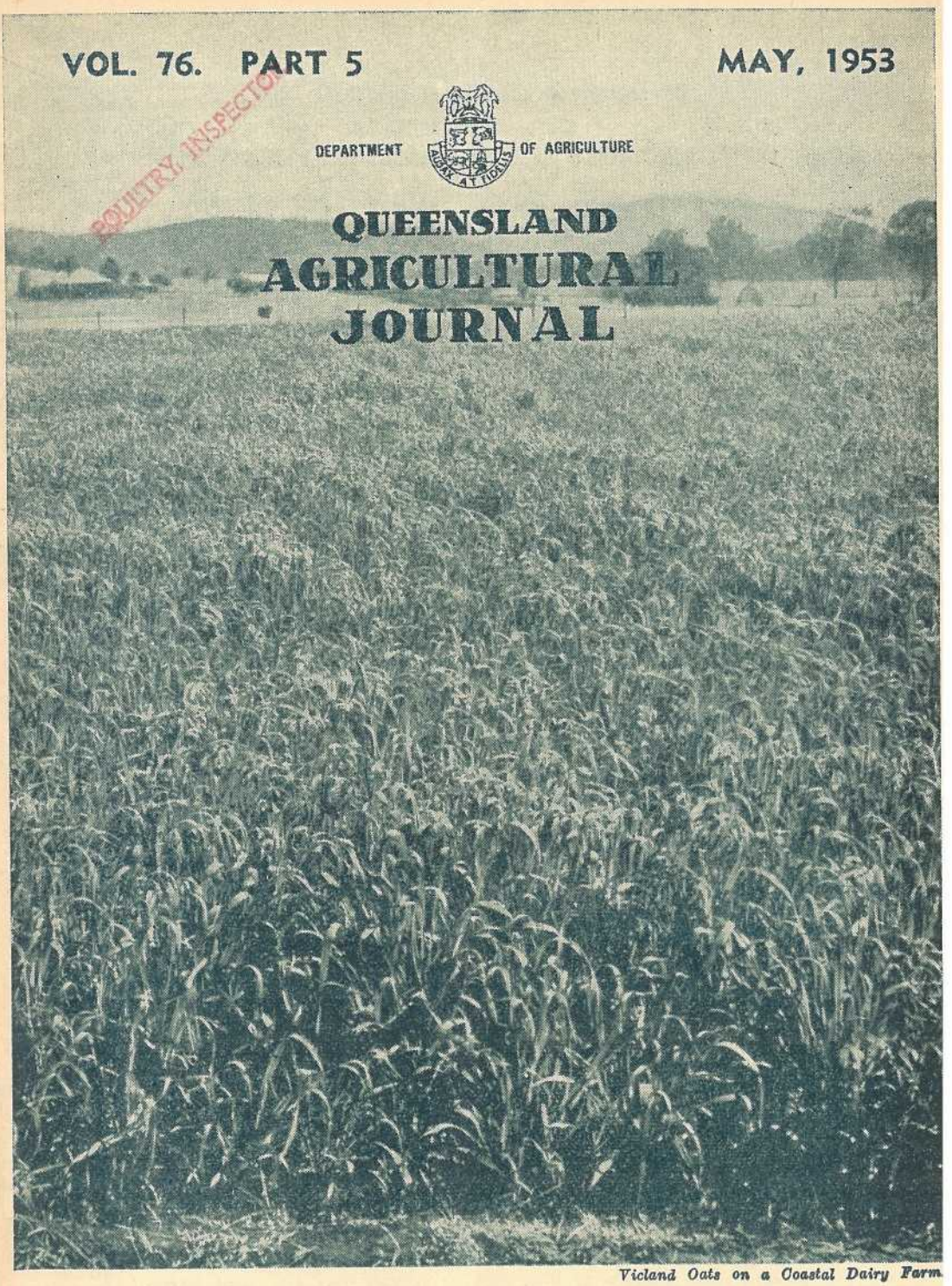
VOL. 76. PART 5 MAY, 1953

DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL



Vicland Oats on a Coastal Dairy Farm

LEADING FEATURES

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

Volume 76 Part 5

QUEENSLAND AGRICULTURAL JOURNAL

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

MAY, 1953

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

GOVERNMENT PRINTER, BRISBANE

Contents

Maize Fertilizer and Rotation Trials on the Atherton Tableland.

W. J. CARTMILL, Chief Soil Conservationist.

THE Atherton Tableland is part of the Cairns hinterland in North Queensland. Although it is situated in tropical latitudes the elevation of the Tableland gives it a temperate climate. The maize-growing belt is a relatively small part of the Tableland country, covering approximately 30,000 acres in a compact area at the northern end.

The town of Atherton, on the south-western edge of the maize belt, is 2,469 feet above sea-level. The average annual rainfall at Atherton is approximately 54 inches, about three-quarters of which falls during the four summer months of December to March. Although the summer rainfall is fairly reliable, it is subject to considerable variation from year to year. Table 1 shows the average monthly rainfall at Atherton over a 42-year period, and the monthly rainfalls for 1947 to 1951 inclusive, the period over which the trials reported herein were conducted. The variability of the annual as well as the monthly totals is well exemplified in this table.

TABLE 1.

RAINFALL (IN POINTS) AT ATHERTON.

Month.	Average (42 Year Period.)	1947.	1948.	1949.	1950.	1951.
January	1,152	442	1,200	1,475	1,401	1,514
February	1,144	1,239	365	2,588	595	1,164
March	908	1,089	1,107	1,822	1,562	284
April	442	200	319	607	1,005	8
May	234	332	190	265	91	99
June	173	245	325	96	470	130
July	112	79	161	127	262	64
August	84	499	113	201	26	29
September	74	248	0	84	178	426
October	90	257	8	69	126	52
November	260	547	346	582	787	96
December	702	380	640	503	2,389	327
Total	5,375	5,557	4,774	8,419	8,892	4,193

The soils of the Atherton Tableland maize-growing belt are colloquially described as red volcanics for the obvious reasons that they are red in colour and have been derived from basalt. They are deep, well-structured clays, friable and permeable, with a red-brown

surface horizon changing gradually to a bright red in the deep subsoil. They are usually broadly divided into two classes according to whether they carry a vegetation of rain-forest ("scrub") or of hardwood forest ("forest"), and are referred to locally as scrub and forest soils respectively. The scrub soils are recognised as having a higher inherent fertility than the forest soils, although both classes rank high in productivity.

Maize sowing takes place during the period November–January with the bulk of the sowing being carried out in December, if soil moisture is adequate. Harvesting may begin in May and continue till October, depending on weather conditions.

Maize has been grown on the Tableland for grain production for upwards of 60 years. It has been grown mostly under a system of monoculture and without the use of fertilizers. Yields have been relatively high, the average of 32 bus. per acre being the highest district average in the State. Individual farm yields of 80 bus. or more per acre have been recorded. That good yields have consistently been obtained under such farming practices over a long period is a clear indication of the high productivity of the soils. Until fairly recently, there was a general belief amongst growers on the Tableland that fertilizers were of no benefit, and a number of trials which had been conducted in the past mostly confirmed this opinion. Many of the trials, however, were conducted on the more fertile scrub soil. Recent trials with fertilizers and with green manures indicate that the forest soil responds markedly to these soil amendments, whereas on the scrub soils little or no response is obtained.

A summary of these recent trials, covering investigations into the influences on maize grain yields of fertilizer applications, green manures and crop rotations is presented here.

The fertilizer trials involved mainly investigations of the requirements of the soil for the three major plant foods—nitrogen, phosphorus and potassium. Nitrogen was supplied as sulphate of ammonia, phosphorus as superphosphate, and potassium as sulphate of potash. These are forms in which the particular plant foods are commonly supplied in commercial fertilizer mixtures. In each trial each fertilizer was applied at three levels, as follows:—

Sulphate of ammonia—

Nil	(N_0)
1 cwt. per acre	(N_1)
2 cwt. per acre	(N_2)

Superphosphate—

Nil	(P_0)
2 cwt. per acre	(P_1)
4 cwt. per acre	(P_2)

Sulphate of potash—

Nil	(K_0)
1 cwt. per acre	(K_1)
2 cwt. per acre	(K_2)

All possible combinations of these treatments were applied, making in all 27 different applications. These were:—

$N_0P_0K_0$ (nil)	$N_1P_0K_0$	$N_2P_0K_0$
$N_0P_1K_0$	$N_1P_1K_0$	$N_2P_1K_0$
$N_0P_2K_0$	$N_1P_2K_0$	$N_2P_2K_0$
$N_0P_0K_1$	$N_1P_0K_1$	$N_2P_0K_1$
$N_0P_0K_2$	$N_1P_0K_2$	$N_2P_0K_2$
$N_0P_1K_1$	$N_1P_1K_1$	$N_2P_1K_1$
$N_0P_2K_1$	$N_1P_1K_2$	$N_2P_1K_2$
$N_0P_1K_2$	$N_1P_2K_1$	$N_2P_2K_1$
$N_0P_2K_2$	$N_1P_2K_2$	$N_2P_2K_2$

Data for trials covering five seasons from 1947-48 to 1951-52 are given in the following sections.

FERTILIZER TRIALS ON FOREST SOILS.

Trial No. 1.

Location: Massasso Bros., Mapee. *Season:* 1947-48.

A summary of the results of this trial is given in Table 2. The yield of 25·63 bus. per acre for N_0 is the mean yield of all plots to which no sulphate of ammonia was applied, irrespective of whether they received applications of superphosphate or of potash or of both. Similarly the yield of 37·27 bus. for N_1 is the mean value of all plots treated with 1 cwt. per acre of sulphate of ammonia regardless of what other treatments they received. Other figures are mean values obtained in a similar way.

TABLE 2.

SUMMARY OF RESULTS (MEAN VALUES)—TRIAL NO. 1.

Treatment.	Shelled Grain (bus./ac.)	Percentage of Barren Stalks.
N_0	25·63	34·6
N_1	37·27	22·7
N_2	47·80	19·4
P_0	32·31	30·5
P_1	39·02	23·7
P_2	39·37	22·5
K_0	35·84	26·9
K_1	35·66	28·0
K_2	39·20	21·8
Significant differences	N_1 greater than N_0 N_2 greater than N_1 and N_0 P_1 greater than P_0 P_2 greater than P_0	N_1 and N_2 less than N_0 P_1 and P_2 less than P_0

The increased yield for an application of 1 cwt. of sulphate of ammonia per acre amounted to 11·64 bus. per acre, and for 2 cwt. of sulphate of ammonia the increase was 22·17 bus. Superphosphate at 2 cwt. per acre increased the yield by 6·71 bus. per acre. The potash fertilizer had no effect on yields. There was no interaction effect

between nitrogen and phosphorus in this trial; in other words, the responses to nitrogen and phosphorus were independent of one another. An application, therefore, of 2 cwt. of sulphate of ammonia and 2 cwt.

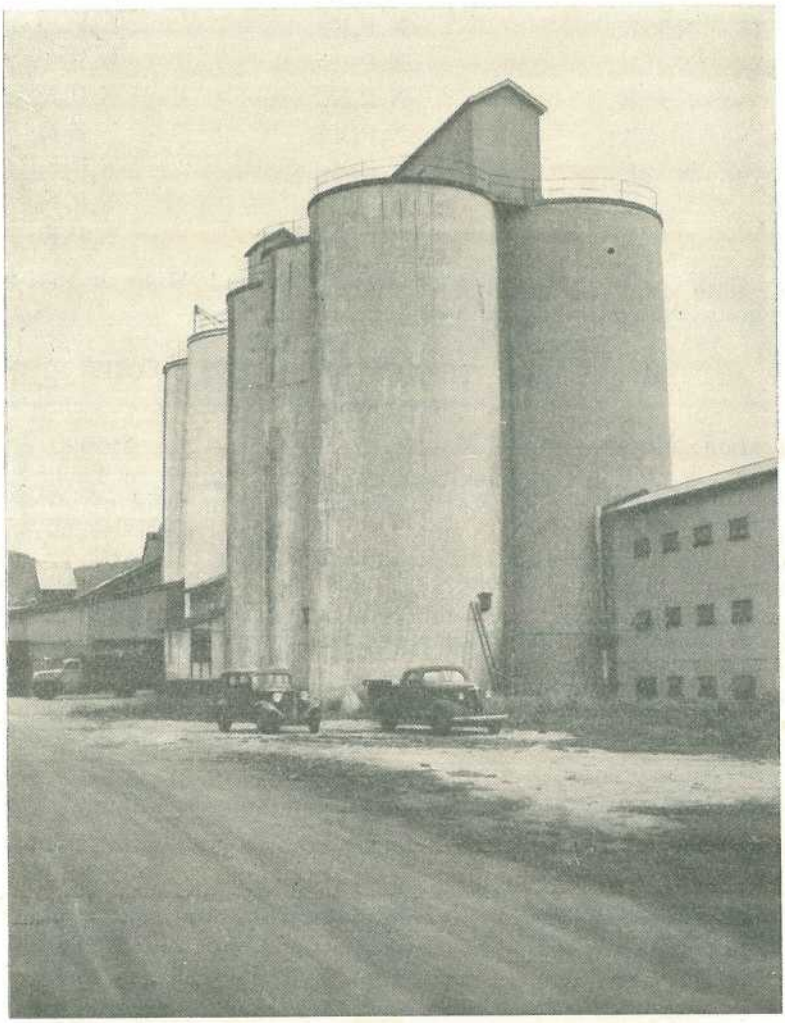


Plate 1.

The Atherton Tableland Maize Marketing Board's Silos at Atherton.

of superphosphate per acre increased the yield by 28·88 bus. per acre, and thereby more than doubled the yield of grain. The fertilizer dressings also considerably reduced the percentage of barren stalks in the crop, as is indicated in the table.

In this trial a mean of 13·4% of cobs was affected by disease (cob rots); there were no significant differences between plots in this respect. The shelling percentage was relatively high at 83·7.

Trial No. 2.

Location: Massasso Bros., Mapee. *Season:* 1948-49.

The results of this trial are summarized in Table 3.

TABLE 3.

SUMMARY OF RESULTS (MEAN VALUES)—TRIAL NO. 2.

Treatment.	Shelled Grain (bus./ac.)	Percentage of Barren Stalks.
N_0	27·37	22·8
N_1	30·79	20·3
N_2	37·07	14·5
P_0	31·92	19·0
P_1	30·90	19·5
P_2	32·41	19·2
K_0	31·55	19·7
K_1	30·99	21·8
K_2	32·69	16·1
Significant differences ..	N_2 greater than N_0 N_2 greater than N_1	N_2 less than N_0 N_2 less than N_1

There was a response to nitrogen only. The response to 1 cwt. of sulphate of ammonia per acre was only slight, but it was marked at the 2 cwt. level. It is interesting to note that on the same farm in the previous season a more marked response to nitrogen and a response to phosphorus was obtained.

The different responses are probably due to different seasonal conditions. The 1947-48 season was preceded by a wet spring, 1,551 points being recorded at Atherton for the 4-month period August-November; whereas for the corresponding period before the 1948-49 season only 467 points were recorded. When a wet period precedes the planting period a deficiency of available nitrogen (nitrates) in the soil is created because of leaching effects, and nitrogenous fertilizers are required to correct the deficiency. Conversely, when a moderately dry period precedes the planting period, soil nitrates accumulate and a deficiency of available nitrogen is either slight or non-existent. The different responses to phosphorus are explained by the contrasting rainfalls during the respective growing periods. For the 6-month period December-May in the 1947-48 season, 3,561 points were recorded at Atherton, and for the corresponding period in 1948-49 the recording was 7,397 points. The wetter period is conducive to a more ready uptake of phosphorus from the soil by the crop.

As well as increasing the yield, the heavier application of sulphate of ammonia greatly reduced the number of barren plants.

Trial No. 3.

Location: Massasso Bros., Mapee. *Season:* 1949-50.

As shown in Table 4, sulphate of ammonia again considerably increased the yield, particularly when applied at the higher level of 2 cwt. per acre. Neither phosphatic nor potassic fertilizers had any significant effect on yield. Sulphate of ammonia also greatly reduced the percentage of barren plants, as before.

TABLE 4.

SUMMARY OF RESULTS (MEAN VALUES)—TRIAL NO. 3.

Treatment.	Shelled Grain (bus./ac.)	Percentage of Barren Stalks.
N_0	27·80	20·1
N_1	36·71	8·3
N_2	43·92	10·0
P_0	35·23	15·2
P_1	38·35	10·8
P_2	34·84	12·3
K_0	36·10	13·2
K_1	35·49	14·4
K_2	36·84	10·6
Significant differences ..	N_1 greater than N_0 N_2 greater than N_1	N_1 less than N_0 N_2 less than N_0

Trial No. 4—Residual Fertilizer Trial.

