover. Whatever the prussic acid content of the shoots and leaves of sorghum, the actual effect on animals depends largely on whether they have been grazed elsewhere just prior to allowing them to feed off sorghum plant material.

TABLE 1.

YIELD OF GRAIN SORGHUM STOVER (TONS/ACRE).

Season.	Depth of Wet Soil at Planting.	Row Spacing.			Average.
		42 in.	28 in.	14 in.	
	in.				
1951–52	18	0·88	0·85	0·82	0·85
1952–53	80+	0·92	1·12	1·36	1·13
1953–54	19	0·72	0·68	1·01	0·80
1954–55	39	1·25	1·41	1·40	1·35
Average ..		0·94	1·02	1·15	1·04

FACTORS AFFECTING YIELD.

Investigations at Biloela Regional Experiment Station have shown that yield of stover depends largely on three major factors—

(*a*) Nitrogen status of the soil.

(*b*) Depth of wet soil at planting plus rainfall received during growth of the crop.

(*c*) Row spacing.

The last two factors clearly govern the amount of soil moisture available at critical stages in the development of the plants. It has been shown, moreover, that there is considerable interaction between all three factors. Table 1 illustrates the effect on yield of such interactions on comparable soil types.

Table 2 presents the monthly rainfall during the growing period of all four seasons.

In a good season, such as 1952-53, the narrower row spacings with their higher plant populations produced a greater amount of stover than the wider spacings. However, in a dry season, such as was experienced in 1951-52, the reverse position held.

TABLE 2.

MONTHLY RAINFALL (INCHES).

Season.	December.	January.	February.	March.	April.	December-April.
1951–52 ..	2·32	2·85	2·31	4·71	2·54	14·73
1952–53 ..	3·99	6·74	4·55	2·29	0·28	17·85
1953–54 ..	6·02	2·02	8·15	2·40	0·64	19·23
1954–55 ..	3·21	3·29	6·34	4·34	1·83	19·01
Average ..	3·89	3·72	5·34	3·43	1·32	17·70

FACTORS AFFECTING PROTEIN CONTENT.

The protein content of stover is dependent on several factors, some of which have already been mentioned. The more important of these factors are—

(*a*) Soil moisture at planting plus seasonal rainfall.

(*b*) Nitrogen status of the soil.

(*c*) Row spacing.

(*d*) Stage of growth.

Soil Moisture and Rainfall.

Both soil moisture and seasonal rainfall affect the amount of water available to the crop. Whereas the grain crop requires a good moisture supply in the critical period up to flowering for high yields, both yield and protein quality of stover are influenced greatly by rainfall subsequent to flowering. The rainfall effect on protein value is complicated, however, by other factors such as soil nitrate supply and row spacing.

Nitrogen Status of the Soil.

If a soil has a limited supply of nitrate-nitrogen, good rainfall late in the growing season will produce a greater bulk of sorghum stover but the average content of crude protein per plant will be lower than normal. Conversely, if rainfall is sparse there will be a lower yield of stover but it will have a higher protein value.

A similar kind of interaction exists between soil nitrate and row spacing. Nitrogen deficiency may occur in the narrower row spacings, particularly on poorly fallowed land with a low nitrate-nitrogen content. Early inter-row cultivation in the wider row spacing stimulates soil nitrate production and the crop is benefited thereby.

Effect of Row Spacing.

The effect of row spacing on the protein content of stover varies according to the season. Table 3, showing the available protein per acre for three row spacings and four seasons, illustrates the seasonal fluctuations in protein yields.

TABLE 3.

AVAILABLE CRUDE PROTEIN IN SORGHUM STOVER (LB./ACRE).

Season.	Depth of Wet Soil at Planting.	Row Spacing.			Average.
		42 in.	28 in.	14 in.	
	in.				
1951–52	18	191	143	123	152
1952–53	80+	79	84	102	88
1953–54	19	93	78	95	88
1954–55	39	133	141	122	132
Average ..		124	111	110	115

Over the whole period of investigations the wider row spacings have produced the greatest amount of available crude protein per acre (Plate 2). It is evident, however, that in a good season the narrower spacings produced more crude protein per acre despite their lower content per plant. It is concluded, therefore, that in a good season the narrower spacings will produce more crude protein per acre, but under average seasonal conditions in the Callide Valley the trend is in favour of wider spacings.

Effect of Stage of Growth.

Regular fortnightly chemical analyses of stover were made throughout the 1949-50 growing season. These showed there was a gradual decline in crude protein content from about 16 per cent. in the young seedlings to

Plate 2.

Higher Stover Yields Can be Expected from Grain Sorghum Grown in Rows. This 10-weeks-old crop in 42-in. rows produced only 14 bus. of grain per acre in the poor 1951-52 season but it provided excellent grazing after the grain was harvested.

10-11 per cent., at which level the protein content remained almost constant until harvesting. Subsequently, the level fell away gradually in the stover to 6-7 per cent., and after some months' standing in the field it was finally below the normal requirements of animals.

The general pattern outlined above may vary somewhat with seasonal conditions. In one notable case, late rains promoted a vigorous regrowth of shoots from the crowns. These shoots proved to be of high protein value and brought about a considerable increase in the average protein content of late-season stover.

SUMMARY.

Since the investigations leading up to this article have been carried out at Biloela in the Callide Valley, most of the conclusions reached may apply only to that and adjacent districts. It is apparent, however, that in such areas grain sorghum stover can be a valuable fodder during the autumn and early winter months.

The use of row spacings of 28-42 in. is strongly recommended for the Callide Valley to provide a margin of safety for the moisture requirements of a sorghum crop in an unfavourable season. Under dry conditions the wider spacings have often enabled plants to set a grain crop where closer spacings have entirely failed. Conversely, a row spacing of 14 in. or less, while having greater crop potential under favourable conditions, stands a far greater risk of producing a crop failure during stress periods.

Under conditions of limiting soil nitrate, the crude protein content of the stover varies according to the stage of growth, the density of the crop and the moisture supply, particularly after the grain crop is set. In a good season of high grain yields the stover is usually of low protein value. However with its lasting quality in the field, sorghum stover should normally provide satisfactory grazing. In some seasons, supplementary grain feeding or access to a pasture of high protein content may be necessary for the dairy herd.

MIXED FARMING IN THE ATHERTON DISTRICT.

Recently, a research team from the Department's Economics Section assembled the data needed to advise Atherton Tableland farmers who desire to change over from crop farming to mixed farming. In the survey, the officers examined both the effect of the change-over on the farmers' financial return and the capital and labour commitments it would involve.

The survey team's report points out that the change is a long-term plan for improving the farm's financial return. A farmer can expect little or no improvement in his income for the first two or three years. However, by making the change, it is possible within five to seven years to convert declining yields into a healthy profit.

As to the problems of the new farming system and the change-over period, more labour time will be required for the dairy enterprise than for crop-growing alone. Management, too, will be a much more involved matter than on a cropping farm. There will be little margin for inefficiency.

If any great number of farmers decide to make the change, prices and quality of dairy stock are likely to become important problems. There are indications of a shortage, particularly of adult milking cows.

As the grain-growing side of mixed farming requires a great deal of labour for limited periods, there would be room for contract operations or inter-farm co-operation schemes. Outside help would be necessary for ploughing, planting and harvesting.

The 22-page report discusses fully the problems of management, capital, labour and size of holdings. It analyses the returns from both mixed farming and maize growing and can be used as a guide by farmers interested in altering their farming system. Copies of the report are available to Tableland farmers free of charge from the Department of Agriculture and Stock, Brisbane.

Pig Raising Along the Middle Reaches of the Dawson River

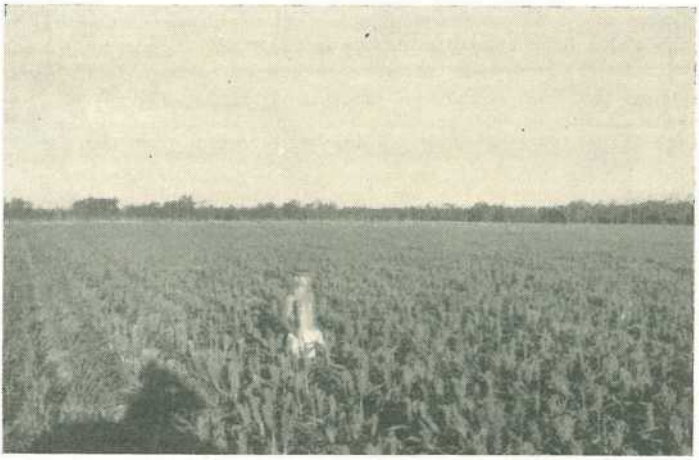
By J. A. CHRISTENSEN, Adviser, Pig Branch.

The increase in acreage of land under cultivation which resulted from the demand for foodstuffs as an aftermath of the war was not overlooked by landholders along the Dawson River valley and surrounding areas. Previously the land was used for raising beef cattle but now much interest is displayed in cropping this fertile land.

The area embraces a belt of fertile country bordering both sides of the Dawson River extending upstream from Baralaba to a point just south of the Theodore irrigation settlement. The country in close proximity to the river is a sandy loam interspersed with sandy ridges and some patches of heavy soil. Adjacent to the river country is the typical heavy melon-hole brigalow country, in which much interest has been shown in recent years.

Following the initial clearing of the land and preparation for sowing, excellent grain crops were grown. However, the grower's path was often beset by the difficulty of transporting the grain over rough tracks which during periods of wet weather were often impassable. As a result, numerous growers considered that a different avenue must be found for disposing of their grain crops. After careful consideration, pig raising on the open range system was decided upon.

There are also isolated localities within this area where pig raising is conducted in conjunction with dairying. Such areas include Moura, Cedars and Theodore. Here we find that dairy cows are kept for the production of cream and pigs are kept on these properties to utilise the skim-milk. Quite a number of these pig raisers grow crops of grain, while others rely on purchasing their grain requirements from nearby grain-growers. However, within these areas we find many farmers raising pigs without the assistance of milk



A Good Crop of Grain Sorghum.

Harvesting Wheat.

by-products. On such properties the grain ration is supplemented with green crops and meatmeal.

A weir constructed across the river at Theodore backs the water up for many miles, thus providing an adequate water supply for irrigation purposes. A central pumping plant delivers the water along channels to the numerous farms in the area. Another weir backs up a large volume of water downstream at Moura. In this locality the settlers have their own individual pumping plants. Such areas have a great scope for the production of green crops, so necessary where pigs are raised without the help of dairy by-products.

Most of the properties have their own breeding stock, though on occasions when feed is in oversupply stores are purchased.

On the grain-growing properties we find a somewhat revolutionary system of raising pigs. In the majority of instances the pig yards on these properties are well isolated from neighbours and as a result the general rule is to allow the pigs free range. Some, however, use a large paddock enclosed with netting wire. Within this paddock subdivision fences divide the larger area into smaller paddocks in which green crops are grown. Oats and wheat are favoured for winter cropping and sweet sorghum for summer green feed.

On occasions the pigs are more or less "let loose" to scavenge an area of grain sorghum stubble following the harvesting of the grain crop. Very often much grain falls to the ground due to shedding when crops cannot be harvested owing to adverse weather, and the pigs make good use of it. At the same time, legumes and other green feed growing amongst the sorghum plants provide excellent cheap feed for pigs.

The growing of sweet sorghum is considered of major importance in this area. This crop is sown about February and is ready for feeding during July and August, when green feed could be scarce in the event of dry weather preventing the sowing of winter green crops. Sweet sorghum is also sown at other times during the summer months and grazed off when 2-3 ft. high. After grazing down, the pigs are removed to a fresh area, allowing the grazed paddock to "ratoon," when a further grazing is

made. This crop is particularly valuable in that the pigs relish it either as green feed or when mature, both the grain and stalk being readily eaten.

Under this system of pig raising a much longer period is necessary to bring baconers up to market weights, though the additional exercise and age materially assist in developing the muscle tissues so necessary for top gradings.

The breeds of pigs in use embrace the Large White, Tamworth, Berkshire, Wessex Saddleback and their crosses. Most pigs are taken on to baconer weights.

Facilities for farrowing sows and pig housing in general are by no means elaborate, as rough bush timber is often used in their construction. In the majority of instances, sows are allowed to farrow out in the paddocks, making their nests of grass. While this system is often frowned upon, it is considered superior to farrowing sows in unsuitable pig houses.

Certain difficulties are encountered under this system of pig raising. Firstly, there are losses due to paddock farrowing. Here we find crows and other pests taking their toll, particularly during the first few days after farrowing. Wild pigs are troublesome in certain areas, particularly towards the Baralaba section. Wild boars fight the herd boars, often with disastrous results. They also mate with herd sows, producing inferior type pigs. Wild pigs cause tremendous damage to fencing, allowing herd pigs to escape. However, they have the advantage of keeping dingoes away from a herd of domestic pigs. Usually a wild sucker pig is captured and fed with the domestic herd and thus proves its worth as a "watch dog."

