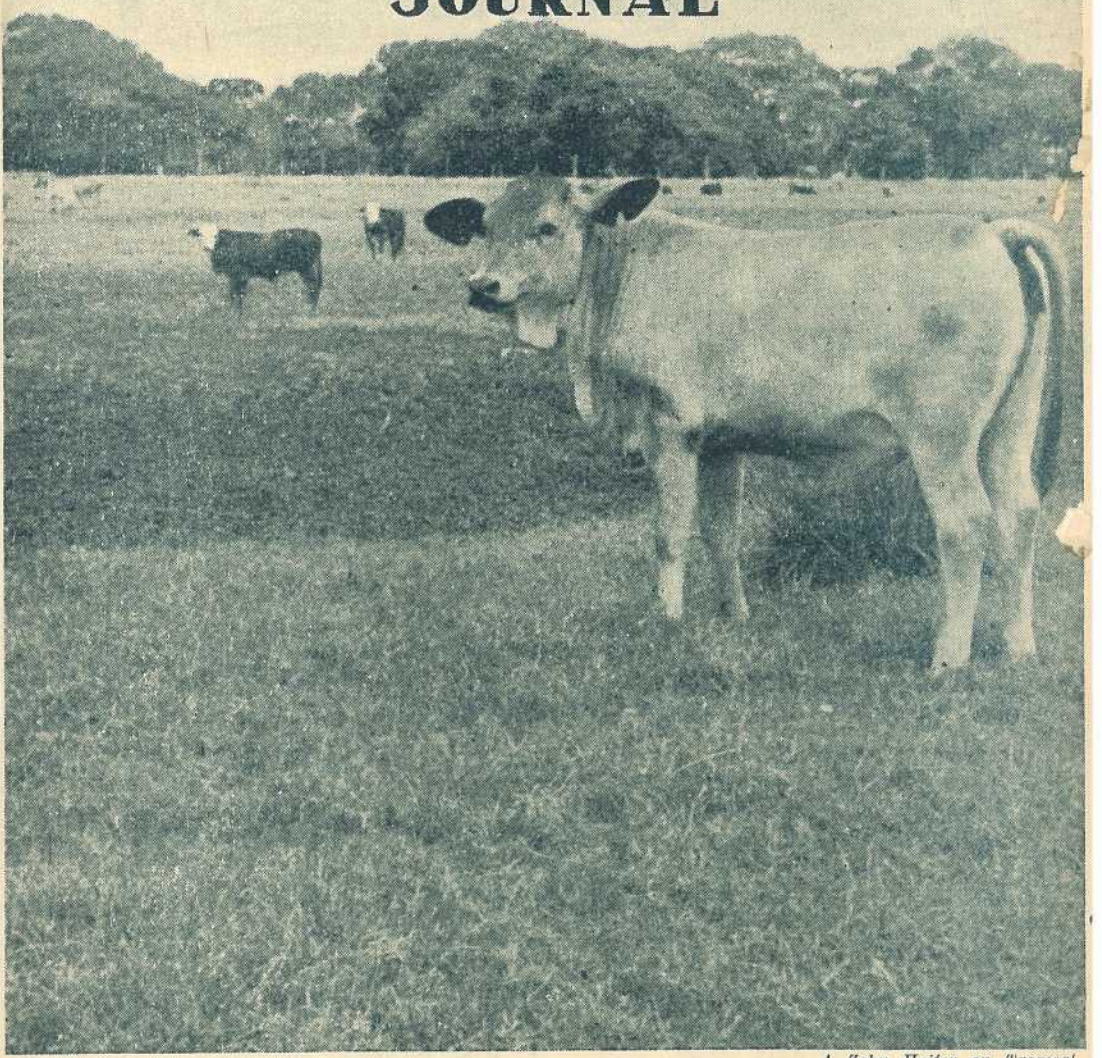
VOL. 76. PART 4 APRIL, 1953

DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL



A Zebu Heifer on Tropical Pasture, North Queensland.

LEADING FEATURES

Registered at the General Post Office, Brisbane, for transmission by Post as a Newspaper.

Volume 76 Part 4

QUEENSLAND AGRICULTURAL JOURNAL

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APRIL, 1953

Issued by Direction of
THE HONOURABLE H. H. COLLINS
MINISTER FOR AGRICULTURE AND STOCK

GOVERNMENT PRINTER, BRISBANE

Contents

Some Agricultural Features of the Central Highlands Region of Queensland.

P. J. SKERMAN, Agricultural Resources Officer, Bureau of Investigation, Department of Public Lands.

(*Continued from page* 149 *of the March issue.*)

Frost and Sorghum Growing.

In a study of frost in the Australian region, J. C. Foley, of the Commonwealth Meteorological Bureau, has presented data for light and heavy frosts at Clermont, Emerald and Springsure. He took a screen temperature of 36° F. to indicate a light frost at ground level, and 32° F. a heavy frost on the ground and frost extending above the ground to the level of foliage, blossom or setting fruit (four feet or so).

Referring to the Central Highlands area, Foley wrote: "Few heavy frosts are recorded in this region except in the Mackenzie River Valley (Emerald and Springsure), where the average first and last dates of screen temperatures of 32° or under are 5th-7th July and 24th-28th July. Screen temperatures of 36° or under may occur, however, from the end of April in the Springsure-Clermont area (average 16th to 23rd June) . . ."

The data in Tables 8 and 9, taken from Foley's lists, provide information on frost occurrence in the Central Highlands.

TABLE 8.

First and Last Severe Frosts of the Season (32° Screen).

Station.	Years of Records from—	First 32° 1930–39.	First 32° since First Records Kept.	Last 32° 1930–39.	Last 32° since Records Kept.
Clermont	1911	July 14	May 15	July 27	Aug. 25
Emerald	1908	July 5	May 26	July 24	Aug. 25
Springsure	1913	July 7	April 27	July 28	Aug. 25

TABLE 9.

AVERAGE NUMBER OF DAYS PER MONTH OF MINIMUM SCREEN TEMPERATURES OF 32° F. OR UNDER (1930–1939).

Station.	April.	May.	June.	July.	Aug.	Sept.	Year.
Clermont	..	..	2·2	3·0	1·9	..	7·1
Emerald	..	..	2·6	2·8	2·5	..	7·9
Springsure ..	..	0·2	4·1	3·0	4·0	0·4	11·7

Elaborating on the low temperature factor, workers in the Department of Agriculture and Stock in 1948 prepared the information shown in Table 10.

TABLE 10.

DATA ON FROST OCCURRENCE.

Station.	Mean Annual Rainfall.	Mean Minimum Temperature for Coldest Month.	Average Date of First Occurrence of Screen Temperature of 36 °F.	Mean Deviation from Average. (days).	First Recorded Date of Occurrence of Screen Temperature of 36 °F. since 1938.	Average Frost-free Period (36 °F.) in Days.
	In.	°F				
Clermont ..	26·97	42·7	June 21	10	April 28	319
Emerald.. ..	24·61	44·2 } July	June 23	15	April 28	311
Springsure ..	26·19	43·0	June 16	11	April 22	299
Dalby	26·12	40·1	May 18	18	April 17	246
Miles	25·63	38·4	May 19	17	April 17	238
Pittsworth ..	27·22	41·3 } July	May 27	21	April 17	267
Goondiwindi ..	24·05	41·3	May 31	12	April 17	274
Warwick ..	27·49	37·8	May 12	18	April 10	233

The workers concerned stated: "It will be seen that in the Clermont-Emerald-Springsure area the first frost is later than in the Darling Downs region and there is a longer frost-free period. The later onset of frost in the more northerly region gives a growing period for summer crops about 30 days longer than in the Darling Downs. This longer growing period may allow of later planting, so that advantage may be taken of the late summer rains which are more reliable than those of October, November and December."

TABLE 11.

CHANCE (AS A PERCENTAGE OF YEARS) OF RECORDING SCREEN TEMPERATURES BELOW 36° F. and 32° F. at CLERMONT.

Date.	Chance.	
	36 °F. or Less.	32 °F. or Less.
Before—	%	%
April 7	Nil	Nil
April 14	Nil	Nil
April 21	Nil	Nil
April 30	3	Nil
May 7	3	Nil
May 14	16	3
May 21	24	3
May 31	33	8
June 7	50	20
June 14	66	25
June 21	75	33
June 30	75	50

A study of the incidence of screen temperatures of 36° F. or lower and 32° F. or lower for Clermont since 1938 reveals that the chances of receiving recordings within various ranges are as given in Table 11.

Sorghum Planting Time in Relation to Frosts.

From field observations at Peak Downs made by M. Davis (Agricultural Assistant, Queensland-British Food Corporation), the collation of data for the main sorghum varieties in use shown in Table 12 has been made.

TABLE 12.

Developmental Periods of Sorghum Varieties.

Variety.	Days from Planting to Flowering.	Days from Planting to Maturity of Primary Head.	Days to General Harvest.
Early Kalo	54	110	129
Wheatland	63	117	133
Caprock	63	117	133
Kalo	62	117	129
Martin	60	117	129
Plainsman	63	117	129
Hegari	59	110	129

The variety Kalo has been planted on large acreages, and adopting this variety for discussion, a growth chart can be drawn up as shown in Table 13.

TABLE 13.

Theoretical Development of Kalo Grain Sorghum Planted at Various Dates.

Planting Week.	1st Flowering.	1st Head Mature.	General Harvest.
Oct. 1– 8	Dec. 2– 9	Jan. 27– 3 Feb.	Feb. 8–15
9–15	10–17	Feb. 4–11	16–23
16–23	18–25	12–19	24– 3 Mar.
24–31	26– 3 Jan.	20–27	Mar. 4–11
Nov. 1– 8	Jan. 3–10	28– 7 Mar.	12–19
9–16	11–18	Mar. 8–15	20–27
17–24	19–26	16–23	28– 4 Apr.
25– 2 Dec.	27– 3 Feb.	24–31	Apr. 5–12
Dec. 3–10	Feb. 4–11	Apr. 1– 8	13–20
11–18	12–19	9–16	21–28
19–26	20–27	17–24	29– 6 May
27– 3 Jan.	28– 4 Mar.	25– 2 May	May 7–14
Jan. 4–11	Mar. 5–12	May 3–10	15–22
12–19	13–20	11–18	23–30
20–27	21–28	19–26	31– 7 June
28– 4 Feb.	29– 5 Apr.	27– 3 June	June 8–15
Feb. 5–12	Apr. 6–13	June 4–11	16–23
13–20	14–21	12–19	24– 1 July
21–28	22–29	20–27	July 2– 9
Mar. 1– 8	30– 7 May	28– 4 July	10–17
9–16	May 8–15	July 5–12	18–25
17–24	16–23	13–20	26– 2 Aug.

Early Kalo and Hegari ripen about a week earlier than Kalo, but the main varieties, such as Wheatland, Caprock and Martin, have a similar growing period to Kalo. It is also a fact that the same variety planted late in the season takes fewer days to mature than when planted early.

From limited observations in the Central Highlands, it would appear that the hard-dough stage is reached approximately one month before the general harvest. Frost damage after the hard-dough stage is reached would be relatively slight, whereas before that stage severe pinching of the grain would result.

From a perusal of Table 13, it appears that plantings made up to January 28 should generally be free from frost damage. Thereafter, the risks would be as set out in Table 14. Though damage after the hard-dough stage is reached would not be substantial, for safety's sake, damage is taken in Table 14 to be likely up to 14 days before general harvest.

TABLE 14.

FROST RISK AS RELATED TO PLANTING DATE.

Planting Date.	Flowering Date.	Frost Risk at Flowering.	Frost Risk for Grain (i.e., Frost Occurs before 14 Days from Full Maturity).	1st Head Maturity Date.
Jan. 28 to Feb. 4	Mar. 29 to Apr. 5	Nil	33% of years possibility of some pinched grain. *No frost for fourteen consecutive years* 1930–43	May 27 to June 3
Feb. 5–12	Apr. 6–13	Nil	50% of years risk of some pinched grain but incidence irregular (e.g., seven consecutive frost-free years)	June 4–11
Feb. 13–20	Apr. 14–21	Nil	67% of years risk of some pinching of the grain	June 12–19
Feb. 21–28	Apr. 22–29	1 in 38 years	75% of years risk of pinched grain or failure to set grain	June 20–27

NOTE.—Heavy frosts on May 8, 9, and 10, 1949, severely damaged the first crop grown by the Queensland–British Food Corporation. A frost as early as this had been recorded only once in the previous 36 years.

Plate 4.

The Black Earth of Peak Downs, Capella. Virgin land being brought under the plough for the first time.

The average frost-free period for the Central Highlands area is 310 days, just over twice the necessary frost-free period for the crop. Hence early and mid-season plantings would normally escape. However, it is in the years when no early planting rains occur that close consideration must be given to frost hazards and the risks involved.

Heat Waves and Sorghum Growing.

A characteristic of Queensland's sub-tropical and tropical agriculture is the occurrence of heat-wave periods during the summer months. The incidence and severity of these may vary and an analysis of actual heat-wave occurrences for Clermont, and comparisons with Biloela and Downs centres, are presented in Table 15. A "heat wave" on Plate 6 is indicated by a succession of days on which the maximum temperature exceeded 100°F. This is an empirical standard, as no actual correlations have been established, but it is near the mark. It is known that a succession of three days in which the maximum temperature exceeded 100°F. has adversely affected sorghum crops on the Regional Experiment Station at Biloela.

Plate 5.

A Crop of Wheatland Sorghum on Cullen-la-ringo.

The time of occurrence of the heat wave in relation to the stage of plant growth is important. A heat wave can be most destructive at the flowering period, as the heat may destroy the vitality of the pollen. It can also be very destructive within the first month of the growing period. An established crop can withstand hot weather fairly well if there is sufficient subsoil moisture from which the roots can draw their supply. Sorghum, by the aid of the waxy stem covering, curling of the leaves and relatively small number of leaf stomata, is better adapted to withstand drought conditions than most other agricultural crops.

The distribution of "heat waves" for Clermont, the Callide and Downs centres is given in Table 15. From a perusal of the heat-wave data as presented it can be seen that very early and very late plantings will generally miss the heat waves, whereas normal plantings always run some risk of heat-wave interference. Table 16 gives some idea of what might be expected.

TABLE 15.

HEAT WAVE DATA (NOVEMBER–MARCH), 1914–1950.

Heat Waves.	Clermont.					Dalby.					Warwick.					Pittsworth.				
	N.	D.	J.	F.	M.	N.	D.	J.	F.	M.	N.	D.	J.	F.	M.	N.	D.	J.	F.	M.
2 consecutive days with maximum temperature over 100° F	31	45	57	19	10	6	8	18	6	3	1	7	8	1	..	1	1	5	2	..
3 ditto	16	30	41	14	7	3	3	9	1	2	1	1	6	1	..	1	1	3	..	..
5 ditto	6	8	14	1	..	..	1	..	..	..	..	..	1	..	..	..	..	..	..	..
7 ditto	..	6	9	5	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2 consecutive days with maximum temperature 105° F or over	6	17	24	7	1	1	1	5	..	..	..	..	2	..	..	..	..	1	..	..
3 ditto	3	7	14	1	..	1	..	2	..	..	..	..	1	..	..	..	..	..	..	..
5 ditto	1	3	5	1	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..
7 ditto	..	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

HEAT WAVE DATA, 1926–1950.

Heat Waves.	Clermont.					Biloela.					Dalby.					Warwick.					Pittsworth.				
	N.	D.	J.	F.	M.	N.	D.	J.	F.	M.	N.	D.	J.	F.	M.	N.	D.	J.	F.	M.	N.	D.	J.	F.	M.
2 consecutive days with maximum temperature over 100° F	22	31	43	13	8	..	6	14	3	..	3	5	14	2	1	1	5	8	..	..	1	..	4	..	..
3 ditto	11	20	32	9	5	..	3	9	1	..	1	1	8	1	..	1	..	6	..	..	1	..	2	..	..
5 ditto	3	11	15	2	..	..	..	4	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..
7 ditto	..	4	11	2	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2 consecutive days with maximum temperature 105° F or over	4	13	16	3	..	..	..	4	..	..	1	1	4	..	..	..	..	2	..	..	..	..	1	..	..
3 ditto	2	6	9	1	..	..	..	1	..	..	1	..	2	..	..	..	..	1	..	..	..	..	..	..	..
5 ditto	..	2	5	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7 ditto	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

TABLE 16.

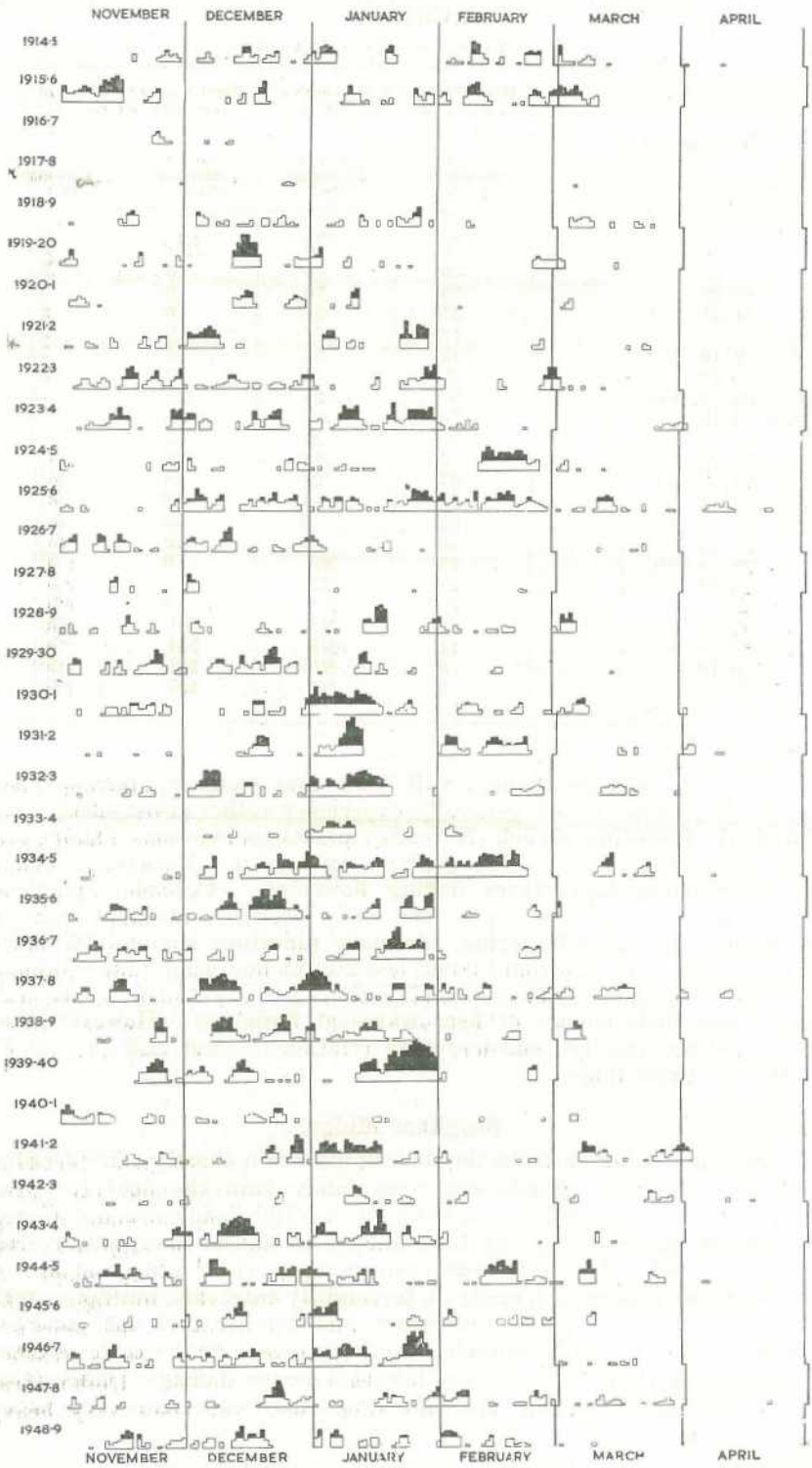
EXPECTATION OF HEAT WAVES.