Location: Massasso Bros., Mapee. *Seasons:* 1948-49 and 1949-50.

Following the good responses to nitrogen and to phosphorus obtained on the forest soil at Massasso Bros. in the 1947-48 season and the response to nitrogen in the 1948-49 season, it was decided to replant the sites of the plots with maize in the 1948-49 and 1949-50 seasons respectively to observe if the beneficial effects of the fertilizer would extend into the second season. The sites of the original plots were easily located from datum pegs, and the rows were placed to coincide with the positions of the original rows. The results are shown in Table 5.

TABLE 5.

SUMMARY OF RESULTS (MEAN VALUES)—TRIAL NO. 4.

Treatment.	Shelled Grain (bus./ac.)		Percentage of Barren Stalks.	
	1948–49.	1949–50.	1948–49.	1949–50.
N_0	20·59	30·61	29·2	12·4
N_1	19·31	29·35	30·2	19·6
N_2	23·43	33·05	22·1	19·2
P_0	21·86	33·15	23·6	12·4
P_1	21·96	29·89	25·9	21·2
P_2	19·51	29·97	31·9	17·5
K_0	20·78	28·09	27·9	23·2
K_1	21·66	32·86	27·8	14·2
K_2	20·88	32·06	25·8	13·8

There were no significant differences in yield due to fertilizer treatments of the previous season in either of the two trials, which indicates that there was no carry-over effect of fertilizer from one season to the next.

FERTILIZER TRIALS ON SCRUB SOILS.

Trial No. 5.

Location: Kairi Regional Experiment Station. *Season:* 1948-49.

The results of this trial are shown in Table 6.

There was no response to fertilizer on this soil. While responses are usually not obtained on the scrub soils of the maize belt, this particular soil at Kairi has probably a higher than average fertility. It has been cultivated only since 1940 and was heavily fertilized for a few years subsequently, when the farm was used by the Army for the production of vegetables.

TABLE 6.

SUMMARY OF RESULTS

(MEAN VALUES)—TRIAL NO. 5.

Treatment.	Shelled Grain (bus./ac.)	Percentage of Barren Stalks.
N_0	59·27	10·3
N_1	57·90	13·4
N_2	58·80	11·2
P_0	59·05	12·5
P_1	58·63	11·8
P_2	58·29	10·6
K_0	58·68	11·8
K_1	58·25	11·0
K_2	59·04	12·1

Trial No. 6.

Location: J. A. & J. H. Bravery, Tolga. *Season:* 1950-51.

Although, as stated previously, responses to fertilizer are not usually obtained on the scrub soils, it is found that in cases where the fertile topsoil has been eroded fertilizers are beneficial. This experiment was conducted to determine the plant food requirements of a typical eroded area of scrub soil.

Table 7 shows that there was a marked response to sulphate of ammonia applied at 1 cwt. per acre. The further response when double this amount of fertilizer was applied was small and non-significant. Phosphatic and potassic fertilizers were of no benefit. The yield figures in this trial showed some variations which are difficult to explain, especially in relation to phosphate, but they are probably due to extreme soil variability, since the area has suffered severely from gully and rill erosion.

The low yield figures are a reflection of the low productivity of this eroded area. Nearly half the plants did not produce cobs, as is indicated in the table.

The restoration of the productivity of areas such as this requires more than the mere application of fertilizers. An improvement in the physical condition of the soil is an essential prerequisite, and is best achieved by putting the area under a pasture ley for a year or two.

TABLE 7.

SUMMARY OF RESULTS (MEAN VALUES)—TRIAL NO. 6.

Treatment.	Shelled Grain (bus./ac.)	Percentage of Barren Stalks.
N_0	17·49	58·6
N_1	27·04	41·4
N_2	29·14	38·2
P_0	26·07	42·5
P_1	21·78	50·9
P_2	25·83	44·8
K_0	25·88	45·6
K_1	23·00	49·6
K_2	24·80	43·0
Significant differences	N_1 and N_2 greater than N_0 P_0 and P_2 greater than P_1 K_0 greater than K_1	N_1 and N_2 less than N_0 P_0 less than P_1 K_2 less than K_1

Plate 2.

A Maize Fertilizer Trial on the Farm of Massasso Bros., Mapee, in 1950. The centre row, which has been broken down, was sown for the purpose of separating plots receiving different fertilizer treatments.

PHOSPHATE TRIAL ON FOREST SOIL.

Trial No. 7.

Location: A. Brown, Tolga. *Season:* 1949-50.

This trial was designed to test the relative values of various phosphatic fertilizers on the red loams of the Atherton Tableland. These soils, in common with all soils of the same type, have the property of rendering soluble phosphates such as superphosphate relatively unavailable to plants in a short period of time. It was desired to determine whether other less soluble phosphates would give better results than superphosphate. Sulphate of ammonia was also used in half of the plots because of the possibility that the phosphates might perform better in the presence of nitrogen.

The following treatments were used:

A. Superphosphate 336 lb./acre (=78 lb. phosphoric acid as P_2O_5).

B. Serpentine superphosphate 457 lb./acre (=78 lb. phosphoric acid as P_2O_5).

C. Basic superphosphate 386 lb./acre (=78 lb. phosphoric acid as P_2O_5).

D. Rock phosphate 205 lb./acre (=78 lb. phosphoric acid as P_2O_5).

E. No phosphate.

X. Sulphate of ammonia 112 lb./acre.

Y. No sulphate of ammonia.

The results (Table 8) give a rather confused picture of the effect of the various phosphates on yield. Without sulphate of ammonia, serpentine superphosphate was the only phosphate that effected much improvement in yield. With sulphate of ammonia, however, all the phosphatic fertilizers caused an increase in yield, more particularly superphosphate and basic superphosphate. Sulphate of ammonia alone was ineffective but it increased the yields appreciably when applied with the phosphates other than serpentine superphosphate.

TABLE 8.

RESULTS (MEAN VALUES)—TRIAL NO. 7.

Treatment.	Shelled Grain (bus./ac.)	
	Without Sulphate of Ammonia (Y).	With Sulphate of Ammonia (X).
A. Superphosphate	43·91	53·15
B. Serpentine superphosphate	50·96	49·26
C. Basic superphosphate ..	40·41	55·35
D. Rock phosphate	36·07	49·21
E. No phosphate	41·26	41·32
Significant differences ..	B greater than D B greater than C	C greater than E A greater than E
	X greater than Y with A, C, and D X greater than Y on mean values	

CONCLUSIONS AND RECOMMENDATIONS ON FERTILIZERS.

This series of fertilizer trials leads to the conclusion that the *forest soils* on the Atherton Tableland will respond markedly to applications of certain fertilizers, but the *normal scrub soils* will not. Scrub soils that have been eroded will also respond to fertilizer applications but cannot be restored to full productivity by this means alone.

The plant food which is found to be most deficient in the *forest soils* is nitrogen. This is indicated by the marked responses obtained to applications of sulphate of ammonia in all trials on that soil type. Satisfactory responses are sometimes obtained also to phosphorus, applied as superphosphate, on the forest soils. The degree of responses to nitrogen and phosphorus seems to bear some relationship to the seasonal conditions which prevail during the spring and summer months. The greatest response to nitrogen occurs following a wet spring and early summer. The relationship between phosphorus response and seasonal conditions is not so definite, but it seems that phosphatic applications are beneficial on forest soil in all but exceptionally wet seasons. There is also evidence from one trial to support the suggestion that on some areas of forest soil an interaction between nitrogen and phosphorus occurs, whereby each of these plant foods is only beneficial when applied with the other.

The potassium status of the soils is apparently satisfactory, since potassic fertilizers give no response.

The nitrogen requirements of the soils could largely be met by a rotational cropping system in which a leguminous green manure precedes the maize crop. Under the monoculture system normally used on the Tableland, however, this is not practicable, and nitrogen requirements must be supplied through artificial fertilizers. Phosphatic fertilizers must be used in any case to supply the phosphorus requirements.

On the basis of results obtained in this series of trials, it is recommended that for forest soils of the Atherton Tableland "maize belt" a fertilizer mixture containing equal parts by weight of sulphate of ammonia and superphosphate be applied at the rate of about 4 cwt. per acre. This treatment can be expected to increase the yields by 10-25 bus. per acre, according to the season. The fertilizer should be applied in the drill at sowing time. Care should be taken to ensure that it is either covered by or mixed with soil so that seed does not come in direct contact with it and thereby have the germination impaired.

It is recommended that *eroded scrub soils* be fertilized as for forest soils. Full productivity of eroded soils, however, cannot be restored until their organic matter status has been improved and this can most readily be achieved by putting them under a pasture ley for a year or two.

Normal scrub soils in the maize belt have not been found to respond to applications of fertilizer.

It is considered that when a protracted period of wet weather follows the maize sowing, it would be advantageous to side-dress the crop with sulphate of ammonia at the rate of about 1 cwt. per acre.

The reason for this recommendation is that the soluble nitrogen compounds in the soil, derived either from added fertilizer or from natural sources, are readily leached from the topsoil by water and

consequently copious rains early in the season might well cause the crop to suffer from a deficiency of nitrogen with resultant low yields of grain. Under such conditions a side-dressing of sulphate of ammonia at the last cultivation period would replenish the nitrogen supplies within the root zone at a time when the crop's requirements of this plant food are high.

GREEN MANURE–MAIZE ROTATION TRIALS.

Previous investigations have shown that maize crops on the Atherton Tableland respond to green manures ploughed in some 6–8 months prior to the maize planting. The degree of response is variable, being mostly of the order of 25 per cent. increase in grain yield. In these trials, responses were not obtained beyond the first season following the green manure. It would appear from these investigations that green manuring is not an economical practice for Tableland maize soils, since the increase in yield following the green manure does not compensate for the loss of a season's crop.

It has been pointed out, however, that the influence of seasonal conditions may have an important bearing on the degree of response obtained, which, apparently, is most marked in dry seasons. It is possible also that the number of seasons over which the beneficial effects of a green manure may last may likewise be influenced by seasonal conditions. Furthermore, the ploughing under of a green manure as soon as the crop matures or earlier, which allows a fairly long period to elapse before the following-on maize crop is planted, may not be as advantageous in preserving the benefits of the green manure for the maize crop as one which allows the legume to remain as a mulch on the surface of the soil until the land is ploughed preparatory to planting the maize. To observe the effects of different seasons on both the degree and the period of response, two long-range trials were set out in 1947. They were planned to run for four years or longer and to include the following rotations.

(1) Maize grown continuously.

(2) Green manure for one season followed by maize the next season.

(3) Green manure for one season followed by maize for next two seasons.

(4) Green manure for one season followed by maize for next three seasons.

The trials were designed so that comparisons of maize continuously and maize following the green manure could be made each year after the first by including five treatments as follows:

Treatment.	1st Year.	2nd Year.	3rd Year.	4th Year.	5th Year.
a	M	M	M	M	M
b	G	M	M	M	G
c	M	G	M	M	M
d	M	M	G	M	M
e	M	M	M	G	M

G = Green Manure ; M = Maize.

The green manure used was velvet bean and it was ploughed under each year when the land was prepared for the next season's maize crop. No fertilizer was applied.

The trial was established on each of the forest and scrub soil types.

Trial No. 8—Forest Soil.

Location: Massasso Bros., Mapee.

From the results of the trial on the forest soil (Table 9) it is clear that in each of the three seasons the green manure caused a marked improvement in yield in the following maize crop based on a comparison with the continuous maize plots. The increases were respectively 60 per cent., 58 per cent., and 105 per cent. There is some evidence that the benefit of the green manure extended into the second following maize crop in the 1950-51 season, but the increased yield in this instance is not significant. There is no evidence of any carry-over effect to the third year for the only season for which third-year data are available.

TABLE 9.

SUMMARY OF RESULTS (MEAN VALUES) OF GREEN MANURE-MAIZE ROTATION TRIAL ON FOREST SOIL.

Season.	Treatment.	Yield (bus./ac.)	Percentage of Barren Stalks.
1947–48	1. Maize each year	24·80	34·60
1948–49	1. Maize each year	22·15	29·18
	2. 1st year after green manure..	35·62	16·25
		(2 sign. greater than 1)	(2 sign. less than 1)
1949–50	1. Maize each year	32·02	13·9
	2. 1st year after green manure ..	50·62	6·9
	3. 2nd year after green manure..	33·86	11·7
		(2 sign. greater than 1 and 3)	(2 sign. less than 1)
1950–51	1. Maize each year	19·20	70·13
	2. 1st year after green manure ..	39·30	25·13
	3. 2nd year after green manure..	23·40	57·54
	4. 3rd year after green manure ..	19·40	64·49
		(2 sign. greater than 1, 3, 4)	(2 sign. less than 1, 3, 4)

To assess the economic value of the rotation, it is necessary to examine the yields obtained over the various periods of the rotation and compare them with those for the same periods from the continuous maize treatment.

From the table above it is readily seen that for a 2-year rotation of maize-maize v. green manure-maize, three comparisons are possible; for a 3-year rotation (maize-maize-maize v. green manure-maize-maize)

there are two comparisons; and for a 4-year rotation there is one comparison. These are tabulated as follows:—

2-YEAR ROTATION.

Total Yields (bus./ac.).

Maize-Maize.	Green Manure-Maize.
46·95	35·62
54·15	50·62
51·22	39·30

3-YEAR ROTATION.

Total Yields (bus./ac.).

Maize-Maize-Maize.	Green Manure-Maize-Maize.
78·97	69·48
73·37	74·02

4-YEAR ROTATION.

Total Yields (bus./ac.).

Maize-Maize-Maize-Maize.	Green Manure-Maize-Maize-Maize.
98·17	88·88

From these figures it is doubtful if any of the green manure rotations could be justified on economic grounds. Further experimentation would be required to prove this point definitely. On the data available, the 3-year rotation appears the most promising. For one 3-year period, two maize crops following the green manure gave a slightly better total yield than three successive maize crops over the same period.

In assessing the economic value of the rotations, consideration must be given to the saving of the costs of production of one maize crop, although this is offset to some extent by the expenses associated with the production of the green manure crop. The difference between these costs would probably leave a balance in favour of the rotation.

Trial No. 9—Scrub Soil.

Location: Kairi Regional Experiment Station.

The results shown in Table 10 indicate that the green manure improves the yield of the following maize crop in the scrub soil in some years but not in others. The improvement was most pronounced in 1949-50 and in 1950-51 The 1951-52 results are not good criteria of the value of the rotation because the stand of velvet beans in the preceding season was poor and the stand of maize in the same season was likewise unsatisfactory. Furthermore, this soil had not been cropped with maize for a long succession of years prior to commencing

this experiment and consequently was in a highly productive condition at the start. It is probable that continued cropping to maize would exhaust the fertility of the soil to a point where the green manure would have pronounced beneficial effects. Such effects are strongly suggested from the results of the 1949-50 and 1950-51 seasons already referred to. In the former season, the value of the green manure was still evident in the second maize crop.

TABLE 10.

SUMMARY OF RESULTS (MEAN VALUES) OF GREEN MANURE-MAIZE ROTATION TRIAL ON SCRUB SOIL.

Season.	Treatment.	Yield (bus./ac.)	Percentage of Barren Stalks.
1947–48	Maize each year	44·30	15·90
1948–49	Maize each year	65·67	17·51
	1st year after green manure ..	69·56	16·78
1949–50	Maize each year	50·92	11·80
	1st year after green manure ..	64·27	9·50
	2nd year after green manure ..	58·66	13·60
1950–51	Maize each year	32·10	19·38
	1st year after green manure ..	46·80	20·32
	2nd year after green manure ..	33·30	20·61
	3rd year after green manure.. ..	38·20	18·98
1951–52	Maize each year	61·1	13·80
	1st year after green manure ..	63·7	13·10
	2nd year after green manure ..	60·3	18·10
	3rd year after green manure.. ..	64·6	12·40

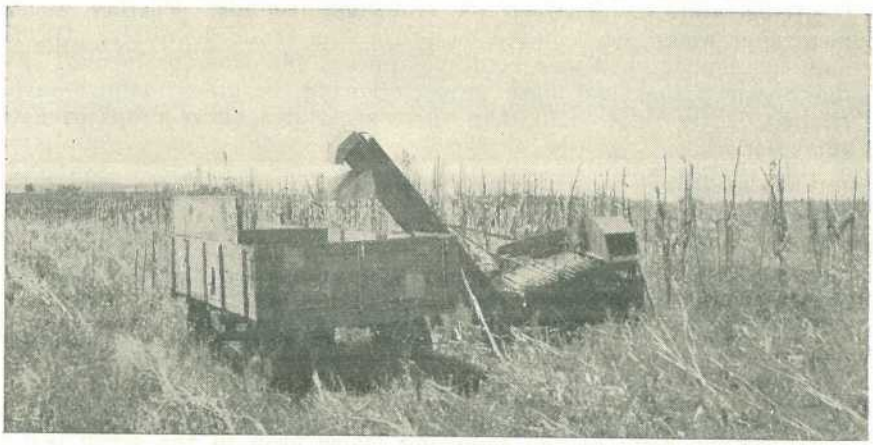


Plate 3.