Floods are troublesome, necessitating the awkward task of shifting pigs to higher ground at such times. A further disadvantage of wet weather and flooding is that it does interfere with controlled mating and the marketing of baconers when ready. Generally following a flood the country is infested with a plague of sandflies, which irritate the pigs. However, wallowing in mud holes affords partial protection from these pests.

Pigs Grazing on Sweet Sorghum.

Effect of Row Spacing on Grain Sorghum Yield

By R. B. BYGOTT, Assistant Experimentalist, Biloela Regional Experiment Station.

While experience has shown grain sorghum to be more reliable than maize in areas of irregular or marginal summer rainfall, it is by no means a certain grain crop even within the 25-30 in. rainfall belt, which normally provides a growing season rainfall of some 14-18 in.

It is considered, however, that 15 in. of water available to the plants during the main growing period of a crop of sorghum should be sufficient to produce satisfactory grain yields. The amount of rainfall required to yield 15 in. of available water will vary greatly according to the district and seasonal conditions, depending on such factors as depth of moisture at planting, evaporation, regularity and intensity of rainfall, and permeability and fertility of the soil.

The ever-present risk of dry conditions being experienced during the growing season makes the question of what row spacing and rate of seeding to use very important. In our choice we are influenced by the variety, the soil and climatic conditions under which the crop will be grown, and the purpose for which the crop will be required.

EXPERIMENTAL RESULTS.

Over the past four seasons row spacing trials embracing spacings of 42 in., 28 in., and 14 in. have been conducted at the Biloela Regional Experiment Station in the Callide Valley of Central Queensland. Alpha grain sorghum, the most popular variety in this district, was used for these trials. Yields of 25-30 bus. per acre are normally expected under reasonable farming conditions in this district, while yields of up to 60 bus. per acre are not uncommon. (The State's average is approximately 20 bus. per acre). The average rainfall for Biloela is 27.83 in. per annum, approximately 70 per cent. of this rain being recorded in the October-March period.

The rainfall records (December to April) for the four seasons in question at the Biloela Regional Experiment Station are given in Table 1.

Grain Yields.

The grain yields shown in Table 2 were obtained in the respective row spacings during the four seasons.

TABLE 1.

RAINFALL AT BILOELA FOR FOUR GROWING SEASONS (IN INCHES.)

Season.	December.	January.	February.	March.	April.	December-April.
1951–52 ..	2·32	2·85	2·31	4·71	2·54	14·73
1952–53 ..	3·99	6·74	4·55	2·29	·28	17·85
1953–54 ..	6·02	2·02	8·15	2·40	·64	19·23
1954–55 ..	3·21	3·29	6·34	4·34	1·83	19·01
Average ..	3·89	3·72	5·34	3·43	1·32	17·70

TABLE 2.

YIELD OF SORGHUM, 1951–1954 SEASONS (BUS. PER ACRE).

Season.	Row Spacing.			Average.
	42 in.	28 in.	14 in.	
1951–52	19·66	23·89	27·65	23·73
1952–53	40·08	41·31	31·34	37·58
1953–54	14·10	14·10	12·00	13·40
1954–55	33·70	32·50	31·50	32·60
Average ..	26·88	27·95	25·62	26·83

Planting Rates.

The rate of planting during each season is shown in Table 3.

TABLE 3.

RATE OF PLANTING.

1951–54 (3 seasons).		1954–55.
Row Spacing.	Planting rate.	
in.	lb./ac.	lb./ac.
42	3½	4
28	5½	5¾
14	10½	7½

Seasonal Influences.

The climatic conditions and other factors affecting crop growth in these trials may be briefly summarised as follows:—

1951-52.—Planted January 14—depth of subsoil moisture 18 in. Crop experienced insufficient rainfall during a prolonged growing period. Good rains in mid-March were of greatest benefit to the later maturing 14 in. rows, which produced the highest grain yield. Grain was already set in 42 in. and 28 in. row spacings when this rain occurred (see Plate 1) but the 14 in. rows probably would never have headed at all had the rain been delayed for a further week or two. Midge damage was severe during April.

1952-53.—Planted November 28—depth of subsoil moisture over 80 in.

Plate 1.

Alpha Grain Sorghum Sown in 42-in. Rows. The soil was wet only to 18 in. at planting time, but in a dry season this crop produced 19 bus. per acre.

The 14 in. plots wilted somewhat just prior to heading, mainly on account of weed competition resulting from showery weather followed by dry conditions early in January. Sufficient moisture was available in the wider row spacings, which had been cultivated.

1953-54.—Planted December 7—depth of subsoil moisture 19 in. Season of high-intensity summer rains which were of limited benefit to the crop. Lack of moisture was experienced just prior to heading. Midge damage was severe on all late-formed heads.

1954-55.—Planted December 21—depth of subsoil moisture 39 in. The relatively dry early growing period experienced caused wilting in the 14 in. plots. The mid-February rains benefited the later formed crop in the 14 in. rows and the overall final yields were approximately the same for all spacings.

DISCUSSION.

As a result of the varying climatic conditions experienced over the four seasons, and the effect of other factors such as midge damage, the average yields in the three row spacings are approximately the same for the period of the experiment. However, the merits of each row spacing in relation to grain production may be discussed as follows:—

42 in.—This row spacing provides a reasonable margin of safety for the moisture requirements of a crop during a dry season. In previous seasons at the Experiment Station such a row spacing has been able to produce a reasonable crop in seasons when closer row spacings have failed entirely.

Inter-row cultivation is necessary during the early stages of plant growth, but the yields obtained over a series of years should more than compensate for the extra costs incurred. Inter-row cultivation also stimulates nitrate-nitrogen production in the soil and improves the penetration of moisture from our high-intensity summer rainfall. The use of this row spacing may be strongly recommended for early plantings from October to December to increase the chances of the crop obtaining sufficient moisture during any dry periods experienced before the onset of the usual wet season rains in late January.

28 in.—This row spacing may be used successfully in early plantings under conditions of ample storage of soil moisture. Under favourable conditions 28 in. row spacing has a greater crop potential than 42 in., but its moisture requirements are correspondingly higher. Once again early efficient inter-row cultivation is very necessary.

14 in.—As the incidence of the early summer rainfall in this district is so variable, using this row spacing for early plantings is inadvisable on account of the greater risk of crop failure during stress periods. For late plantings (January onwards), in which the crop heads are formed during the wet season from mid-February, good yields may be obtained in the absence of severe midge attacks, as under favourable growing conditions this row spacing has a greater potential than the wider row spacings on account of its higher plant population. Early row cultivation with either harrows or combine equipment generally is desirable to eliminate any weed growth which may otherwise reduce yields if dry conditions are experienced. However, many growers are of the opinion that the main benefit of the closer row spacings and heavier rates of seeding is in the suppression of weed growth and the elimination of the necessity for inter-row cultivation.

Plate 2.

Row Cultivated Grain Sorghum is Capable of High Yields. This plot of Alpha in a varietal trial produced 82 bus. per acre.

The more vigorous types of plants in the wider row spacings tend to tiller more freely and to produce larger seed heads (see Plate 2), thus compensating for the higher plant populations obtained by closer spacings. The coming-out of the seedheads is better in the closer row spacings, however, and this tends to promote a more even heading height, which is advantageous from the point of view of harvesting.

The period to full head of the plants in the 14 in. row spacing is approximately one week later than in the 42 in. and 28 in. rows.

SUMMARY.

Row spacings between 7 in. and 21 in. have produced excellent yields of grain sorghum on fertile well fallowed land in a good season in this district. However, the summer rainfall in the Callide Valley is so variable in quantity and occurrence during critical phases of the sorghum crops that the use of a row spacing of 28 in. to 42 in. is strongly recommended to provide a margin of safety of the water supply for the plants during stress periods. Under dry conditions, the wider spacings have often enabled the plants to set a grain crop when closer spacings have failed entirely.

Inter-row cultivations are necessary to control weed growth during the early stages of growth and these cultivations also stimulate soil nitrate production and increase moisture penetration.

A row spacing of 14 in., while having a greater crop potential than either 28 in. or 42 in. under favourable conditions, stands a far greater risk of crop failure during stress periods.

Problems in Pineapple Flower Induction

By J. T. O'ROURKE (Adviser in Horticulture) and H. M. GROSZMANN (Senior Plant Breeder).

Flower induction is widely practised in the pineapple industry. The term refers to flowering which is induced or brought about artificially when the grower wishes it to take place. Several materials can be used for this purpose but the two best known are (*a*) a saturated solution of acetylene gas prepared by immersing calcium carbide in water; and (*b*) the hormone ANA (alpha naphthalene acetic acid) at a concentration of 10 parts per million in water.

These solutions are normally poured into the heart of the plant at the rate of about 2 fluid ounces per plant. In the case of ANA, however, the solution may be sprayed onto the whole plant provided at least twice as much is used.

CONTROLLED CROPPING.

In commercial practice, the grower tries to get the maximum crop from his plantation in the minimum time. In order to do this, he must achieve complete control of harvesting periods.

Essential features of controlled cropping are grading of the planting material and planting it at the correct time of the year—March in the case of tops, and August to September in the case of forward slips and suckers.

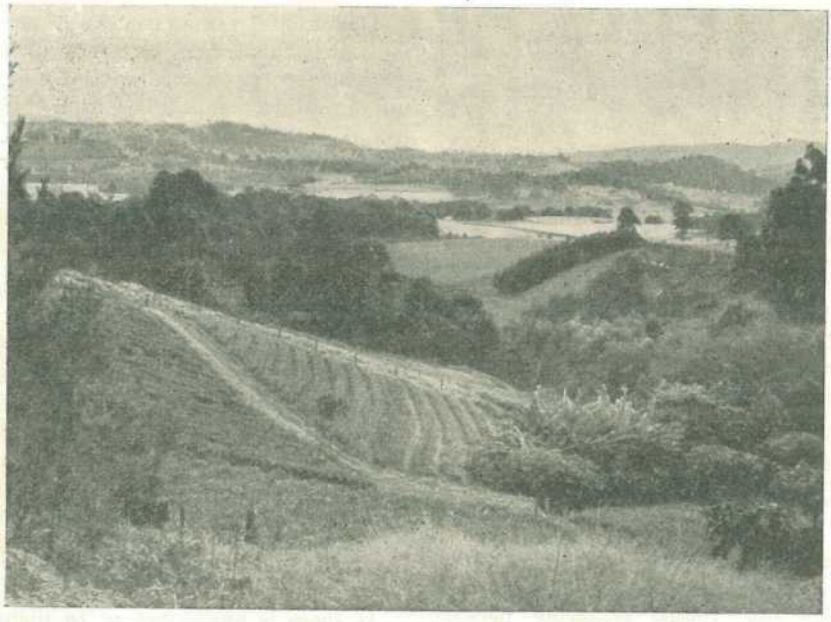


Plate 1.
Pineapple Plantation in the Maroochy Shire.

Even so, there are some seasons in which natural flowering does not occur at the right time although the plants are obviously large enough to bear fruit. The whole cropping programme is then thrown out of gear. Treatment of the crop with a solution of acetylene or ANA at the time when flower buds should be forming in the plants is a precautionary measure which ensures that the crop matures when it is wanted.

Controlled cropping not only means quick returns to the grower but also avoids disruptions to cultural operations and the high harvesting costs which are inevitable when the crop from any given area matures over a period of several months.

ADVANTAGES OF TREATMENT.

Flower induction is a useful tool in the hands of the farmer who wishes to control his crop. It can be used for various purposes, the more important of which are:—

(1) *To ensure harvesting of the plant crop in summer and the production of good sucker growth for the following ratoon crop.*—Plants which "hold-over" and do not mature fruit until winter usually bear few suckers and these are invariably set high on the stem. As a result, partial collapse with its associated wastage of fruit is likely to occur in the ratoon crop.

(2) *To permit the efficient use of labour.*—When "hold-over" crops fruit at the same time as normal crops, insufficient labour may be available to cope with harvesting operations.

(3) *To reduce the amount of winter fruit to a minimum.*—Winter fruit has to be protected from chilling and is somewhat susceptible to the disorder known as black heart which occurs in July and August following periods characterised by low temperatures and overcast skies. In addition, plant crops which fruit in winter usually produce weak sucker growth for the ratoon crop.

(4) *To assist mass selection, which is part of the plant improvement programme on the farm.*—In plant crops maturing fruit during the summer months, the selection of good-type plants for propagation is relatively simple; off-types such as collar-of-slips are then easily recognised.

(5) *To produce the maximum amount of fruit in the final harvest on old plantings which are near the end of the cropping cycle.*

PROBLEM CASES.