Planting Period.	Heat Waves of 3 Consecutive Days or More over 100 °F.		Heat Waves of 3 Consecutive Days or More over 105 °F.	
	Within One Month of Planting.	During Flowering Week.	Within One Month of Planting.	During Flowering Week.
	%	%	%	%
Oct. 1– 8	6	70	Nil	28
9–15	20	70	6	33
16–23	25	70	6	33
24–31	37	67	6	28
Nov. 1– 8	42	67	8	28
9–16	42	67	22	33
17–24	50	40	22	20
25– 2 Dec.	67	28	25	6
Dec. 3–10	70	28	28	3
11–18	70	28	33	3
19–26	70	28	33	Nil
27– 3 Jan.	67	22	28	Nil
Jan. 4–11	67	14	28	Nil
12–19	67	3	33	Nil
20–27	40	3	20	Nil
28– 4 Feb.	28	Nil	6	Nil
Feb. 5–12	28	Nil	3	Nil
13–20	28	Nil	3	Nil
21–28	22	Nil	Nil	Nil
Mar. 1– 8	14	Nil	Nil	Nil
9–16	3	Nil	Nil	Nil
17–24	3	Nil	Nil	Nil

A study of these figures will show that October plantings miss the early heat waves but generally experience rather severe heat waves during the flowering period. November plantings experience about even chances of heat waves on young plants and about a 1 in 4 to 5 chance of experiencing heat waves during flowering. December plantings generally have hot weather in the early growth, with much risk of severe heat waves at flowering. January plantings have slightly more risk of early heat waves and much less risk at flowering. Late January and February plantings have still less chance of experiencing early heat waves and little chance of heat waves at flowering. However, these late plantings must be considered in relation to frost risks, as set out in the frost-risk table.

Sorghum Midge.

Sorghum midge attacks the developing grain shortly after fertilisation and in severe attacks may completely ruin the field for grain purposes. It is subject to some climatic control, being dormant during the cool weather. In spring the numbers of adults emerging are relatively few and so the early-sown crops escape serious midge damage. A succession of generations occur at fortnightly intervals, building up the population as the season progresses and temperature and moisture conditions become more suitable. Activity ceases as the cooler weather approaches and crops sown very late also escape damage. Under these conditions the mid-season and late crops may experience very heavy midge attack.


NOVEMBER
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1944-5
1945-6
1946-7
1947-8
1948-9
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL

Plate 6.

The Central Highlands were relatively free from midge damage during the first two crops grown by the Queensland-British Food Corporation, but subsequently midge damage has been quite a factor in depressing yields in certain fields.

One control measure is to stagger plantings so that the crop misses the main population waves. However, on the large properties, with so much sorghum regrowth and volunteer growth from spilled grain on roadways, railway sidings, etc., it is very difficult in practice to avoid midge infestation by planting-date control in the main growing season. Air-dusting or spraying for midge control is being introduced into the sorghum-growing areas, using DDT dust or spray. The cost of the spraying operation must be set out against probable increased yields to determine the economics of treatment. Costs are frequently changing but are of the order of 25s. per acre (1951) and the increased yield because of dusting would depend on the severity of the midge attack, usually a 60% save (that is, an estimated crop of 30 bushels might yield 12 bushels under midge attack and 24 bushels as the result of spraying).

Summary of Risks.

Having considered the meteorological (including sorghum midge) risks individually, a general table of risks in relation to planting has been drawn up (Table 17).

No account has been taken of risk of drought during the fallowing or growing period. It will be seen that the planting rain constitutes the greatest risk and that opportunity should be taken to make use of each planting rain which falls. Plantings made in the first three weeks in October, however, run a big risk of flowering in the main heat-wave period, while those made in the first three weeks in December experience the heat in their very young stages. February plantings run a risk of early frosts. Early plantings have an advantage in that if some setback occurs the crop can be fed off or ploughed in and a replant made later. Consequently it would appear that plantings should be staggered and sowings made after good falls of rain from the third week in October until mid-February at the latest.

EXPERIMENTAL SORGHUM PLANTINGS, PEAK DOWNS, 1950.

The following experimental results were obtained on the black soil experimental area at Peak Downs during the very good rainfall year of 1950 on land prepared by one sundercutting and two cultivations with the combine. It will be seen that under the good rainfall conditions practically a straight-line increase in yields accompanied each heavier planting, and if a preliminary subsoil moisture survey revealed good moisture, heavier plantings should pay handsomely in these good years.

EXPLANATION OF PLATE 6.

Diagram Showing the Occurrence of Heat Waves at Clermont from 1919 to 1949. The temperature baseline in each year is 95°F. and temperatures exceeding 100°F. are blacked in. This diagram is a reduced copy of one which appeared in the Report of the Bureau of Investigation for 1949.

TABLE 17.

SORGHUM PLANTING RISKS, CLERMONT, 1914–1949.

Percentage of years in which there are risks in relation to planting date.

Proposed Planting Week.	Insufficient Planting Rain (less than 150 Points).	Early Heat Wave.		Heat Wave at Flowering.		Frost (up to 14 Days before General Harvest).		Midge Damage.
		Medium Intensity.	Severe.	Medium.	Severe.	36 °F.	32 °F.	
	%	%	%	%	%	%	%	
Oct. 1– 8	97	6	Nil	72	29	Nil	Nil	
9–16	97	20	6	73	33	Nil	Nil	
17–24	97	25	6	73	33	Nil	Nil	
25–31	91	37	6	67	29	Nil	Nil	Slight to Nil
Nov. 1– 8	94	43	8	67	29	Nil	Nil	
9–16	80	43	22	67	33	Nil	Nil	
17–24	91	50	22	40	20	Nil	Nil	
25– 2 Dec.	91	67	25	29	6	Nil	Nil	
Dec. 3–10	80	72	29	29	3	Nil	Nil	
11–18	74	73	33	29	3	Nil	Nil	
19–26	83	73	33	22	Nil	Nil	Nil	
27– 3 Jan.	77	67	29	14	Nil	3	Nil	Severe
Jan. 4–11	74	67	29	3	Nil	3	Nil	
12–19	80	67	33	3	Nil	17	3	
20–27	71	40	20	Nil	Nil	25	3	
28– 4 Feb.	74	29	6	Nil	Nil	33	8	
Feb. 5–12	69	29	3	Nil	Nil	50	20	
13–20	77	29	3	Nil	Nil	67	25	
21–28	83	22	Nil	Nil	Nil	75	33	
Mar. 1– 8	94	14	Nil	Nil	Nil	75	50	Slight to nil
9–16	77	3	Nil	Nil	Nil	80	55	
17–24	80	3	Nil	Nil	Nil	87	67	

Sorghum Variety Trial.

Eight varieties were tried here, each variety being represented four times in an 8 x 4 trial. The following average yields per acre were obtained. (The plots were sown in 14-inch rows at 7.7 lb. per acre; planted 26-1-50; harvested 16-6-50).

Variety.	Mean Yield. Bushels.	Significantly Better Than—
1. Hermitage Selection ..	66·72	4, 5, 6, 7, 8
2. Kalo	63·00	6, 7, 8
3. Caprock	62·05	6, 7, 8
4. Plainsman	61·18	6, 7, 8
5. Hegari..	61·00	6, 7, 8
6. Wheatland	52·42	8
7. Martin..	51·22	8
8. Early Kalo	33·28	..

Sorghum Rate-of-Planting Trial.

This trial consisted of five plots each of 9½ lb., 7.7 lb. and 5.6 lb. per acre in rows 14 inches apart, using Kalo. The yields were as follows:

Sowing Rate.	Mean Yield. Bushels.	Significantly Better Than—
1. 9·5 lb.	54·70	2, 3
2. 7·7 lb.	48·76	3
3. 5·6 lb.	35·16	..

Sorghum Rate-of-Planting and Spacing Trial.

This trial consisted of six plots of Kalo, each with the following combinations of row space and planting rate—

7 in. spacing; 10 lb. seed per acre.
14 in. spacing; 7.7 lb. seed per acre.
21 in. spacing; 5.1 lb. seed per acre.
28 in. spacing; 4.25 lb. seed per acre.
35 in. spacing; 3.8 lb. seed per acre.

The average per acre yields obtained were:—

Treatment.	Mean Yield. Bushels.	Significantly Better Than—
1. 7 in. x 10. lb. ..	51·37	2, 3, 4, 5
2. 14 in. x 7·7 lb. ..	43·07	3, 4, 5
3. 21 in. x 5·1 lb. ..	32·73	4, 5
4. 28 in. x 4.·25 lb. ..	29·32	5
5. 35 in. x 3·8 lb. ..	25·78	..

In order to check the results of the rate-of-planting trials, stand counts of the plots were made to ascertain how many plants per acre were harvested. It is emphasised that all reports submitted during the growth of the trial plots were to the effect that the strike was good and the plots were looking well. The stand counts obtained were as given in Table 18.

TABLE 18.

DATA FROM STAND COUNTS IN RATE-OF-PLANTING TRIALS.

Variety.	Laboratory Germination.	Plants Harvested per Acre.	Tillers Harvested per Acre.	No. of Seeds per Lb. (Approx.).	Effective Seed per Acre (Approx.).		Average Tillers per Plant.
					Plants.	Tillers.	
	%				Lb.	Lb.	
Early Kalo ..	Certified	21,978	45,732	23,200	1	2	2·08
Wheatland ..	70	27,195	53,835	16,880	1½	3½	1·94
Hermitage Selection ..	..	43,845	61,938	23,200	2	2¾	1·41
Caprock.. ..	75	30,414	39,627	16,880	1¾	2⅓	1·30
Kalo	74	36,075	54,279	23,200	1½	2⅓	1·57
Martin	81	26,751	36,186	16,000	1½	2¼	1·35
Plainsman ..	84	41,403	48,507	16,880	2½	2⅘	1·17
Hegari	81	24,864	56,388	16,880	1½	2⅓	2·27

It will thus be seen that for a planting rate of 7.7 lb. per acre only one-eighth to one-third survived as mature plants, bearing out experience on the heavy soils of the Darling Downs and in the United States.

Counts were also made in the row spacing trials, with the results as set out in Table 19.

TABLE 19.

DATA FROM STAND COUNTS IN ROW SPACING TRIALS.

Spacing and Rate.	No. of Plants per Acre.	No. of Tillers per Acre.	Effective Seed per Acre.		Average Tillers per Plant.
			Plants (Approx.).	Tillers (Approx.).	
			Lb.	Lb.	
7 inches x 10 lb. ..	43,829	54,612	2	2½	1·25
14 inches x 7·7 lb. ..	32,412	39,827	1½	1⅘	1·22
21 inches x 5·1 lb. ..	18,648	24,864	¾	1	1·33
28 inches x 4·25 lb. ..	14,341	20,291	⅔	1	1·41
35 inches x 3·8 lb. ..	10,789	14,519	½	⅔	1·34

The results indicate that over all of the trials the germination percentage as indicated by the plant stand at harvest was only 20%—that is, five times the amount of seed was planted for the strike obtained. This result was obtained under *good planting conditions* with *certified seed* under *standard trial conditions.* It is obvious then that a good deal of research is necessary in connection with germination of the seed in the field. With adequate preplanting subsoil moisture, a heavier planting rate is indicated.

In general, the rate of planting of sorghum varies with the expected conditions. That is, if there is sufficient subsoil moisture at planting time to ensure a good crop, the planting can be heavier than in the case of poor subsoil moisture. A moisture survey before planting would be worth while on large areas. Likely rainfall during the post-planting season cannot be predicted and one can only work on averages. Commercial growers in Queensland usually adopt a planting rate of 6-8 lb. of seed per acre with a row spacing of 14 inches, and the whole of the crop is handled with wheat-planting machinery.

The variability of the seed has an important effect on the ultimate stand and very mixed results have been obtained over the years in actual plant stands.

Following on experimental plantings at Peak Downs in the 1949-50 season, Hart in his experiments in 1950-51 at Springsure arrived at an optimum spacing with plants 12-15 in. apart in rows 14 in. apart. On the basis of a 25% field germination this is equivalent to 6½-8½ lb. per acre of Kalo for the Springsure properties, with a possible reduction to 4-6 lb. per acre for Peak Downs because of generally higher field germination.

Hart further showed that there was a significant difference in favour of rolling following planting to press the moist soil around the seed. This press-wheel practice is followed frequently on the Darling Downs and overseas.

A further consideration is one of policy—does it pay better to capitalise the good moisture conditions than to try to arrange an average planting rate year in year out? The former is considered to be a better approach, particularly when grain growing is combined with grazing, as in a good year there will be ample natural feed for the stock and the grain crop can be harvested and sold, whereas in a lean year the poor crop can be utilised for grazing.

The trials reported above were planted in the period January 19-24, 1950, after 176 points of rain on the 18th and a total of 70 points from the 1st to the 12th inclusive. A further 53 points fell on the 23rd. The plots were harvested about June 16, 1950, but any rain after May 16 would have been ineffective so far as yield is concerned.

The rainfall during the growing period was—

	Points.
January 24–31	108
February	585
March	482
April	503
May 1–16	..
	1,678

The rainfall for January-May (inclusive), 1950, compared with the Peak Downs average to 1947, is as follows:—

	1950. Points.	Average. Points.
January	407	440
February	585	325
March	482	260
April	503	125
May	215	95
	2,192	1,245

The experimental results are interesting in that they point to the productive capacity of the Central Highlands black soils under favourable conditions, and indicate problems such as poor germination which are likely to occur. For a closer picture of the problems involved and methods of overcoming them, experiments would have to be continued for a number of years.

THE FEEDING VALUE OF SORGHUM STUBBLE.

Grain sorghum stubble has been utilised for a number of years by dairy-farmers on the Darling Downs and in the Callide Valley to provide roughage and some nutrients during the winter months. The actual feeding value has not been ascertained experimentally.

The Queensland-British Food Corporation, since its inception, has successfully turned off fat bullocks grazed on the residues following the harvesting of the grain crop. Due to the vagaries of the weather, in most cases these residues have been enhanced in feeding value by the presence of second-growth grain, green shoots from the root crowns, and a very rich admixture of native legumes (for example, *Glycine tomentosa*) and native grasses such as Flinders, sago, blue and hoop Mitchell.

Plate 7.

Heavy Volunteer Growth of the Native Legume Glycine tomentosa in Ripening Sorghum, Peak Downs, 1950. This grazing mixture was used to fatten pigs while the legume was succulent.

In an attempt to ascertain the feeding value as indicated by chemical analyses, samples of sorghum "stubble" were collected from various properties in the 1949-50 and 1950-51 seasons and submitted to the Agricultural Chemist of the Department of Agriculture and Stock for analysis. The stalk, flag and threshed heads were analysed separately. The analyses, together with data for lucerne hay and Flinders grass hay from one of the paddocks, are shown in Table 20.

From the analyses it can be seen that considerable variation occurs. In the 1949-50 crop, the protein content of the flag was remarkably high, approximating that of lucerne hay. In the following season, however, the feeding value of the flag was considerably lower.

Field observations indicated that this crop suffered some nitrogen deficiency, due probably to the heavy leaching caused by the excessively wet period from October to January, in which 22·15 inches fell at Peak Downs, compared with 12·93 inches in the same period in 1949-50. There is evidence from the Callide Valley that the protein content of the flag depends a good deal on the nitrogen status of the soil, and this appears to hold also in the Central Highlands.

TABLE 20.

ANALYSES OF "STUBBLE" FROM GRAIN SORGHUM PADDOCKS.

Feed.	Moisture.	Water-free Material.						
		Crude Protein.	Crude Fat.	Crude Fibre.	Carbo-hydrates.	Ash.	P_2O_5.	CaO
	%	%	%	%	%	%	%	%
Lucerne hay ..	10·0	15·0	2·0	28·9	36·6	8·2	..	..
1949–50 Crops.								
Hegari (flag) ..	10·4	8·6	1·6	23·7	40·8	25·3	0·31	1·07
Kalo (flag) ..	12·8	18·1	1·4	27·2	39·8	13·5	0·34	0·87
Early Kalo (flag)..	10·1	12·7	0·6	25·5	42·5	18·7	0·49	1·35
Wheatland (flag)..	10·9	9·1	0·5	22·1	46·1	22·2	0·28	1·07
Caprock (flag) ..	11·0	7·8	1·0	30·9	42·5	17·8	0·38	1·21
Martin (flag) ..	10·9	9·5	1·1	26·0	39·0	24·4	0·31	1·01
Plainsman (flag) ..	10·6	8·3	1·2	29·6	39·1	21·8	0·35	1·07
Wheatland (threshed heads)	12·5	5·0	0·9	39·9	43·5	10·7	0·22	0·26
Wheatland (threshed heads)	12·2	5·9	1·3	37·9	43·1	11·8	0·26	0·71
1950–51 Crops.								
Kalo (stalks) ..	6·3	1·7	..	32·6	..	..	0·28	0·70
Kalo (flag) ..	6·3	2·9	..	27·6	..	..	1·01	0·58
Flinders grass hay	5·6	3·0	..	35·4	..	..	0·36	0·37

With the fertile soils of the Central Highlands, it is almost certain that herbage and grass growth, coupled with sorghum regrowth and residues, will always provide good feed for stock fattening.

ACKNOWLEDGMENTS.

The soil and plant analyses recorded in this article were made in the Chemical Laboratory of the Department of Agriculture and Stock, and the Department's Biometrician in the Division of Plant Industry assisted with interpretation of the experimental data. The Deputy Chairman and staff of the Queensland-British Food Corporation provided information, facilities and materials.