Mechanical Harvesting of Maize on the Atherton Tableland.

From an economic aspect the rotation has not been beneficial. The improved yields following the green manure have in no case compensated for the loss of a season's crop. Although the information so

far obtained from this experiment is inconclusive, it seems improbable that this particular rotation would prove economically acceptable on the fertile scrub soils.

PEANUTS-MAIZE ROTATION TRIAL.

Although a systematic rotation of crops is not a general practice on the Atherton Tableland, it frequently happens that maize is planted on areas which grew peanuts in the previous season. Opinions differ among growers concerning the effect of the peanut crop on the following maize crop, some claiming that the yield of maize is depressed and others that it is improved.

To test the effect over a number of seasons under experimental conditions, a trial was started on the farm of A. Brown, at Tolga, in 1946 and planned to run for four years. It was designed so that comparisons of maize following peanuts against maize continuously could be made each year after the first—that is, in each of three successive seasons. The results are given in Table 11.

TABLE 11.

SUMMARY OF RESULTS (MEAN VALUES) OF PEANUT-MAIZE ROTATION TRIAL ON FOREST SOIL.

Season.	Mean Yields Shelled Grain (bus./ac.)		Percentage of Barren Plants.		Yield of Peanuts (lb./ac.)
	Maize following Maize.	Maize following Peanuts.	Maize following Maize.	Maize following Peanuts.	
1946–47 ..	23·4	..	..	..	886·1
1947–48 ..	26·1	36·7 (Sign. increase)	10·70	4·40 (Sign. lower)	1,042·0
1948–49 ..	23·82	31·4 (Sign. increase)	30·82	23·26 (Sign. lower)	350·3
1949–50 ..	28·96	36·20 (Increase not sign.)	19·60	11·80 (Sign. lower)	1,044·0

Maize following peanuts has consistently yielded substantially higher than maize following maize in each of three seasons for which such data are available. For the 1947-48 season this increase was about 40%; for the 1948-49 season it was about 32%; and for the 1949-50 season, following a light crop of peanuts, it was 25%.

On the basis of these results it would appear that the inclusion of peanut crops in the maize cropping programme would have a beneficial result on maize yields in forest soils.

A Self-Feeding Haystack.

Mr. William Beak, of the Central District, draws attention to a self-feeding haystack that he states has proved very useful on cattle-raising properties in Central Queensland.

Bush hay is harvested and carted to selected parts of the paddocks, where it is stacked and salted in frameworks of bush timber at which stock can feed themselves.

The frames are built on ground which has been built up about a foot to ensure drainage. Each is 21 ft. long by 18 ft. wide and 7 ft. high. The six posts are sunk 3 ft. into the ground. Along the 21 ft. sides, saplings spaced 3 ft. 6 in. apart are spiked to the top plates and slant to the centre of the frame, where the ends are driven 4 in. into the ground. The ends of the frame should be closed.

The hay can be built up to a height of about 10 ft. above the frame, but it should not overlap the top plates, as this prevents automatic lowering of the stack as the hay is eaten from between the slanting saplings. The stack is provided with a weatherproof cap of a suitable material—self-thatch, bark, galvanized iron, &c.

Stock may be given free access to the stacks or the stacks may be fenced off and made available as required. It is stated that salted bush hay held in these stacks has remained in good condition for at least four years.

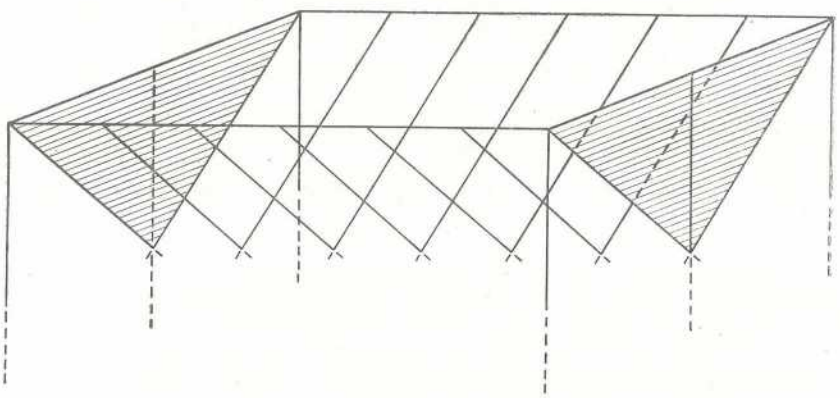


Plate 1.

Diagram of a Self-feeding Haystack.

Tomato, Cape Gooseberry, Egg Plant and Capsicums.

BY OFFICERS OF THE HORTICULTURE BRANCH.

THE tomato, cape gooseberry, egg plant and capsicums or peppers all belong to the same botanical family, the *Solanaceae*, and are known as solanaceous crops. They are herbaceous plants grown as annuals for their fruit, and somewhat similar cultural methods are employed for them all. They are grown from seed, usually in specially prepared beds or boxes, and transplanted to the field.

SEEDBEDS.

The production of sturdy, vigorous seedlings is essential. Virgin ground is preferred for the seedbeds; if it is not available, land which has previously grown solanaceous crops may be used, but sterilizing with formalin or by a surface fire before planting is usually advisable. The site selected for the seedbed should receive the maximum amount of morning sun and adequate protection from heavy winds.

Preparation.

Raised beds approximately 4–6 in. high and 4 ft. wide ensure good drainage and give ample depth of soil for root development (Plate 1).

The seedbeds should be well dug to spade depth and brought to a fine tilth. During the preparation of the bed, a small quantity of fertilizer or well-rotted stable manure may be added to the soil. A sufficient application for the average soil is a handful (about 3 oz.) of blood and bone or one of the recognised vegetable fertilizers to the square yard. The beds should be completed by levelling, raking and watering about two weeks before the seed is sown. Watering consolidates the soil and germinates weeds, which can then be destroyed just prior to sowing.

If plants are raised during cool weather, cold-frames may be used to hasten the germination of the seed and the growth of the seedlings.

Planting the Seed.

The seed is sown in shallow drills about 4–6 in. apart and about ¼ in. deep. After covering the seed with soil, the bed should be gently firmed with a flat board and lightly watered. If a light mulch is placed

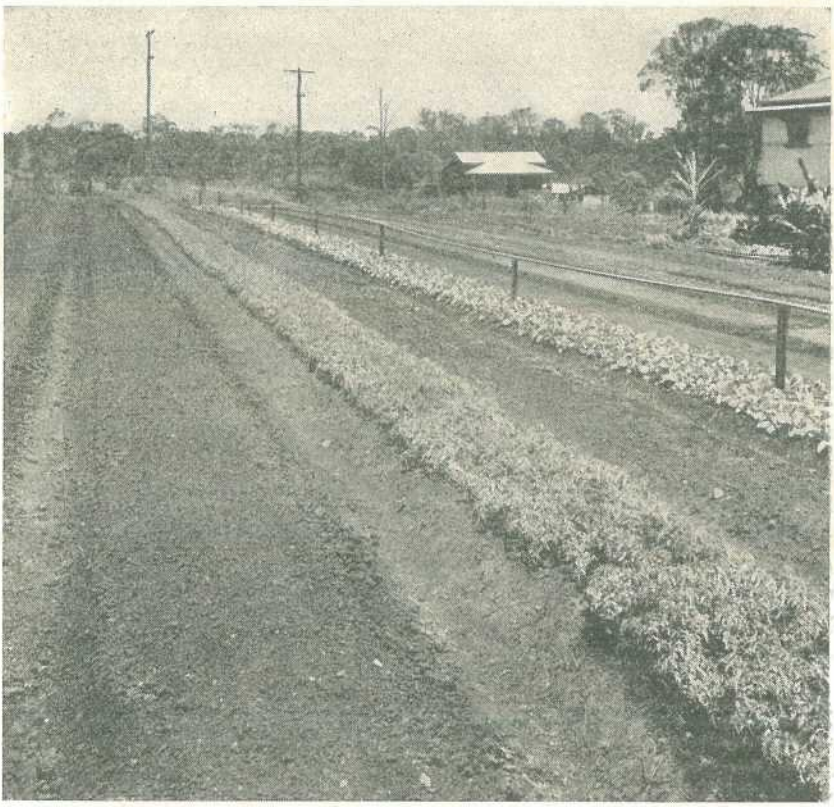


Plate 1.
Tomato Seedlings Raised in the Open in a Hilled Bed. The bed on the left has been prepared for later sowing.

over the bed, further watering will not be needed until the seeds have germinated. Well-rotted manure and clean sawdust are good mulching materials. Old bags are often used for this purpose, but they must be removed immediately the plants appear above the ground. Seedbed covers are needed in some areas to protect the seedlings from heavy rain.

About 1–1½ oz. of seed should be sown for each acre to be planted. This rate of sowing will provide a surplus of plants from which the best can be selected for transplanting into the field.

Tomato seedlings can advantageously be raised individually in small containers, such as iron cylinders (Plate 2). Under this method the plants can be set out in the field without disturbing the roots, and the consequent absence of the transplanting shock usually advances the first pick by about two weeks. A similar result may be obtained if seeds are planted directly in the field in "hills" which are ultimately thinned to one or two plants.

Plate 2.

Tomato Seedlings in Galvanized Iron Cylinders Which are Open on One Side.
Plants raised in this way suffer little or no transplanting shock.

Watering.

Excessive watering of seedbeds should be avoided. There is, however, no hard and fast rule regarding the amount of water required, for some soils, such as red volcanic loams, dry out much more quickly than heavy black loams. In warm weather, daily watering is necessary, but in cool weather one or two waterings each week should suffice. Water should be applied in the morning.

LAND PREPARATION.

Tomato, egg plant, peppers and cape gooseberry crops occupy the ground for periods up to six months and the land must therefore be prepared for the crop with great care. The seedlings do not transplant well into soil containing a great deal of raw vegetable matter, and for this reason, a green manure crop should be turned in several weeks before planting so that the soil will be in good physical condition to take the seedlings. Normally, the land is ploughed to a depth of 8–10 in. and allowed to weather until a few weeks before planting. It is then ploughed again and finally brought to a good tilth with disc cultivators or harrows. Before transplanting, the plant rows are opened up and a basal fertilizer is applied in the drills. A scuffler or hoe is used to mix the fertilizer with the soil in the plant row.

TRANSPLANTING.

In 4-8 weeks after sowing, according to the time of the year and the locality, the seedlings should be large enough for transplanting. About a day or two before transplanting, they are hardened off by withholding water, but immediately before transplanting the seedbeds are given a good soaking to facilitate the removal of the seedlings

without excessive injury to the roots. For preference, transplanting should be done during cloudy or showery weather, but if the work is carried out in unfavourable weather, the young plants should be irrigated or alternatively watered in by hand. As a further precaution, particularly if the plants are large, the leaves should be trimmed to lessen transpiration until growth is resumed (Plate 3). During transplanting, the roots of the young plants should be kept damp by standing them in a bucket containing a puddle of soil and water, or alternatively by placing them in a shallow tray which can be covered with a wet bag.

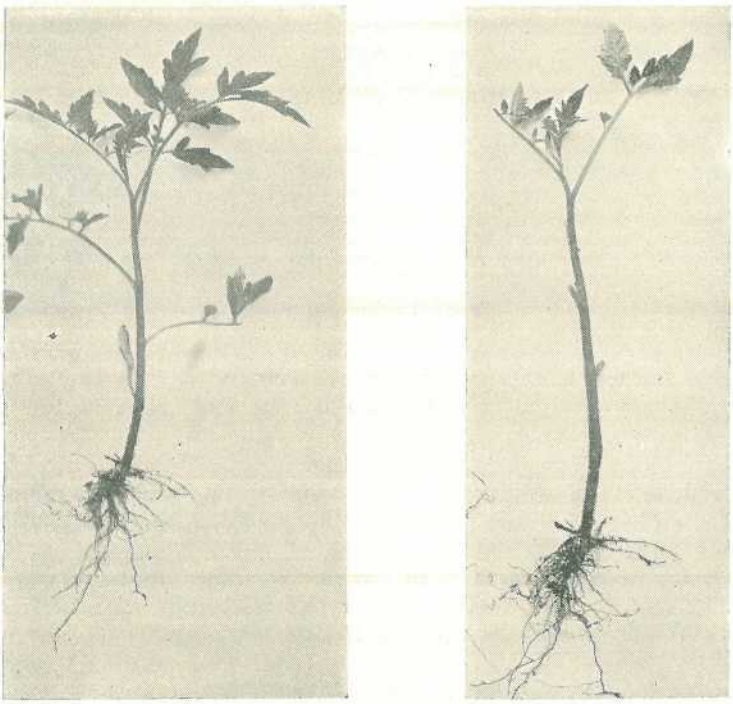


Plate 3.

Tomato Plants at the Transplanting Stage. The plant on the right has been trimmed to reduce moisture losses through the leaves.

When planting, a hole is first made in the ground with a short-handled hoe or by hand; it should be deep enough to allow the roots of the seedling to reach the bottom. A little earth is turned into the hole and the plant is then drawn slightly upwards before pressing the soil firmly around it. This ensures that the main root is not doubled up.

THE TOMATO.

The tomato (*Lycopersicon esculentum*) is grown as an herbaceous annual, and its fruit is botanically described as a berry. The plant is native to tropical America and was known in Europe prior to 1600. Since 1750, great strides have been made in the development of the crop. In Queensland, about 75% of the tomato crop is produced in three districts—the Granite Belt, the Brisbane area, and Bowen—the balance being contributed by the rest of the State. The fruit is in season practically the year round.

In the cool temperate climate of the Granite Belt (Plate 4), the crop is planted from October to early January and harvested in summer and early autumn. Little or no irrigation is practised in this area, but the rainfall is usually sufficient to ensure good crops of high-quality fruit. The more important varieties grown in this district are selected strains of Sioux, Grosse Lisse, Valiant and Rutgers.

In the Brisbane area, the crop is grown mainly under irrigation, with successive plantings throughout the year except the hot summer months of December and January. Autumn ground crops are field planted in late January and February. Cluster varieties grown on trellises and stakes are field planted during April for a winter harvest. An early spring crop is field planted during June, usually on trellises, though in some instances as a ground crop. Field plantings for the late spring ground crop are made in early August. The varieties favoured in this area for the autumn and spring crops are Grosse Lisse, Rutgers and Break o' Day. Salads Special, Potentate and Geraldton Smooth Skin cluster types are used for the winter crop.

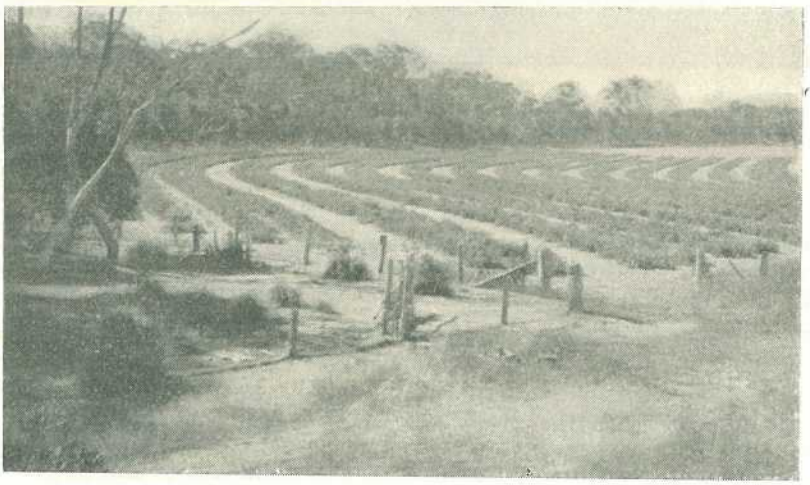


Plate 4.

Contour-planted Tomatoes in the Stanthorpe District.