Flower induction or, to use a colloquial term, "gassing" is obviously a great asset to the grower who has a good knowledge of the pineapple crop. Nevertheless, there are still many who hesitate to "gas" either because they are not aware of the value of flower induction or because they have heard of mishaps in the field where it has been improperly used.

Operations such as "gassing" must be viewed in perspective. If fertilizer is inadvertently placed in the hearts of pineapple plants, some injury will result. However, no grower would contemplate the omission of fertilizer from his production programme because it is occasionally responsible for damage to the crop.

It is sometimes claimed that "gassing" reduces the size of the fruit, and it is true that small fruit may be harvested from a "gassed" crop if treatment is carried out when the plants are not large enough to bear fruit of average weight. As an appropriate guide, it can be assumed that a plant is large enough to gas when its longest leaf is 30 in. long. Ratoon suckers may be smaller.

If there is any doubt as to plants being large enough to "gas" in May for a crop in the following summer,

it is better to defer treatment until the late September-early October period and produce an autumn intermediate harvest between May and June. If such crops are allowed to fruit naturally and "hold-over" for a winter harvest, sucker growth may be weak and the production of the ratoon crop is then delayed for a full year.

At certain times of the year, pineapple fruits are prone to various defects. Thus, black heart is frequently prevalent in the July-August period, whilst splitting of the fruit followed by yeasty rot is sometimes troublesome in November and December. When crops are "gassed" to produce fruit at these periods of the year, normal seasonal defects may be responsible for wastage. The defects, however, are not the result of "gassing"; they are natural phenomena associated with fruit maturing under particular climatic conditions.

FRUIT SIZE.

Provided the pineapple plantation is vigorous and the plants are large enough for treatment with acetylene or ANA solutions, the size of the harvested fruit should be satisfactory. However, as the plants are treated some six to nine months before harvesting, weather conditions subsequent to treatment inevitably influence both the size and the weight of the fruit at the time of picking. Dry weather after bud initiation, for example, may reduce the size of the fruit. Fruit which develops from a natural flowering is subject to the same hazard.

Plate 2.

Flower Induction. Plants "gassed" prematurely. Note the small fruit on elongate stems.

Plate 3.

Pineapples at the Right Stage of Growth for Treatment with Acetylene or ANA Solutions to Induce Flowering.

The effects of adverse weather during the period of fruit development can, however, be reduced to a minimum by using vigorous planting material, establishing it at the correct time, applying fertilizer regularly at the prescribed rate, and keeping weeds under control. If plantation management is efficient, flower induction is as reliable as any other routine operation on the farm.

FLOWER INDUCTION TREATMENT TIMES.

In southern Queensland, flower induction may be carried out at the following times:—

(1) *In May or early June for a summer (February-March) harvest.*—This should be normal practice in the plant crop on well-managed plantations.

(2) *In September or early October for an autumn intermediate (May-June) harvest.*—This is the usual method of dealing with "hold-over" plants in a plant crop which has been allowed to flower naturally in early spring. "Hold-over" plants should be "gassed" as soon as natural flowering is sufficiently advanced for them to be distinguished. If treatment is delayed beyond mid-October, the plants will fruit in June and sucker poorly.

(3) *In December or January for a September-October harvest.*—This practice is applicable to ratoon crops only and treatment is restricted to the large suckers.

(4) *In February for a November harvest.*—Treatment in February is not normally desirable, as the quality of the fruit harvested in November is generally poor. However, some growers who are interested in the southern fresh fruit markets adopt this practice.

Minor adjustments in these treatment times are needed to compensate for the aspect and elevation of the plantation, both of which affect the earliness or lateness of the crop in relation to the general average for the district. Areas which are naturally late will need to be treated earlier.

Raising Tomato Seedlings

By A. R. CARR, Experimentalist, Horticulture Branch.

Healthy plants are essential for the production of payable tomato crops and a variety of methods are used in commercial practice for raising seedlings.

DIRECT SOWING IN THE FIELD.

Although direct sowing into the field eliminates the transplanting "shock" associated with normal methods of crop management, this practice has some drawbacks.

The whole area assigned to the crop must be kept free from weeds and regularly watered until the seed has germinated and the seedlings are established. Where diseases are troublesome, the application of fungicides to the young plants is time-consuming owing to the large area which has to be covered. Further, in some districts, such as Stanthorpe, it is much more difficult to protect field-grown seedlings against late spring frosts than it is to protect plants of the same age in a seedbed.

Nevertheless, it is worth noting that direct sowing in the field has been practised in parts of the Lockyer Valley for some time past and that it is becoming increasingly popular in the United States.

Plate 1.

Tomato Crop in the Redlands District. Crop about half grown and managed on the cradling system.

Plate 2.

Open Seedbed. Seed is sown in drills about 6 in. apart on raised beds.

Tomato crops grown from seed sown in the field usually bear fruit earlier than those established from transplanted seedlings.

OPEN SEEDBEDS.

The normal practice in Queensland is to sow tomato seed in rows about 6 in. apart on raised seedbeds. This method of growing seedlings is popular because of the ease with which the plants can be watered and cared for up to the transplanting stage. However, it has some disadvantages, not the least of these being the damage caused to the root systems when the plants are lifted prior to transplanting.

Transplanting "shock" is considerable even when the seedlings are hardened-off before they are removed from the bed. In addition, development of the bushes in the field is rather slow and the plants are somewhat prone to some diseases.

TUBE SOWING IN BEDS.

Some of the advantages of direct sowing in the field and sowing in open seedbeds can be obtained by growing seedlings in tubes, pots and similar containers. Each seedling can then be transplanted with a column of soil around the roots. Where this system is practised, more seedbed space is needed, the soil for the tubes must be specially prepared, and transplanting operations are slowed-up to some extent.

Costs of tube sowing in beds can be reduced to a minimum by using old jam tins with the top and bottom removed and a slit down the side. Seedlings grown in such containers are transplanted to the field with little disturbance to the root system and transplanting "shock" is therefore reduced to negligible proportions.

Cardboard cups are sometimes used in place of metal tubes. However, seedlings grown in these cups occasionally show the yellow leaf symptoms of nitrogen deficiency; bacteria attack the cardboard and compete with the seedlings for the available nitrates in the soil.

Earthenware pots are seldom used for raising seedlings on a commercial scale. They are costly to buy and difficult to handle because of their size and weight. Plants grown in them are vigorous but some root damage at transplanting is inevitable,

as it is difficult to remove the soil together with the seedling in one piece.

In the tube method of raising seedlings the structure of the soil is important. A heavy-textured soil tends to cake after watering and a light-textured soil falls away from the root system at transplanting. A suitable mixture is usually obtained by trial and error methods, seived farmyard manure being incorporated into a sandy loam until the soil is slightly spongy. Such a mixture allows good water penetration and yet remains compacted when removed from the container.

When tomato seedlings are raised in tubes, the containers must be set into the ground with the top at the same level as the surface of the bed; drying of the soil between waterings is excessive when they stand above ground level.

SOWING IN "FLATS."

The practice of raising tomato plants in seedbed "flats" is more or less confined to nurseries. It has, however, the merit of simplifying the transport of seedlings to their field positions and appeals to some growers.

Small flat boxes about 4 in. deep are constructed with one detachable side and filled with soil. The seed is sown at about 3 in. spacings both ways. The soil between the plants is cut into cylinders with a sharp knife just prior to transplanting and the root system of each seedling is therefore enclosed in soil when it is set out in the field.

As in the tube method of raising seedlings, the soil is specially prepared for "flats." Even when the soil texture is satisfactory, there is still a fair amount of root damage at transplanting, although the setback to growth is much less than that in seedlings transplanted from open beds.

STARTER SOLUTIONS.

Starter solutions contain readily available plant foods and are sometimes employed to tide the seedlings over the period between transplanting and the re-establishment of the root system. In Queensland, where basal

Plate 3.

Tube Sowing in Beds. The soil has been removed to give access to the tubes.

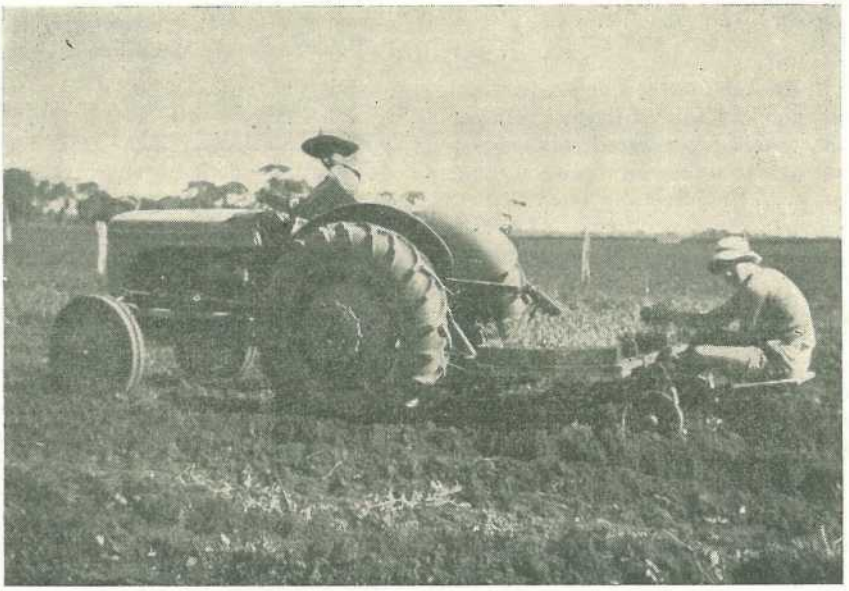


Plate 4.
Machine Transplanting of Tomato Seedlings from "Flats".

fertilizers are usually applied to commercial crops at transplanting, the results obtained with starter solutions have not been impressive.

One of the best known of these solutions has the following formula:— 1¼ lb. monopotassium phosphate, 1¼ lb. diammonium phosphate, 100 gall. water. Each seedling receives one pint of the solution as soon as it has been transplanted into the field.

AFTER-CARE.

Tomato seedlings grown in tubes and flats transplant easily but some precautions are needed when the seedlings are raised in open beds.

In hot weather, it is best to wait until the late afternoon before transplanting; temperatures are then falling and the risk of plant collapse is reduced.

In hot weather it is sometimes necessary to protect the seedlings from direct exposure to the sun for a few days after transplanting. A piece of case timber pushed into the ground alongside the plant is satisfactory for this purpose if it is placed at such an angle that the seedling is sheltered during the middle of the day when temperatures are at their peak.

HUNTING SEASON OVER.

A reminder is given that the shooting season for scrub turkey throughout the State and for quail in south-eastern, central and northern Queensland ended on September 30. Quail may still be taken as game birds in western Queensland.

Molybdenum as a Plant Nutrient

By A. McDONALD, Assistant Soils Technologist.

Molybdenum, along with copper, zinc, boron, iron and manganese, is one of the micro-nutrients, which are also sometimes spoken of as "trace elements" or as "minor elements." This last term is misleading, for although these elements are required by plants in only very small quantities, they are as essential to healthy growth as are nitrogen and phosphorus, which are required in much larger amounts.

In nature, molybdenum occurs mainly in the mineral molybdenite and also in wulfenite. In acid soils it is less available for uptake by plants.

Molybdenum is essential for the metabolism or conversion of nitrogenous substances from one form to

Plate 1.

Whiptail of Cauliflower Caused by a Deficiency of Molybdenum. Normal leaf on left; leaf from whiptail plant on right.

another within the plant and for nitrogen fixation in legumes by root nodule bacteria.

Deficiency.

Molybdenum deficiency is mainly associated with acid soils and can in some cases be corrected by liming. Otherwise it is necessary to add it to the soil, in which case it is normally supplied as either sodium molybdate or ammonium molybdate.

Of all the trace elements, molybdenum gives the most spectacular response for the amount applied. In pastures, where it is required by clovers, medics and other legumes for effective nodulation and fixation of atmospheric nitrogen, as little as 1-2 oz. per acre is sufficient. (A healthy clover plant contains only about 2 parts per million of molybdenum in the dry plant material).

Deficiency of molybdenum has also had a severe effect on yields of small-crop farmers and citrus growers. For vegetable crops, seedbed treatment is effective, using 1 oz. of ammonium molybdate or 1¼ oz. of pure sodium molybdate in 10 gallons of water. This is watered on to the plants at the rate of 1 gallon per square yard, usually 7-10 days before transplanting.

A foliage spray is used for citrus and for field crops showing symptoms of molybdenum deficiency. A solution of ½ oz. ammonium molybdate or pure sodium molybdate in 3½ gallons of water, sprayed on in sufficient quantity to wet the foliage, should be used.

An effective method of correcting molybdenum deficiency in pastures is to topdress with a mixture of sodium molybdate and superphosphate. This mixture can be purchased locally.

Deficiency Signs.