Propagation of Fruit Trees.

By Officers of the Horticulture Branch.

THE majority of fruit trees are vegetatively propagated and consist of two parts, the stock and scion. The stock provides the root system and is chosen for its inherent vigour, its suitability for the soil type and its compatibility with the scion. The scion forms the head of the tree and therefore determines the type of fruit produced. As an orchard does not come into production for several years, well-worked trees with the right stock and scion characteristics are essential in commercial practice.

RAISING THE ROOTSTOCK TREE.

The majority of rootstocks are raised from seed but some can be propagated by cuttings or layers. The seed should be obtained from the mature fruit of disease-free trees with the required characteristics. Some types of seed are stratified in autumn and planted in spring. Others, such as citrus, are generally planted soon after they are extracted.

Fresh seeds of many deciduous fruits remain dormant for some time after they are removed from the fruit. The resting period of these seeds may be broken by low winter temperatures or alternatively by cold storage for periods ranging from one to three months. Usually the seed is stratified between layers of moist sand or peat moss and held in a cool place. Stratified seeds are normally planted early in spring before germination commences. Large seeds may, however, be examined at regular intervals during the stratification period, so that those which are ready to strike immediately can be planted at the one time.

Seed-beds.

A well-drained light sandy loam is required for the seed-bed to promote deep root growth. Such a soil is naturally infertile, and it is usual to add well-rotted compost, leaf mould or manure some weeks before the seed is planted. Facilities for overhead watering and shading are essential, as for some weeks after germination the young plants can tolerate neither lack of water nor exposure to the hot sun.

The normal seed-bed is 4 ft. wide and any convenient length, and it may be constructed with 8 in. x 1 in. hardwood frames raised about 4 in. above ground level. The soil is dug some weeks before the scheduled planting date, and subsequently brought to a fine tilth. The seed is usually sown in rows 4-6 in. apart, the depth and the rate of

sowing varying with the specific requirements of the plant. After sowing, the bed is smoothed and lightly tamped. Regular watering is then required until germination takes place.

Nursery Rows.

When the seedlings are 6-18 in. tall (again depending on the species), they are transferred to nursery rows (Plate 1) on land which has been cultivated deeply, the plant rows being opened up at 3½ ft. spacings to a depth of about 6 in.

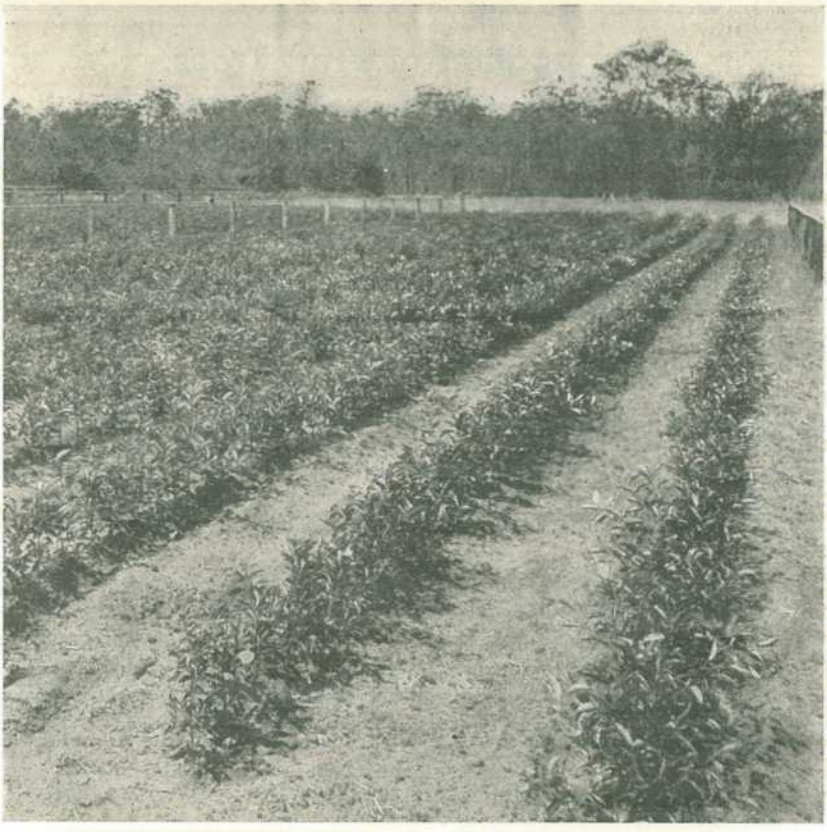


Plate 1.

Nursery Rows of Citrus. Seedlings are transplanted from the seed-bed to nursery rows when they are about nine inches tall.

After first thoroughly soaking the seed-bed, the young trees are lifted. Any misshapen or backward trees are discarded at this stage. After shortening the tap roots, the sound trees are set out 12 in. apart in nursery rows at the same depth as they were in the seed-bed. At this stage great care must be exercised in the placement of roots during transplanting; otherwise the trees may develop twisted and malformed roots. The nursery rows should be watered heavily after the trees are planted.

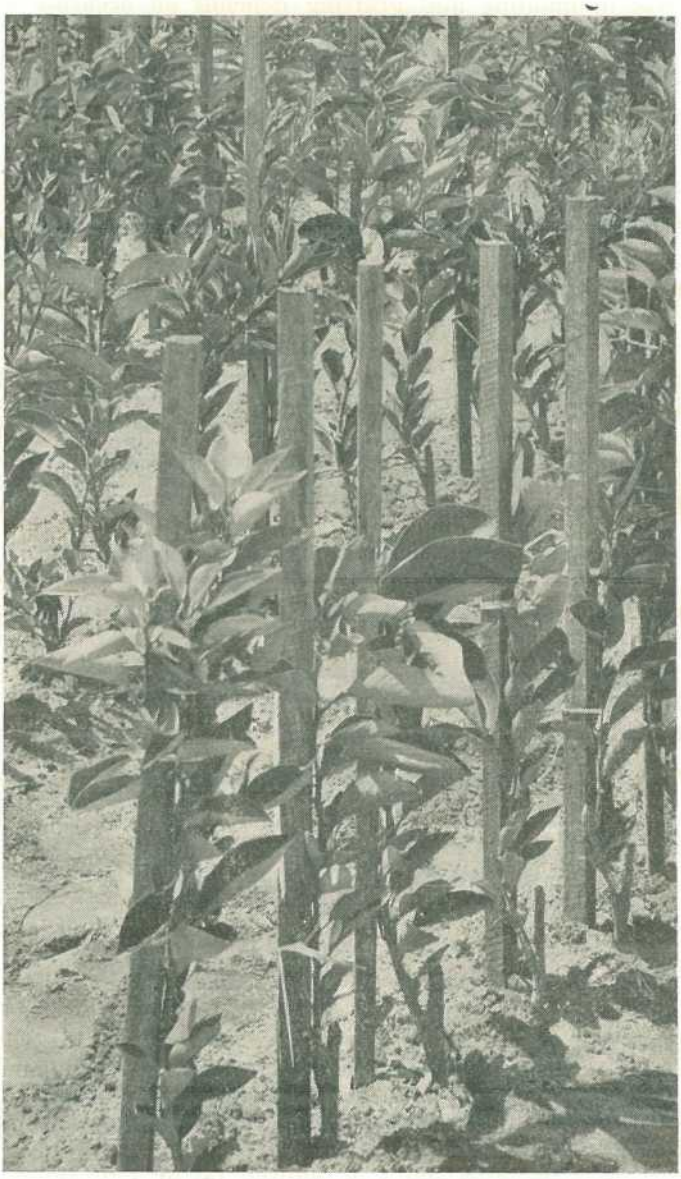


Plate 2.
Worked Citrus Trees in Nursery Rows.

When growth in the nursery rows is well forward, and the seedlings are large enough for "working," the trees are usually budded or grafted (that is, a scion of the required variety or strain is worked onto each stock). Only healthy, vigorous trees should be budded or grafted (Plate 2).

PRINCIPLES OF BUDDING AND GRAFTING.

Success in budding and grafting depends on accurate matching of, and close contact between, the growing tissues of the stock and scion. These tissues are known as the cambium tissues and lie between the bark and the wood. When a graft is made, callus tissue is formed in the region of the graft and the adjacent cells of the stock and scion interlock with each other to form a strong union.

Close contact between the cambium tissues of the stock and scion is only one factor in successful budding and grafting. Equally important are compatibility between the stock and scion varieties, careful handling of the wood to prevent drying-out, correct timing of the operation, efficient after-care of the graft and good workmanship.

Selection of Budwood and Graftwood.

Scions are selected from mature wood bearing strong, healthy buds. In most fruit trees, scion-wood is taken from the previous season's growth, but in the fig, 2-year-old wood is preferred. In subtropical fruits such as citrus and the avocado, mature wood from a recent flush of growth may be used. Scions or buds from the central portion of a bud-stick give the best results.

The trees from which budwood or graftwood is cut should be healthy, vigorous and free from virus diseases which are transmissable through the bud or graft. They must also be true to type and have a good cropping record.

In certain hardwood species, such as Macadamia nut, the branches of the trees are girdled some weeks before the scion-wood is cut to allow the accumulation of food reserves in the tissues.

Time of Budding and Grafting.

In many grafts, a scion has to be inserted under the bark of the stock and the work is usually carried out during periods of sap flow when the bark lifts freely. Normally, budding and grafting are performed in early spring, although in citrus and some other subtropical fruits the work can also be carried out in autumn.

After-Care of Grafts.

After-care of the graft is just as important as the budding or grafting operation itself. Most grafts are tied, preferably with damp raffia, and waxed or otherwise protected to prevent drying-out of the tissues and to exclude air and moisture from the union until the stock and scion have grown together. Commercial grafting waxes are available for protecting the union, but a home-made preparation containing 1 lb. beeswax, 1 lb. resin and ½ lb. mutton fat or 1 lb. tallow is quite satisfactory. Such materials may be used alone or on waxed cloth.

The tie must be cut when the tissues of the stock and scion have knitted together, usually 2-3 weeks after grafting. The cut is made on that side of the stock opposite to the graft in order to avoid possible injury at the union.

In autumn-budded and autumn-grafted nursery trees, the stocks are shortened back early in the following spring to force the growth of the buds. With spring- or late-winter-worked trees, cutting-back may not

be necessary until the bud or graft has made some growth. In either case the stock is headed back just above the bud or graft with a sloping cut. Sometimes the stock trees are broken and bent over about 6 in. above the union to force the bud or graft into activity; the stock is then cut back when the scion is sufficiently large for staking.

A wire or wooden stake is frequently driven into the ground close to the stock of each worked tree and the shoot is tied to it with tape, raffia or string. Even in topworked trees, the grafts may require some support from stakes, which are lashed to the stock or driven into the ground.

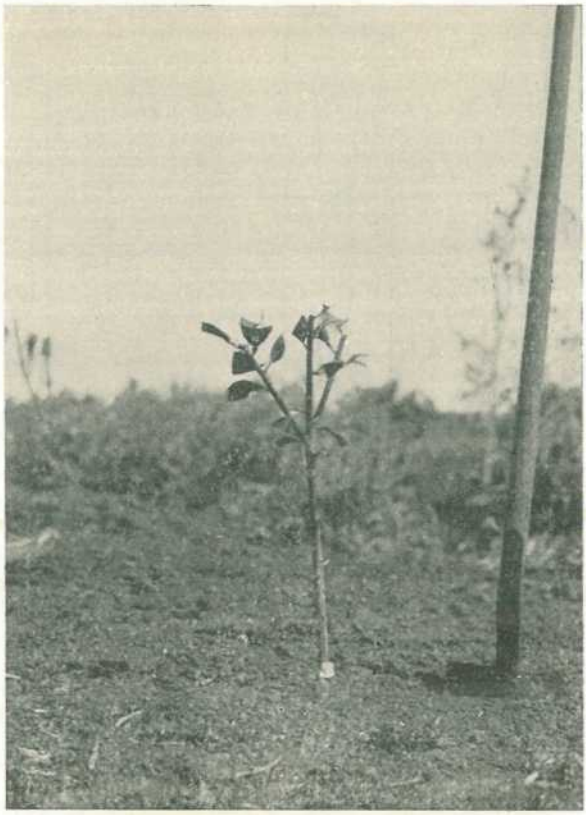


Plate 3.

Young Citrus Tree Planted in the Orchard. The fork is about 18 inches above ground level.

Any shoots thrown by the stock after grafting or budding must be rubbed off as they appear. Similarly, side shoots developing on the scion must be suppressed until the terminal reaches the required head height for the tree. One or two lateral shoots may then be allowed to grow and form the framework of the future tree. The height for topping varies from 18 to 24 in. (Plate 3.)

Equipment.

The range of tools needed by the propagator depends on the method of budding or grafting to be used. They include budding and grafting knives (several types are available), secateurs, pruning saws, hammer chisels and, in the case of cleft grafts, a splitting tool. All tools should be of the best quality available and in first-class condition.

BUDDING.

Budding is generally used in nurseries for the propagation of young trees and also in the orchard to work one variety over to another. The work is carried out in autumn or spring, and occasionally in the late summer. There are several recognised methods of cutting the bud and inserting it on the stock plant. The best known and most widely practised is shield budding.

Shield Budding.

Shield budding (Plate 4a) is commonly used in nursery practice for many deciduous and subtropical fruits.

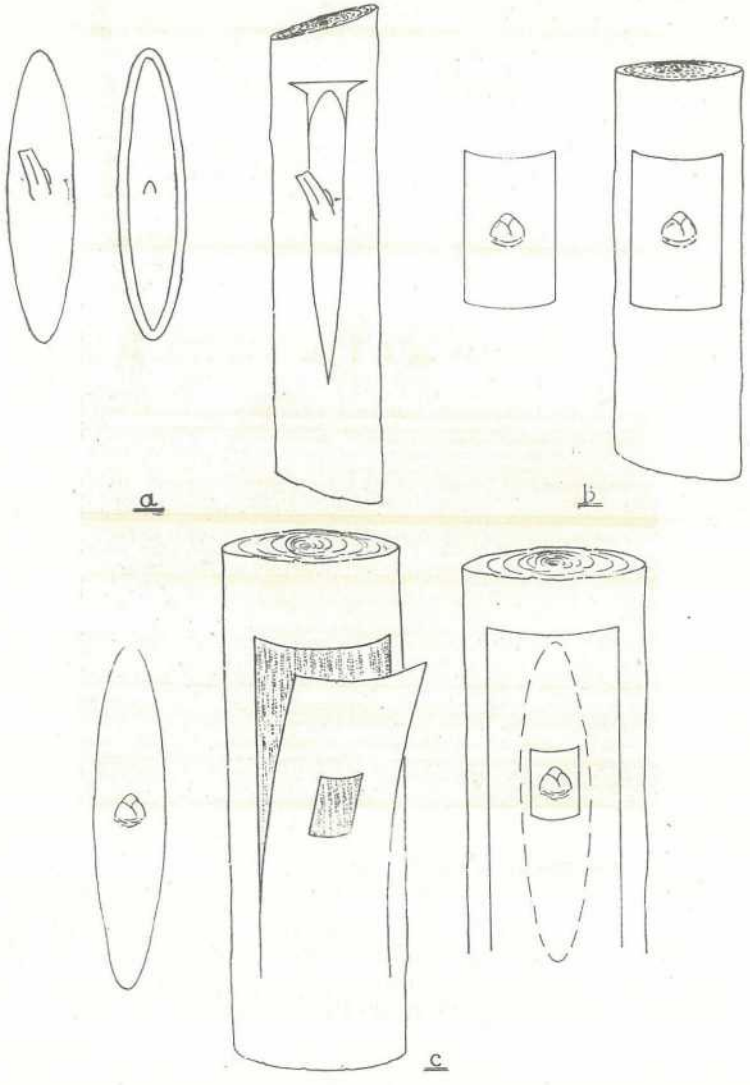


Plate 4.

Methods of Budding: a, Shield bud—bud with leaf stub protruding; inner view of bud; bud inserted in stock. b, Patch bud—bark patch with bud in centre; patch in position on stock. c, Window bud—bud; stock with raised bark flap and window; bud in position.

The bud should be inserted in the stock tree 3-6 in. above the ground according to the species, but many nurserymen work as close to the ground as practicable. The bud is usually placed on the south side of the rootstock seedlings for protection against the sun.

The correct procedure is to make a T cut on the rootstock seedling at the selected position, the vertical slit and horizontal cuts of the T being no longer than is necessary to accommodate the bud. Some nurserymen prefer an inverted T. The flaps of bark on the T are prized open ready to receive the bud.

A bud with a thin slice of bark about 1¼ in. long is cut from a bud-stick with a sharp, thin-bladed budding knife, the bud-stick being held firmly in the hand. The budding knife is inserted into the bark about ½ in. below a bud, which is then detached with a sliding cut towards the operator. In some plants, the small wood chip below the bud may be removed before the latter is inserted into the T cut on the stock tree. When placed in position, the shield of bark with a central bud lies under the bark flaps of the T.

The bud is tied firmly in position with raffia or waxed tape, the bud and the petiole stub, if present, being left exposed.

Raffia, tape or string ties must be cut away 10-14 days after budding unless the unions are covered with soil, when they rot fairly quickly.

Modifications of the shield bud are the H bud, the patch bud, the window bud and the chip bud. In the H bud, bark cuts are made in the form of an H and the bud is inserted under the flaps. In the patch bud (Plate 4b), a rectangular piece of bark is completely removed from the stock and replaced by a piece of bark from the scion of the same size and carrying a single scion bud. The window bud (Plate 4c) is a modification of the patch bud in which a flap of bark is lifted from the stock and replaced with a shield bud from the scion underneath and protruding through an opening in the centre of the flap.

GRAFTING.

Budding is by far the most economical method of using scion material, but grafting is more widely practised in propagating some types of fruit trees. Scions should be cut with at least three prominent buds.

Whip-Tongue Graft.

The whip-tongue graft (Plate 5) is commonly employed in many deciduous-fruit nurseries, particularly when the stock and scion are less than 1 in. in diameter and about the same thickness. It is also used in top-working and in crown-grafting a tree to another variety or strain.

A sloping cut about 1½ in. long is made on the base of the scion and also on the top of the stock. The length of the cut depends on the size of the wood being grafted; the greater the diameter, the longer the

cut surface. Starting about one-third of the way back from the tip of this cut, a reverse cut is made about half an inch deep and at an angle of about 15 degrees to it. Reverse cuts are made on both scion and stock, which are then fitted together so that the tongues slide one inside the other. If the stock and scion are not the same size, the cambiums are matched on one side only.