The tomato season in the Bowen district extends from March until the end of October. Field planting begins towards the end of the wet season and continues until June, while harvesting proceeds from June to September. The crop is grown under irrigation and most of the fruit is marketed in the southern States. The main variety grown is the locally named Bowen Globe (Plate 5), but other varieties of some interest in the district are Valiant and Sioux.

Plant Characteristics.

An undisturbed plant produces a strong tap-root two feet or more in length, with several lateral roots. When a seedling is transplanted, the tap-root often dies and the root system in the field consists mainly of lateral roots relatively close to the surface of the soil. Adventitious roots will arise on any part of the stem which is covered with moist soil.

Plate 5.

A Tomato Crop at Bowen, North Queensland, Showing the Great Vigour of Bowen Globe Plants.

The many branches of the plant are decumbent or partly erect. The stems are round, soft, brittle, and hairy when young, becoming somewhat hard and woody when old. The compound leaves are alternate, 5-15 in. long, pinnate, with 7-9 short-stemmed leaflets.

The tomato shows two distinct types of growth habit. The more common is the indeterminate type, in which a blossom cluster is usually produced at every third node and the plant is able to produce new terminal shoot growth indefinitely. The other type of plant is determinate and blossoms very freely, with a flower cluster at every node; the stem eventually terminates in a blossom cluster and no further shoot elongation takes place. A determinate plant is much more bushy than an indeterminate one.

In the common commercial globe varieties, small, yellow flowers are borne on the stems in clusters of 4-8, and in each cluster they open at intervals over a period of several days, those more basally situated developing first and producing the largest fruits. In the cluster and ornamental varieties, the flowers are more numerous and the fruits smaller than in the above types. The flowers are usually self-fertilised. The fruit is a 2- to many-celled berry with fleshy walls dividing the cells or cavities, which contain numerous small, flat seeds covered with short, stiff hairs.

Soil Requirements.

The tomato may be grown on soils of widely different types. The sandy loams and loams are preferred to both lighter and heavier soils, for they are less affected by extremes of dry and wet weather. Although excellent tomatoes are sometimes grown on fairly heavy soils, a healthy, vigorous crop may collapse if the drainage is bad.

Medium loams with a more or less uniform texture to a depth of about two feet are most suitable for tomato production under irrigation. Such soils may be cultivated within a reasonable period after rain.

Location and Aspect.

Areas suitable for tomato growing are protected from heavy winds, have a well-drained soil and are free from frost. In southern Queensland, warm slopes with a north to north-easterly aspect should be reserved for winter plantings, as this crop, though not easily grown, is a very valuable one. Southerly and westerly slopes may be used for early autumn plantings, which are normally harvested before cold winds and frosts occur. Low ground which is too wet for an autumn planting is often useful for a late spring crop, as the weather at that time of the year is usually fairly dry.

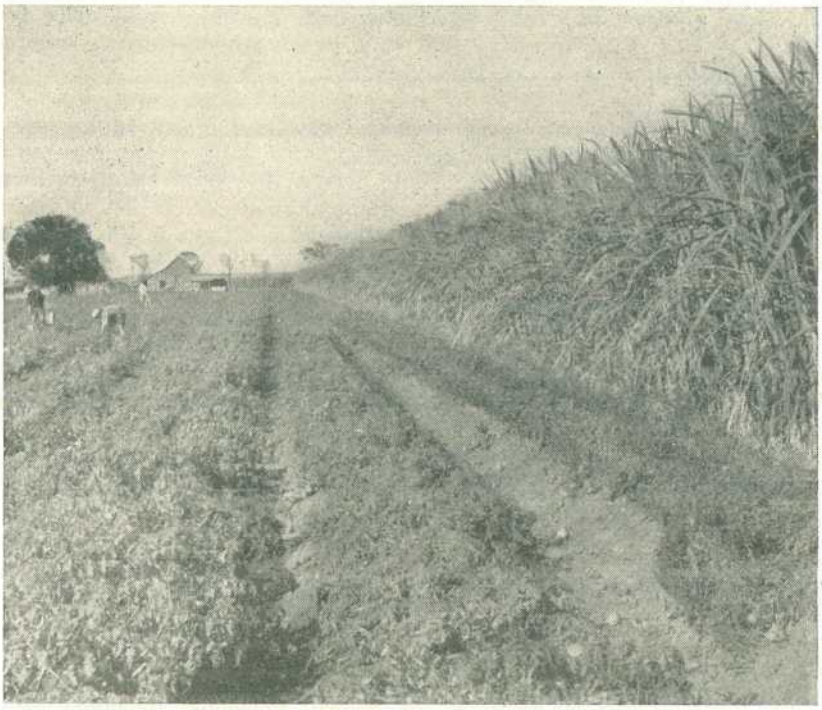


Plate 6.

A Ground Crop of Tomatoes Protected by a Windbreak of Sugar-cane.

Considerable damage may be done to a tomato crop by heavy winds, which not only injure the plants but also have an adverse effect on fruit setting. The crop may be protected by windbreaks. On the coast, an excellent series of temporary windbreaks can be made by planting rows of cowcane or pigeon pea across the farm and on the headlands (Plate 6). Windbreak spacings of 40 yards work well in practice. If the windbreak is planted in spring, it has usually grown sufficiently high by early autumn to protect the new season's crop.

Varieties.

Innumerable varieties of tomato have been developed in many countries for specific purposes. These differ in their habit of growth, the appearance of the fruit, and their susceptibility to disease attacks. In Queens.and the range of suitable commercial types has been reduced to a relatively small number, chief among which are:—

Sioux.—An early tomato which is ready to harvest 10 weeks after transplanting and yields heavily until the final picking. The bush is indeterminate, medium sized, open and sprawling, with long, narrow leaves. The fruit is large in size, slightly flattened in shape and pale green when mature; it ripens to bright red. Cracking is uncommon. The strain certified in Queensland is known as Q1.

Red Cloud.—A first early tomato which is ready to harvest 10 weeks after transplanting. The bush is indeterminate, medium sized, semi-erect to sprawling, and has moderately narrow leaves. The fruit is globe to flat globe in shape and pale green when mature; it ripens to a bright red. Yields are very variable.

Break o' Day.—An early variety, which is ready to harvest in 10-11 weeks after transplanting and has a long cropping period. Indeterminate in habit, it has an open sprawling habit of growth and medium-narrow leaves. The fruit is globe shaped and rather subject to radial and circular cracking when conditions are dry; losses from sunburn are sometimes heavy.

Grosse Lisse.—A mid-season variety which is ready to harvest in 11–12 weeks after transplanting. It has an extended cropping period. Indeterminate in habit, it produces a semi-erect to spreading bush with medium-dense foliage and normal leaves. The mature fruit is large, slightly pointed in longitudinal section, green in colour with dark-green shoulders, and ripens to a bright red. It has good carrying qualities. The strain certified in Queensland is known as Q2.

PLANTING TABLE FOR VARIETIES.

Time of Planting Out.	Varieties Recommended.
A.—FOR COASTAL SOUTHERN QUEENSLAND.	
February to March (ground crops)	Q1 or Sioux, Q2 or Grosse Lisse, Q4 or Rutgers, Red Cloud, Break o' Day
April to May (off-the-ground crops)	Salads Special, Potentate, Geraldton Smooth Skin
June to August (ground crops)	Q1 or Sioux, Red Cloud, Break o' Day, Rutgers, Grosse Lisse
B.—FOR COASTAL TROPICAL QUEENSLAND.	
February to June (ground crops)	Q1 or Sioux, Red Cloud, Stokesdale, Grosse Lisse, Valiant, Bowen Globe
July to September (ground crops)	Burwood Prize, Red Cloud
C.—FOR COOL TABLELANDS.	
October to January (ground crops)	*First Choice:* Q1 or Sioux, Q2 or Grosse Lisse, Q3 or Valiant, Q4 or Rutgers *Second Choice:* Among others, good varieties are Break o' Day and Pearson.

Rutgers.—A late variety. The plant is indeterminate, with an erect and dense bush with large leaves. The fruit is medium in size, globe to deep globe in shape; when mature, it is green in colour with dark-green shoulders, and ripens to orange-red. The strain certified in Queensland is known as Q4.

Valiant.—Mid-season to late, determinate in habit, with a compact, erect bush. Fruit deep globe; when mature, it is green in colour, with dark-green shoulders, and ripens to a bright red. The strain certified in Queensland is known as Q3. An indeterminate type is commonly grown in southern States.

Bowen Globe.—A mid- to late-season variety grown almost exclusively in the Bowen district under irrigation. The bush is very vigorous, open and sprawling, with globe shaped fruit which is pink in colour. The cropping period is exceptionally long.

Transplanting.

Where possible, field planting is done on a cool day, but if this is not practicable, seedlings may be transplanted in the afternoon. Some latitude is permissible, however, on farms with irrigation facilities.

All small, misshapen and blemished plants should be discarded and the remainder more or less graded for size; the grading for size can, however, be done to a large extent by selecting the more forward plants in the seedbed. The smaller plants left in the bed will very often improve in size rapidly, and can be planted a week or so later if necessary. The crowns of the plants should be kept as free from dirt as possible.

When setting the plants in the field, they are placed deeper than they were in the seedbed. This encourages deep rooting and helps to keep them upright.

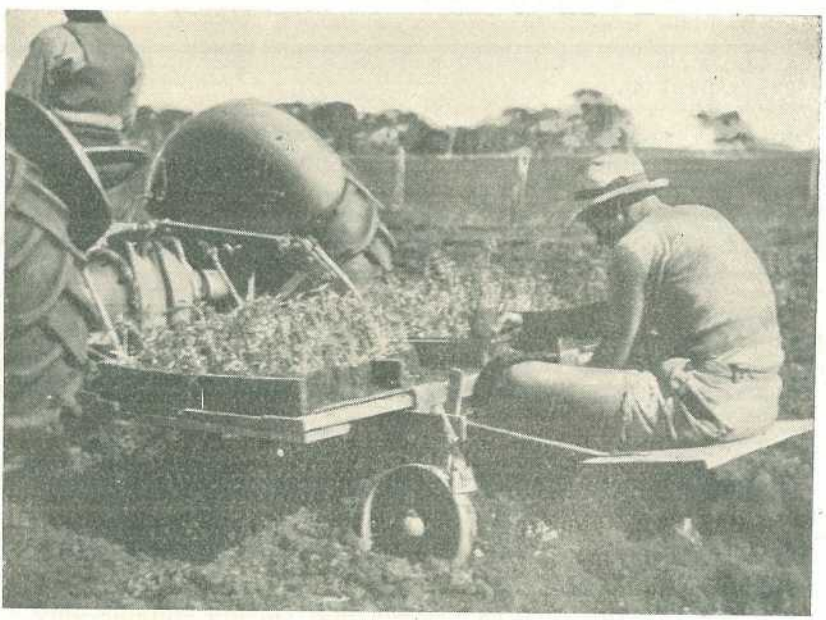


Plate 7.

Planting Out with Mechanical Aid at Bundaberg. Note that the seedlings are in individual containers.

As soon as practicable after the plants are set out they should be watered, each plant receiving 1-1½ pints of water. This settles the soil around the roots and ensures that lack of moisture will not hinder the rapid establishment of the field crop. Care in transplanting is very well worth while, for replacements are rarely satisfactory. It is highly desirable that only good, well-grown plants be set out and that they be planted as quickly as possible after they are taken from the seedbed.

"Buck" Plants.

In plantings of some varieties of tomato, "buck" plants occur. When young, these plants are much sturdier than the others and have short internodes, small leaves and numerous laterals. They do not crop satisfactorily and bear small numbers of misshapen fruit. The "buck" plants can often be detected in the seedbeds when the seedlings are only 3-4 in. high. If they are noticed after transplanting, they should be removed immediately and replaced by good plants. One method of guarding against this trouble is to obtain seed from reliable sources only.

The varieties grown in Queensland which commonly show "buck" plants are Salads Special, Walker's Recruit, Planter's Favourite and Australian Dwarf Red.

Planting Systems and Pruning.

The systems adopted for growing tomatoes in Queensland are:—

(1) Ground crops grown without any mechanical support.

(2) Cradled crops supported by wires at the sides of the bush.

(3) Trellised crops trained along twine joining two wires in the plant row.

(4) Staked crops tied to a 1 in. x 1 in. stake in each plant position.

In a trellised or staked crop which is being trained to a single stem, all lateral growth from the leaf axils and the base of the plant is removed every 10 days or so during the growing season. If the tomatoes are being trained to two stems, the lateral immediately below the first flower cluster is allowed to develop and form the second arm of the plant, but all other laterals are removed.

Pruning should be done by breaking out the shoots; cutting or pinching them out is inadvisable as there is a danger of spreading some virus diseases by these methods. When the plants reach the top of the trellis or stake, the growing tips may be broken out if desired.

Ground Crops.

In Queensland, most tomatoes are grown as ground crops. Ground crops are much cheaper to plant and maintain than crops grown by the other methods, but losses from blemishes, diseases and pests are greater, particularly in the winter months. The fruit is relatively well protected from sunburn; this is most desirable during hot weather. Determinate varieties such as Pearson and Q3 are suitable only for use as ground crops, but indeterminate varieties can usually be adapted to any planting system.

Planting distances vary with the district and the variety grown. A spacing of 6 ft. between rows and 2½-3 ft. between plants in the row is frequently used for varieties such as Break o' Day. The Bowen Globe is planted much wider (10 ft. x 8 ft.) and upright types such as Pearson and Q3 may be planted closer (4½ ft. x 3 ft.) When c'ose-planted in the rows, the plants grow together quickly and thus are not blown about so much as they would otherwise be. Square planting is commonly adopted in districts where two-way cultivation is practised. Except in the Bowen Globe variety, from 1,000 to 2,000 plants may be required for each acre of tomatoes planted as a ground crop; the number needed in the case of Bowen Globe is much less.

Cradling.

Cradling (Plate 8) was popular some years ago in the Brisbane area, but trellising is now more widely practised. Cradling is useful during the autumn months, especially for thick, bushy varieties which are not easily pruned, as it keeps the plants up off the ground, fruit wastage from ground rots is kept to a minimum, and the fruit is not difficult to pick. No pruning is required.

Plate 8.

Tomatoes Grown on the Cradling Method.

The cradle (Plate 9) is constructed by placing short hardwood posts 2 ft. 6 in. in the ground and 2 ft. 3 in. high (4ft. 9 in. overall) at each end of the cultivated field. These should be set at a slightly backward angle and well stayed. Five feet is the usual spacing between the rows. Hardwood intermediate posts 3 ft. 3 in. long are placed in line and driven into the ground every 12 ft. so that the actual height is 2 ft. 3 in. Each intermediate post has two holes bored through it—one almost at the top and the other about 15 in. below the first. These holes need be only of ordinary nailbit size (No. 5) to carry a short wire pin made from 10 or 12 gauge galvanised or steel wire. The wire pins carry the cross-arms. The top cross-arm should be 2 ft. x 1½ in. x 1½ in. sawn hardwood with a centre pin-hole and a ½ in. sawn slot in each end. Two top wires are run from each side and very near the top of the strainers. Similarly, two wires are

LOW TRELLIS TO AVOID PRUNING.

Fig 1. Top Cross Arm 24" x 1½" x ½" made of sawn hardwood with hole bored for wire pin and sawn slots in each end.

Fig. 2 Lower Cross Arm 12" long and otherwise similar to the top arm.

Fig 3. Dropper 3' 3" long x 2" x 2" bored about 2" from top and 15" further down. Pointed at the bottom end and driven about 12" into the ground.

Fig 4 Wire pin about 6" long made from 10 or 12 gauge wire and used for pinning Cross Arms to Droppers.