Whiptail in cauliflowers, in which the leaf blade is much reduced in size and very irregular in outline, is a familiar symptom of molybdenum deficiency. Symptoms in other plants are cupping of the leaves, mottling between the veins and marginal wilting of lettuce, cabbage, swede turnip, broccoli, tomato and beet; yellow "leaf blotch" of citrus; leaf scorch and yellowish-greening of clovers and lucerne, and marginal yellowing and death in cucurbits (cucumbers, pumpkins, chokos, etc.).

The yellowing present in affected plants is associated with the inability of the affected plant to utilise nitrates taken up from the soil. Knowledge of this fact leads to the common chemical test for molybdenum deficiency, in which leaf tissue from a suspected plant is tested for an excess of nitrate. Corrective treatment as outlined above can then be applied.

Care should be taken to apply only at the recommended rates, as excessive molybdenum is poisonous to plants, and excessive molybdenum in pastures can cause chronic disorders in stock.

PLANTS FOR NEW SOUTH WALES MUST BE DIPPED.

A New South Wales stock regulation requires all plants and planting material sent from Queensland to or through New South Wales to be free of soil and to be dipped in an approved insecticide under the supervision of an officer of the Queensland Department of Agriculture and Stock.

Nurserymen and other interested persons are advised to consult the nearest officer of the Department before attempting to send or take material into New South Wales.

Marketing Facilities for Fruit and Vegetables in Cities Overseas

By H. S. HUNTER, Director of Marketing.

(*Continued from page 557 of the September issue.*)

THE PROBLEM IN SOME OTHER PLACES.

Very large cities, such as New York and London, with completely hemmed-in, old-style markets, appear to face an insoluble problem. New York's Washington market, occupying several city blocks at the lower eastern end of Manhattan Island, is hemmed in by the river and by the densely built financial centre surrounding Wall Street. However, the market's operations are aided by the availability of extensive floor space on the neighbouring roofed and enclosed wharf buildings of several railroad companies, where daily auctions of fruit and vegetables are conducted.

London's Covent Garden has long since burst beyond its original confines into adjacent areas, the buildings and streets of which appear quite unsuitable for the great volume and nature of the business done there. Selling is done mainly by private treaty.

Whilst Covent Garden may superficially appear to lack adequate planning and organisation, the countries of the European continent, which compete with their produce in that important market (for example, The Netherlands) have obviously well designed marketing facilities and orderly systems of marketing.

Plate 18.

Auction Buildings Adjacent to New York's Washington Market.

THE NETHERLANDS.

Amsterdam.

The Amsterdam Central Vegetable and Fruit Market includes an auction mart and wholesale and retail facilities. It is run by the municipal council as an independent concern. Construction of the market on its present location was begun in 1930. It is interesting to note that the main reasons for its relocation then were "(i) insufficient space; (ii) the lack of a railway siding resulted in transport costs being unnecessarily high; (iii) ordinary town traffic moving through the market made conditions very unsatisfactory." It might also be noted that when plans were being prepared, features regarded as essential were—(*a*) connection with the railway system, (*b*) accessibility for barges of ample draft, and (*c*) a large enough area to allow for further expansion and adequate parking.

Amsterdam market authorities today regard it as being very fortunate that construction of the market took place at a time when building costs were comparatively low and when finance was readily available at an interest rate of 3 per cent. Naturally these factors would exert a very favourable influence on the costs of management—possibly too, they may be responsible in part for the fact that in Amsterdam consumer prices of vegetables are usually 1 to 2 cents lower per unit than elsewhere. However, this saving is generally regarded as the effect of reducing transport costs to a bare minimum.

A more recent development involves the speedier handling of produce at the market by using elevators and belt conveyors to shift the goods from the barges and railway vans to the warehouses. Not only is a saving in time effected but the amount of labour required is also less.

The Dutch Auction.

Perhaps the most interesting feature of produce marketing in the Netherlands is that it is primarily grower organised and based upon the universal use of the auction system of selling. Today the whole country is served by a network of auction marts which handle practically the whole national output of fruit and vegetables. This achievement follows a period of apparently vigorous development over the last few decades, for records show that the auctions date from 1887 and the co-operatives from about 1896.

The number of auction marts operating was in the vicinity of 180, which included a small number run by private concerns. The co-operative mart societies established an overall organisation called the Central Bureau of Horticultural Auction Marts, the function of which was primarily to look after the development and administration of the auctions. In this regard, the Bureau makes available to the auction societies expert advice on all matters relevant to their work. It also undertakes advertising and sales promotion both at home and abroad. Quite early in its history, the Bureau concerned itself with grading and packing standards as a basic essential for good marketing, and today virtually all the produce distributed must conform to certain standards.

Most of the auction marts are located in the producing districts, where they are mainly concerned with the produce peculiar to those districts. Naturally a wider variety of produce is handled in the so-called consumption auctions situated in or near the large towns, since they draw on a number of different producing areas. Where it is necessary to supplement growers' deliveries, "imports" are made from distant auctions, but this produce does not usually pass through the local auction, being brought in by merchants and passed direct to the retailer.

In practice, the produce is delivered to the auction of the grower's choice, packed and graded ready for sale either by the grower himself or by the co-operative mart's own facilities. When the produce is received, growers' descriptions are first checked and the produce displayed for appraisal. The actual auction is usually conducted in a special room by the electric clock system.

The apparatus used is merely a large clock face divided into sections representing money values through which a pointer revolves from a high price to a low price. Room is left between the clock installation and the buyers' seats for the display of samples. The quantity and quality of each lot is announced and the pointer set in motion. As soon as the pointer indicates a price a buyer is prepared to pay, he presses an arrestor button which both stops the pointer and illuminates a number indicating the button pressed and thereby the buyer. These details are noted by the auctioneer and the pointer reset.

Auction charges are usually just sufficient to cover operating expenses and establish reserve funds for maintenance, extensions and equipment. A large export auction can often operate for as little as 1 or 2 per cent. of gross turnover, although fruit auctions seldom work on less than 4 per cent. Before comparing these commissions with those obtaining in Australia, it should be noted that the buyers at auctions are mostly the wholesalers, who in turn resell to the retailers.

Finance for the establishment of auctions is generally obtained from the banks, which gives some idea of the relative soundness of this form of organisation in the Netherlands.

SOUTH AFRICA.

South Africa also has the problem of market congestion in its larger cities of Johannesburg and Cape Town.

Johannesburg.

The Johannesburg Municipal Produce Market (also known as the Newtown Market) covers an area of about 14 acres, on which are the market buildings, railway sidings for fruit, green and dry vegetables and poultry, a market square and the "outspan." The outspan is a large open space reserved for local farmers who sell direct to the public from their farm waggons. A square adjacent to the market buildings provides parking space for 500 vehicles.

The Johannesburg Market has the unique feature that produce consigned to it is sold by auctioneers employed by the Municipality, with the exception of deciduous fruits and citrus, which are subject to price control from time to time and are sold through statutory marketing boards. The Market itself is organised in an unusual manner

in that it is divided into commodity sections—for example, pineapples are confined to one section. So are peaches, tomatoes, watermelons and potatoes, etc. Minor commodities, such as root vegetables (other than potatoes) are sometimes grouped. The Johannesburg Market supplies deciduous fruits (which are controlled by the South African Deciduous Fruits Board) to Bloemfontein and Pretoria. Grapes from the Cape, also under Board control, come into competition at Johannesburg with uncontrolled grapes from the north-west Provinces.

There are 40 licensed Commission Agents in the market who receive produce on consignment. Such produce is assembled according to its commodity and placed with similar produce consigned to other agents on the section of the market allotted to it. Whilst the agent is not permitted to sell, he looks after the interests of his principal in all other respects. He may place a reserve on the offering. His rate of commission is 7½ per cent.

The Market Department employs a large staff, including 40 auctioneers, with an accounting division consisting of accountants, tellers and clerks. The market is controlled by a Market Master, who has the assistance of an Assistant Market Master.

Auctions are conducted simultaneously on different sections, but in rotation in respect of each agent's produce and in his presence or in the presence of one of his staff. The successful bidder may take all or part of the offering. Details of the sales are recorded in triplicate by the auctioneer. One copy is given to the buyer, who presents it with payment to a market teller in exchange for a receipt which authorises his removal of the goods purchased by him. In some instances 24 hours' credit can be arranged provided security is lodged. The market staff makes payment to the agent, who in turn remits the net proceeds to his principal, the grower, with a copy of the auctioneer's slip, which carries detailed information on the transaction.

The Market Master (Mr. R. F. Thurgood) informed the writer that the authorities are not entirely satisfied with the auction system. Some abuses have crept in, including a practice known as "booking up," which usually involves purchases by the agent on behalf of wholesalers, retailers or other buyers. It seems that permission for buyers to delegate their authority to an agent was granted during the war years, when there was a shortage of personnel, and it has persisted ever since. The Market Master takes the view that with 40 registered commission agents there is ample opportunity for buying and selling. No objection is raised to a commission agent bidding on or buying any produce offered, provided that it is not the produce of his principal and also that it is not "booked up."

The Johannesburg Newtown Market also has a retail division, the main feature of interest being its size, which is 36,000 sq. ft. Facilities comprise 262 table spaces for local market gardeners and farmers, 44 retail fruit and vegetable stalls and 48 shops licensed to sell all kinds of foodstuffs. This does not prevent householders and small buyers from bidding at auction in the wholesale market for case lots.

The Newtown Market is not particularly old so far as markets are concerned, as it was opened in 1913 as a newly constructed unit. However, the facilities have become quite inadequate to cope with the

volume of business transacted, and the solution of the problem has become even more urgent because the Railway Administration cannot continue to serve the existing site for an indefinite period.

Investigations reached a point in February, 1951, when a Technical Committee set up by the municipal authority recommended that the produce market be moved to a site at Langlaate which was about 4½ miles from the centre of the city. However, this recommendation was not acted on by the Council although the Minister for Agriculture was prompted in July of that year to appoint a committee to enquire into the functioning of South African municipal markets generally.

The report to the Minister of Agriculture indicated that produce marketing should be the subject of national policy. However, the committee were somewhat divided on how the principle should be put into effect. Majority decision was to set up a National Advisory Marketing Board to improve marketing conditions generally and to allow the Board to operate for five years to prove its worth before making a final decision on the transfer of powers. The minority group, on the other hand, claimed that only through the transfer of Provincial powers to the Central Government could a national policy be formulated and the necessary machinery created. Consequently, this group recommended that the responsible parties confer, and that as soon as agreement was reached the existing powers of the four Provinces be transferred to the Central Government, either by mutual agreement or by legislation, and the control of the municipal markets be entrusted to the Minister of Agriculture.

Up to September 1954 no decision has been given by the Minister of Agriculture, and because of the nature of the recommendations, the local authorities have deferred major decisions regarding improvements to existing markets or the building of new markets.

Cape Town.

Cape Town (population 800,000) has a wholesale market situated beside a main thoroughfare (Sir Lowrie Road) half a mile from the city, which is so congested that much of the produce is displayed for sale outside of the market buildings.

It is proposed to move this market, which occupies an area of 9 acres, to a 67-acre new site situated on the Cape flats at a distance of six miles from the present market. The selection of the new site was aided by the fact that the city, which is expanding, can move only in that direction because in other directions lie the sea or Table Mountain. According to the Market Master (Mr. P. W. Venter) the City Council was guided by the following considerations, when selecting the new site:—

(1) It is as near as possible to the geographical centre of the population of the peninsula, which with the city of Cape Town has a total population of 1,500,000.
(2) All arterial roads meet near this spot.
(3) The market can be provided with rail facilities.
(4) The City Council owns the land, which is level, of adequate area, and suitable for a market which can be so sited that inward traffic can be received on one side and outgoing traffic can depart from the other.

It is intended to keep construction costs down to about £¾m. and retain sufficient land so that additions can be made in the years to come.

Unlike the Johannesburg Market, in the Cape Town Market the agents have their own sections. Selling is by private treaty and by auction. Auction does not commence until 11 a.m.; consequently the first selection is made by the private treaty ("out of hand") buyers. Exceptions are bananas and poultry, which are sold by auction only.

Auction is conducted by auctioneers employed by the market authorities, as in Johannesburg. Only one rostrum is used and agents must bring before it from their sections samples of the produce to be sold. Whether sales are made by private treaty or by auction, City Council employees in the market collect the money from the buyers and pay the agents as in other South African markets.

RELOCATING THE MARKET.

Where it has become necessary for a city to relocate its wholesale fruit and vegetable market, the factors which must be taken into consideration in selecting a new site may be taken from the following summary of the contents of the foregoing sections of this report.

It is important that the topography of the land and its approaches be such that an up-to-date market can be developed thereon without creating traffic bottlenecks or detracting from the close cohesion of its parts which is necessary for the institution to perform efficiently its chief function of determining market price.