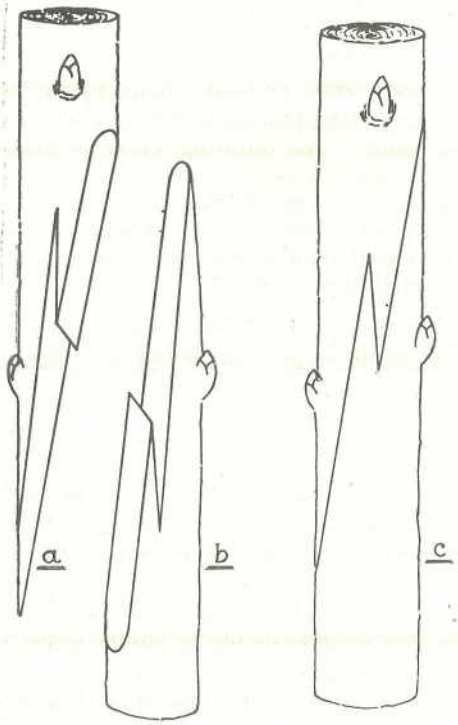


Plate 5.

Whip-tongue Graft: a, Prepared scion; b, Prepared stock; c, graft in position with stock and scion matched.

The graft union is then tied in position with raffia or tape and sealed with grafting wax.

Bark Graft.

Bark grafting (Plate 6) can only be performed during an active growing period when the bark lifts freely, and is mainly used in top-working.

The top of the tree is removed and the grafts are made in the stubs of the trunk or branches. A 2 in. slit is cut in the bark from the edge of the stub, and the bark flaps are raised slightly with the back of the knife blade. Scions are prepared with a sloping cut 2 in. long on one side and a similar but shorter cut on the opposite side. With thick scion-wood, a shoulder is cut into the scion before the long, sloping cut is made. The scion is inserted behind the bark

flaps with the longer cut inside. A small nail ($\frac{5}{8}$–$\frac{3}{4}$ in. long) is driven through the centre of the scion into the stock. The scion is then bound with tape or string and the whole of the graft, including the stub and the ends of the scions, is waxed. As many as six scions may be inserted on each stub of top-worked trees.

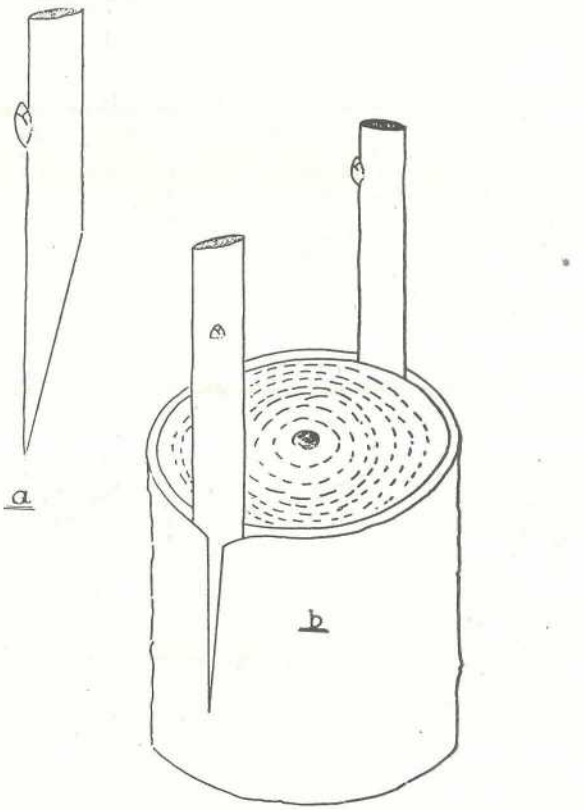


Plate 6.

Bark Graft: a, Prepared scion; b, Stock with two scions in position.

With some subtropical species, better results can be obtained by making two bark slits on the stock, one on each side of the scion after it has been shaped and placed against the stub. The chip of bark is then peeled back, the scion inserted, and the bark nailed back onto the scion and stub.

A number of other types of bark graft (Plate 7) are used for re-working deciduous fruit trees. These include the modified bark graft, the L graft, the T or ⊥ graft and the gouge graft.

In the modified bark graft, a single downward cut is made from the stub and the bark is lifted on one side only. The scion is prepared as in the usual bark graft and slipped under the bark of the stock so that the trimmed edge of the scion lines up with the cut on the stock.

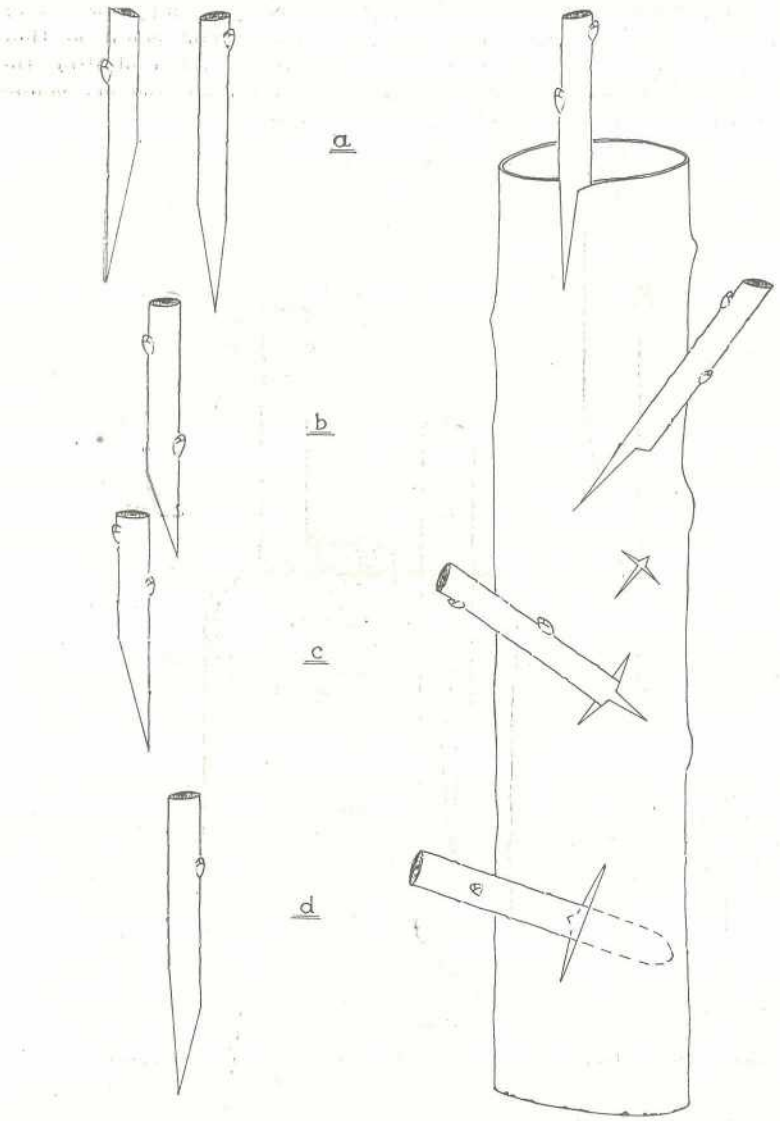


Plate 7.

Other Bark Grafts for Use in Deciduous Fruit Trees: a, Modified bark graft; b, L graft; c, T or ⊥ graft; d, gouge graft.

Side-Wedge Graft.

Side-wedge grafting (Plate 8) may be employed when the stock tree is too large for whip-tongue grafting. It is also a satisfactory method for working nursery trees with a hard, brittle wood.

With stocks about 1 in. in diameter, an oblique, downward cut is made into the centre of the stock. The scion is prepared by shaping the lower end to a wedge with two sloping cuts, one longer than the other—the longer cut being the same length as the cut made in the stock. The top of the stock is bent back to allow the insertion of

the scion, which is placed in position with the longest side of the wedge innermost and the two cambiums together on one side of the stock. The scion is then tied or nailed in position and the union and the tip of the scion waxed.

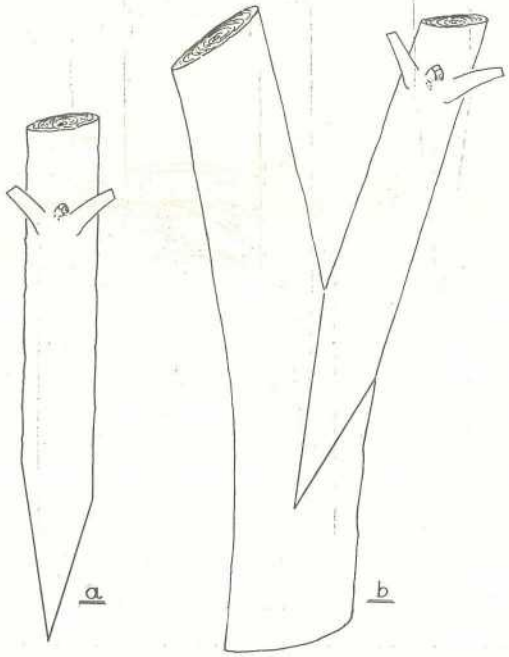


Plate 8.

Side-wedge Graft, α Method Used in Macadamia Nuts: a, Prepared scion; b, Scion in position on the stock.

If the stock and scion are less than 1 in. in diameter and approximately the same size, the procedure is slightly different. The stock is grasped with the finger-tips of the left hand, the third finger being a few inches above ground level, where the graft is to be made. An oblique, downward cut is then made rather more than half-way through the stock. Care must be taken not to split the stock. After the wedge-shaped scion is inserted in the cut on the stock, the union is bound with raffia or tape and waxed. Small worked trees of this type must be tied to a stake so that the graft will not be damaged by wind. The graft tie is cut in 14-21 days.

Cleft Graft.

The cleft graft (Plate 9) was formerly used mainly for reworking apple trees to another variety and is now a popular method of reworking grapes.

The branches of the tree are sawn off about 18 inches above the crotch. The edges are trimmed and each stub is then split open at the centre with a chisel and mallet, a wedge being used to keep the split open until scions have been inserted. The end of the scion is shaped in the form of an elongated wedge and inserted into the bark end of

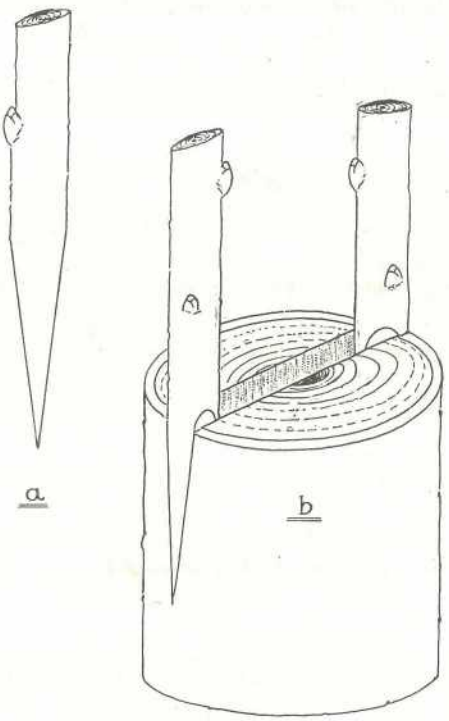


Plate 9.

Cleft Graft: a, Prepared scion; b, Scions in central cleft on stock.

the split, so that the cambium of the stock matches that of the scion. The scion is tied into position and the whole of the stub, including the cleft itself, is thoroughly waxed.

Cleft grafts are usually made during a sap flow in early spring, but as the bark has not to be lifted, the work may be done in late winter, if necessary.

Side-Cleft Graft.

Another form of side graft, the side-cleft graft (Plate 10) is sometimes used in propagating custard apples.

The scion is prepared with a long, sloping cut at one end; a second cut is then made at an angle to the first and the tip of the scion is bevelled. Corresponding cuts are made in the side of the stock tree at the point of the proposed graft. They include a sloping cut extending almost halfway through the stock, a second cut beginning at the same point as the first but at an angle of about 10 degrees from the vertical, and finally a more or less horizontal cut which removes the outer chip of wood. When fitted together, the tongues of the stock and the scion match and the bevel of the scion sits flush with the outer edge of the stock.

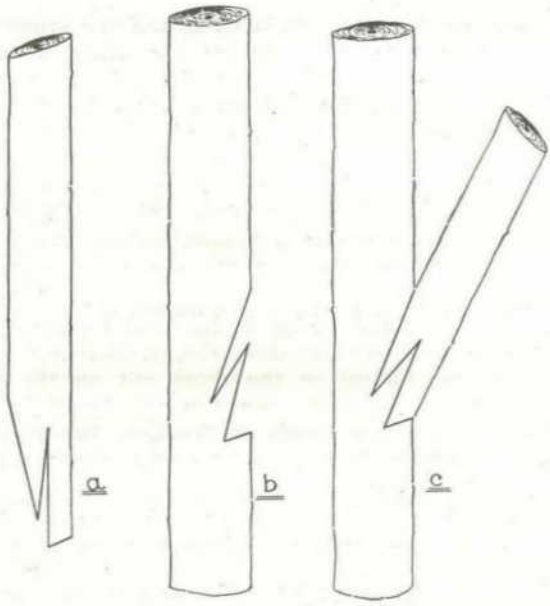


Plate 10.

Side-cleft Graft: a, Prepared scion; b, Prepared stock; c, Scion in position on stock.

Strap Graft.

The strap graft (Plate 11) is commonly used to re-furnish deciduous fruit trees at Stanthorpe.

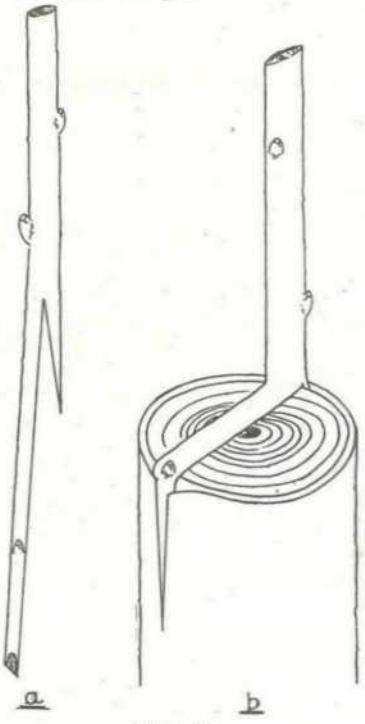


Plate 11.

Strap Graft: a, Prepared scion; b, Scion in position on stock.

The branches are first shortened back and the stubs are trimmed. On a small branch 1-2 in. in diameter for which a single scion is required, a longitudinal cut about 1½ in. long is made in the bark on the upper side of the stub, the bark then being freed. A similar but shorter cut is made on the opposite side of the stub The scion is prepared by first cutting the strap—a thin shaving of bark and wood about 1 in. longer than the diameter of the stub. The strap so formed is attached to the scion at its upper end. The wood on the opposite side of the scion is removed with a sloping cut to form a wedge about 1 in. long. Finally, a small, sloping cut is made on the outer edge of the free tip of the strap.

In fitting the scion, the wedge is inserted between the bark and the wood at the long cut on the stub, the strap being taken over the stub and its free end placed in the short cut on the opposite side. The strap must fit closely onto the top of the stub. When both the wedge and the strap are firmly in position, the graft is tied and waxed. The tie should be cut some four weeks after the graft is made.

Strap-grafts are usually made as soon as the sap flow in late winter or early spring permits the bark to lift freely. Two scions—one on each side—may be fitted to stubs which are more than 2 in. in diameter.

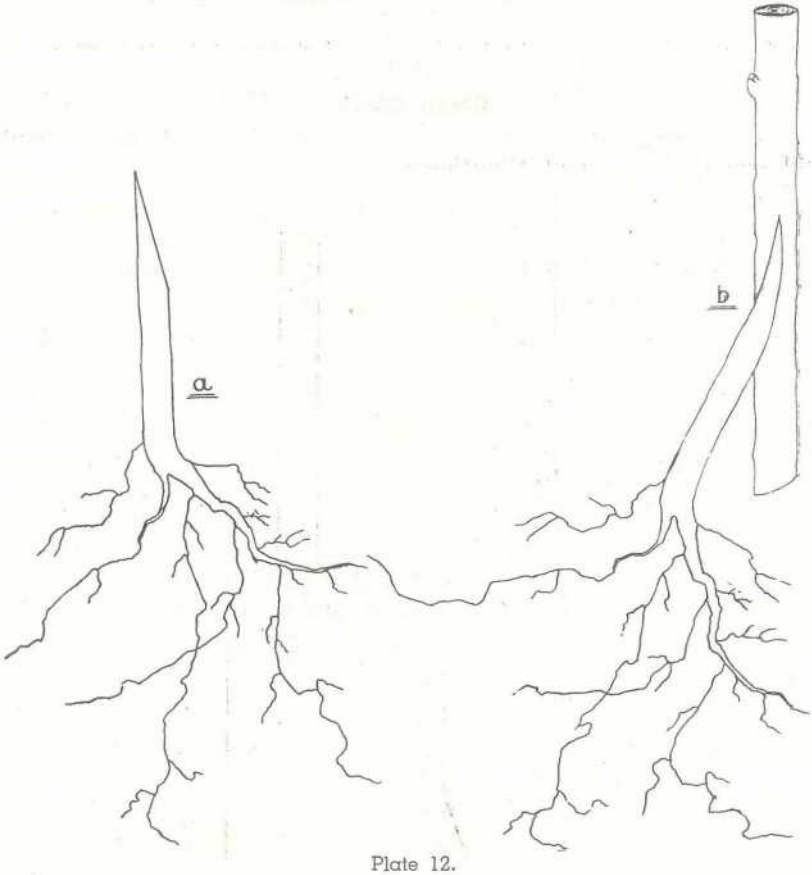


Plate 12.

Root Graft: a, Prepared scion; b, Stock and scion matched.

Root Graft.

The root graft (Plate 12) is mainly employed for propagating apples on free-rooting stocks such as Northern Spy, and for propagating grapes on phylloxera-resistant stocks. The work may be done indoors (bench grafting) or in the nursery. In the former case, 1-year-old rooted plants are taken up in winter, grafted, stratified and then replanted in the following spring.

When the stock diameter is less than that of the scion, it is shortened back with two sloping cuts about 1½ in. long into the form of a wedge. The scion is opened up with a single cut reaching almost to the centre, the stock and scion being then fitted into each other, tied and waxed. This graft is essentially a reverse side-graft.

When the stock diameter is equal to or greater than that of the scion, the whip-tongue graft takes precedence over the root graft as a method of propagation.

If root grafting is carried out in the nursery row, the plants are hilled up with soil to cover the union.

Inarching.

Inarching (Plate 13), or grafting by approach, is sometimes used to rejuvenate trees which are lacking in vigour because the root system is faulty. A young tree is planted beside the weak tree and its stem is grafted into the trunk. The work is carried out in early spring.