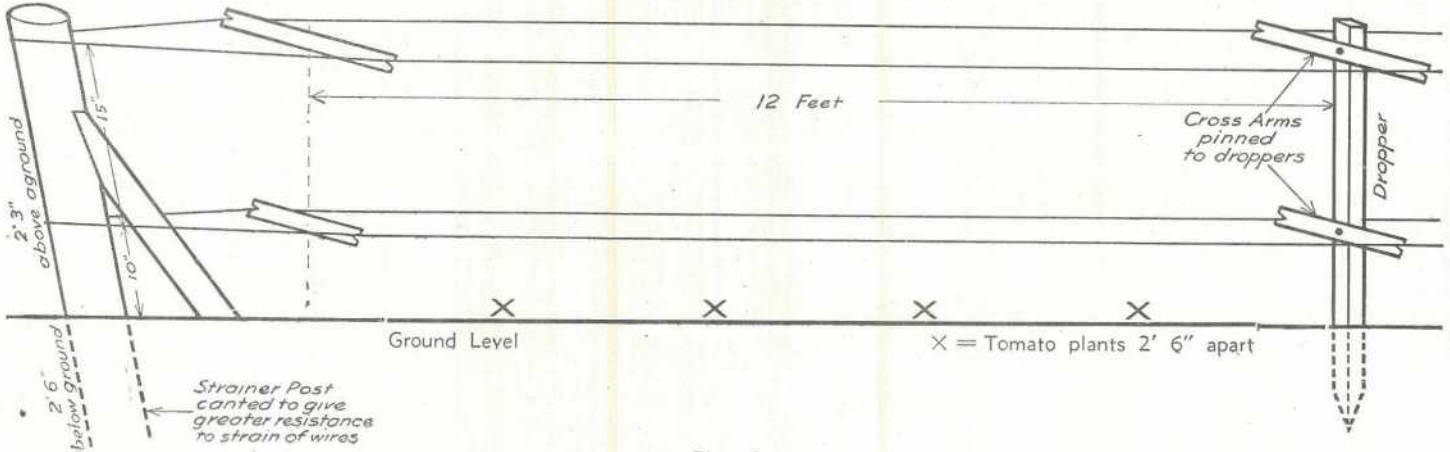


Plate 9.

Sketch Showing the Method of Constructing a Cradle.

run from each side of the strainers at about 10 in. from the ground. The wires are strained tight, the cross-arms placed in position, and attached to each dropper with a wire pin, which is then bent over.

The seedlings are planted between the wires at a 2½-3 ft. spacing (approximately 3,000 plants per acre). Depending on their position, the laterals are spread over the lower or the top wire, and allowed to grow towards the ground again.

Trellising.

Trellising of winter and spring tomatoes (Plate 10) is general throughout the Brisbane area. Although a lot of work is involved in erecting the trellis and training the plants, the system has many advantages. The crop is easier to pick, spray and irrigate, while the fruit is large, of excellent quality and relatively free from defects.

Plate 10.

A Trellised Crop Under Furrow Irrigation at Rockhampton.

Salads Special and other cluster varieties which usually crop well under winter conditions are grown almost exclusively on trellises. Because of their small fruit they must, however, be pruned if the crop is to meet market requirements at that period of the year.

Two types of trellis are in common use. The first (Plate 11) is constructed by sinking two strong posts of about 7 in. diameter and 7 ft. long firmly in the ground to a depth of 2 ft. 6 in. at the ends of each row with the usual stays. The rows are spaced 4 ft. 6 in. apart. Between the posts, strong hardwood stakes are driven into the ground every 12 ft. to act as intermediate supports; the end posts are bored at about 9 in. and 4 ft. 6 in. above the ground level to carry two 12½ gauge wires, which are tightly strained and stapled.

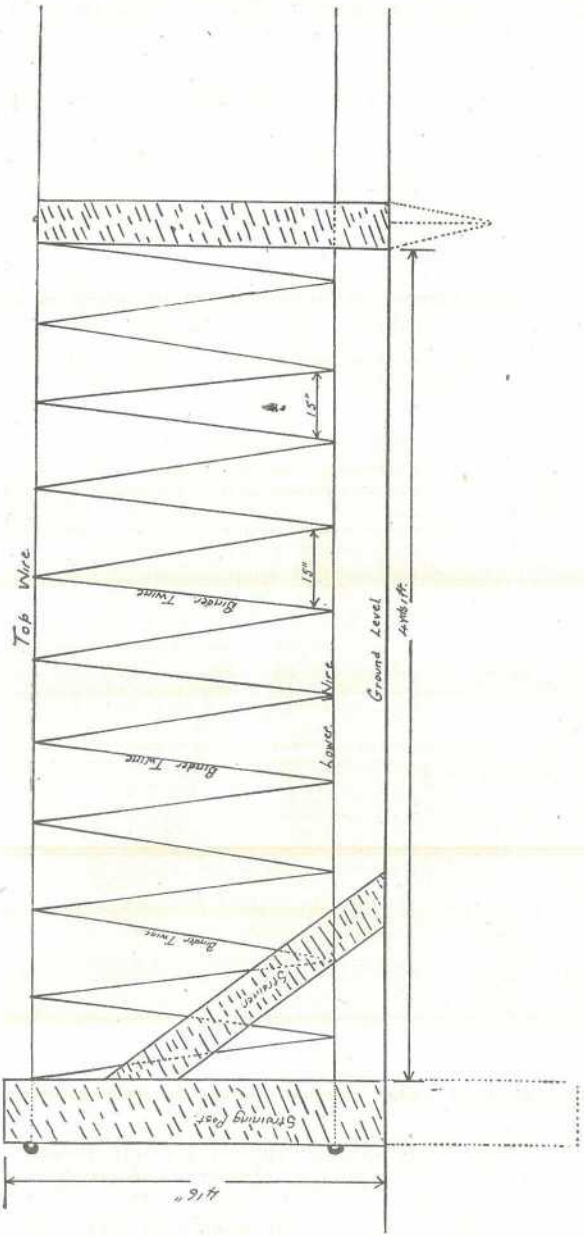


Plate 11.
Sketch Showing Method of Constructing a Trellis.

In the second type of trellis, the holes for the posts at the ends of the rows are dug with an 8-in. soil auger to a depth of 3 ft. at an angle of about 60 degrees and a post of about 7 in. diameter and 8 ft. long is dropped into each hole. There is no need to stay these posts. The posts are bored at the 9 in. and 4 ft. 6 in. levels and 12½ gauge wire is strained through them. The intermediate supports are small posts about 4 in. in diameter and 6 ft. 6 in. long, set firmly into the ground every 22 yards to a depth of 2 ft. Between the intermediate

posts are four hardwood droppers which rest on the ground. The top wire is stapled to the tops of droppers and intermediate posts, while the bottom wire is stapled to the sides. If the staples are not driven in too far they can be removed at the end of the season and used again.

Both trellises are completed by tying the end of a ball of binder twine to the top wire and passing the ball down under the bottom and back over the top wire to form a "V" pattern. The bottoms of the "V"s should be 15 in. apart, which is the space between the plants in the rows. A 7 lb. ball of twine will cover approximately 7 chains of trellis.

The young plants are set out immediately under each "V" and an arm is trained up each length of twine. When the trellised rows are 4 ft. 6 in. apart, approximately 7,000 plants are required to the acre.

Staking.

Staking (Plate 12) has been largely replaced by trellising in most districts. Hardwood stakes about 1 in. square and 7 ft. long are driven 2 ft. into the ground at 18 in. spacings in rows 4 ft. 6 in. apart. The stakes can be driven with a piece of 2-in. pipe about 2 ft. 6 in. long with a plug in one end. The stake is placed in position, and the pipe slipped over the top and operated in pile-driver fashion. A plant is placed at each stake and each is pruned to one or two stems.

Plate 12.

A Staked and Pruned Crop at the Four-hand Stage.

The stem is tied to the stake every 12-15 in. with binder twine. The tie is made loosely so that it does not cut the stem and should be placed under a leaf where possible. The twine is passed around the stem, crossed, and again wrapped around the stake twice before knotting.

Cultivation.

If the ground has been well ploughed and thoroughly prepared for the tomato crop, there is no need for deep cultivation at any stage during the growing period. On most types of soil, shallow cultivation when the weeds are small will do all that is required. Deep cultivation injures the root system of the plant and there is always the risk of cultivating too close to trellised plants in order to avoid chipping. Ground crops are probably not seriously affected, as the bush itself prevents implements from coming in too close after the crop is a few weeks old.

When the crop is topdressed, the fertilizer is distributed along the sides of the row. The first rain or irrigation will dissolve the material and carry it down to the roots of the plant, but if necessary, the fertilizer can be worked into the soil by a light cultivation. The opening of a deep furrow for the fertilizer alongside the plants, particularly when the crop is starting to set fruit, may offset any benefits which might be derived from the addition of the fertilizer.

If necessary, the plants may be hilled up slightly a few weeks after planting out.

Fertilizing.

The production of good-quality tomatoes is closely linked with correct fertilizing methods. Vigorous, healthy bushes tend to produce good yields of first-class tomatoes, while poor yields and inferior fruit are associated with unthrifty plants. Since the necessary plant foods can be largely provided by proper methods of fertilizing, the grower is able to exercise a considerable measure of control over both yield and quality. Few soils in Queensland grow a good tomato crop without fertilizer. Crops on some virgin scrub soils of high natural fertility may yield reasonably well without fertilizer, but even in such cases the addition of suitable fertilizers will usually result in greater production.

In designing a fertilizer programme for tomatoes, the grower has to consider the type of fertilizer to be used, the amounts required, placement and time of application.

Type of Fertilizer.

The most satisfactory fertilizer for both the pre-planting and early side-dressing applications is a complete mixture containing nitrogen, phosphoric acid and potash. The pre-planting mixture should have approximately 4·5% nitrogen, 13·5% phosphoric acid and 5% potash. This mixture also gives good results when applied as a side-dressing. A suitable mixture may be composed solely of the water-soluble fertilizers or it may contain both soluble and insoluble constituents.

For the pre-planting application, a mixture which is partly soluble and partly insoluble is preferred because there is less likelihood of loss from leaching by rain or irrigation water before it is taken up by the plant. In such a mixture, some of the nitrogen and phosphoric acid is contained in blood and bone. In contrast to the pre-planting mixture, the side-dressing should be wholly water-soluble—that is, it should contain only ammonium sulphate, superphosphate and muriate or sulphate of potash.

Amounts Required.

When using a pre-planting mixture with a formula such as 4·5/13·5/5, a normal rate of application is 7 lb. per chain row, or about 8 cwt. per acre with rows 5 ft. apart, for the heavier soils such as loams and clay loams. On sandy loams, this amount can be reduced to 5 lb. per chain, or about 6 cwt. per acre, provided the amount applied as a side-dressing is increased proportionately.

In general, only one side-dressing is required on the heavier soils when the correct pre-planting dressing has been applied. This side-dressing should be approximately 3 lb. of the water-soluble mixture per chain row. On the lighter soil types, the side-dressing is increased to 4 lb. per chain row. In the case of trellised or staked crops on light soils, the side-dressing can with advantage be divided into two applications with an interval of about 3 weeks between them. Since ground crops spread over the surface of the soil, it is difficult to apply a late side-dressing effectively. However, if the variety has a compact and erect habit, the method recommended for trellised or staked crops is applicable.

A water-soluble fertilizer which supplies nitrogen only, such as ammonium sulphate, may be used as a late side-dressing for trellised or staked crops. It is applied when harvesting of the lower hands begins. The application of nitrogen at this period stimulates the growth of the plant and assists in the production of fruit of marketable size and quality from the uppermost clusters. A suggested rate is 2 lb. of ammonium sulphate per chain row.

Placement and Time of Application.

The pre-planting fertilizer should be placed in a band along the length of the row rather than broadcast over the whole surface. The most efficient method of doing this is to open up a drill about 8-10 in. deep, throw the fertilizer as evenly as possible along the bottom and lower portions of the sides and then work it into the soil immediately. Most of the fertilizer will then be directly below the plant and yet be sufficiently deep to ensure that the seedling is not placed directly into soil containing a high concentration of fertilizer.

When the pre-planting mixture contains part of its nitrogen and phosphate as blood and bone, it should be applied in the drill a week or more before planting out and well mixed with the soil. When using such a mixture, there is little risk of losing plant foods from the soil except under very wet conditions.

The side-dressing should be applied along both sides of the row in a band 4 in. from the base of the plant row and 18 in. wide. This application is not applied until the first fruit cluster has set, which is usually 3-5 weeks after transplanting. Only shallow cultivation is needed to work the fertilizer into the soil. Whenever a side-dressing is applied, every care should be taken to avoid injuring the roots in the following cultivation.

In fertilizing the tomato crop, it should be borne in mind that excessive vigour is sometimes associated with faulty flower setting and consequent poor yields. Excessive use of nitrogen may increase this tendency.

Liming.

The tomato plant is rather tolerant of acid soil conditions and is often grown satisfactorily in soils which are too strongly acid for many other crops. However, optimum growth occurs when the pH is between 5·5 and 6, and it is therefore sometimes desirable to add either lime or dolomite to the soil. Continuous cultivation, especially under irrigation, and the use of acid fertilizers such as sulphate of ammonia tend to increase soil acidity, and periodical liming is necessary to restore the pH to a satisfactory level. When tomatoes are grown in rotation with such crops as cabbages, cauliflowers, beans, beetroot and lettuce, and lime is applied to these crops, further applications of lime or dolomite are not then required for the tomato crop. Tomatoes grow best in a soil which is well supplied with organic matter. Green manure crops, which are included in the rotation to add organic matter to the soil, usually grow best in a soil which is not highly acid. Occasional applications of lime to these crops will, therefore, benefit the tomato crop. The need for such applications can be determined periodically by simple laboratory tests.

When soil acidity has to be corrected, lime or dolomite should be applied to the cropping area before the land receives its final preparation for planting. These soil amendments can usually be applied within a few weeks of planting They should be broadcast and incorporated into the soil by the usual cultivation methods at the rates shown below (an application of 224 lb. to 1 sq. chain is equivalent to 1 ton per acre). The figures are for dolomite, processed lime or ground limestone.

Degree of Acidity.	Sandy Loams.	Loams.	Clay Loams.
	Tons per acre.	Tons per acre.	Tons per acre.
Acid (pH 5·0-5·5)	1	1½	2
Strongly acid (pH 4·5-5)	1½	2	3

Green Manures.

An effective way of replenishing soil organic matter is to grow cover crops (Plates 13-15), which have an important place in any well-regulated system of farm and soil management. In areas where the land is not normally in production during the wet summer months, the cover crop is particularly important, for it protects the soil from heavy rains which not only cause erosion but also compact the ground and make it difficult to work. Unless the cover crop follows a cash crop which has received liberal applications of fertilizer, it usually pays to fertilize the area before sowing. Suitable dressings are:—legumes, 2 cwt. of a 4·5/15/2·5 mixture per acre; non-legumes, 1½ cwt. of sulphate of ammonia per acre.

A number of plants can be used as cover crops and the grower should select those which are known to grow satisfactorily in his particular district. Those in common use are:—

Legumes.—

Summer-growing.—Cowpea (varieties Reeves, Poona, Groit and Cristaudo), pigeon pea, and velvet bean.

Winter-growing.—New Zealand blue lupin, field pea, and golden tares.

Plate 13.

A Maize Crop Being Disced Prior to Turning Under for Green Manuring Purposes.

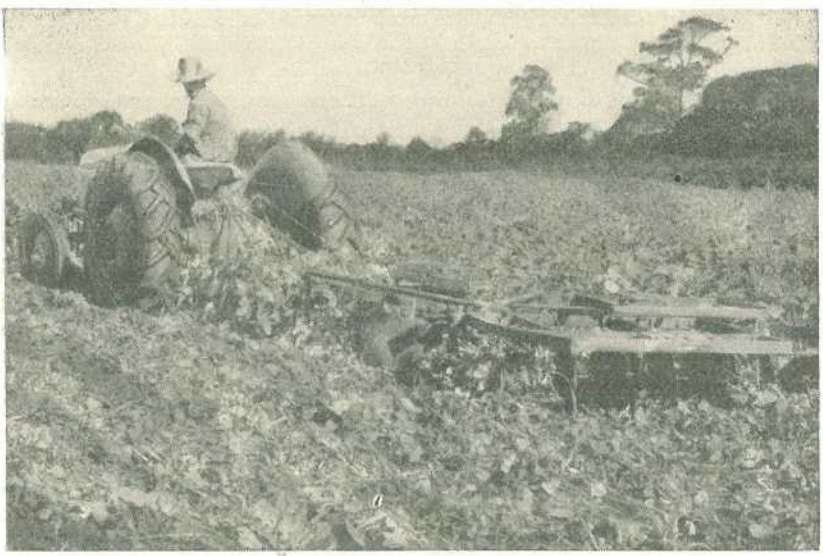


Plate 14.

Discing Poona Pea to be Turned Under as a Green Manure Crop.