All too frequently the ideal site is not available and consequently careful and exhaustive enquiry must be made, with an estimation of the cities' needs for many years in the future, before the best available site can be decided upon. The economics of the project also must be taken into consideration if the new market is to be self supporting without placing too great a burden upon the community.

Area of Land Required.

The exact amount of land required would depend to some extent on the shape and physical features of the site because of their influence on layout. Also important in this regard is the location of the railway facilities, as they must enter the site.

The U.S.D.A. has adopted a factor of 10 acres per 100,000 of the human population to be serviced by the market, but because of increasing efficiency in the use of facilities the figure is shaded as the population gets high.

We have seen that Atlanta (with a population of 500,000) erred by ignoring the U.S.D.A. recommendation of 75 acres and relocated on an area of 16 acres. Indianapolis (450,000) has set aside 67½ acres; Toronto (680,000) 50 acres, and Cape Town (800,000) 67 acres.

Other estimates of the area required include Boston (2,000,000) 170 acres, San Antonio (500,000) 65 acres, and Louisville (500,000) 30 acres.

At first glance some of these estimates appear to be very high, but allowance should be made for the size of the community catered for and the wide scope of business concentrated in the market. For example, the population of the metropolitan area of Boston, including the adjacent cities and towns within a radius of about 12 miles, as published by the market survey authority in 1949, was given as 1,948,647. Moreover, the new market was planned to accommodate a large retail centre and such wholesale groups as fruit and vegetables, meat, dairy products, poultry and egg, fish, frozen foods and dry grocery. Also provided for were a vehicle service station and rail facilities, including a large shunting yard and a number of lines for holding trucks and the sidings at the market platform. It was estimated that 125 acres were required to meet current needs and that an additional 45 acres should be obtained for future expansion. In practically all cases the area contains provision for a farmers' market.

In the case of San Antonio, the market also functions as an important concentration point for a relatively large volume of fruit and vegetables from various areas of production in Texas. The area of 65 acres was based on the following facilities: Sales sheds for farmers and truckers; stores for produce wholesalers; offices for brokers; a combination packing and buyers' shed and icing station; an office building containing space for a restaurant, communications centre, bank, barber shop and related concessions; rail connection with the stores and packing shed; team tracks; and parking area. Poultry and egg wholesalers were the only group provided for apart from the fruit and vegetable trade. It was estimated that a further 15 acres would be required if wholesale grocers and allied industries moved to the new market area.

While it might appear that some provisions for future development were rather extravagant, committees acted on the assumption that the construction of a new wholesale market tends to increase land values, thereby making it more expensive to acquire land needed to enlarge facilities in later years. At the same time, it was considered that investment in land was more likely to appreciate than depreciate over a period. Experience appears to have endorsed these views and it is a widely held opinion that it is far better for a market to have too much land than not enough.

Selection of a Market Site.

In selecting a market site, consideration should be given to all the groups using the market, but as the interests of buyers and sellers are more likely to be directed towards efficient marketing, they should be given some prominence. To reach a conclusion as to the best place to build a market, six principal factors should be considered.

(1) *Convenience for local buyers.*—The ideal location from the point of view of local retailers, restaurants, hotels and institutions would be at a point that could be reached in the shortest average time from all their establishments or places of business. This point normally would be the geographic centre of buyers if from it satisfactory streets and highways radiate in all directions.

(2) *Convenience for out-of-town-buyers.*—As far as out-of-town buyers are concerned, the ideal site would be roughly located by an analysis of the volume and direction of out-of-town traffic. However, the final choice would depend upon the degree of accessibility or relative freedom of movement between the market and the various points of exit. It will be appreciated that to out-of-town buyers who have to travel a considerable distance to the city, any additional travel required after they reach the city will not be important. In fact, the additional distance might be particularly unimportant to them if they are able to avoid traffic congestion in reaching the new market and can get from it all needed products.

(3) *Convenience for rail receipt.*—The necessity for rail connection with the market is almost axiomatic with market authorities in the U.S.A. To some extent this may be because in the past the railways have provided a good deal of the market facilities in use and have handled a large proportion of the total produce tonnage. However, if any proof is needed, it is perhaps provided by the unanimity of opinion expressed in its favour by market experts in other parts of the world and the cold economic facts of the cost of the additional handling and transport entailed when the market and rail terminal have separate locations. It is evident then that where a large volume of rail traffic occurs, it is desirable to bring rail tracks into the market area so that the ideal site will be one on or near a railroad.

(4) *Convenience for motor-truck receipts.*—The best market location for motor-truck receipts would be indicated by an analysis of data regarding volume classified according to direction of entry. However, it would also be important to consider the situation in relation to circumference highways.

(5) *A location that will avoid non-market traffic.*—The movement of produce at wholesale necessitates the use of many trucks and other vehicles and invites traffic congestion. Thus, it is obvious that the market should be located in an area reasonably free from non-market traffic or where the market may be fenced and non-market traffic excluded.

(6) *Availability of land at a reasonable cost.*—For a proposed wholesale market, the cost of the land on which the proposed market is to be developed, together with the cost of placing the land in condition for construction, will have a definite influence on the financing of the project and upon the amount of rental income necessary. Therefore, principles to keep in mind when selecting a site are—(i.) the avoidance of areas where land values are unusually high, and (ii.) the desirability of not procuring land on which there are now buildings of other industries which would have to be razed in preparing the land for construction.

Comparison of Sites.

In practice, the selection of a market site usually involves making a choice between several different locations. So long as the selection is in the first instance limited to those locations which meet the estimated space requirements, the comparison and evaluation can effectively be made by giving each site a rating in respect of each of the six factors

outlined above. Needless to state, the total rating given each site should be used only as a guide, since a low rating for any one of the major factors may require that a site be eliminated from consideration.

The initial comparison of market sites might not point to any one location as being markedly superior; it is possible that two or three might seem to offer a similar degree of convenience and practicability. In this event, further comparisons could be made with regard to total cost and potential benefits. However, even if further comparison was not necessary, it would still be desirable for both these aspects to be investigated prior to market development. The likely total cost would determine the feasibility of any project, whereas an accurate assessment of what savings may be realised would indicate its merit.

Total cost would naturally include the cost of land placed into condition for building, the cost of the buildings and the cost of other improvements. Also, this information should be supplemented by estimates of operating costs, annual amortisation payments, and rentals and fees which would have to apply if operating costs were to be met from revenue.

With regard to amortisation, current practice in the United States is for new markets to be self-liquidating. The period over which the investments are amortised is what is considered to be the useful life of the facilities, generally about 30 years. Where it seems improbable that the value of the land will depreciate, it is usual to charge only interest on the investment in land rather than to amortise its cost.

In assessing the benefits of a proposed market, the general avenues for saving are:—(1) Rent for store facilities; (2) cartage to stores and to rail; (3) loss by theft and breakage during handling operations; (4) loss by spoilage and deterioration due to inadequate facilities; (5) labour costs; and (6) value of time lost through traffic delays to both buyers and sellers. The increased capacity of the proposed development can also be expressed in definite terms, but other benefits accrue which are not so easy to measure—for example, the advantages to the city through greater freedom of traffic and improvement in sanitation.

Some surveys made in the United States have dealt with the questions of who should build and manage the market, and finance. As these questions must eventually be considered whenever a change in market location is contemplated, and in order to complete the foregoing information on market development, the relevant details have been extracted from the survey of the Indianapolis produce market and are summarised in Appendix B.

ACKNOWLEDGEMENT.

Much of the information contained in this report has been gleaned from material made available by officers of various organisations, private, municipal and governmental, that are connected with produce marketing.

APPENDIX A.

EXTRACTS FROM "LONG-HAUL TRUCK TRANSPORTATION OF CALIFORNIA FRESH FRUITS AND VEGETABLES."

Equipment Used.

For long-distance transportation of fresh fruits and vegetables, the operating costs of very large units are lower than the costs of smaller units by such a margin that only large-scale equipment is used.

Associated Facilities.

Efficient truck operation requires loading docks at pickup and delivery points. Terminals are needed where assembly, distribution, or trans-shipment are common.

Mechanics of Truck Movement.

Very frequently, truckers will pick up their load at a number of scattered points rather than have the entire cargo assembled with smaller vehicles to be loaded at one point. The trucker's willingness and ability to pick up loads this way is among his important competitive advantages over railroads.

Refrigeration Equipment.

Ice is the standard refrigeration material in produce transportation. Trailers used for produce hauling are designed with bunkers in the nose, holding up to 3,000 lb. of ice plus 10-25 per cent. of that weight of salt. In addition, snow or chopped ice may be blown in on top of loads to provide extra cooling or to create the moist condition favourable to preservation of quality. Circulating fans or air vents are used to circulate the cool air, and canvas ducts are used to improve its distribution.

Dry ice can be used in place of "wet" ice, although it is more expensive and not so widely available and adequate control of temperature variation has been hard to obtain. Its widespread use depends on development of satisfactory temperature control and lower costs. Dry ice has the additional advantages of lower weight and dryness, which make it easier on the truck equipment. With salty wet ice, moisture corrodes the truck body and eventually gets into the insulation, greatly reducing efficiency. Dry ice is widely used for frozen commodities, where temperature variation is not a problem provided the load is cold enough.

Mechanical refrigeration is also common. Some mechanical refrigeration units are small and merely supplement other means of cooling or delay the inevitable rise in temperature long enough for the truck to arrive at its destination without too much loss from deterioration. Other refrigeration units have a capacity equal to four or five tons of ice and are capable of maintaining near-zero temperature for considerable periods of time. Such units are used with trailers insulated to meet the stringent requirements of frozen foods, concentrated juices or meats. They more than meet the requirements for fresh fruits and vegetables.

Precooling.

Precooling is especially important in truck shipment, since truck refrigeration units are often just barely adequate and trucks are often loaded in ways which result in poor air circulation.

What Users Said.

Claimed advantages to shippers of using trucks were:—

(1) Multiple pickups and deliveries can be arranged with trucks where they could not be arranged with rails. Split and mixed load arrangements are often taken by truckers without extra charges which railrods would require.

(2) Frequently, a truck can be obtained for loading more quickly than a railroad car.

(3) Fruits and vegetables shipped in trucks often arrive in better condition because of speed of transit.

(4) There is less mechanical damage in truck transit than with railroad cars for many fresh fruits and vegetables (but not all).

(5) Claim adjustments with truckers often can be made on the spot, while the process of claim settlement with railroads is involved, drawn out, and less likely to be favourable to the claimant.

(6) Price risk is reduced by shorter transit time and the decreased possibility of a price change while in transit.

(7) Rates are lower.

The disadvantages claimed were:—

(1) Trucks, more than railroads, have delaying emergencies en route—such as accidents, breakdown of equipment, action of public authorities for traffic violations, overweight, etc.

(2) Icing facilities for trucks are not so widely established and not so well organized as for railroads.

(3) Additional precooling facilities are sometimes necessitated by extensive use of trucks, since adequate precooling is particularly essential with trucks.

(4) Special loading facilities must be constructed where trucks are used extensively.

(5) Lack of uniformity of equipment is more of a problem with trucks than with railroad cars.

(6) The irregularity of truck transit time means more uncertainty in planning day-to-day business operations than with railroads.

(7) There are no diversion privileges with trucks, and often there is no way of getting in touch with the trucker while en route.

Transportation Efficiency.

Present-day truck transportation of fresh fruits and vegetables has been seen to be less than ideal. There are three general areas where improvement can be sought: First, equipment and physical operations can be improved—better and more easily utilized trucks, better roads, and adequate mechanized loading terminals; second, governmental policy and regulations need to be formulated with economic efficiency clearly the major policy objective; and third, the structure of the transportation industry itself needs to be reconsidered in the light of objectives of efficiency.

Competition in Transportation.

Aside from rates lower than rail sometimes charged by truckers in recent years, the main effect of truck competition has been to delay increases in rail rates and stimulate improvements in rail service rather than bring about any actual reduction in the rail rates. This is why even shippers who do not use trucks much are helped by having them compete with the railroads.

Truck rates are tied in with rail rates, but truck operating costs are determined by quite independent factors. Truck costs increase with distance more rapidly than rail costs, and they continue to increase as distance increases even though rail rates—and, consequently, the rates truckers can charge—flatten out at great distances. The rail rate structure has become especially different from truck operating costs in recent years.

APPENDIX B.

EXTRACTS FROM THE REPORT OF A SURVEY MADE BY THE U.S. DEPARTMENT OF AGRICULTURE MARKETING AND FACILITIES RESEARCH BRANCH—"THE WHOLESALE PRODUCE MARKET AT INDIANAPOLIS, INDIANA."

"Who Should Build and Manage the Market.

A wholesale produce market can be built, financed and managed by: (1) a private corporation for profit; (2) the State, city or other governmental agency; (3) a farmers' co-operative association; (4) a public non-profit corporation; and (5) a private nonprofit or limited profit corporation.