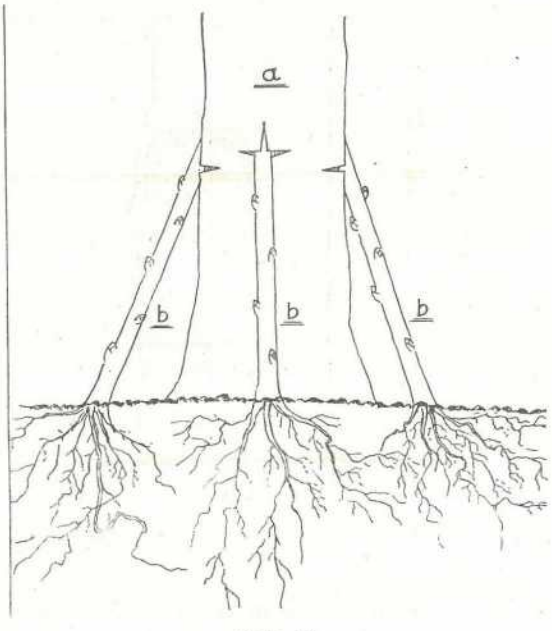


Plate 13.

Inarching or Grafting by Approach: a, Original tree; b, Young trees on their own roots grafted onto the original tree.

The graft can be made by either of two methods—the ⊥ or the slot. In the first of these, a ⊥ cut is made in the trunk about 16 in. from the ground, and a small piece of bark is cut out just below the

horizontal cut to allow the seedling stem to fit snugly. The seedling is prepared by making a sloping cut about 2 in. long at a height which allows it to fit into the ⊥ cut on the older tree. When so inserted, it is tacked into position and waxed.

In the slot method, a strip of bark about 2 in. long and the width of the seedling trunk is removed from the older tree on the side adjacent to the seedling. The seedling is prepared by making a long, sloping cut on the side facing the trunk of the older tree at the proper height, thus cutting the top off the seedling, and by a shorter cut on the opposite side. The wedge-shaped tip is then fitted into the slot on the trunk, the upper portion being pushed under the bark at the top of the slot. The seedling is held in position by a long tack or brad and the graft is sealed with wax.

During the first year after grafting, shoots on the seedling tree may be retained, but from then on they should be completely suppressed.

Bridge Graft.

The bridge graft (Plate 14) has a limited application for repairing extensive bark injury to the trunk and is sometimes a useful method of saving valuable trees.

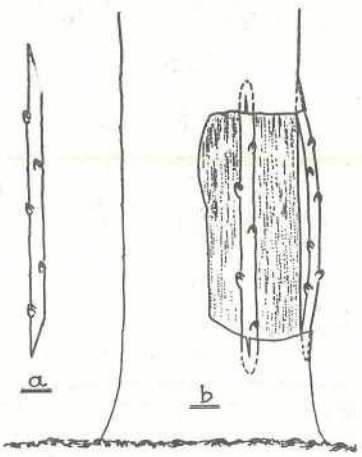


Plate 14.

Bridge Graft: a, Prepared scion; b, Scions inserted over injured part of trunk.

The injured bark is trimmed to healthy tissue and two parallel cuts are made vertically in the bark above and below the exposed wood. A scion of the right length is cut with an elongated wedge at each end. The ends of the scion are then inserted under the bark of the older tree at each cut, tacked into position, and the exposed surfaces thoroughly waxed. Several bridge grafts may be required on a badly injured tree.

Suckers arising from the trunk below the injured bark may be grafted into healthy bark higher up the trunk to take the place of the bridge grafts already described.

LAYERING.

Layering is a method of rooting stems or branches while they are still attached to the parent plant.

Simple layering consists of pegging-down a branch so that part is buried under soil and the tip is uncovered. If the buried portion of the branch is first girdled, roots will often form at the callus. The rooted branch is severed from the parent and established as a separate plant on its own roots during the dormant season. This method of propagation is commonly used for some shrubs and grapes.

Tip layering and *stool layering* are modifications of simple layering which are particularly suitable for propagating some vine plants or scramblers. Essentially the method is to cover the branch tips (tip layers) or the branch bases (stool layers) with soil to encourage root development. When detached from the parent, the rooted portions can be established as new plants.

In *trench layering*, the whole top of a young tree is pegged down in a shallow trench, and shoots are partly covered with soil to encourage root formation. The rooted shoots are later detached from the parent tree and planted out separately.

CUTTINGS.

A cutting is a piece of a twig, branch or root which is detached from the plant and placed in a rooting medium.

Hardwood cuttings are usually selected in early winter from the previous season's growth, but with some species, such as the fig, 2-year-old wood is generally used. They are usually 5-15 inches in length, with several buds, the lower cut being made immediately below a bud, and the upper cut midway between two buds. The cuttings may be stored in moist sand or moss or they can be planted in a sandy loam under partial shade in the nursery. Each is planted with one or more buds showing above the surface of the soil at spacings of 2-3 in. in the nursery row.

Root cuttings are often employed in propagating berry plants. The roots are cut in pieces 2-4 in. long and planted in a nursery row. Most raspberry and blackberry cuttings are laid horizontally at a depth of 2-3 in., but in some other plants the root cuttings are placed upright with the top of the cutting at ground level.

Cuttings of some tropical and subtropical plants root only under warm, humid conditions and in such cases specially designed propagating boxes supplying bottom heat are used. Coarse calcareous sand is an effective propagating medium, provided that the sand is kept moist.

BUDDING AND GRAFTING METHODS AND ROOTSTOCKS USED IN THE PROPAGATION OF FRUIT TREES.

Crop.	Effective Methods.		Recommended Rootstock.
	Nursery.	Re-working.	
Apple	Whip-tongue and root grafts	Cleft, strap and bark grafts	Northern Spy ; French crab seedling ; Merton 778, 789, 793 ; Local S4
Apricot ..	Whip-tongue graft ..	Bark graft ; budding in new growth	Apricot, peach, Myrobolan plum
Avocado ..	Budding	Bark graft ; budding	Mexican seedlings
Citrus	Budding	Budding in new growth ; bark graft	Sweet orange ; rough lemon
Custard apple	Side-cleft graft ..	Budding ; bark and cleft grafts	Seedlings
Fig	Cuttings	Cleft and bark grafts (take 2-yr.-old wood for scions)	Fig (cuttings)
Grape	Cuttings ; root and whip-tongue grafts	Cleft graft ; budding	Grape (phylloxera-resistant)
Macadamia nut	Side-wedge graft ..	Side-wedge graft ..	Seedlings
Mango	Window, shield and patch budding ; inarching	Budding ; grafting..	Seedlings
Olive	Cuttings	Budding ; bark and cleft grafts	Olive (cuttings)
Peach	Whip-tongue graft ..	Bark graft ; budding	Peach seedlings
Pear	As for apple.. ..	As for apple.. ..	Pear seedlings
Pecan nut ..	Budding (shield, chip and patch) ; whip-tongue graft	Budding in new growth ; bark graft	Pecan (cuttings)
Plum	Whip-tongue graft ..	Strap and cleft grafts ; budding in new growth	Peach (cuttings) ; Myrobolan plum
Quince ..	As for apple.. ..	As for apple.. ..	Quince seedlings

Orderly Purchase of Farm Needs.

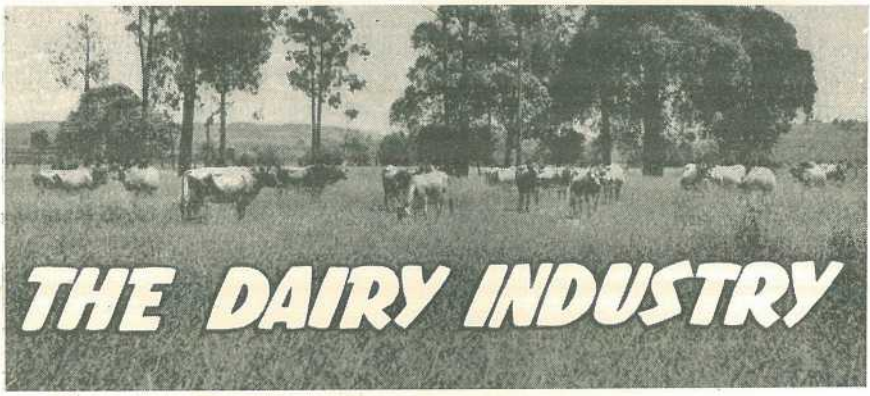
Primary producers can help to overcome the periodic difficulties in the supply position of various pest destroyers and other agricultural chemicals by informing their usual suppliers of their likely requirements for some time ahead, or, where practicable, keeping reserve stocks on the property.

Temporary shortages of insecticides, fungicides and so on have in the past seriously affected many producers. The main reasons for these shortages have been the limited availability of some raw materials to Australian manufacturers, and import difficulties. On many occasions, however, importers, manufacturers and distributors have been hampered in their efforts to maintain ample supplies by not knowing well in advance the likely requirements of certain lines.

Weather conditions can, of course, upset calculations of requirements, and forward planning of a cropping or livestock programme may be affected by many factors. Nevertheless, producers could ensure a more reliable supply position by booking or securing their needs in a somewhat more orderly fashion than has been usual.

There are many lines which are subject to deterioration in storage, and it is not recommended that these products be bought far in advance of the time at which it is intended to use them. The supplier might, however, be notified by the producer of his anticipated needs.

As the orderly distribution of materials is often disrupted by insufficient storage space in factories and warehouses, growers would be serving their own interests by taking early delivery of lines which do not deteriorate.



Report on Group Herd Recording for the Year Ending September 30, 1952.

S. E. PEGG, Chief Adviser, Herd Recording.

DURING the 12 months ending September 30, 1952, seasonal conditions varied greatly At the commencement of the period most of Queensland was in the throes of one of the worst droughts experienced for many years. In most districts relief was not received until late in February. As a result of these conditions most cows which completed lactation during the 12 months milked throughout a drought and the average production per cow was much below that of the previous years.

During the year, 45 groups were in operation, although in many cases the number of herds in each group was reduced; 23,123 cows in 818 herds completed lactation.

The total number of completed lactations and average production for each year are given in Table I.

TABLE 1.

NUMBER OF COMPLETED LACTATIONS AND AVERAGE PRODUCTION PER COW.

Year.	No. of Herds.	No. of Lactations.	Average Production per Cow.		
			Milk.	Test.	Butterfat.
			Lb.	%	Lb.
1948–49 ..	507	17,216	3,289	4·3	144
1949–50 ..	715	22,392	3,523	4·3	152
1950–51 ..	814	26,798	3,312	4·4	146
1951–52 ..	818	23,123	2,657	4·2	112

The decrease in the average production in 1951-52 compared with that of previous years is very largely due to drought, and stresses the need for fodder conservation to combat recurring dry seasons. The losses, both in stock numbers and in decreased production, incurred during the recent drought should serve as a lasting reminder of the need to conserve fodder. Unfortunately, in the past such good resolutions regarding the necessity for adequate fodder reserves have been forgotten soon after the season has improved, but it is hoped that a similar indifference will not be shown in the future.

Table 2 gives, according to age groups, the numbers of cows which completed lactation periods of 270 days or less, and their average production of milk and butterfat. All completed lactations are included even though due to the drought many were of short duration.

TABLE 2.

AVERAGE PRODUCTION OF COWS WHICH COMPLETED LACTATION PERIODS OF 270 DAYS OR LESS.

Age Group.	No. of Cows.	Average Production per Cow.		
		Milk.	Test.	Butterfat.
		Lb.	%	Lb.
2 years	2,554	2,334	4·3	101
3 years	2,135	2,449	4·3	106
4 years	1,788	2,561	4·3	111
Mature	6,948	2,780	4·2	117
Unknown	9,698	2,718	4·2	113
Total	23,123	2,657	4·2	112

The Queensland Government Statistician's report on dairy cattle and milk production for the year ending March 31, 1952, shows the average production of milk per cow as 195 gallons. Using the same average butterfat content as shown in group recording (4.2%), the average butterfat production would be 82 lb.

Effect of Length of Lactation.

The average production of cows with full lactation periods of 270 days was 149 lb. butterfat, while the average production of cows with completed lactation periods of less than 270 days was 93 lb. butterfat.

Details according to age are given in Tables 3 and 4.

TABLE 3.

AVERAGE PRODUCTION PER COW, ACCORDING TO AGE, OF COWS WHICH MILKED FOR THE FULL LACTATION PERIOD OF 270 DAYS.

Age Group.	No. of Cows.	Average Production per Cow.		
		Milk.	Test.	Butterfat.
		Lb.	%	Lb.
2 years	959	3,168	4·4	138
3 years	884	3,039	4·4	134
4 years	629	3,237	4·5	144
Mature	2,448	3,561	4·3	153
Unknown	2,954	3,697	4·2	156
Total	7,874	3,479	4·3	149

TABLE 4.

AVERAGE PRODUCTION PER COW, ACCORDING TO AGE, OF COWS WHICH COMPLETED LACTATION PERIODS OF LESS THAN 270 DAYS.

Age Group.	No. of Cows.	Average Production per Cow.		
		Milk.	Test.	Butterfat.
		Lb.	%	Lb.
2 years	1,595	1,832	4·3	79
3 years	1,251	2,032	4·3	86
4 years	1,159	2,194	4·2	92
Mature	4,500	2,356	4·1	97
Unknown	6,744	2,290	4·1	95
Total	15,249	2,233	4·2	93

These tables show that the 34% of cows which completed a 270-day lactation period produced 149 lb. butterfat, but those with a lactation period of less than 270 days produced only 93 lb. butterfat. The former production is 60% greater than the latter, clearly indicating the value of being in a position to maintain a nutritional standard which will ensure that cows milk for a full lactation period.

The average length of completed lactations for the year 1951-52 was 209 days. The average length of lactation over the three previous years was:—

1948-49 .. .. 220 days
1949-50 .. .. 223 days
1950-51 .. .. 203 days

The average length of lactation for each age group in each district for 1951-52 is given in Table 5.

TABLE 5.

AVERAGE LENGTH OF LACTATION FOR EACH AGE GROUP ACCORDING TO DISTRICT.

District.	2-year-old.	3-year-old.	4-year-old.	Mature.	Unknown Age.	All Cows.
	Days.	Days.	Days.	Days.	Days.	Days.
Atherton Tableland ..	222	227	223	227	228	226
Mackay District	182	192	212	194	181	186
Port Curtis	228	195	210	189	227	202
Upper Burnett	196	207	222	217	198	203
Central Burnett	213	207	213	221	201	212
South Burnett	210	213	213	203	195	201
South-Eastern Queensland..	214	229	215	220	208	215
Eastern Downs	185	189	195	188	198	195
Western Downs	184	188	191	182	181	184
All Queensland ..	207	217	211	213	204	209

Production per Cow.

Table 6 shows the average production per cow in each of the herd recording groups.

TABLE 6.

AVERAGE PRODUCTION PER COW, NUMBER OF HERDS AND NUMBER OF COWS WHICH COMPLETED LACTATION IN THE VARIOUS GROUPS, 1951–52.

Group.	Herds.	Cows.	Length of Lactation.	Milk.	Test.	Butterfat 1951–52.	Butterfat 1950–51.
			Days.	Lb.	%	Lb.	Lb.
Beaudesert ..	20	817	215	3,116	4·2	131	170
Biggenden.. ..	21	485	228	2,559	4·4	114	105
Boonah District ..	15	243	216	2,815	4·4	124	149
Burncluith ..	14	440	174	1,851	3·7	68	100
Cedar Pocket ..	15	422	231	2,817	4·8	135	162
Coomera	18	1015	200	2,525	3·9	98	..
Cooroy No. 1 ..	19	613	215	2,227	4·4	99	145
Cooroy No. 2 ..	21	661	218	2,314	4·2	98	133
Eungella	19	493	186	2,046	4·6	95	106
Gayndah	7	55	220	2,526	4·2	107	..
Goomeri	17	610	194	2,128	4·0	85	117
Gympie	14	278	219	2,028	4·3	88	122
Kenilworth ..	18	646	224	2,396	4·6	108	157
Kilcoy	19	833	176	2,086	4·4	92	124
Kilkivan	15	392	216	1,737	4·2	73	..
Killarney	11	213	151	2,247	3·9	88	171
Kingaroy No. 1 ..	20	451	188	1,988	4·0	79	136
Kingaroy No. 2 ..	22	403	211	3,150	3·7	118	138
Maidenwell ..	8	343	213	2,349	4·1	96	..
Malanda No. 1 ..	24	813	229	3,982	4·1	162	195
Malanda No. 2 ..	21	717	229	3,740	3·9	145	207
Malanda No. 3 ..	23	332	212	3,168	4·0	128	160
Maleny No. 1 ..	19	726	236	2,976	4·7	138	170
Maleny No. 2 ..	21	917	222	2,772	4·6	128	176
Mapleton-Kureelpa	24	564	237	2,703	4·4	119	137
Maryborough ..	25	405	169	1,459	4·4	64	..
Merrimac-Mudgeeraba	19	613	207	2,222	4·0	90	..
Miles	10	440	194	2,780	3·9	107	136
Millaa Millaa ..	21	707	226	3,371	4·5	153	186
Miva-Theebine ..	16	590	231	2,005	4·5	90	127
Monto	22	673	203	3,159	4·0	127	159
Mount Tamborine	24	551	214	2,456	4·5	111	147
Mundubbera ..	14	304	186	2,065	4·4	91	64
Oakey No. 1 ..	14	273	168	2,214	4·1	91	135
Oakey No. 2 ..	23	685	216	3,761	4·0	152	191
Oakey No. 3 ..	17	478	178	2,806	3·7	105	163
Pittsworth ..	16	430	220	3,936	4·0	157	186
Pomona	22	656	236	2,117	4·4	93	133
Tansey	19	570	201	2,417	4·3	105	132
Toogoolawah ..	19	527	214	2,736	4·3	117	129
Toowoomba No. 1	15	270	187	2,652	4·0	106	174
Toowoomba No. 2	19	323	175	2,183	4·1	89	150
Wallaville ..	14	173	202	2,180	4·7	103	64
Warra	23	639	185	2,566	3·9	101	149
Warwick	17	334	218	3,529	4·4	154	166

Value of Continuous Recording.

The value of herd recording is illustrated in Table 7, which shows the number of cows and the average production per cow of a herd whose owner has made excellent use of the information given by the scheme in applying the results to his herd management.

TABLE 7.

PRODUCTION RECORDS OF A HERD WHICH HAS SHOWN AN IMPROVEMENT IN PRODUCTION EACH YEAR SINCE RECORDING WAS COMMENCED.

Year.	No. of Cows.	Average Production.			Increase in Total Production Over 1948–49.
		Milk.	Test.	Butterfat.	
		Lb.	%	Lb.	%
1948–49 ..	49	2,613	5·2	137	..
1949–50 ..	53	3,248	5·2	169	33
1950–51 ..	44	4,285	5·2	221	45
1951–52 ..	44	4,418	5·1	225	47

The table shows that despite the drought the production of the herd showed an increase for the fourth year, when the average production per cow was 64% greater than that of the first year of recording and the total production of the herd 47% greater. It is results such as these that illustrate the potential production likely from many herds and farms when properly managed.