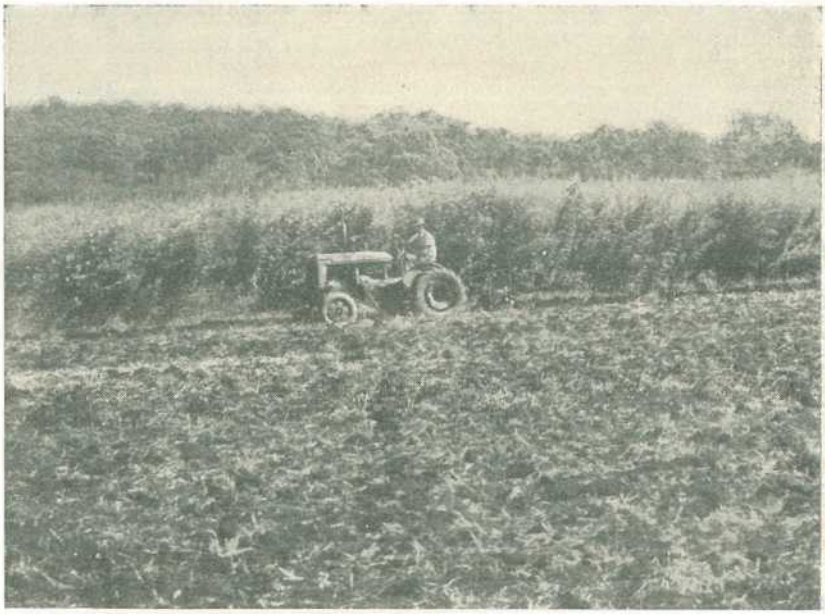


Plate 15.
A Good Green Manure Crop of Pigeon Pea.

Cereals.—

Summer-growing.—Maize, Japanese millet, white panicum, sorghum, and Sudan grass.

Winter-growing.—Oats, rye, and wheat.

Irrigation.

Most tomato crops in the Granite Belt are grown during the summer without irrigation. In other parts of the State, however, production is seldom attempted in the wet summer months and irrigation facilities are more or less indispensible during winter and spring for most commercial growers who specialise in the tomato crop. Two methods of irrigation are practised—furrow and spray.

Furrow irrigation is the system normally used at Bowen and to a lesser extent elsewhere where ample supplies of underground or surface water are available at a reasonable cost. The system is well adapted to the heavier soil types with an easy slope to give the required run. Installation costs are low, for there is no expenditure on spray lines other than the head mains. The normal practice on ground crops is to open up a furrow on each side of the row after the crop is planted. These furrows are used to distribute water in the first and sometimes the second irrigations. The amount of water applied is controlled by the use of check mounds in the furrow. Later, the crop is watered from one side only, each new furrow for irrigation being worked further away from the plant row so that injury to the root system is kept at a minimum. When opening up a furrow, the soil should be thrown towards the plant row and not away from it. The third or fourth

furrow made is allowed to remain permanently for the remainder of the crop cycle. By that time, cultivation is more or less impracticable and the sole aim is to get sufficient water to the plants to fill out the later-set fruit.

The main merits of spray irrigation are its suitability for light soils and the more uniform coverage obtained. The Skinner system (Plate 16) is widely used in the Brisbane district, water being fed through 2-3 in. mains to 1-1¼ in. spray lines with nipple outlets spaced approximately 2 ft. 6 in. apart along the line. The angle of discharge is controlled by a lever at the end of each line. The popularity of the system, in spite of the high cost of installation, is due to its suitability for areas in which water supplies are limited; a pressure of 30 lb. per sq. in. in a 2½ chain spray line delivers about 500 gallons per hour over a bay 33 ft. wide. Disadvantages of the system are the heavy work of moving lines (unless the producing area is completely equipped

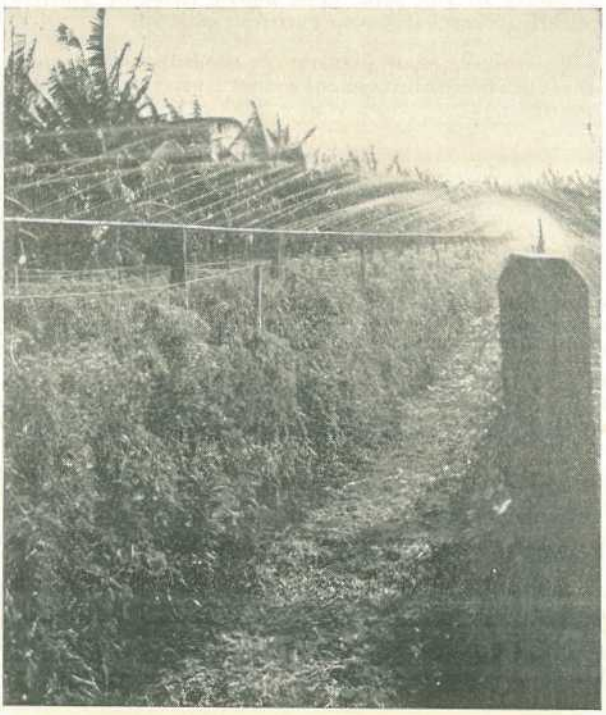


Plate 16.

Irrigating Tomatoes by the Fixed Overhead Perforated Pipe System.

with permanent lines) and the necessity for adjusting the feed angle at short intervals to ensure even soil coverage. When greater quantities of water are available, rosette and rotating outlets can be used on 3-4 in. portable spray lines. These lines do good work but frequently do not stand up well to hard usage.

Sufficient water must be applied to ensure even and rapid growth, but excessive water can be harmful, particularly on ground-grown tomato crops which are bearing; rots develop very quickly in maturing fruit which is on or close to the ground. The tomato plant draws much

of its moisture from 6-9 in. below the surface of the soil. A dry mulch on the top of the ground is, therefore, not necessarily an indication that the plants require water. Before irrigating, the soil moisture in the 6-12 in. layer should be checked.

Some irrigation principles worth noting are:—

(1) Irrigation is only necessary when the soil shows signs of drying out in the root zone of the crop.

(2) Less water is required on light than on heavy soils at each application. In the lighter soils, one inch may be sufficient to link the applied water to the wet soil layer underneath, while twice that amount can be necessary in a heavy loam. Moreover, frequent waterings are usually necessary on the lighter soils.

(3) The rate of application should be adjusted to the intake capacity of the soil. Too heavy rates of application lead to puddling and soil loss through erosion.

(4) The tomato is a relatively deep-rooted plant, and heavy infrequent waterings are therefore preferable to light frequent ones.

Harvesting.

Harvesting from any one crop normally extends over a period of 6-8 weeks, but is much longer in the case of the Bowen Globe. Pickings are made either once or twice in each week, depending on the size of the crop, the time of the year, transport facilities and the requirements of the markets being supplied. Normally only mature green fruit is forwarded to the more distant markets. However, coloured fruit of the cluster varieties grown in the Brisbane district is placed on the Sydney market from August to early October. Mature green fruit varies in both appearance and firmness in the several commercial varieties, and experience in picking is essential if the fruit is to be marketed in good

Plate 17.

Harvesting a Trellised Crop of Tomatoes Near Brisbane.

order. Mature green fruit must be fully grown, pale green in colour, glossy in the skin and the flesh around the seed deep amber in colour. Immature fruit will not develop full colour or flavour.

At each pick, mature green and coloured fruit is harvested into tins, working from the bottom hand along the stems of the plant. Sound fruit must be handled carefully, and if necessary the tins of fruit should be covered with bags to protect them from the sun until they reach the packing shed. In the packing shed, the fruit is graded for size and evenness of colour. The better packs should be free from catface, ring cracks and other blemishes. Packing methods are now more or less standardised, the half-bushel case being generally used in Queensland.

Yields range up to 2,250 half-bushel cases per acre.

Saving Seed.

The tomato plant is very susceptible to its environment and many growers therefore save their own seed from selected plants in each crop grown. The practice is sound if precautions are taken to ensure that the plants from which the fruit is reserved for seed extraction are true to type and free from disease.

The normal procedure is to mark (with stakes) the more attractive plants in the crop and examine them regularly during the season. These should be well-grown, free from disease and show the plant and fruit characters considered desirable. Any which show symptoms of virus diseases or which bear a good first hand and inferior later hands must be rejected. At the height of the cropping period the selected plants can be reduced to the best six. The fruit from the lower three hands in each plant should be reserved for seed.

Fruit for seed extraction may be harvested in the mature green stage and then ripened on the bench, or is allowed to ripen on the plant. In extracting the seed, the fruit is cut in halves and the pulp squeezed into a wooden barrel or some other vessel constructed from a non-corroding material. The vessel is covered and the pulp is allowed to ferment for 2-5 days according to prevailing temperatures. During fermentation most of the good seed will sink to the bottom of the vessel. When fermentation is complete, the floating pulp may be separated from the sunken seed by pouring off, and then by repeated washing, stirring and pouring off the remaining sound seed may be separated from the pulp. When the seed has been washed clear, it should be thinly spread out on clean hessian and thoroughly dried under atmospheric conditions as quickly as possible. When dry the seed should be rubbed briskly to break up the clusters and packed in airtight containers. A half-bushel case of fruit will yield approximately 1 oz. of seed.

An alternative rapid and effective method of extracting seed is to mix concentrated hydrochloric acid with tomato pulp, at the rate of 1 fluid oz. to 5-6 lb. of pulp. The lot is mixed thoroughly and repeatedly with a suitable stirring rod during a period of three hours. At the end of that time, the seed is separated from the pulp and is carefully washed in at least four changes of fresh water. This extraction must be done in glass or porcelain vessels and all necessary precautions taken with the acid, which is highly corrosive.

Well-dried seed will, if stored in airtight containers, retain its viability for at least three years.

THE CAPE GOOSEBERRY.

The cape gooseberry (*Physalis peruviana* L.) is a native of Peru and in no way related to the English gooseberry.

Two varieties of cape gooseberry are grown in Queensland, the more common being a small-fruited type with yellow berries which measure half an inch or a little more in diameter. The other, known as Golden Nugget, bears slightly larger fruit. Both can be used in jams and preserves, but the small-fruited variety has the better flavour and is much preferred for factory fruit.

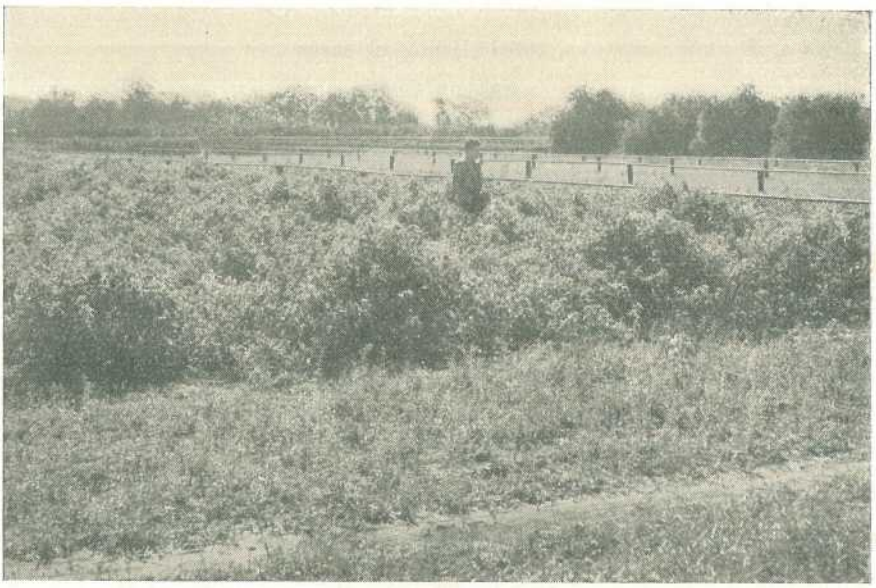


Plate 18.

A Vigorous Cape Gooseberry Crop at Sunnybank, Near Brisbane.

The plant is an herbaceous perennial, commonly growing to a height of 3 ft. and having a spread of 5-6 ft. (Plate 18). The fruit is enclosed in an inflated calyx—the "husk" (Plate 19). Though the plant is a perennial, it is invariably cultivated in Queensland as an annual. In the southern part of the State, the main crop is harvested between May and September.

Climatic and Soil Requirements.

The growing conditions required by the cape gooseberry and the cultural methods used for the field crop are similar to those suitable for the tomato. In southern Queensland, the plant is favoured by a warm spring and summer climate with abundant rain, but relatively dry weather is desirable when the crop matures and harvesting is in progress. Severe frosts may kill most of the aboveground portion of the plant.

The most suitable soils are sandy loams and loams, but provided drainage is reasonably good, the plant makes good growth on a wide range of soil types.

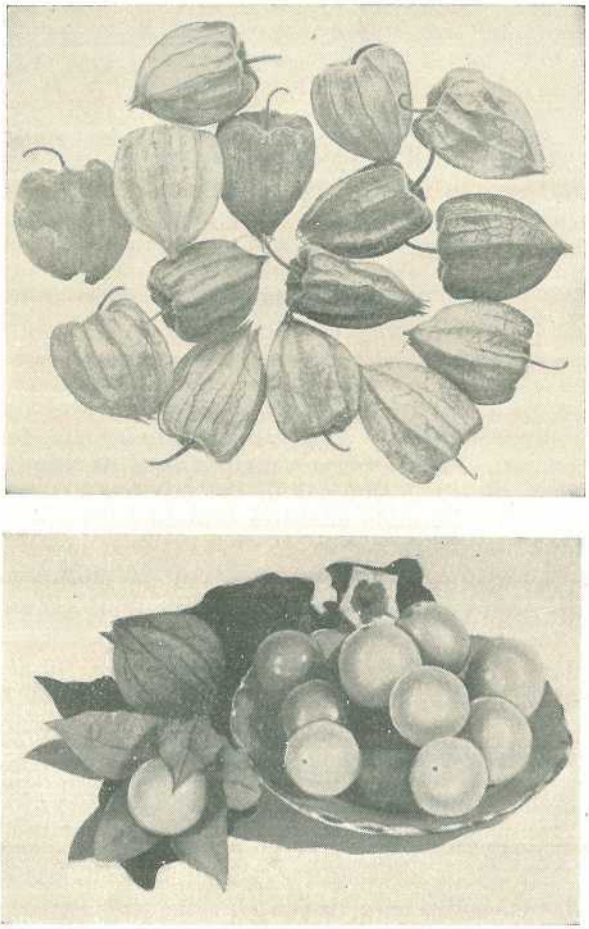


Plate 19.

Cape Gooseberry Fruits. Top, fruit in inflated calyces ("husks"). Bottom, husked fruit and flowers.

Propagation.

The cape gooseberry is propagated from seed and the methods used in raising tomato seedlings are equally suitable for this plant. However, germination is frequently slow and irregular. There are 5,000-8,000 seeds to the ounce, and this quantity is usually required to provide sufficient plants for an acre of ground.

Plants are raised during spring and early summer in well-prepared seedbeds, and the seedlings are later thinned or pricked out into nursery beds in which the rows are about 6 in. apart and the plants 2-4 in. apart. The seedlings should be ready for transplanting in the field about eight weeks after sowing.

Planting Out.

Planting out in the field should, of course, be preceded by thorough soil preparation. Planting distances vary according to the fertility of the soil. In sandy soils plants may be set out at intervals in rows 6 ft. apart, but in richer loams the plants may be set 4-6 ft. apart in the row, with a distance of 7-8 ft. between rows. Under this system of planting

900-1,800 plants are required per acre. If horse- or tractor-drawn implements are to be used in the early stages of plant growth, a wide spacing is desirable. The plants are set out in late summer or early autumn. Spring planting is hazardous in some localities because the crop is very liable to attack by corn ear worm and red spider. The cape gooseberry has a large proportion of its feeding roots near the surface of the ground, and as these roots spread across the rows, cultivation with implements must be shallow and kept to a minimum. Light cultivation with hand tools should suffice for weed control during the later stages of growth.

Fertilizing.

A basal fertilizer application can be made by opening a furrow along the row to be planted and then spreading 4 oz. of a complete fertilizer at each plant position. After turning another furrow, the seedlings can be set out. A basal dressing can also be applied by opening a hole with a hoe, spreading and mixing the fertilizer in it and then planting. Some growers omit the basal dressing and topdress the plants when they are established, the mixture being chipped into the soil with a hoe. Suitable mixtures contain 5-8% nitrogen, 10-15% phosphoric acid and 5-6% potash.

Topdressing with sulphate of ammonia or the above mixtures, when the plants are about half-grown, is practised at times with beneficial results.

Harvesting and Marketing.

The crop will begin to mature approximately three months after planting out and harvesting may extend over a period of a further 2-3 months. Maturity of the berries is indicated by a change in the husk colour from green to pale brown and at this stage the fruit commences to fall from the bush; the fruit then is yellow. There is some advantage in gathering the fruit from the ground rather than picking it from the plant, as the fallen fruit is reasonably uniform in both colour and maturity. The fruit should be gathered at regular intervals and it is well to jar or shake each plant so that all mature fruit will fall to the ground. Harvesting should not commence until morning dew has dried from the fruit.