Markets have been constructed, financed and managed by private firms for profit. This type of corporation is not recommended. Experience has indicated that most of these corporations are interested chiefly in revenue and not the needs of those doing business in the market. A private corporation may increase rents at will without too much concern as to the possibility of tenants moving from the market.

A number of cities operate public wholesale and retail market places. The chief problem in this type of financing and operation is that persons from outside the city, served by the market, may not receive full consideration. Some cities have reached the limit of their bonded indebtedness and cannot obtain money to build a wholesale market.

A farmers' co-operative association can build, finance and operate a market for the use of farmers. This method is satisfactory for assembly point markets where most of the business is done by farmers.

A nonprofit public benefit market corporation is one created by legislative action. This type of corporation offers many desirable features not found in most other types of management. Some of these features are:—(1) It permits all interested groups to participate in building, financing and managing the market; (2) it is definitely nonprofit-making because, when properly created, rents cannot exceed the amount needed to pay the cost of operation, amortise the investment and maintain a limited reserve for contingencies; (3) it establishes a continuing organization; (4) it gives some representation on the board of directors to governmental agencies interested in the wholesale market; and (5) it does not place a burden on taxpayers of the community in which it is established.

A private nonprofit or limited profit corporation could be created to construct, finance and manage the recommended wholesale produce market for Indianapolis. The charter for this type of corporation should embody the following features:—

(1) All interested groups operating on the market should be represented on the board of directors.

(2) Profits of the corporation owning the facility should be limited to a fixed amount or eliminated entirely.

(3) A continuing organization should be provided.

(4) Ownership of the corporation should always be retained by operators in the market.

(5) For the benefit of the city and community, taxes should be paid.

(6) If possible, representation of the city or State should be permitted on the board of directors.

Finance.

Where the proposed market is to be operated by a corporation the board of directors should have power to issue bonds and contract indebtedness against revenues and other assets of the corporation.

The board of directors would have to raise a part of the funds needed to finance the market recommended before it would be possible to borrow funds from other sources. These funds might be obtained from prospective tenants or any other persons interested in the market. The amount needed probably would range from 10 to 30 per cent. of the total cost of the market and could be prorated to lessees of the facilities to be constructed on the market.

It would be the responsibility of the board of directors to arrange for financing, acquire the site, construct the facilities, arrange for leasing the facilities and provide for revenue to liquidate the project.''

[CONCLUDED.]

Skeleton Weed and Some Related Plants

By S. L. EVERIST, Government Botanist.

Skeleton weed (*Chondrilla juncea*) is so common in southern New South Wales and northern Victoria that there is always a chance it might accidentally be introduced into Queensland, although the plant may not legally be brought into this State, either as an impurity in seeds or in any other agricultural requirement, including machinery.

Up to date no authentic specimens of skeleton weed have ever been reported from Queensland. Two plants are often mistaken for it, chicory and willow lettuce. The purpose of this article is to enable farmers and others to identify skeleton weed if they do see it and to distinguish it from other plants which resemble it superficially.

Skeleton weed itself is a biennial or perennial plant with a deep tap-root. It first appears as a flat rosette of narrow green leaves with the edges deeply divided into backward-pointing lobes like a many-barbed arrow-head. From the centre of each rosette there arises a slender, thin, stiff, upright stalk which soon branches repeatedly and forms a bunch of skeleton-like branches bearing small flower-heads on their tips and at intervals along them. As the stems develop the rosette leaves wither and disappear, leaving only the "skeleton" of stalks sprawled on the ground.

Each individual flower head consists of several *yellow* narrow petal-like florets with square ends, the whole surrounded by a tubular green structure. The "seeds" consist of a rough brown basal portion containing the seed itself, joined to a spreading downy "parachute" by a slender beak. They can be carried long distances in the air and can also cling to hair or clothing.

The roots, stems, and leaf stalks all exude a sticky milky sap if cut or broken.

Chicory (*Cichorium intybus*), the plant most often mistaken for skeleton weed in Queensland, also has milky sap, a deep tap-root, a rosette of green leaves which disappear as the flowers mature, and a skeleton-like mass of flowering stalks. However, the flowers are bright blue and the rosette leaves are often larger and more succulent, although they vary tremendously from plant to plant. The stalks, too, are coarser than those of skeleton weed and the individual flower heads are surrounded by stiff, small, green, overlapping leaf-like bracts.

Occasionally, the willow lettuce (*Lactuca saligna*) is thought to be skeleton weed, although the two plants do not look very much alike. However, it does have long, thin stems, yellow flowers, and a milky sap. The leaves are narrow, deeply lobed and scattered along the stems, which generally grow upright but with a peculiar distorted appearance. The flower heads are small and mostly in the upper part of the stems. They consists of a bunch of yellow florets surrounded by a green tube. The "seeds" are similar in structure to those of skeleton weed but have thin ribs along the face. The plants do not grow into bunches of skeleton-like stems but remain slender and not much branched.

Chicory is well established in the West Moreton, Darling Downs and

Burnett districts. It grows mostly in the winter and does particularly well on black soil. In some countries the plant is cultivated for its roots, which are dried, ground, and mixed with coffee. The young leaves are very succulent and palatable to stock, and they are quite a useful fodder. The plant is not particularly aggressive and is not a troublesome weed, but if necessary it can be killed by spraying with 2,4-D at about 1 lb. per acre. Older plants may need twice this amount.

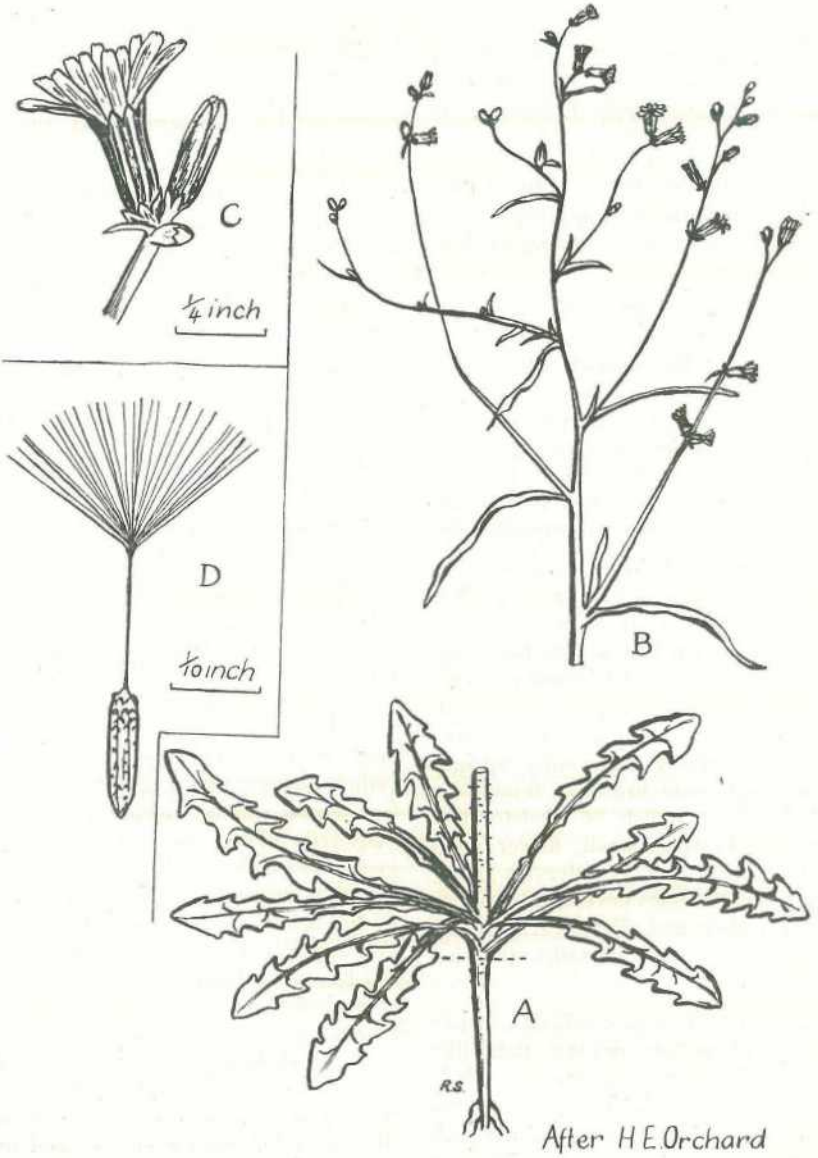


Plate 1.

Skeleton Weed (Chondrilla juncea). A, basal leaves, tap root and base of stem; B, flowering stem; C, flower head and buds; D, "seed".

Willow lettuce is not particularly common in Queensland. In some seasons it is locally abundant on roadsides in parts of the northern Darling Downs and Burnett and it has been reported from between Bundaberg and Gladstone. It does not appear to be of any significance as a weed in this State.

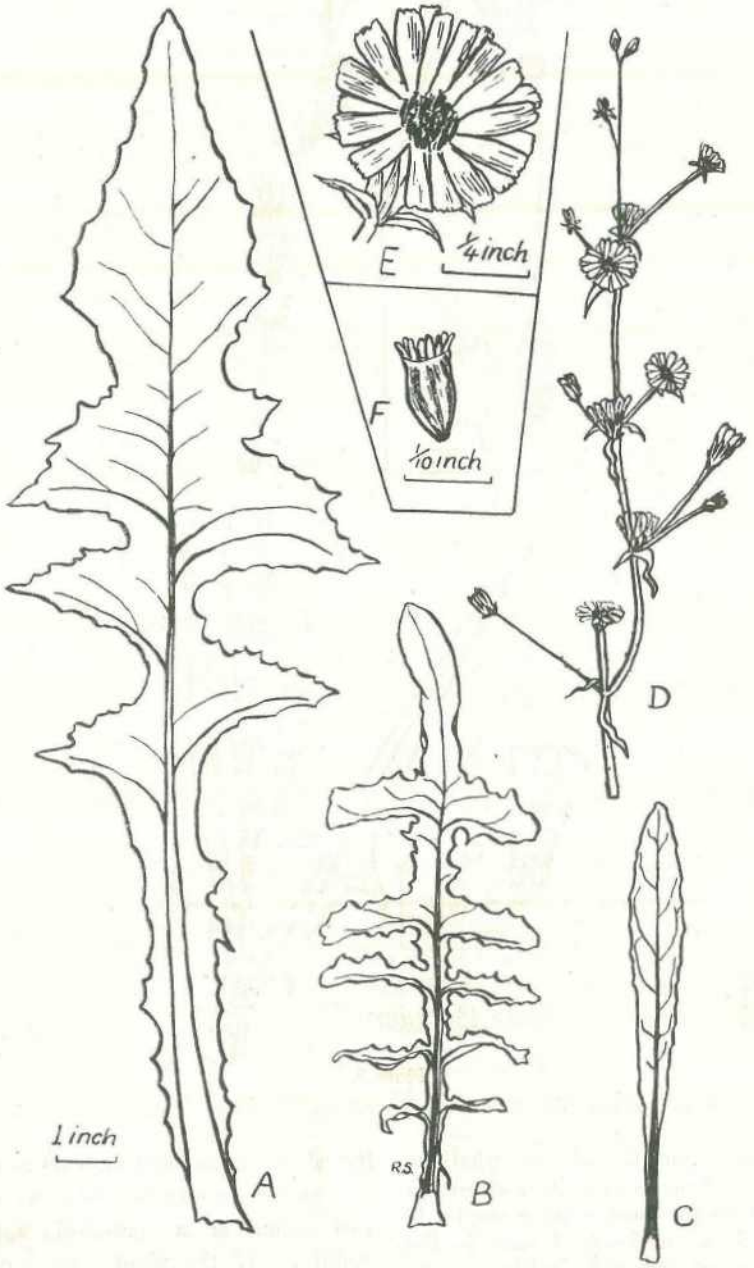


Plate 2.

Chicory (Cichorium intybus). A, B, & C, rosette leaves from three different plants; D, flowering stem; E, flower head; F, "seed".