Production According to District, Age and Size of Herd.

Table 8 gives the average production per cow according to the main districts of the State.

TABLE 8.

AVERAGE PRODUCTION PER COW ACCORDING TO THE MAIN DISTRICTS OF THE STATE.

District.	Herds.	Cows.	Average Production.		
			Milk.	Test.	Butterfat.
			Lb.	%	Lb.
Atherton Tableland ..	89	2,569	3,641	4·1	150
Mackay District	19	493	2,046	4·6	95
Port Curtis..	14	173	2,180	4·7	103
Upper Burnett	22	673	3,159	4·0	127
Central Burnett	42	844	2,379	4·4	105
South Burnett	104	2,769	2,286	4·0	93
South-Eastern Queensland	349	11,077	2,462	4·4	108
Eastern Downs	132	3,006	3,091	4·0	125
Western Downs	47	1,519	2,421	3·9	93

The average production of butterfat in the lowest and highest producing herds in each district according to herd size is shown in Table 9.

TABLE 9.

AVERAGE PRODUCTION OF BUTTERFAT OF THE LOWEST AND HIGHEST HERDS IN EACH DISTRICT ACCORDING TO SIZE OF HERD.

District.	Average Production of Butterfat.									
	1–10 Cows.		11–20 Cows.		21–50 Cows.		51–100 Cows.		Over 100 Cows.	
	Lowest Herd.	Highest Herd.	Lowest Herd.	Highest Herd.	Lowest Herd.	Highest Herd.	Lowest Herd.	Highest Herd.	Lowest Herd.	Highest Herd.
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Atherton Tableland ..	52	184	100	151	77	215	118	251	..	..
Mackay District	95	140	80	206	65	115	67	109	..	..
Port Curtis	54	111	84	160	45	105	..	..	..	..
Upper Burnett	23	257	110	240	78	144	111	148	..	..
Central Burnett	4	184	66	173	78	143	71	160	..	..
South Burnett	3	200	32	158	26	227	61	189	..	..
South-Eastern Queensland	3	203	11	175	18	205	64	198	86	146
Eastern Downs	12	217	28	281	14	202	50	211	..	..
Western Downs	7	158	59	185	21	155	39	155	..	..

TABLE 10.

NUMBER AND PERCENTAGE OF COWS GROUPED ACCORDING TO AGE.

Age Group.		Under 50 Lb.	50–99 Lb.	100–149 Lb.	150–199 Lb.	200–249 Lb.	250–299 Lb.	300–349 Lb.	350–399 Lb.	400–449 Lb.	450–499 Lb.	Over 500 Lb.	Total.
2 years	No.	486	794	843	303	100	25	3	..	..	..	..	2,554
	%	19·03	31·09	33·01	11·86	3·92	·98	·12	..	..	..	..	..
3 years	No.	297	692	749	293	78	24	1	1	..	..	..	2,135
	%	13·91	32·41	35·08	13·72	3·65	1·12	·05	·05	..	..	..	..
4 years	No.	262	538	588	276	95	23	6	..	..	..	..	1,788
	%	14·65	30·09	32·89	15·44	5·31	1·29	·34	..	..	..	..	..
Mature	No.	912	1,946	2,229	1,256	435	123	36	6	4	1	..	6,948
	%	13·13	28·01	32·08	18·08	6·26	1·77	·52	·09	·06	·01	..	..
Unknown	No.	1,563	2,617	2,984	1,689	618	177	37	11	2	..	..	9,698
	%	16·12	26·98	30·77	17·42	6·37	1·83	·38	·11	·02	..	..	..
Total	No.	3,538	6,564	7,388	3,830	1,323	372	83	18	6	1	..	23,123
	%	15·30	28·39	31·95	16·56	5·72	1·61	·36	·08	·03	·004	..	..

Some of the very low productions were from herds which owing to drought withdrew from recording after only a few cows had been recorded and dried off.

Table 10 shows the number and percentage of cows in various butterfat ranges according to ages. It is noted that of the 23,123 cows which completed their lactation, 10,102 (43.69%) produced less than 100 lb. butterfat.

Seven cows produced over 400 lb. butterfat, one producing over 450 lb. This cow is owned by Mr. R. S. Griffiths, Moregatta, Atherton Tableland. She is a 9-year-old A.I.S. cow and in 270 days produced 9,195 lb. milk and 455 lb. butterfat with an average butterfat content of 4.9%.

Table 11 shows the number and percentage of herds in each district in various production ranges. It is noted that 43.9% of the herds had an average production of less than 100 lb. butterfat, while only 3.4% averaged over 200 lb. butterfat.

TABLE 11.

NUMBER AND PERCENTAGE OF HERDS IN VARIOUS BUTTERFAT PRODUCTION RANGES, 1951–52.

District.		Total No. of Herds.	Under 100 Lb.	100–149 Lb.	150–199 Lb.	200–249 Lb.	250–299 Lb.	300 Lb. Over
Atherton Tableland	No.	89	12	44	25	7	1	..
	%	..	13·5	49·4	28·1	7·9	1·1	..
Mackay District	No.	19	12	6	..	1	..	..
	%	..	63·2	31·6	..	5·2	..	..
Port Curtis..	No.	14	6	7	..	..	..	..
	%	..	42·9	50·0	7·1	..	..	..
Upper Burnett	No.	22	4	13	3	1	1	..
	%	..	18·2	59·1	13·6	4·5	4·5	..
Central Burnett	No.	42	24	14	4	..	..	..
	%	..	57·1	33·3	9·5	..	..	..
South Burnett	No.	104	68	26	8	2	..	..
	%	..	65·4	25·0	7·7	1·9	..	..
South-Eastern Queensland	No.	349	168	139	37	5	..	..
	%	..	48·1	39·9	10·6	1·4	..	..
Eastern Downs	No.	132	39	56	27	7	3	..
	%	..	29·5	42·4	20·4	5·3	2·3	..
Western Downs	No.	47	26	18	3	..	..	..
	%	..	55·3	38·2	6·4	..	..	..
All Queensland	No.	818	359	323	108	23	5	..
	%	..	43·9	39·5	13·2	2·8	0·6	..

Highest Producing Herds.

The herds having the highest average production in the State during the 12 months were as follows:—

The herd of Mr. A. M. Lee, Goomburra, Eastern Downs, which had the highest average production for the year 1950-51, again had the highest average production. This year 17 cows completed lactation for an average production of 5,163 lb. milk and 281 lb. butterfat, the average butterfat content being 5·4%. During the year the herd was grazed on natural pastures and cultivated crops, and was also fed a supplementary ration of crushed grain.

This Jersey herd has produced consistently during the last four years, the figures being set out below.

Year.	Cows.	Average Lactation.	Average Production per Cow.		
			Milk.	Test.	Butterfat.
		Days.	Lb.	%	Lb.
1948–49 ..	18	253	5,892	4·3	256
1949–50 ..	19	245	4,490	4·6	208
1950–51 ..	20	270	5,728	5·1	293
1951–52 ..	17	259	5,163	5·4	281

Mr. Lee's 17 cows consisted of three 2-year-olds, two 3-year-olds, five 4-year-olds and seven mature cows.

The second highest herd was owned by Mr. H. Geise, Pittsworth, Eastern Downs. This A.I.S. grade herd of 13 cows had an average production of 6,358 lb. milk and 262 lb. butterfat (average butterfat content 4·1%), and an average lactation period of 240 days. Mr. Geise commenced recording in September, 1950, and for the year 1950-51 his herd of 20 cows averaged 6,311 lb. milk and 258 lb. butterfat (average butterfat content 4.1%).

The position of third highest herd was shared by two A.I.S. herds, those of Mr. R. S. Griffiths, Moregatta, Atherton Tableland, and Mr. W. Bourke, "College Green," Clifton, Eastern Downs.

Mr. Griffiths' herd, which last year occupied the position of second highest herd, had 51 cows with completed lactations for an average production of 5,986 lb. milk and 251 lb. butterfat. This herd, which has been recorded since the inception of herd recording on the Atherton Tableland in 1948, has given the following average production:—

Year.	Cows.	Average Lactation.	Average Production per Cow.		
			Milk.	Test.	Butterfat.
		Days.	Lb.	%	Lb.
1949–49 ..	29	261	5,833	4·3	252
1949–50 ..	32	258	6,107	4·4	269
1950–51 ..	52	254	6,554	4·4	287
1951–52 ..	51	252	5,986	4·2	251

Mr. W. Bourke had 16 cows which completed lactation for an average production of 6,270 lb. milk and 251 lb. butterfat (average butterfat content 4.0%). The average length of lactation was 242 days.

Register of Merit for Dairy Cattle (First Supplementary List).

S. E. PEGG, Chief Adviser, Herd Recording.

A REGISTER of Merit for Dairy Cattle was instituted by the Department in 1952 and the list of entries as compiled to June 30, 1952, appeared in this journal for September, 1952. Accompanying the list were the reasons for instituting the register and the rules governing registration.

Research into the records has been continued and it has been found that a further 32 cows and 2 bulls are eligible for entry into various sections of the register, as follows:—

Elite section	1
Lifetime section	7
Intermediate section	24
Sires section	2

This brings the total number of cows in the register to 105 and the number of sires to 3.

Table 1 shows, according to breed, the number of cows which have qualified for entry into the register as compiled to December 31, 1952.

Two more bulls, both Jerseys, have qualified for entry into the Sires Register of Merit. This makes a total of three animals in the register—1 A.I.S. and 2 Jerseys.

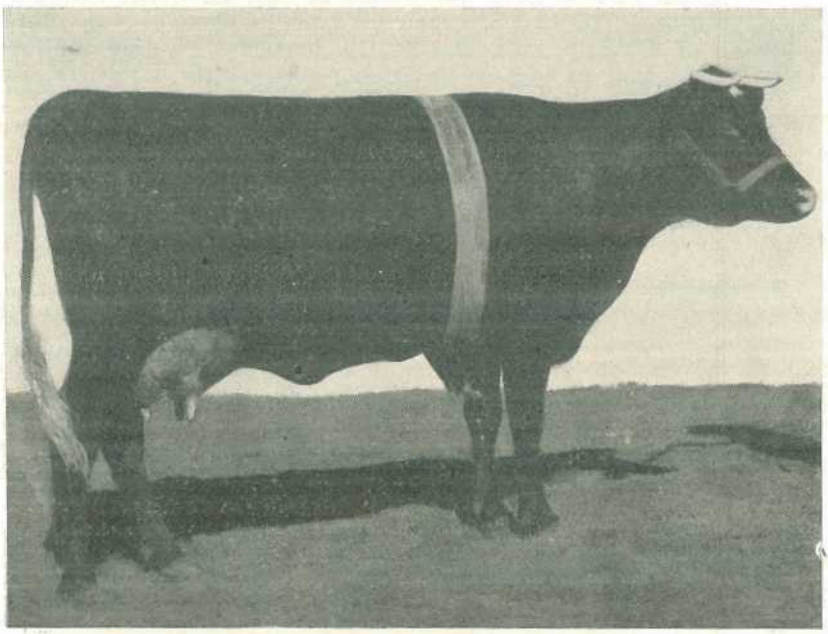


Plate 1.

"Navillus Charm 17th," owned by Mr. C. O'Sullivan, "Navillus," Greenmount. This animal is in the Lifetime Register of Merit with a production of 82,371 lb. milk and 3,281 lb. butterfat in seven lactations.

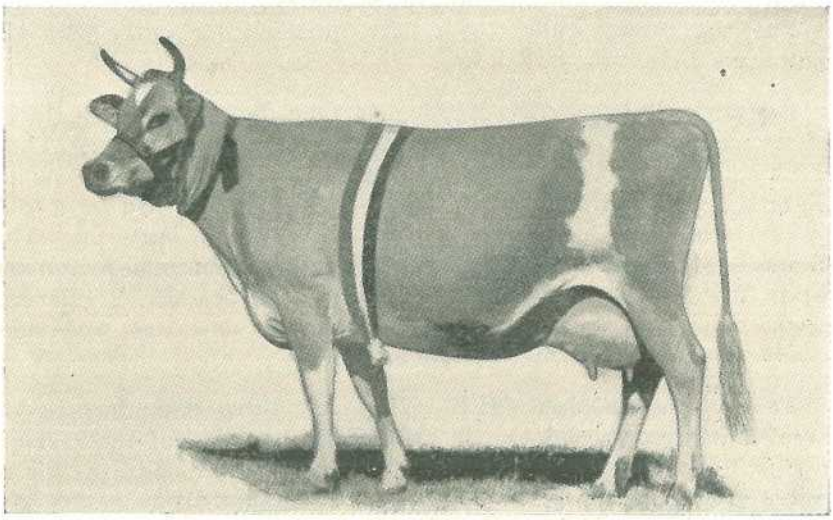


Plate 2.

"Trecarne Rosella 4th" was owned and bred by the late Mr. T. Petherick, "Trecarne" Jersey Stud, Lockyer. She qualified for entry into the Elite Register of Merit with a production of 74,936 lb. milk and 4,118 lb. butterfat in nine lactations.

TABLE 1.

Composition of Register of Merit (Females).

Section.	Breed.					Total.
	A.I.S.	Ayrshire.	Friesian.	Guernsey.	Jersey.	
Intermediate..	21	1	..	2	60	84
Lifetime ..	7	..	1	1	10	19
Elite	1	..	..	..	1	2

All the additional animals included in the register are shown in Tables 2-5, which are compiled in alphabetical order according to breed and owner. Animals which have further lactation records since the original list was published are also shown.

Trecarne Rosella 4th qualified for entry into the Elite section with a production of 74,936 lb. milk and 4,118 lb. butterfat in nine lactations. She commenced her first lactation record at the age of 1 year 10 months and her final lactation at 11 years 11 months. She was born on 25-8-29.

This cow was bred by the late Mr. T. Petherick, of "Trecarne" Jersey Stud, Lockyer. She was sired by Trinity Officer and her dam was Sultane's Rosella of Brookland. Trinity Officer was used with success first in the "Trecarne" stud and later in the "Glenview" stud at Biggenden. He has 23 recorded daughters with 44 lactations and an average production of 349 lb. butterfat.

Sires Register of Merit.

The two Jersey bulls which have qualified for entry into the register are Bellgarth Stylish and Trinity Some Officer.

Bellgarth Stylish (H.B. 10878) has four daughters in the Intermediate section and one in the Lifetime section of the register. These five daughters averaged 373 lb. butterfat from 19 lactations. In all, Bellgarth Stylish has 18 daughters which have been recorded for a total of 55 lactations, for an average production of 347 lb. butterfat. This bull was bred by Mr. D. R. Hutton, "Bellgarth," Cunningham, and was used in the stud of the late Mr. P. Kerlin, "Glenrandle," Killarney. He was sired by Trecarne Renown 2nd and his dam was Woodlands Fashion, who is in the Intermediate section.

Trinity Some Officer (H.B. 6798) has three daughters in the Intermediate section and two in the Lifetime section of the register. These five daughters were recorded over a total of 22 lactations for an average production of 423 lb. butterfat. Altogether, 19 daughters have been recorded over 44 lactations for an average production of 369 lb. butterfat. Trinity Some Officer was bred by Messrs. J. Sinnamon and Sons, "Trinity," Moggill, and was used in the "Trecarne" stud, Lockyer. His sire was Somehope (Imp.) and his dam was Trinity Hazeldale.

TABLE 2.

INTERMEDIATE REGISTER OF MERIT (FIRST SUPPLEMENTARY LIST).

Name of Cow. (*Name of Sire.*)	Herd Book No.	Date of Beginning of Record.	Age.	Production Records.		
				Milk.	Average Test.	Total Butterfat.
			Yrs. Mths.	Lb.	%	Lb.
AUSTRALIAN ILLAWARRA SHORTHORN.						
R. S. GRIFFITHS, "FERNHOME," MOREGATTA.						
Fernhome Bonnie	57709	1–1–49	3 5	8,508	4·5	387
(*Glengarry Gem's Royal*)	4854	1–6–50	4 9	9,285	4·2	391
	..	13–8–51	6 1	8,790	4·0	354
Fernhome Charity 2nd	57711	24–7–48	3 0	8,712	4·4	380
(*Glengarry Gem's Royal*)	4854	20–11–49	4 4	8,040	4·4	359
	..	6–11–50	5 3	9,105	4·3	391
Fernhome Marion	36471	25–3–48	7 2	8,750	4·6	402
(*Glengarry Gem's Royal*)	4854	16–4–49	8 3	7,790	4·6	359
	..	13–7–50	9 6	8,325	4·4	369
GUERNSEY.						
A. RUGE AND SON, "WOOWOONGA," BIGGENDEN.						
Springvale Verla	19876	9–10–49	2 7	8,517	5·3	455
(*Moongi Lloyd George*)	7657	18–11–50	3 8	8,286	4·9	407
	..	21–12–51	4 9	9,667	4·6	446
JERSEY.						
R. J. BROWNE, "HILL 60," YANGAN.						
Nairfale Brown Belle	42734	26–5–46	3 3	7,341	5·2	384
(*Nairfale Count's Prominence*)	19871	12–6–47	4 4	7,687	5·0	387
	J.S.B.A.	30–6–48	5 5	6,620	5·1	339
Nairfale Lena	42731	15–9–49	5 2	7,500	5·0	377
(*Nairfale Golden Reality*)	17826	7–8–50	6 1	7,371	5·3	390
	J.S.B.A.	26–7–51	7 0	7,245	4·9	356
E. BURTON AND SONS, "OXFORD," WANORA.						
Oxford Jezebel	26784	21–7–39	1 11	7,314	5·7	420
(*Oxford Daffodil's King*)	8131	10–7–40	2 10	8,443	5·6	475
	..	14–7–41	3 11	10,949	5·9	644