If necessary, the berries should be spread out in thin layers for a day or two to dry. Preparation for market includes the dehusking of the fruit and placing it in suitable containers. Two-pound boxes are preferable if the fruit is to be forwarded to the fresh fruit market and 12 lb. boxes or half-bushel cases (holding about 26 lb.) if it is to be sent to the factory.

Yields and Bearing Period.

Under good cultural and growing conditions, the cape gooseberry can be expected to yield 3,000 lb. of fruit per acre, but heavier yields are obtained from time to time.

EGG PLANT.

The egg plant (*Solanum melongena*) is probably a native of India and has been in cultivation a long time in Asia and southern Europe.

The plant is an annual, with a compact bush which attains a height of 1½-4 ft. The stems are woody. The leaves are large, simple, and oval or ovate. The stems and leaves are often armed with spines, but these are much reduced in the so-called spineless varieties.

The flowers are large and purple in colour; they are formed progressively throughout the growing season. Self-pollination is common, though considerable crossing occurs.

Varieties.

Black Beauty.—A large-fruited, dark purple variety. The fruits are slightly elongated and taper towards the stem end.

New York Spineless.—A large-fruited variety, somewhat lighter in colour and more elongated than Black Beauty.

Culture.

The plants raised in seedbeds are sometimes transplanted into pots or some other type of individual container in order to reduce planting shock. In southern Queensland, sowings should be made during August and September for field planting during October and November, but in coastal North Queensland field planting takes place from April to June. One ounce of seed should be sown for each acre of field to be planted.

Seedlings are large enough for transplanting about 6-8 weeks after sowing. The smaller varieties are spaced 18 in. to 2 ft. apart in rows 3-4 ft. apart, but larger varieties are spaced about 3 ft. apart in the rows. The egg plant resembles the tomato in its cultural requirements, but it has a longer growing season and is more seriously checked in growth by cool weather. The fruit begins to mature about three months after transplanting.

A sandy loam which is well drained and plentifully supplied with humus should be selected for the crop. The cultivation and fertilizing programme is similar to that required for the tomato.

Harvesting.

The fruit of the most commonly grown variety in Queensland is harvested when it has reached the deep purple stage; it is then fully grown and the sepals at the stalk end tend to dry off and curl up.

Some varieties must be picked in an immature condition, before the flesh of the fruit becomes coarse and tough. Each fruit should be cut rather than pulled from the plant.

PEPPERS OR CAPSICUMS.

The sweet peppers or capsicums (*Capsicum frutescens*) and the pungent chili are distinct from the pepper of commerce, which is the fruit of *Piper nigrum.*

The capsicum plants are erect, compact in form, 12-24 in. high, regularly branched, and with angular herbaceous stems which become woody with age. Although peppers may be perennials in the tropics, they are usually cultivated as an annual crop. The flowers occur singly in the axils of the branches and are formed continuously throughout the season. They are either white or purple in colour. Self-pollination is general, but there also appears to be a considerable amount of cross-pollination. The fruit is a podlike hollow berry, borne on a short, stout peduncle, erect at first but in some varieties curving downwards at maturity.

Although of minor importance commercially, the various forms of peppers are widely cultivated in the home garden. The large-fruited, non-pungent, sweet peppers used in salads are grown as a market

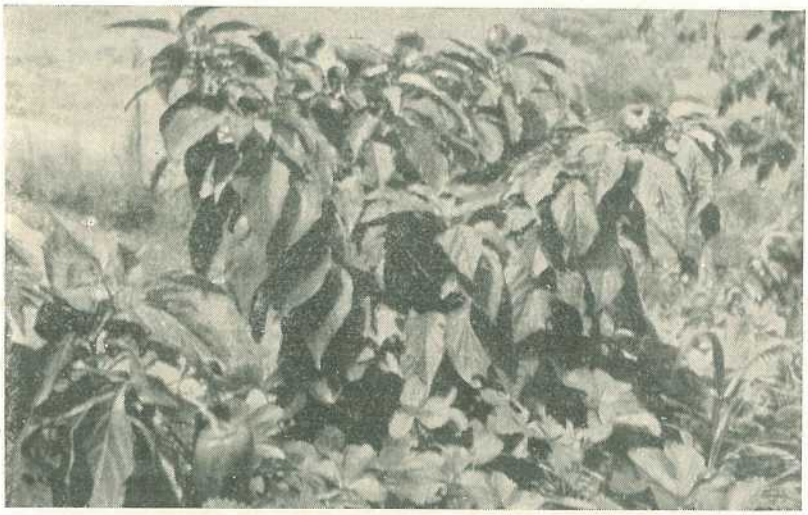


Plate 20.
Capsicum Plants with Maturing Fruit.

garden crop (Plate 20). Cayenne, the red pepper of commerce, consi ts of the fruit of small pungent varieties and capsicum ground to a fine powder. In pepper sauces the pungent varieties are preserved in brine or strong vinegar.

Varieties.

Bull Nose (sweet)—Extremely large and blocky.
Chinese Giant (sweet)—Extremely large and blocky.
Ruby King (sweet)—Large and rather elongated.
Ruby Giant (sweet)—Large and rather elongated.
Long Cayenne (pungent)—Small, long, slender, and smooth-fruited.
Tabasco (pungent) (chili group)—Small, long, slender and smooth-fruited.

Culture.

Peppers and the tomato have a similar range of climatic and soil requirements. The plants are raised in seedbeds or boxes, although sometimes the seed of chili peppers is sown direct in the field. Field plantings coincide with those of the tomato. Planting distances are influenced by variety and irrigation faci ities, but rows 2½-3 ft. apart, with the plants 18 in. apart in the row, are common. To ensure satisfactory cropping, equable growing conditions are necessary. A season of 3-4 months is required to mature the crop.

Harvesting.

The stage of maturity at which peppers are picked depends upon the purpose for which they are required. The large sweet peppers are usually picked mature green, although there is some demand for red ones. The fruits will remain on the plants for some time after maturity without deterioration. They are usually picked by snapping off the brittle stems with the hand. They are packed for market in various kinds of containers, including half-bushel and bushel cases.

The Honey Flora of South-Eastern Queensland.

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

THE production of honey is dependent upon an abundant supply of nectar- and pollen-producing plants within easy flight range of the apiaries. The largest crops are obtained by beekeepers who have acquired a knowledge of the floral resources of their districts, and consequently maintain apiaries in the most suitable locations.

This article is the first of a series giving an account of plants important to beekeepers in the pastoral districts of Moreton, Darling Downs, Wide Bay and Burnett, which contain the principal honey-producing areas of Queensland (Plate 1). The information is based upon material supplied by commercial beekeepers and honey packers, and observations made by the writers over many years.

Because of variations in climatic and other factors, minor local differences in times of flowering and secretion of nectar may be found within the extensive tract of country comprising south-eastern Queensland.

To the beekeeper, the flower is the most important part of the plant. Although there are many different kinds, most flowers have a number of features in common. The *ovary* is the central part which later produces the seed. It sometimes has a stalk-like prolongation at the top called the *style*. Surrounding either the top or the bottom of the ovary are the *stamens*. Each of these consists of a thread-like stalk, sometimes very short, at other times quite long, carrying at the top an *anther*, or pollen-sac, which consists usually of two tiny compartments containing the pollen. The anthers open in different ways to shed the pollen grains. Outside the stamens are the *petals* and outside these again are the *sepals*.

In many flowers the petals are the showy part, but sometimes it is the stamens or the sepals that are most conspicuous, and some have no petals at all. In some flowers the sepals and petals are joined in their lower parts to form tubes, one inside the other; in these flowers the stamens are attached to the tube formed by the petals. Nectar is produced by small *glands* or *nectaries* usually placed between the ovary and the stamens.

After fertilisation, the ovary develops into the *fruit*, which contains the seeds. The fruit is often fleshy, but in most of the plants to be dealt with it is not so, and is then often called a seed-pod or *seed-capsule*. These seed-capsules are usually divided into compartments or *cells*, each of which may split separately or open by a lid-like *valve* to set free the seed.

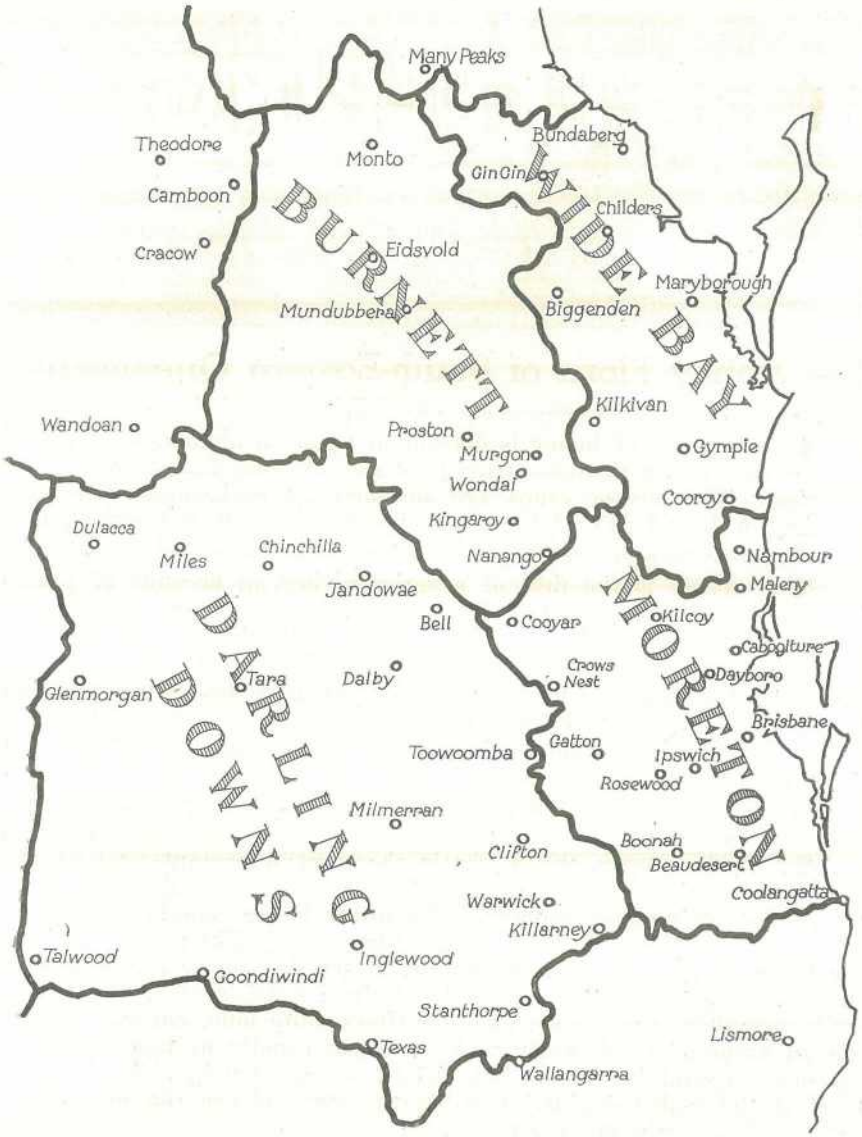


Plate 1.

Sketch Map of the Region Containing the Principal Honey-Producing Areas.

The plants of greatest importance to the beekeeper may be grouped as follows:—

(1) **The Eucalypts.**—These are trees classified as species of *Eucalyptus* and include boxes, ironbarks, stringybarks, bloodwoods and gums. The flowers of eucalypts have no sepals or petals and appear to consist mostly of a large number of stamens. The bud opens by throwing off the upper part, known as the *lid, cap* or *operculum*. The opening of the bud by means of a lid is a very characteristic feature. The seed-capsules are divided into three, four, five or six cells, which open by valves. Usually there are four or five cells and the valves are not easily seen.

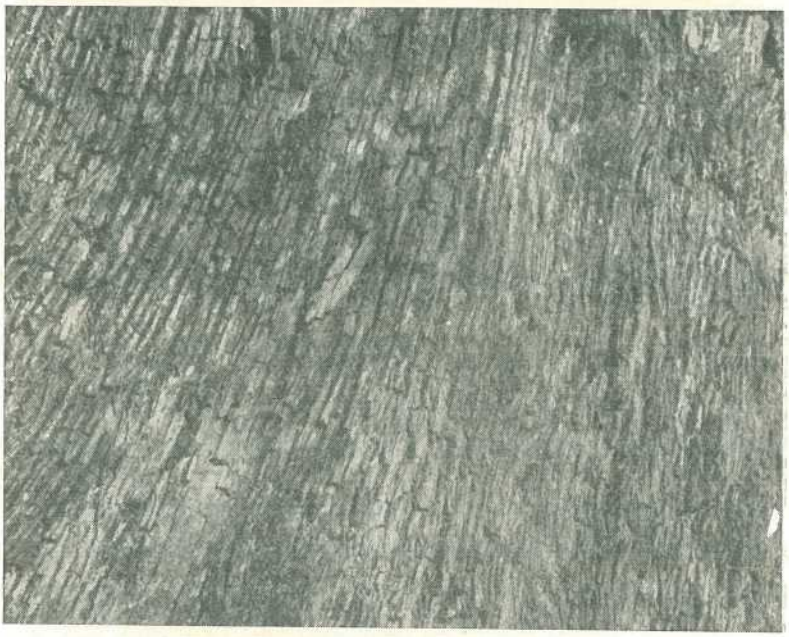


Plate 2.
Bark of Poplar Box (Eucalyptus populnea).

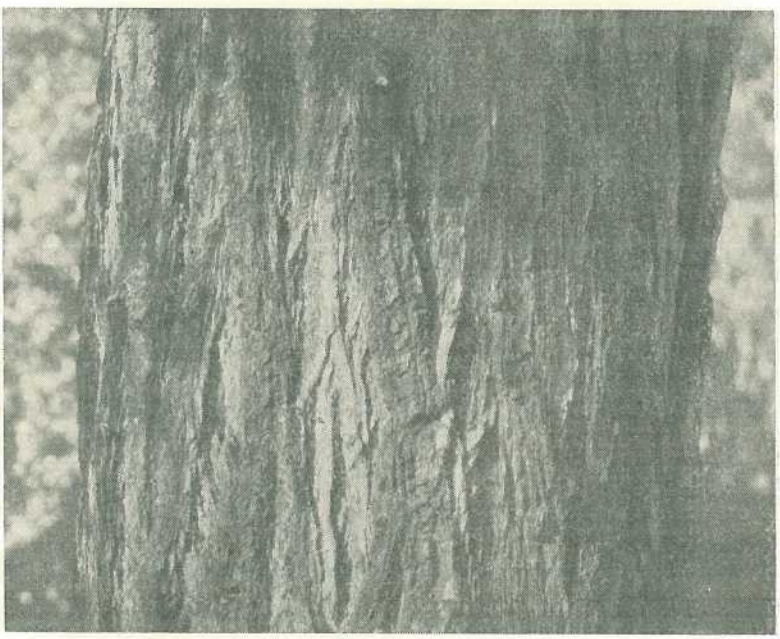


Plate 3.
Bark of Broad-leaved Ironbark (Eucalyptus siderophloia).

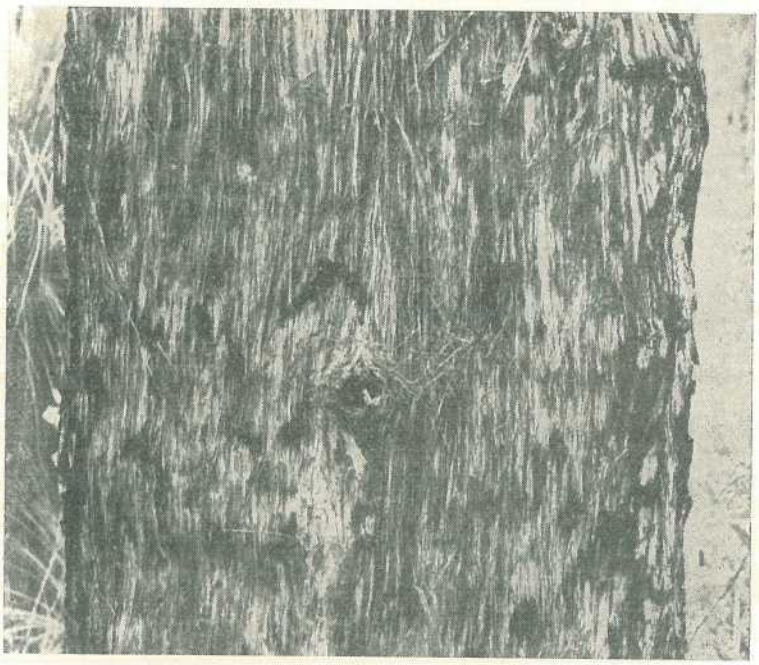


Plate 4.
Bark of a Stringybark (Eucalyptus umbra).