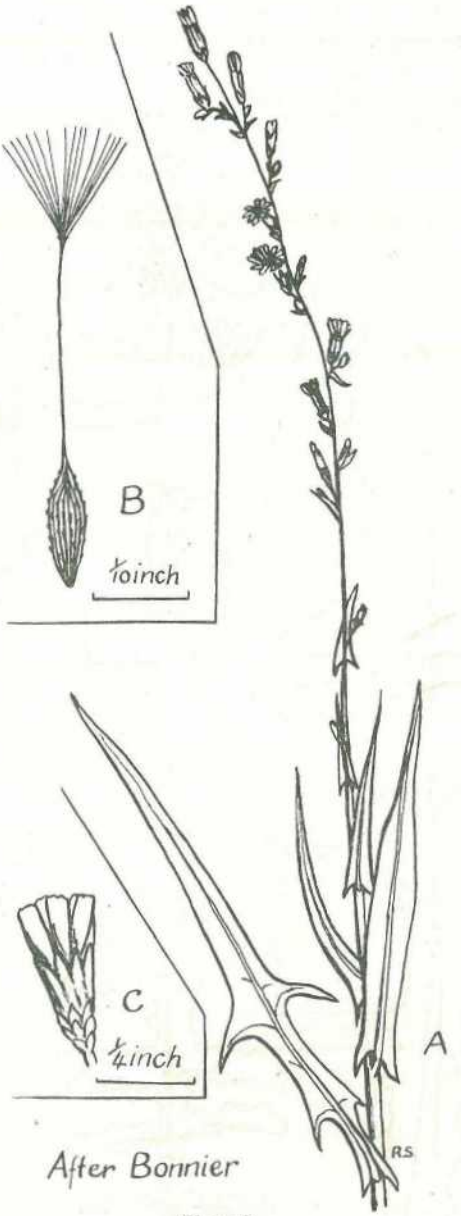


Plate 3.

Willow Lettuce (Lactuca saligna). A, flowering stem; B, "seed"; C, flower head.

If any one should see what he thinks is skeleton weed in Queensland, he will do the community a service if he sends a specimen at once to the Government Botanist, Brisbane. In New South Wales and Victoria skeleton weed has proved costly to the wheat farmer and difficult to control and it is now so abundant that eradication is a practical impossibility. If the plant does appear in Queensland, prompt identification will enable it to be dealt with at once.

The Honey Flora of South-eastern Queensland

By S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture).

(*Continued from page 537 of the September issue.*)

Black She-oak.

Botanical Name.—*Casuarina littoralis* Salisb.

Other Common Names.—She-oak, wallum oak.

Other Botanical Name.—*Casuarina suberosa* Otto & Dietr.

Distinguishing Features.—This is a tree sometimes conical in shape with a somewhat corky fissured grey bark. The branches usually curve upwards near the ends and the green twigs are erect or spreading, 3-6 in. long, with 6-8 teeth at each joint. The cones are shortly cylindrical, about $\frac{1}{2}$-$\frac{3}{4}$ in. long and $\frac{1}{2}$-$\frac{5}{8}$ in. wide. (See Plates 167-168.)

Distribution.—Widely distributed in south-eastern Queensland, especially in forest country on sandy or stony soils. It is especially abundant on sandy coastal country. It is found over most of eastern Queensland and much of eastern New South Wales.

Usual Flowering Time.—April-October.

Importance as Source of Honey.—Nil.

Importance as Source of Pollen.—Medium.

General Remarks.—This tree provides a useful supply of pollen early in the season.

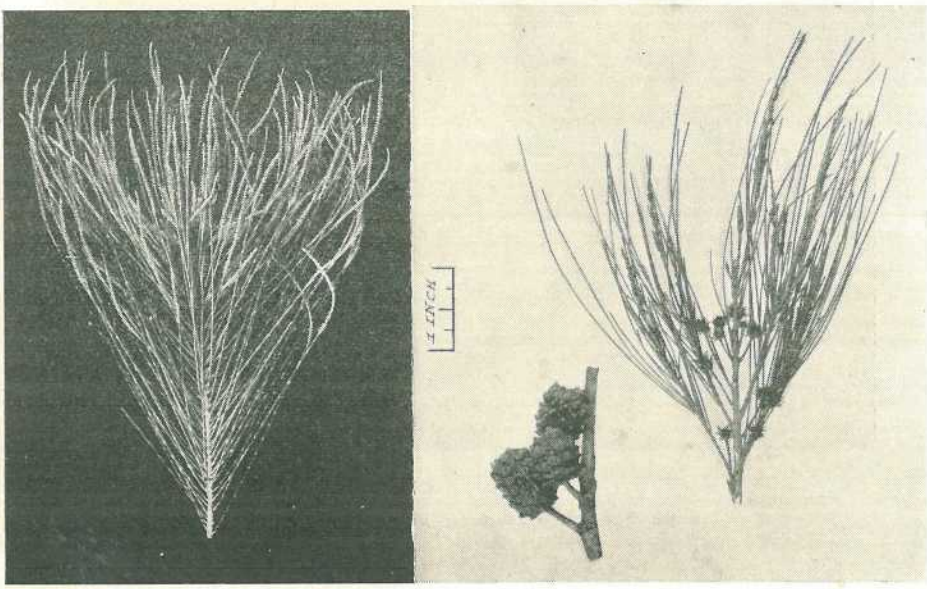


Plate 167.

Black She-oak (Casuarina littoralis). Left: Twigs with male flowers. Right: Cones and twigs with female flowers.

Plate 168.

Black She-oak (Casuarina littoralis). Redcliffe.

Swamp Oak.

Botanical Name.—*Casuarina glauca* Sieb.

Other Common Name.—Swamp she-oak.

Distinguishing Features.—This is a greyish looking tree of stiff appearance with closely cracked scaly-looking grey bark, stiff spreading branches and stiff, relatively stout, erect or spreading, greyish twigs longer and thicker than those of the other species and up to 12 in. long, with 10-12 teeth at each joint. The cones are shortly cylindrical, $\frac{1}{2}$-$\frac{5}{8}$ in. long, $\frac{1}{2}$ in. wide, much like those of the black she-oak. (See Plates 169-171.)

Distribution.—Swamp oak is almost confined to lowlying, often brackish land near the coast, sometimes forming pure stands. It is also in coastal New South Wales.

Usual Flowering Time.—September-October.

Importance as Source of Honey.—Nil.

Importance as Source of Pollen.—Minor.

General Remarks.—This species produces pollen which is sometimes deficient as a bee-food, and accordingly brood-rearing is not always stimulated.

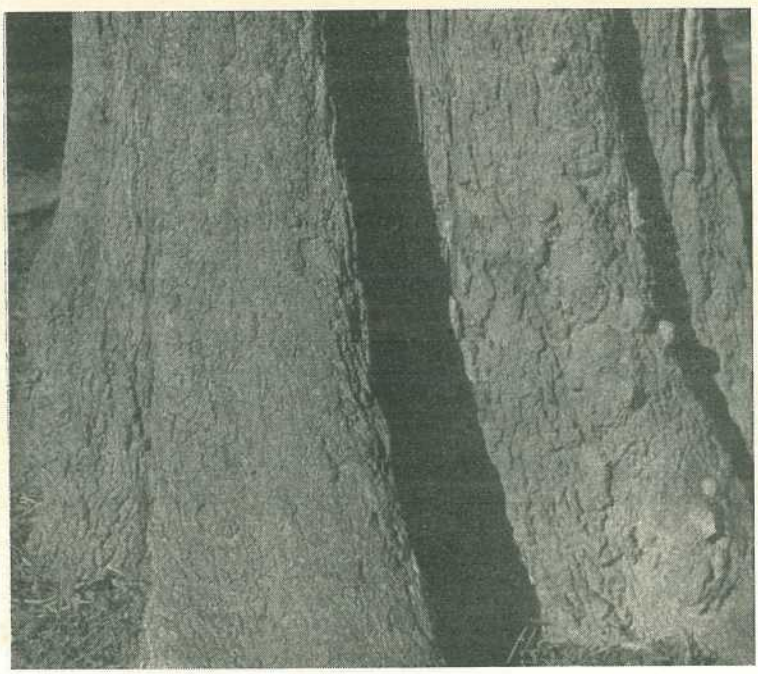


Plate 169.

Swamp Oak (Casuarina glauca). Portion of trunk.

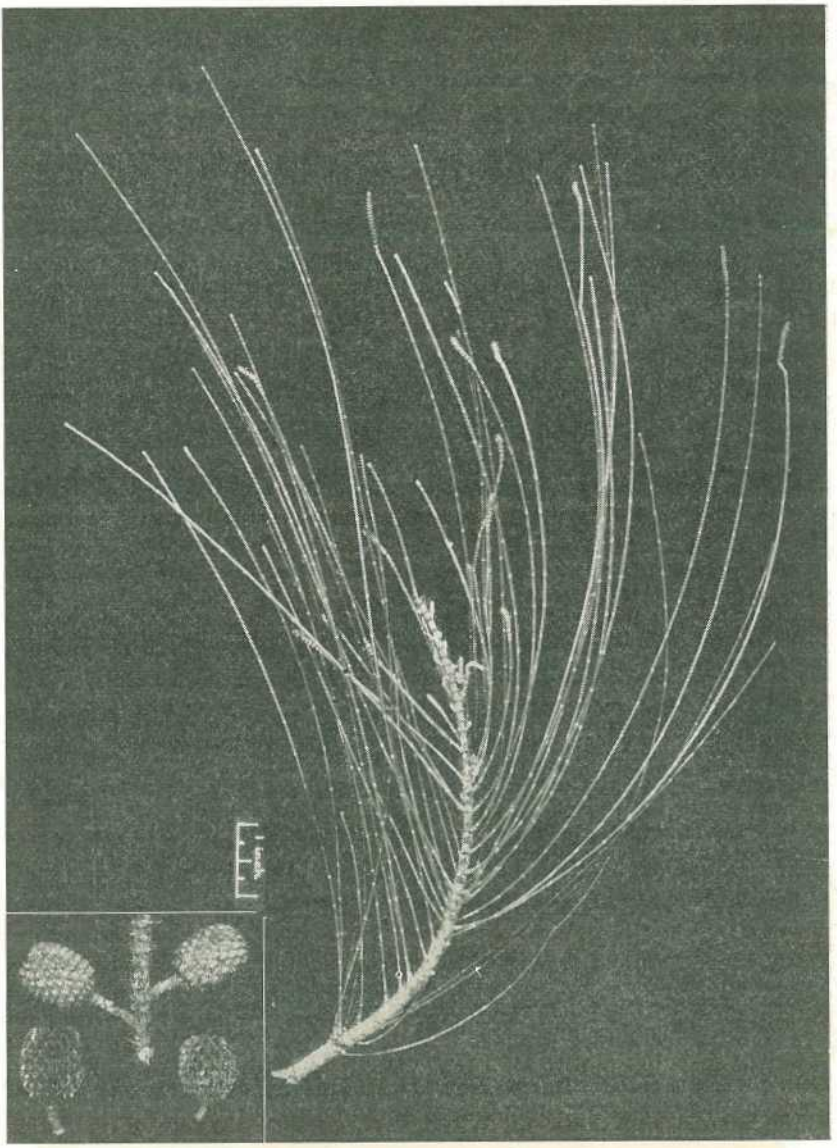


Plate 170.

Swamp Oak (Casuarina glauca). Branchlet. Unopened cones at top and opened cones at bottom in inset.

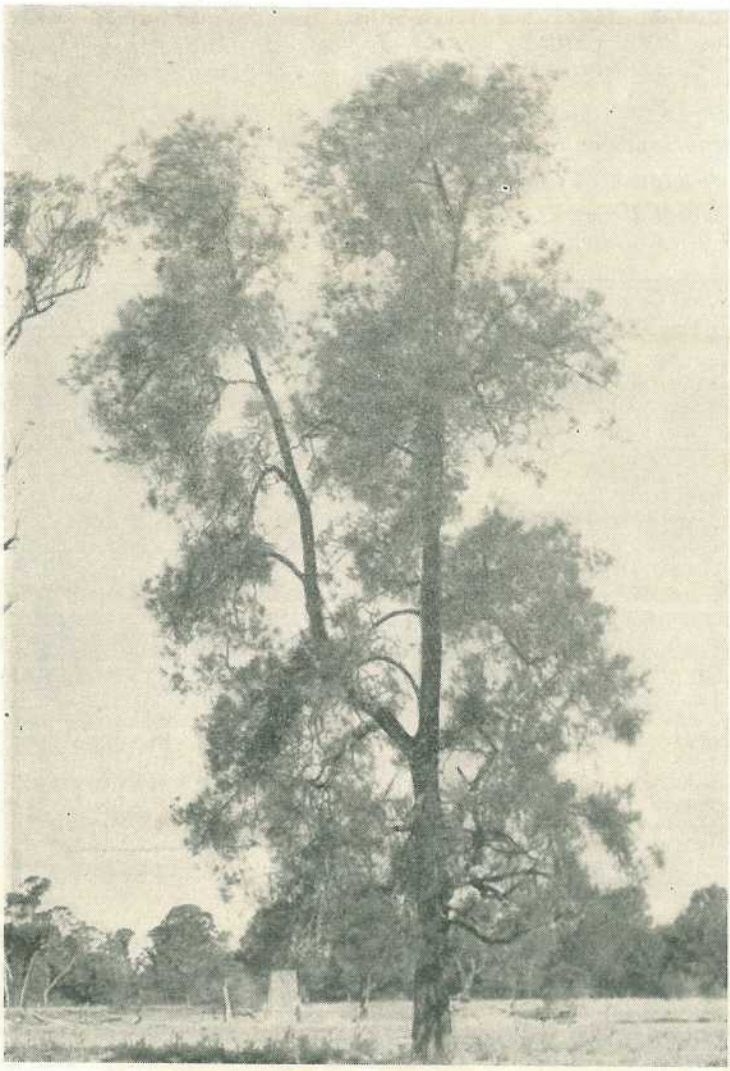


Plate 171.