TABLE 2—*continued.*

INTERMEDIATE REGISTER OF MERIT (FIRST SUPPLEMENTARY LIST)—*continued.*

Name of Cow. (*Name of Sire.*)	Herd Book No.	Date of Beginning of Record.	Age.	Production Records.		
				Milk.	Average Test.	Butterfat Total.
			Yrs. Mths.	Lb.	%	Lb.
R. J. CRAWFORD, "INVERLAW," KINGAROY.						
Inverlaw Patsy	24383	11–9–38	1 11	5,974	5·4	322
(*Oxford Royal Lad*)	8001	4–9–39	2 11	8,263	5·7	475
	..	21–10–40	4 1	8,222	5·5	456
FARM HOME FOR BOYS, "WESTBROOK," WESTBROOK.						
Westbrook Safety 14th	21346	19–1–38	2 4	6,440	5·0	322
(*Oxford Gem's Ambassador*)	6440	21–2–39	3 4	8,971	5·2	468
	..	20–2–40	4 5	8,806	5·0	437
F. P. FOWLER, "GLENVIEW," COALSTOUN LAKES.						
Glenview Sultan's Majesty	13058	13–3–34	2 8	7,579	5·3	398
(*Trinity Officer*)	1513	10–6–35	3 11	9,356	5·5	517
	..	4–7–36	4 11	10,344	5·3	553
Glenview Twinkle	24454	7–12–38	2 4	6,764	4·7	316
(*Trinity Governor's Hope*)	5730	18–3–40	3 7	7,763	4·5	348
	..	17–8–41	5 0	10,808	4·9	530
J. HUNTER AND SONS, "PINEVIEW," BORALLON.						
Shamrock Farm Jean	3502	30–4–32	9 7	8,532	6·3	537
(*Shamrock Farm Palatine*)	1102	29–4–33	10 7	9,634	6·0	574
	..	20–4–34	11 7	8,720	6·3	551
D. R. HUTTON, "BELLGARTH," CUNNINGHAM.						
Bellgarth Fashion 2nd	32610	20–6–42	2 3	7,946	4·4	347
(*Trecarne Renown 2nd*)	5546	23–6–43	3 3	7,762	5·0	386
	..	11–7–44	4 3	8,463	4·6	390
Woodlands Fashion	20640	12–10–36	2 1	5,742	5·1	295
(*Kenmore Victor*)	3895	4–11–37	3 2	7,383	5·2	383
	..	24–2–39	4 6	8,182	5·1	417

P. Kerlin, "Glenrandle," Killarney.						
Glenrandle Golden Girl	36169	2–7–47	5 11	7,229	5·7	411
(*Bellgarth Stylish*)	10878	25–10–48	7 3	7,793	5·4	420
	..	7–4–50	8 8	6,800	5·7	392
Glenrandle Joan	50015	10–2–49	2 2	7,048	5·5	387
(*Gem Rodney*)	15568	9–4–50	3 4	6,219	5·7	357
	..	20–2–51	4 2	6,122	6·1	374
Glenrandle Larkspur	41027	3–9–45	1 11	8,089	5·6	450
(*Bellgarth Glory King*)	12971	22–11–46	3 2	8,218	5·4	443
	..	1–1–48	4 3	8,912	5·4	484
J. B. Keyes, "Wyreene," Gowrie Little Plain.						
Greenstock Poppy	9952	20–6–31	1 5	7,054	4·7	330
(*Greenstock Commander*)	2779	16–7–32	2 5	9,318	5·2	480
	..	6–9–33	3 7	8,842	4·7	417
J. S. McCarthy, "Glen Erin," Greenmount.						
Glen Erin Princess 2nd	51594	15–8–49	2 1	7,048	4·8	343
(*Ashfield Prometheus*)	18258	5–7–50	2 11	7,396	5·3	388
	..	11–7–51	3 11	9,110	4·9	446
T. A. Petherick, "Trecarne," Lockyer.						
Trecarne Eileen 7th	24267	17–8–38	1 11	4,534	6·5	294
(*Trinity Some Officer*)	6798	23–8–39	2 11	7,001	6·6	461
	..	28–7–40	3 10	6,953	6·9	483
Trecarne Jersey Maid 3rd	22307	22–8–39	3 10	7,272	5·9	432
(*Trinity Some Officer*)	6798	11–8–40	4 10	7,386	5·5	409
	..	27–8–41	5 10	7,425	5·6	413
J. Sinnamon and Sons, "Trinity," Moggill.						
Trinity Princess Royal 2nd	34635	19–7–44	2 0	5,543	5·4	302
(*Trinity Crowning Effort*)	12311	22–7–45	3 0	6,884	5·9	403
	..	29–7–46	4 0	8,120	5·7	459
R. A. Slaughter, "Cleeve," Clifton.						
Trecarne Jean	11618	11–10–32	1 11	7,628	4·9	375
(*Mascot of Brasseldale*)	3618	9–11–33	2 11	7,684	5·1	392
	..	18–10–34	3 11	5,681	5·4	309
H. Sigley, "Myrtledale," Jaggan.						
Palm Ridges Sylvinia	32912	5–9–46	6 2	9,618	5·3	513
(*Overlook Financier*)	14991	17–11–47	7 5	10,023	5·8	588
	..	25–11–48	8 5	9,984	5·2	515

TABLE 3.

LIFETIME REGISTER OF MERIT (FIRST SUPPLEMENTARY LIST).

(2,240 Lb. Butterfat Minimum).

Name of Cow.	Herd Book No.	Age at Start of Recording.	Age at Commencement of Last Test.	No. of Records.	Total Milk.	Average Test.	Total Butterfat.	Name of Sire.	Herd Book No. of Sire.
		Yr. Mth.	Yr. Mth.		Lb.	%	Lb.		
AUSTRALIAN ILLAWARRA SHORTHORN.									
C. O'SULLIVAN, "NAVILLUS," GREENMOUNT.									
*Navillus Charm 17th ..	45661	3 0	8 10	7	82,371	4·0	3,281	Greyleigh Eros ..	2193
W. H. THOMPSON, "ALFA VALE," NANANGO.									
Alfa Vale Model 3rd ..	6291	1 11	8 0	5	53,811	4·3	2,331	Reward of Fairfield ..	1769
JERSEY.									
R. J. BROWNE, "HILL 60," YANGAN.									
Nairfale Likeness	42730	2 0	7 0	6	49,984	4·9	2,463	Nairfale Golden Recorder	19872 J.S.B.A.
H. COCHRANE, "FAUVIC," KIN KIN.									
Fauvic Rejoice	6267	8 3	14 8	6	40,766	6·0	2,442	Zingara King	1682
P. KERLIN, "GLENRANDLE," KILLARNEY.									
Glenrandle Fashion Lady..	39201	1 8	8 1	7	39,999	5·6	2,260	Bellgarth Stylish ..	10878
T. A. PETHERICK, "TRECARNE," LOCKYER.									
Trecarne Chimes 2nd ..	15997	2 0	7 11	6	41,363	5·7	2,378	Trecarne Golden King	3030
Trecarne Rosella	6611	4 1	12 1	6	46,339	5·8	2,686	Trinity Officer ..	1513

* Additional record included.

TABLE 4.

ELITE REGISTER OF MERIT (FIRST SUPPLEMENTARY LIST).

(3,600 Lb. Butterfat Minimum.)

Name of Cow.	Herd Book No.	Age at Start of Recording.	Age at Commencement of Last Test.	No. of Records.	Total Milk.	Average Test.	Total Butterfat.	Name of Sire.	Herd Book No. of Sire.
		Yr. Mth.	Yr. Mth.		Lb.	%	Lb.		
JERSEY.									
T. A. PETHERICK, "TRECARNE," LOCKYER.									
Trecarne Rosella 4th ..	10586	1 10	11 11	9	74,936	5·5	4,118	Trinity Officer ..	1513

TABLE 5.

SIRES REGISTER OF MERIT.

Name of Sire (Breed).	Herd Book No.	Intermediate Register of Merit.		Elite and Lifetime Registers of Merit.		Total Daughters in Registers of Merit.			Total Daughters Recorded.		
		No. of Daughters.	Average Butterfat.	No. of Daughters.	Average Butterfat.	No. of Daughters.	Lactations.	Average Butterfat.	No. of Daughters.	Daughters' Total Lactations.	Recorded Average Butterfat.
			Lb.		Lb.			Lb.			Lb.
W. H. THOMPSON, "ALFA VALE," NANANGO.											
* Reward of Fairfield (A.I.S.)	1769 IMSHB	5	599	4	594	9	42	595	44	89	461
P. KERLIN, "GLENRANDLE," KILLARNEY.											
Bellgarth Stylish (Jersey)	10878	4	382	1	323	5	19	373	18	55	347
T. A. PETHERICK, "TRECARNE," LOCKYER.											
Trinity Some Officer (Jersey)	6798	3	402	2	437	5	22	423	21	46	371

* Additional records included.

Some Notes on Pig Feeding.

F. BOSTOCK, Officer in Charge, Pig Branch.

THE importance of correct feeding as a factor in economical pig production is indicated by the fact that feed represents a very large proportion of the total cost of production. The farmer who expects to make maximum profits should, therefore, realise the significance of suitable rations and proper methods of feeding.

Pigs are kept on many farms as a means of marketing the surplus grain produced and to utilize dairy by-products. The feeder should have some knowledge of the suitability of the variety of feeds available and, at the same time, realize that complete success cannot be achieved unless thought and care are given to organization, management, layout of the piggery, selection of good quality breeding stock and a high standard of sanitation.

Feeding can influence the quality of the flesh produced and fat development, but breeding also carries weight and good quality breeding stock should always be used. Prime quality pigs are only produced by proper selection of breeding stock, combined with right feeding and good sanitation.

The body development of growing pigs is continually changing, and experimental work has shown that some parts of the body develop more quickly than other parts. In the first stage, partly before birth, bone development predominates; during the second stage, muscular growth takes precedence; in the third stage, the greatest tendency is to fat development. Early-maturing pigs pass through all stages more rapidly than late-maturing pigs.

Consideration of these factors indicates that, to obtain desirable development of the carcase, pigs should be well fed during the stage when muscular growth predominates—that is, up to light porker stage.

PRINCIPLES OF FEEDING.

Feeds are usually divided into two classes—concentrated feeds, or concentrates; and bulky feeds, commonly called roughages.

The seed of all plants, whole or ground, and all such feeds as are produced from the by-products of commercial establishments, supply a large amount of nutriment in small bulk, and are called concentrates. The "body" of plants, in the form of hay, straw, green feed, pastures, and root crops, gives bulky feed or roughage.

The function of bulk in a ration is more than the mere provision of nutriment; in a mechanical way it aids digestion, for the stomach has to be comfortably filled to produce contentment. The pig, however, requires less bulky feeds than other domestic animals, but it has been found that bulk or roughage, to some extent, is very valuable in the profitable production of pork. Where roughage is not supplied and the animal is fed exclusively on concentrates, derangement of digestion usually results.

Food Constituents.

From a chemical standpoint, the constituents of feed which immediately concern the pig feeder are the nitrogenous substances, the carbohydrates and fats, and the minerals. The first-named, generally termed proteins, are used chiefly for the development of flesh. The carbohydrates, embracing starches, sugar, &c., together with the fats and oils, are used for making fat and for the supply of body heat and energy. Mineral matter or ash is not only valuable in bone-forming processes, but is necessary for the normal functioning of every organ of the body.

When feed is utilized in the animal body, a certain amount of heat is generated. This heat is converted into energy, which is necessary wherever work is performed. The term "work," however, has a very wide meaning and denotes more than actual muscular effort; for, in fact, the performance of nearly every function of the body is actually some form of work, involving the expenditure of energy. It is readily apparent that the heat-producing powers of feed have a much more important function than merely the maintenance of bodily warmth.

In selecting food for stock, consideration should be given to the appetising character of the food, its flavour and digestibility, its laxative or constipating character and its cost. We must take into account the quantities needed to make a balanced ration and the increase of food required during cold weather.

Importance of Balancing a Ration.

A ration should, therefore, be properly balanced with proteins, fats, and carbohydrates, contain a sufficiency of mineral matter, and be suitable as to digestibility and bulk.

To balance a ration or obtain the nutritive ratio, which denotes the number of parts by weight of digestible carbohydrates and fats associated in the food with one part of digestible protein, multiply the percentage of digestible fat by 2·25 (because 1 lb. of fat is approximately as effective as 2·25 lb. of carbohydrates) and add this to the percentage of digestible carbohydrates; then divide by the percentage of digestible protein. When this ratio is more than 1 to 7·0 the ratio is said to be wide; when less than 1 to 4·0 it is said to be narrow.

Suitable Nutritive Ratios.

The following nutritive ratios will be found to be suitable for the different classes of stock:—

Weaners	1 to 4·0
Stores	1 to 4·5 to 1 to 5·0
Fattening Pigs	1 to 5·0 to 1 to 5·5
Baconers	1 to 6·0 to 1 to 7·0
Sows in Milk	1 to 5·0
Stud Boars	1 to 5·0

While the nutritive ratio is undoubtedly a good means of determining whether a ration is suitable, it should only be regarded as a rough guide, for it has been found in experiments that pigs increase in weight more in accordance with the total digestible nutrients than with nutritive ratio.

Total digestible nutrients per day suitable for different classes of stock would be:—

Weaners	1·8 to 2·0 lb.
Stores	2·18 to 2·5 lb.
Fattening Pigs	2·96 to 3·4 lb.
Baconers	3·74 to 4·5 lb.
Sows in Milk	7·2 to 8·4 lb.
Stud Boars	3·2 to 4·1 lb.

The following table shows analyses of samples of various feeding stuffs. These analyses can of course vary quite a lot.

DIGESTIBLE NUTRIENTS PER 100 LB. OF VARIOUS FEEDING STUFFS.

Feed.	Crude Protein.	Carbo-hydrates.	Fat.	Total.
Barley	8·4	67·5	2·0	80·4
Wheat	9·2	67·5	1·5	80·1
Maize	7·0	65·5	3·5	82·4
Sorghum	8·7	66·2	2·2	79·9
Oats	9·6	49·5	4·1	68·3
Peas	19·0	55·8	0·6	76·2
Millet	8·4	63·7	2·4	77·5
Beans	18·8	51·3	0·8	71·9
Rice	6·2	69·7	1·7	73·1
Canary Seed	11·5	48·7	4·3	71·0
Pumpkins	1·1	4·5	0·5	6·7
Artichokes	1·0	14·6	0·1	15·8
Arrowroot	0·1	18·5	..	18·5
Cassava	0·6	26·4	0·2	27·4
Sweet Potatoes	0·9	24·2	0·3	25·8
Potatoes	1·1	15·8	0·1	17·1
Mangolds	0·8	6·4	0·1	7·4
Melons	0·5	3·9	0·2	4·8
Molasses	1·0	58·5	..	59·5
Separated Milk	3·6	5·1	0·2	9·1
Meatmeal	56·2	..	7·2	71·4
Blood Meal	67·0	..	1·3	71·0
Fish Meal	40·1	..	8·3	58·8
Pollard	13·4	46·2	4·3	69·3
Bran	12·5	41·6	3·0	60·9
Linseed Meal	31·7	37·9	2·8	75·9
Peanut Meal	40·3	22·5	9·2	83·5
Peanuts with shell	17·9	8·2	32·6	99·4
Soybeans	33·2	24·7	16·1	94·1
Cottonseed Meal	31·6	25·6	7·8	74·8
Green Lucerne	3·3	10·4	0·4	14·6
Sugarcane	0·4	12·3	0·6	14·1
Green Rape	2·6	10·0	0·3	13·3
Green Maize	0·8	9·9	0·3	11·4
Lucerne Hay	10·6	39·0	0·9	51·6
Oaten Chaff	2·2	34·3	1·2	39·2
Wheaten Chaff	1·1	25·7	0·6	28·2
Bracken Fern Root	7·9	54·0	0·5	62·5

Some Definitions.

Ration is the quantity of food given to one animal for 24 hours, whether given in one or more feeds.

Balanced Ration is the total quantity of food containing the various digestible nutrients in the correct proportions for a given animal for 24 hours.

Maintenance Ration is the quantity of food required by an animal for body maintenance in 24 hours.

Digestible Nutrients is that portion of the crude nutrients which can be assimilated by an animal.

Protein is the term used to denote those nitrogenous compounds used chiefly for growth, flesh development, milk production and reproduction in animals.

Carbohydrates include starches and sugars, comprise the greater part of grains, and besides being used for production of heat and energy, are the main source of fat in the carcase.

Fats can influence the type of fat produced in the carcase. Soft fats or fats of low melting point are generally to be found in grains of such crops as peanuts, soybeans and linseed; on the other hand, fats of animal origin, such as fat in meatmeal, are comparatively hard or of high melting point, and do not affect the quality of the carcase.

Fibre: For maximum growth rates and efficient use of feed, pig rations should not contain a high proportion of fibre. Therefore bulky feeds, such as chaff, hay, silage, &c., should not constitute too great a part of the ration.

Minerals are necessary for normal growth and building up of harder tissues of the body, such as bone. Insufficiency of calcium, iron and phosphorus in the ration will lead to serious trouble and setbacks in growth.

Palatability denotes that foods are pleasing to the taste of animals; it is affected not only by the actual composition and condition of the food, but by the custom of the animals which are being fed.

Assimilation refers to absorption into the system of digestible constituents of foodstuffs.

PREPARATION OF FEEDS.

Most feeds require little preparation for pigs. Maize may be fed shelled or on the cob; it is not materially improved by grinding. Coarsely grinding or cracking small grains, on the other hand, results in a saving of feed. The extent to which a saving can be made by this operation depends somewhat on the hardness of the grain, but primarily on the method of feeding. Because of the pig's habit of rapid eating when hand fed in groups, a large number of small hard grains escape being broken by the teeth, and pass through the body unutilized. Pigs accustomed to eating from a self-feeder eat more slowly and masticate their food more completely than do hand-fed pigs.

Soaking is a poor substitute for grinding small grains, and does not improve the value of maize or cracked grains.

Cooking reduces rather than increases the value of most foods for pigs, hotel and slaughter-house refuse, also English potatoes, being the exceptions. A slight benefit may result by feeding a warm swill in very cold weather. Slopping or swill feeding is an old practice, but tests have not justified its use when fattening pigs, and there is very little evidence to show that it is necessary even with brood sows.

Brucellosis Testing of Swine.

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

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

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

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

TESTED HERDS.
(AS AT 30th MARCH, 1953.)

Breed.	Owner's Name and Address of Stud.
Berkshire	J. J. Bailey, " Lucydale " Stud, East Greenmount
	S. Cochrane, " Stanroy " Stud, Felton
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	G. Handley, " Handleigh " Stud, Murphy's Creek
	J. L. Handley, " Meadow Vale " Stud, Lockyer
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	O'Brien and Hickey, " Kildurham " Stud, Jandowae East
	E. Pukallus, " Plainby " Stud, Crow's Nest
	G. C. Traves, " Wynwood " Stud, Oakey
	E. Tumbridge, " Bidwell " Stud, Oakey
	Westbrook Farm Home for Boys, Westbrook
	H. W. Wyatte, Rocky Creek, Yarraman
	H.M. State Farm, " Palen Creek," Palen Creek
	A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
	H. H. Sellars, " Tabooba " Stud, Beaudesert
	F. Thomas, M.S. 373, Beaudesert
	D. T. Law, Trouts road, Aspley
	C. F. W. and B. A. Schellback, " Redvilla " Stud, Kingaroy
	R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
	F. R. J. Cook, " Alstonvilla," Wolvi, *via* Gympie
	D. E. and E. C. Apelt, " Thelmur," Oakey
	Mrs. I. M. James, " Kenmore " Stud, Cambooya
	H. L. Stark, " Florida," Kalbar
	J. H. N. Stoodley, " Stoodville," Ormiston
	H.M. State Farm, Numinbah
	V. G. M. and A. G. Brown, " Bardell," Goovigen
	R. E. Paulsen, " Hillcrest " Stud, Binjour Plateau, M.S. 670, Gayndah
	M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah
Large White	H. J. Franke and Sons, " Delvue " Stud, Cawdor
	Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
	F. L. Hayward, " Curyo," Jandowae
	J. A. Heading, " Highfields," Murgon
	K. B. Jones, " Cefn " Stud, Pilton
	R. G. Koplick, " Melan Terez " Stud, Rochedale
	R. Postle, " Yarralla " Stud, Pittsworth
	E. J. Bell, " Dorne " Stud, Chinchilla
	L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood
	J. H. G. Blakeney, " Talgai " Stud, Clifton
	H. R. Gibson, " Thistleton " Stud, Maleny
	H.M. State Farm, Numinbah
	K. A. Hancock, " Laurestonvale " Stud, Murgon

TESTED HERDS—continued.