Swamp Oak (Casuarina glauca). Oxley.

Forest Oak.

Botanical Name.—Casuarina torulosa Soland.

Other Common Names.—Forest she-oak, rose she-oak, mountain oak.

Distinguishing Features.—This is a dark-green tree of somewhat weeping habit, with longitudinally cracked or ridged, often very corky, grey or grey-brown bark and dark-green, fine, drooping twigs 3-5 in. long with 4 or 5 teeth at each joint. The cones are oval or oblong, sometimes irregularly so, about ¾-1¼ in. long and ¾-1 in. wide, larger than those of other species. (See Plates 172-174.)

Distribution.—Forest oak is mostly found in forest country on hillsides and mountain sides, chiefly in the Moreton, Wide Bay and Burnett Districts, other parts of coastal Queensland, and northern New South Wales. It is sometimes very common, especially on the deeper soils.

Usual Flowering Time.—April-May.

Importance as Source of Honey.—Nil.

Importance as Source of Pollen.—Minor.

General Remarks.—The small amount of pollen obtained has only moderate value as a bee food.

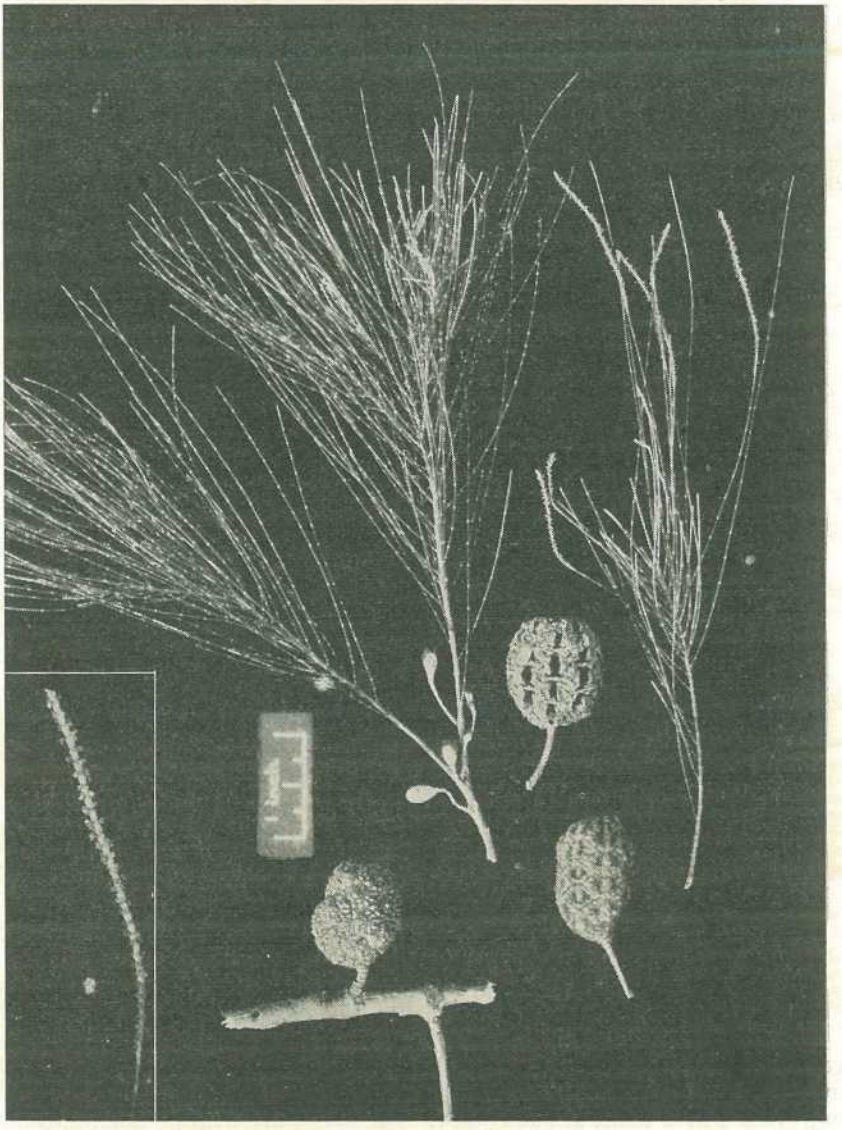


Plate 172.

Forest Oak (Casuarina torulosa). Branches with female flowers (left) and male flowers (right). Unopened and opened cones are also shown, and enlarged male flowers are seen in the inset.

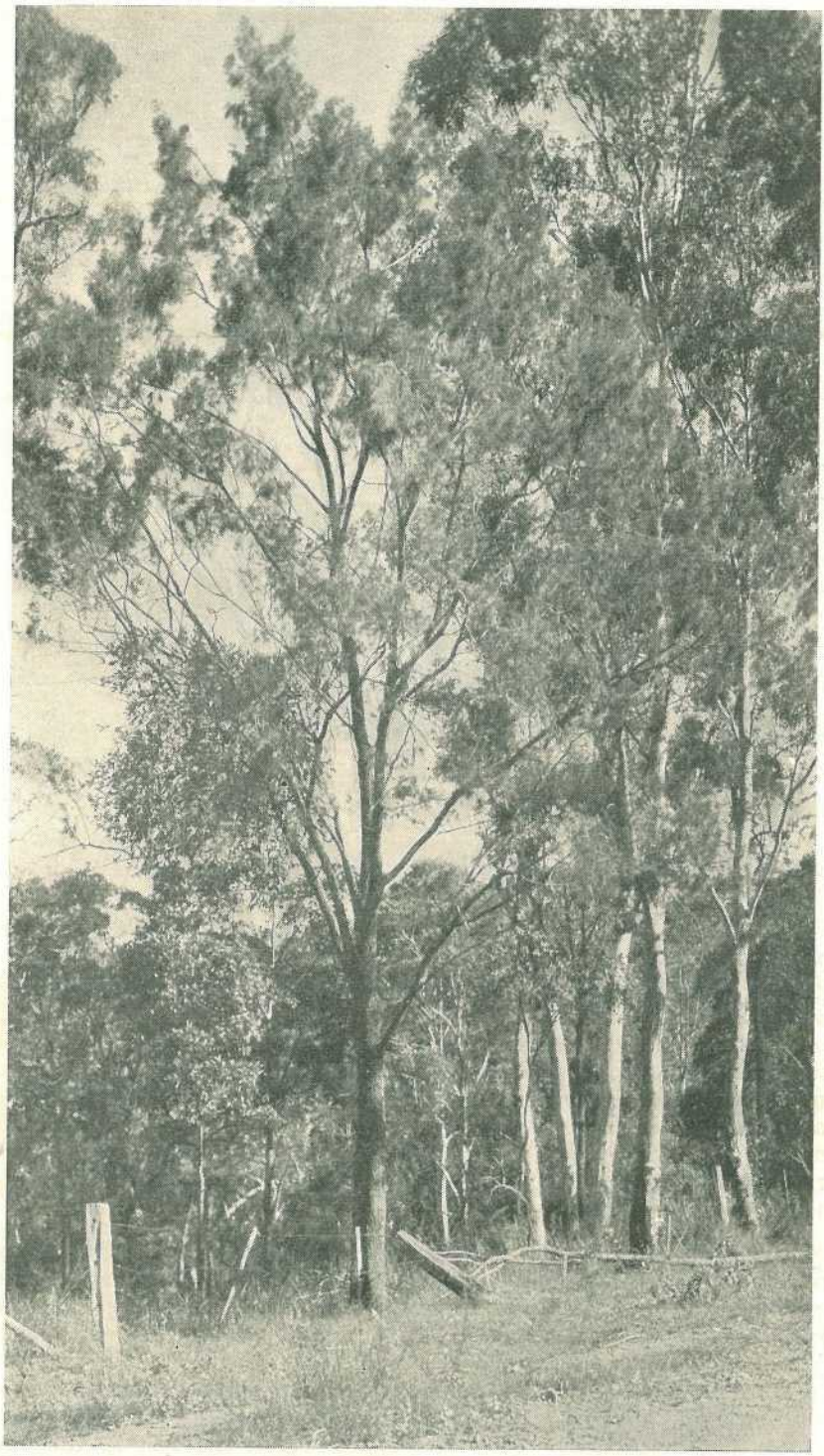


Plate 173.

Forest Oak (Casuarina torulosa). Mt. Nebo.

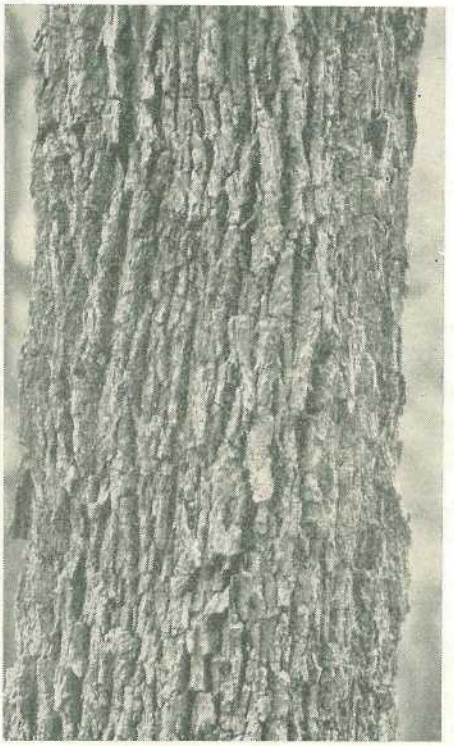


Plate 174.

Forest Oak (Casuarina torulosa). Portion of trunk.

Tumble-down Ironbark.

Botanical Name.—No botanical name is yet available for this species of *Eucalyptus.*

Other Common Names.—Brogan's ironbark, corky ironbark.

Distinguishing Features.—A dull-looking ironbark of usually stunted appearance with drooping branches, narrow leaves, and small flowers in small bunches mostly among the leaves. It resembles narrow-leaved ironbark in foliage, but the trees are usually crooked and smaller, with more drooping branches, and most of the flowers are in small bunches among the leaves instead of in large bunches at the ends of the twigs.

Description.—This ironbark has usually a crooked "tumble-down" appearance, though sometimes up to 60 ft. high. The branches are pendulous. The leaves, scattered along slender twigs, are relatively long stalked, dull greyish green on both sides with faint veins, about $2\frac{1}{2}$-4 in. long and $\frac{1}{3}$-$\frac{3}{4}$ in. wide, and 4-8 times as long as wide. The flowers have distinct stalks and are borne in stalked clusters of 5-7 among the leaves, with one or more similar clusters at the ends of the twigs. The buds have conical lids shorter than the rest of the bud.

The open flowers are about ½ in. wide with white stamens. The seed-capsules are cup-shaped to somewhat basin-shaped, about ¼ in. long and wide.

Distribution.—Sandstone country in the southern part of the Darling Downs District.

Usual Flowering Time.—April-November.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Minor to major.

Importance as Source of Pollen.—Medium.

General Remarks.—This tree, which yields quantities of nectar about once in five years, is often associated with the narrow-leaved ironbark. The honeys are much alike and are usually marketed as narrow-leaved ironbark honey.

Honey from tumble-down ironbark is choice grade, with an excellent mild sweet flavour and moderate density; it candies slowly, some samples remaining liquid for longer than two years.

This ironbark, unlike most others, produces pollen in quantity. When flowering is early and assists spring brood-rearing, the pollen value is enhanced.

Plate 175.

Tumble-down Ironbark (Eucalyptus sp.). Leaves, buds and flowers.

Plate 176.

Tumble-down Ironbark (Eucalyptus sp.). Inglewood.

[TO BE CONTINUED.]

FLEAS IN AND AROUND HOUSES.

Plagues of fleas are fairly common in Queensland during hot, dry weather before the onset of the wet season.

Fleas breed in fine dust, the loose, dry soil under houses being a favoured place, and when they actually invade houses considerable discomfort and inconvenience are caused.

These pests can be readily and quickly controlled by using insecticides. A 10 per cent. BHC dust applied to the soil under houses is effective, and if a dust gun is not available, an old stocking may be used to shake the material over the soil surface. If spraying is preferred, a 0·5 per cent. gamma isomer BHC spray or a 4 per cent. DDT spray will give satisfaction. After dusting or spraying, it is preferable to rake the soil and then water the treated areas.

A good-quality household spray containing lindane or DDT should be used against infestations of fleas in houses.

Care should be taken to ensure that BHC does not contact poultry feed or stored vegetables, as off-flavours may result.