Breed.	Owner's Name and Address of Stud.
Large White	O. H. Horton, Mannuem, Kingaroy V. P. McGoldrick, " Fairymeadow " Stud, Cooroy N. Woltmann and Sons, Wooroolin R. S. Powell, Kybong, *via* Gympie E. B. Horne, " Kalringal," Wooroolin S. T. Fowler, " Kenstan " Stud, Pittsworth J. A. and J. McNicol, " Camden," Canning Vale, Warwick H. L. Larsen, " Oakway," Kingaroy C. Allison, "Colrene" Stud, Lake and Reserve roads, Slacks Creek E. G. Evans, Box 22, Maleny Mrs. I. G. Utting, "White Lodge," Mountain Road, Cooroy
Tamworth	S. Kanowski, " Miecho " Stud, Pinelands N. R. Potter, " Actonvale " Stud, Wellcamp D. F. L. Sherman, " Waverley " Stud, Kaimkillenbun A. C. Fletcher, " Myola " Stud, Jimbour Salvation Army Home for Boys, Riverview F. Thomas, M.S. 373, Beaudesert A. J. Surman, Noble road, Goodna P. V. McKewin, " Wattleglen " Stud, Goombungee Department of Agriculture and Stock, Regional Experiment Station, Kairi P. V. Campbell, Lawn Hill, Lamington E. C. Phillips, " Sunny View," M.S. 90, Kingaroy T. A. Stephen, " Withcott," Helidon W. F. Kajewski, " Glenroy " Stud, Glencoe A. A. Herbst, Bahr Scrub, *via* Beenleigh R. G. Koplick, " Melan Terez " Stud, Rochedale H.M. State Farm, Numinbah
Wessex Saddleback ..	W. S. Douglas, " Greylight " Stud, Goombungee D. Kay and P. Hunting, " Kazan " Stud, Goodna E. Sirrett, " Iona Vale " Stud, Kuraby C. R. Smith, " Belton Park " Stud, Nara H. H. Sellars, " Tabooba " Stud, Beaudesert H. Thomas, " Eurara " Stud, Beaudesert D. T. Law, Trouts road, Aspley G. J. Wilson, " Glenbella " Stud, Silverleigh G. J. Cooper, " Cedar Glen," Yarraman J. B. Dunlop, Acacia road, Kuraby A. Curd, Box 35, Jandowae C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek

ANIMAL HEALTH

NOTES ON LIVESTOCK PEST CONTROL.

Contributed by the Division of Animal Industry.

At recent meetings of the Animal Industry Committee of the United Graziers' Association of Queensland, several questions relating to the health of livestock were raised. These are given here, with comment by the Division of Animal Industry.

Tick Fever Vaccine.

"That efforts be made to evolve a redwater vaccine which will give immunity, with one inoculation, for a long period—for life if possible."

Tick-fever or redwater immunization is effected by introducing blood containing living virulent tick-fever organisms into the animal's body. The animal then develops a typical attack of tick fever which may vary in severity depending on age, condition and type of the animal, but this attack may be controlled by drug treatment. After the attack subsides, the tick-fever organisms remain in the animal's system in a dormant state for a varying time, which may be from three to 12 months or even longer, and the immunity to tick fever continues during this period. There is a general tendency, however, on the part of the body defences to eliminate the parasitic tick-fever organisms, and some time after this process has been completed the body defences relax and lose their power of controlling the tick-fever organisms. The animal then again becomes susceptible to tick fever.

This state of balance between the host and the parasite is maintained in nature by constant re-infestation by means of ticks and artificially by regular inoculations at intervals of six to 12 months.

The period of immunity following inoculation depends on the continuous presence of tick-fever organisms within the animal's body, and any action to prolong this immunity (such as by weakening the body defences) may result in a relapse to an acute attack of tick fever, together with a greater risk at the time of inoculation.

Contagious Pleuro-pneumonia Vaccine.

"That an endeavour be made to obtain information relating to the stability of pleuro inoculation with cultivated virus."

The pleuro-pneumonia vaccine contains the living organism and is therefore somewhat unstable, but before it leaves the laboratory, tests ensure that enough organisms will remain alive in the field for two months after the date of its manufacture. All users should, therefore, be guided by the expiry date which is placed on every bottle of vaccine which is sold. Practices such as leaving unopened bottles lying in the sun and re-stoppering opened bottles and storing them for future use reduce the "life" of the vaccine and should be rigidly avoided. Although not absolutely necessary, the vaccine should be stored in a refrigerator, especially in tropical areas.

Resistance is established in susceptible animals 5-7 days after vaccination and persists for three years. It appears that young calves do not react to vaccination and some authorities in Australia hold that it is of doubtful value to vaccinate calves under 6-8 months old.

Recent laboratory tests have shown that the vaccine is 97% efficient. However, the results of recent field investigations indicate that better results are obtained in actual practice, and the number of cases which can be attributed to the actual failure of the vaccine is less than 1%.

Serious outbreaks sometimes occur in the field among vaccinated cattle. Recent enquiries have shown that a number of factors contribute to this. These include the following:—

(1) Many animals become infected before they are vaccinated, and as vaccination has no effect on the course of the disease, these animals are liable to become clinical cases any time up to three months after vaccination.

(2) Many animals are often missed when vaccination is carried out.

(3) Careless handling of the seton needle, syringe or vaccine is also a cause. The potency of the vaccine may be reduced to negligible proportions by leaving soaked setons to dry out before use, or by allowing a bottle of vaccine to lie exposed to sunlight for a few hours.

(4) Odd instances occur where the vaccine apparently fails to induce resistance. As stated earlier, these amount to less than 1%.

Blackleg Vaccine.

"That intensified research be undertaken in the control of blackleg."

The control of blackleg in Queensland is undertaken by field officers of the Department of Agriculture and Stock working in co-operation with the Director of Research and officers of the Animal Health Stations, Yeerongpilly and Oonoonba.

Field outbreaks are investigated and all relevant information concerning incidence, age and type of animal affected, method of inoculation and when carried out, etc., is obtained. This information, together with suitable specimens, is submitted to the Animal Health Station, where the organism responsible for the outbreak is isolated and closely studied. When this work is completed, a culture of the organism, together with the history of the case, is supplied to the Commonwealth Serum Laboratories, Melbourne, where several officers are engaged in preparing and testing vaccines for blackleg control.

The organisms isolated from field outbreaks are utilized in the preparation of vaccines which are tested in the laboratory on small animals and sheep. The resistance to blackleg in the vaccinated and unvaccinated control animals is challenged by the inoculation of a potent blackleg material in order to obtain information on the value of the vaccine and the degree of resistance to artificial infection in vaccinated and unvaccinated animals. Tests of this nature were recently carried out with the new C.S.L. vaccine in Melbourne and a solid degree of resistance was demonstrated in vaccinated animals, whereas most of the unvaccinated animals developed the disease. This work is now being extended, and the Commonwealth Serum Laboratories employ an officer to undertake field investigations in vaccinated cattle and sheep in Victoria. The work would have been extended to Queensland if sufficient cases had been available in the autumn and winter of 1952.

A limited number of cases of what appeared to be blackleg have been recorded in animals vaccinated with the new C.S.L. vaccine, but the recognised blackleg organism (*Clostridium chauvoei*) has not been isolated from a vaccinated animal, with possibly one exception in Queensland.

Investigations are being continued, but definite information on the value of the vaccine under field conditions cannot be obtained until another severe outbreak of the disease is encountered.

Cattle Tick Control.

"That as DDT and BHC are incapable of controlling the tick in North Queensland, and as all known insecticides appear to have in time proved that an immunity can be built up, C.S.I.R.O. and the Department of Agriculture and Stock be asked to conduct research into the possibility of controlling the cattle tick by injection into the blood stream of something adverse to the tick."

Although there is evidence to suggest that BHC-resistant ticks are developing in overseas countries and there is some indication that BHC has failed to control the ticks in isolated instances in Queensland, the general statement that DDT and BHC are or have been incapable of controlling ticks in North Queensland cannot be accepted. The Department of Agriculture and Stock through its officers has had extensive experience with DDT in northern as well as other parts of Queensland and very satisfactory results have been obtained. No information is available that DDT-resistant cattle ticks have been detected in Australia or elsewhere.

It is recognized that certain strains of cattle are more resistant than others to tick infestation, and broadly speaking Zebu hybrids are more resistant than European breeds. It is also recognized that ticks fail to thrive on certain types of country (for example, the dry inland areas and also in certain country within the recognized tick infested zone, such as Croydon, Georgetown and parts of the Charters Towers district). Such areas are of granitic formation and generally speaking not good country, whereas the ticks thrive in the adjoining country of better type. There must be some reason for this difference and the problem is receiving consideration; it has been listed for investigation by C.S.I.R.O. The explanation may be that moisture is retained to a greater extent in country more suitable for tick propagation.

Although a certain amount of preliminary work has been undertaken over a period of years to determine the effects or value of the injection of certain animal substances to produce antibodies to external parasites, and thus create an immunity, the work has not advanced sufficiently to suggest that this method of control may have practical application. A chemical injected into the body to produce and maintain a concentration in the blood lethal to ticks may kill the animal before effective control is obtained.

There is a reason why Zebu type animals are more resistant than European breeds, and if this factor were thoroughly understood and it could be incorporated in the European-type animals without the disadvantages of the Zebu, the desired result might be obtained. This perhaps is a problem in which assistance could be obtained from the geneticist and cattle husbandry specialist.

Control of Blowfly Strike in Sheep.

"What is the present position as regards blowfly control?"

Research.—Research work into the control of blowfly strike in sheep has been organised by the Joint Blowfly Committee. By 1941 practical methods of blowfly control had been developed. These included the use of a co-ordinated programme based on the Mules operation, care in the docking of lambs' tails, a mid-season crutching and jetting with arsenic when necessary. Subsequently the tail strip operation was introduced and the value of DDT in the prevention of body strike and BHC for the treatment of large numbers of struck sheep was demonstrated under field conditions in 1950.

Extension Work on Control Measures.—In 1941 the Australian Wool Board contributed finance for the conduct of schools of instruction to acquaint wool-growers with the control measures which could be used. Seventeen schools were held in the initial series. Over 1,000 owners and pastoral workers were contacted through the schools. Eight more schools were held in 1942, 1943, and 1944 and about 120 demonstrations were held on properties by the two officers devoting their time to this work. This was an important stage in the extension drive, when the value of the recommended method was established under field conditions and leaders in the sheep pastoral industry became familiar with their true worth.

Since 1945 more staff has been available for demonstration work. Up to the end of the last financial year they had undertaken over 1,000 demonstrations of the Mules operation and of tailing methods on Queensland properties.

There are approximately 4,000 properties on which sheep breeding is carried out in Queensland. It is clear, then, that at least one-quarter of the industry has availed itself of assistance through personal contact with Departmental field officers. There has also been some spread of information about the suggested methods from wool-grower to wool-grower, but the reaction of the industry to methods which have proved their worth has not been enthusiastic.

Evaluation of the Work on Blowfly Control.—One decade has now elapsed since the commencement of the campaign to bring information about blowfly control measures to the sheep industry in Queensland. The field officers charged with this responsibility have been untiring in their efforts. Suitable literature is available giving details of the methods which might be employed. The agricultural press has been extremely helpful and co-operative in publicising information. In particular it has recounted the experience of wool-growers who have proved the value of the suggested methods. It would not be true to say the campaign was a failure—it would be equally untrue to say it had been an unqualified success.

As far as can be determined, about half the industry has to date failed to embrace the methods of fly control which have been proved effective by the other half. It is suggested that the U.G.A. might consider methods it could employ in disseminating information held by its members as a result of their experiences in blowfly control.

TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 30th MARCH, 1953.)

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas
	F. H. Hutton, " Bingegang," Dingo
A.I.S.	F. B. Sullivan, " Fermanagh," Pittsworth
	D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth
	W. Henschell, " Yarranvale," Yarranlea
	Con. O'Sullivan, " Navillus" Stud, Greenmount
	H. V. Littleton, " Wongalea" Stud, Hillview, Crow's Nest
	J. Phillips and Sons, " Sunny View," Benair, *via* Kingaroy
	Sullivan Bros. " Valera " Stud, Pittsworth
	Reushle Bros., " Reubydale " Stud, Ravensbourne
	H. F. Marquardt, " Chelmer " Stud, Wondai
	W. G. Marquardt, " Springlands," 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
	L. Holmes, " Benbecula," Yarranlea
Ayrshire	J. N. Scott, " Auchen Eden," Camp Mountain
	" St. Christopher's " and " Iona " Studs, Brookfield road, Brisbane
	E. Mathie and Son, " Ainslie " Ayrshire Stud, Maleny
	C. E. R. Duncombe, " Marionville" Ayrshire Stud, Landsborough.
Friesian	C. H. Naumann, " Yarrabine" Stud, Yarraman
Guernsey	C. D. Holmes, " Springview," Yarraman
	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, *via* Biggenden
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, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, " The Craigan Farm," Aspley
	R. J. Crawford, " Inverlaw " Jersey Stud, Inverlaw, Kingaroy
	P. H. F. Gregory, " Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, " Yarradale," Yarraman
	A. L. Semgreen, " Tecoma," Coolabunia
	G. & V. Beattie, " Beauvern," Antigua, Maryborough
	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
Polled Hereford ..	W. Maller, " Boreview," Pickanjinnie

ASTRONOMICAL DATA FOR QUEENSLAND.

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

THE STARS.

The discussion of the constellations visible from Queensland which has appeared in this journal for some time has been completed. While dealing with the constellations it may be of interest to mention something of the stars in general and to dispel some of the false impressions often met with.

Confusion often arises as to the difference between a star and a planet. When observed in the night sky with the naked eye, there appears no difference, except, perhaps, that on some occasions planets such as Venus and Jupiter are much brighter than the other objects. Stars, however, differ from the planets in that the stars are huge, incandescent, gaseous bodies which give out light just as our sun, which is a star, gives off light; whereas the planets belong to a system of relatively cool, solid bodies circulating round our sun and, like the moon, shining because their surfaces reflect the sun's light rays to us.

Though the stars are much larger bodies than the planets, because of their tremendous distance from us, even when viewed in the most powerful telescopes they appear only as a pinpoint of light; but the planets under telescopic magnification give a definite disc image. It is frequently stated that a planet may be distinguished from a star because stars "twinkle" and planets do not, and although theoretically this is correct it cannot be relied upon as a means of identification. The condition is brought about by the passage of the light through uneven densities of atmosphere, which cause erratic bending of the rays. As the light from a star is a point of light, any variation in the direction of the rays reaching us makes the star appear to "dance" or "twinkle." The reflected light from the planets, however, is not a point source, but comes from a disc containing numerous points of light, and while each point of light from the planet's disc may suffer the same fate as the light from the star, all the points on the planet's disc are not affected exactly the same at the same instant and some rays are continually passing to our eyes, thus giving a practically uniform light. However, while the bending of the rays may not cause the planets to "twinkle," it often causes an apparent change of colour. The "twinkling" effect is much more marked when the object is near the horizon.

Planets can also be distinguished from the stars by their changing position in the sky. Because of the comparative nearness of the planets to us, their movement is much more marked than the movement of the stars. So far away are the stars that, though they are moving through space at considerable speeds and in all directions, their movement cannot be detected (except by accurate instruments specially constructed for the purpose) and they appear to be "fixed" in relation to one another. Over thousands of years the constellations have remained the same; for instance Orion, Scorpius, The Pleiades, etc. This "fixed" pattern of the constellations in the sky, then, is useful as a reference to indicate the movement of closer objects such as the planets, meteors and comets. The movement of the closer planets such as Venus and Mars in relation to the stars is most noticeable, and over the last few months watchers of the evening sky will have seen quite a change in the positions of these two planets. The closer the planet is to earth, the more apparent the movement, and the outermost naked-eye planet, Saturn, remains in the same constellation for some considerable time.

Though we speak of the sun and planets as being close to us, they themselves are at great distances from the earth. The sun is 93,000,000 miles from us; while Venus may approach as close as 26,000,000 miles and recede to 160,000,000 miles; Mars may come within 34,600,000 miles and at its maximum distance from the earth be 234,400,000 miles away. The outermost member of our sun's system of planets, Pluto, is on the average 3,666,000,000 miles from us. These distances are great, but are insignificant when compared with the distance from us of the stars, the nearest star being almost 25 million million miles away. Even though we gasp at the mention of this figure, we cannot really comprehend its true value and the vastness of space. The following, however, may give some idea of the relative sizes and distances of these objects. Supposing the sun to be represented by a ball 2 feet in diameter, Venus would be represented by a bead moving round the ball in a circle of 142 feet radius; the earth, also, would be represented by a bead and moving in a circle of 215 feet radius, while Mars and Pluto would be represented by a pin's head, that for Mars moving in a circle of 327 feet radius and for Pluto moving in a circle of 1½ miles radius. On this scale the nearest star would be placed 11,000 miles away.

The brightness of the stars is affected by size, temperature, and distance. A small star which is close to us may appear brighter than a large star much farther away. Our sun, for instance, is extremely bright because of its nearness, but it is really only a small star. The bright star Sirius, which is not much larger than our sun, is about 9 light years away (a light-year is approximately 6 million million miles) and is 26 times brighter than our sun; while Betelgeuse has a diameter over 200 times greater than the sun and is 1,200 times brighter, but this star is 272 light-years away.

All the bright stars with millions of other smaller ones are contained in an enormous collection of stars called "Our Galaxy," which measures 100,000 light-years in diameter and is 10,000 light-years thick at the centre. The milky way indicates the boundary of the long axis. Beyond "Our Galaxy" exist millions of other galaxies which appear as misty patches called "Spiral" nebulae.