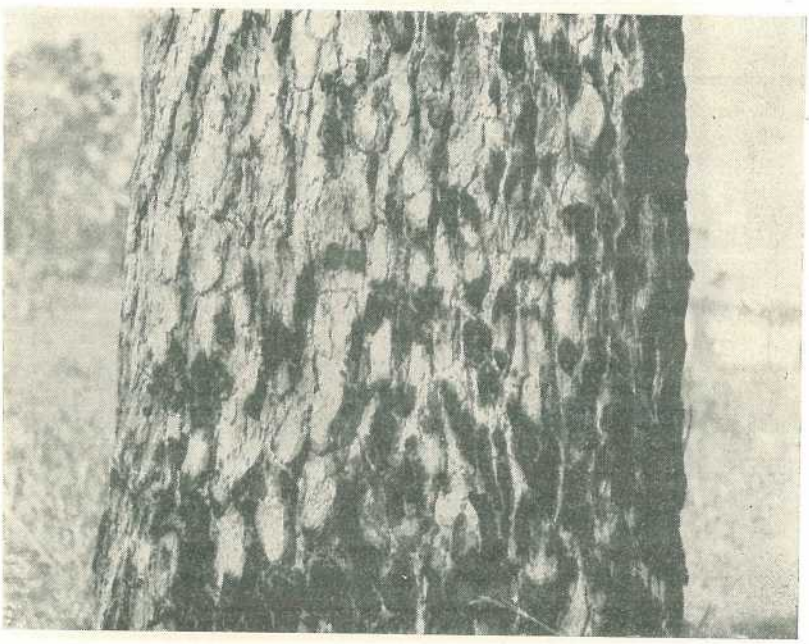


Plate 5.
Bark of Pink Bloodwood (Eucalyptus intermedia).

Among the different kinds of eucalypts, the *boxes* are recognized by a grey, rough, cracky or scaly bark (Plate 2) at least on the trunk; *ironbarks* have the well-known dark grey or black, very hard, deeply furrowed bark (Plate 3); *stringybarks* have a thick, fibrous bark (Plate 4) that can be pulled away in long shreds; *bloodwoods* have a grey, fissured, soft, flaky bark (Plate 5) that can be broken off in small, square or oblong pieces; and *gums* have smooth bark (Plate 6) that is shed each year, but there is commonly some rough, grey bark near the ground. Some eucalypts with rough bark on the lower part of the tree have smooth branches and are said to be "gum-topped" or "half-barked."

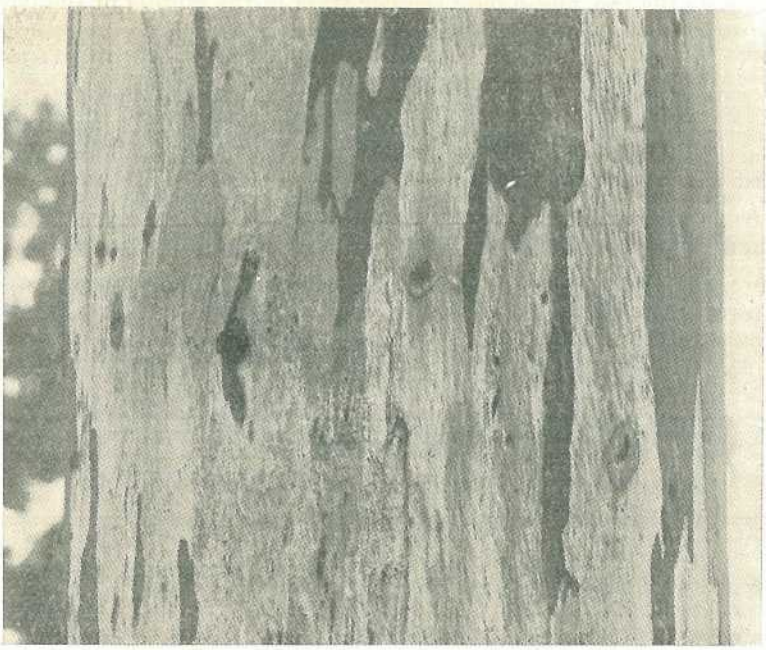


Plate 6.
Bark of Blue Gum (Eucalyptus tereticornis).

The species of *Tristania* and *Angophora* are trees similar to eucalypts in appearance, but the buds have no lid and the flowers have sepals and petals. The stamens are joined into five bundles in *Tristania* and the leaves in *Angophora* are always in pairs.

The trees of this group are valued for both their nectar and pollen.

(2) **Tea-trees.**—These are shrubs or trees belonging to the genus *Melaleuca*. The flowers appear to consist chiefly of the long cream or white bundles of stamens, and are grouped into feathery spikes or heads which often have a tuft of leaves at the top. The leaves have several principal veins running along their length, without a distinct midrib, or else they are small and narrow. *Callistemon* is very like many species of *Melaleuca* but the stamens are usually red and the leaves have a distinct midrib.

Species of *Leptospermum* are also often called "tea-trees." They are shrubs or small trees with small, usually narrow, leaves and rather small flowers. These have five rounded white or pinkish petals and short stamens.

Tea-trees produce both nectar and pollen.

(3) **Banksias.**—The species of *Banksia*, sometimes called bottle-brushes, are shrubs or small trees with hard, often toothed, leaves that are often white underneath, and dense stiff-looking spikes of yellowish or orange-coloured flowers. At first sight the flower-spikes look like those of *Callistemon* and some kinds of *Melaleuca*, but the flowers consist of four narrow, petal-like, often curved or coiled sepals, each with a single anther near the top, and a long slender style in the middle of the flower. They produce pollen and a watery type of nectar.

(4) **Wattles.**—These are species of *Acacia* and are a well-known type of shrub or tree with fluffy, yellow balls or spikes of densely packed, very small flowers having tiny sepals and petals and many longer stamens that give the fluffy appearance. They are valuable to the apiarist as pollen producers rather than as sources of nectar.

(5) **Mangroves.**—These are shrubs and trees which grow in tidal mud and produce nectar and pollen.

(6) **She-oaks.**—These trees are species of *Casuarina*. They produce an abundance of slender green twigs that are often mistaken for leaves. The true leaves are exceedingly small and appear as tiny teeth at the joints of the twigs. There are distinct male and female flowers. The male flowers, consisting of a single stamen, are grouped in orange or brown spikes at the ends of the twigs and produce pollen.

(7) **Crop plants,** such as maize and lucerne.

(8) **Weeds,** such as dandelions, thistles and wild turnip.

(9) **Miscellaneous trees,** shrubs and smaller plants.

For various reasons, no attempt will be made at this stage to treat all members of any one group together.

Yellow Box.

Botanical Name.—Eucalyptus melliodora A Cunn. ex Schau.

Other Common Name.—Yellow jacket.

Distinguishing Features.—This tree (Plates 7 and 8) can be recognized by its "half-barked" appearance, the bright-yellow inner bark, the narrow leaves with 3 slightly prominent longitudinal veins, and the usually 6-celled seed-capsules. The proportion of smooth to rough bark varies from tree to tree.

Description.—A tree up to 80 ft. high but usually much lower, with graceful weeping branches and often with a short trunk and spreading crown. The bark is persistent, grey, somewhat fibrous and wrinkled to flaky ("box"-like) on the lower part of the trunk, and bright yellow internally towards the sapwood; on the upper part of the tree it is deciduous, smooth, light grey or greenish. The leaves, on stalks $\frac{1}{3}$-$\frac{3}{4}$ in. long, are narrow, drooping, greyish green, dull, mostly $2\frac{1}{2}$-6 in. long and usually 4-12 times as long as wide, with 3 main veins—a midrib and one along each side towards the margin. The flowers are usually white, on slender stalks in clusters on main stalks amongst the leaves, about

½ in. wide when fully out; the buds are about ⅓-½ in. long and ⅛-⅙ in. wide, with a rounded or pointed lid about half as long as the whole bud. The seed-capsule is cup-shaped or slightly narrowed in the upper part, with usually 6 (sometimes 5) cells.

Distribution.—On light soils, chiefly in the southern part of the Darling Downs District; occasional on ranges in the Moreton and Burnett Districts. It is widely spread in the southern Australian States.

Usual Flowering Time.—October to December.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Major.

Importance as Source of Pollen.—Nil.

General Remarks.—Yellow box is much sought after by beekeepers operating in the Warwick, Stanthorpe, Inglewood and Texas areas, as it is a prolific producer of quality honey. The honey is exceptionally

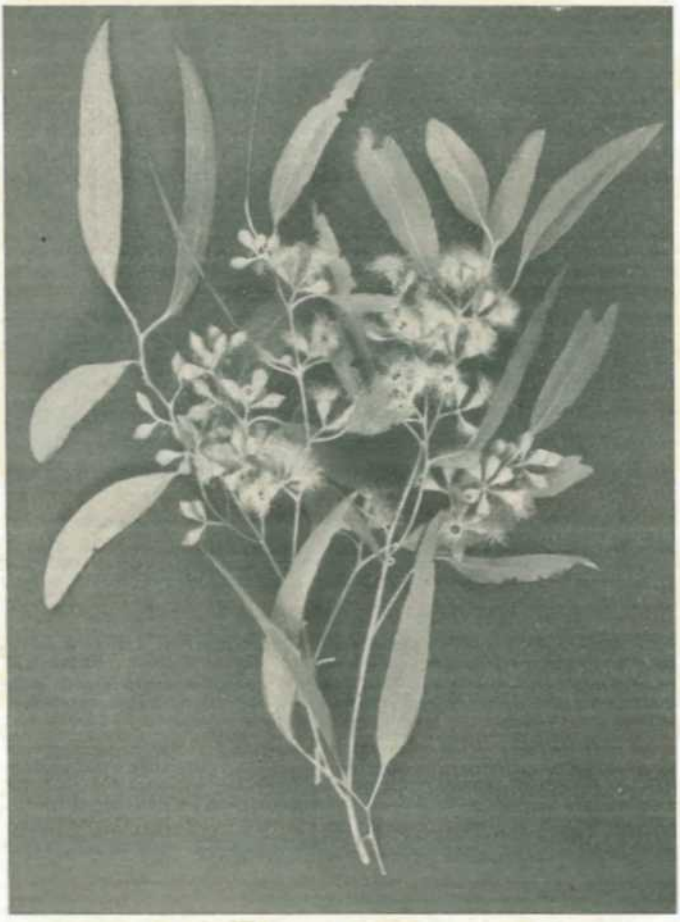


Plate 7.

Yellow Box (Eucalyptus melliodora). Leaves, buds and flowers.

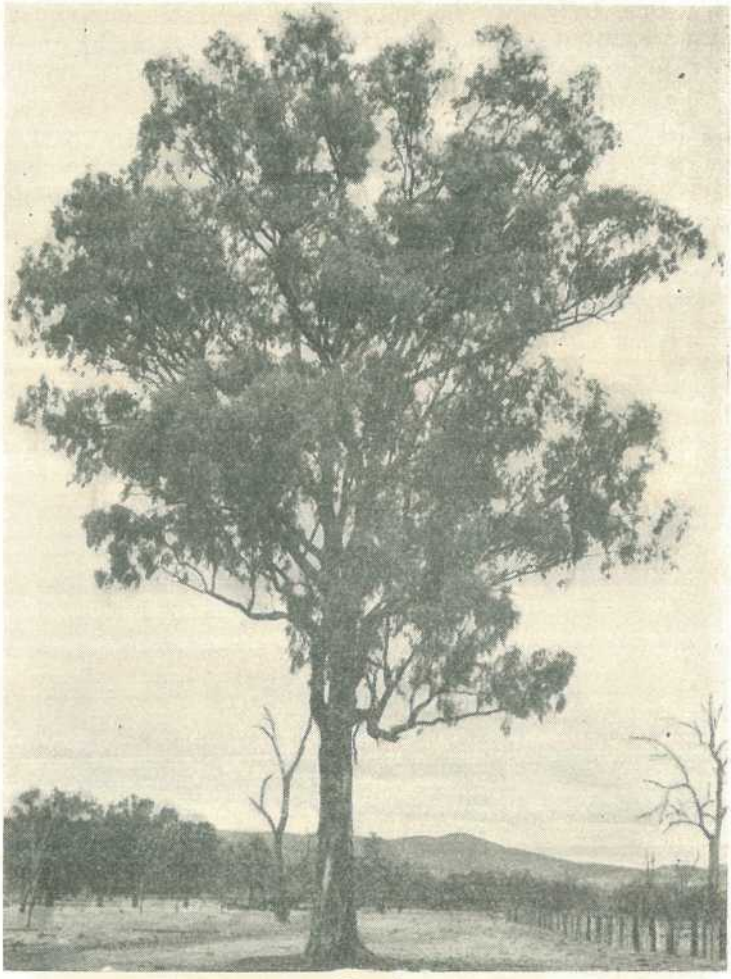


Plate 8.
Yellow Box (Eucalyptus melliodora). Waroo district.

dense, with a pronounced cloying sweet flavour, and remains liquid almost indefinitely. Unlike that of other eucalypts, the quality always remains high whether the flow of nectar is slow or quick.

Colonies occasionally lose strength when working this tree, as pollen is not obtained from it, and this results in restricted brood rearing. Fortunately, yellow box usually flowers at the same time as other pollen-producing species, and colony strength is not then impaired.

Poplar Box.

Botanical Name.—Eucalyptus populnea F. Muell., also known as *Eucalyptus populifolia* Hook. (not *Eucalyptus populifolia* Desf.).

Other Common Names.—Box, grey box, bimbil box, shiny leaf box, round leaf box.

Distinguishing Features.—This tree (Plates 2, 9, 10 and 11) is easily recognised by its typical "box" bark and broad, shining-green, twinkling leaves.

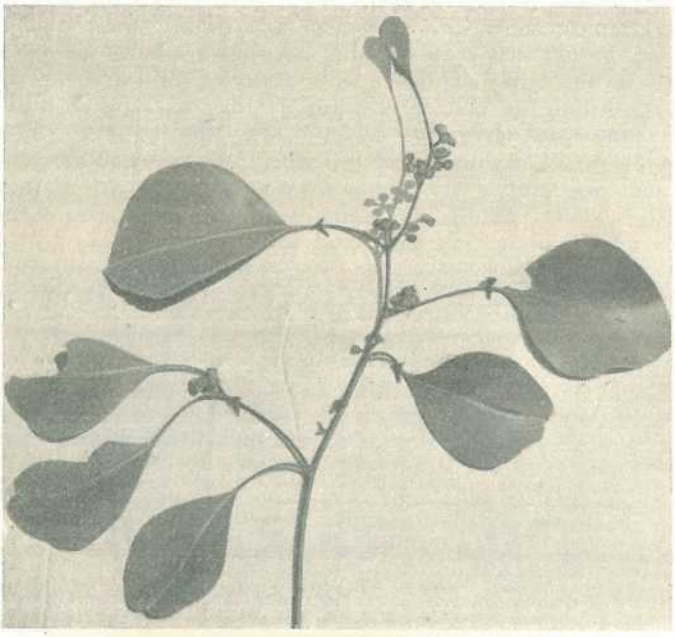


Plate 9.

Poplar Box (Eucalyptus populnea). Leaves and seed-capsules.

Plate 10.

Poplar Box (Eucalyptus populnea). Note the typical "box" bark on the trunk.

Description.—A tree 30-70 ft. high, with rough, grey, wrinkled or scaly bark up to the small branches (a typical "box"). The leaves are shining green, drooping on long, slender stalks of about 1 in. and twinkling in the sun; their shape is rounded or narrowed to one or both ends, as long as wide or up to 2½ times as long as wide, mostly 2-3½ in. long and 1-2¼ in. wide. The flowers are white, about ⅛-⅓ in. wide, in little clusters of 5-9, the clusters on stalks at the ends of the twigs and among the upper leaves; the buds are about $\frac{1}{10}$-⅛ in. long, with a short rounded or slightly pointed lid. The seed-capsules are cup-shaped, about ⅛ in. long and wide.

Plate 11.
Poplar Box (Eucalyptus populnea). Millbrook.

Distribution.—Widely spread in the Darling Downs except in the south-east, and in the western part of the Burnett district; it often forms extensive stands. The tree is also widespread in western Queensland and north-western New South Wales.

Usual Flowering Time.—December to January.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Moderate.

Importance as Source of Pollen.—Minor.

General Remarks.—This tree flowers erratically and produces a moderate crop only once every two or three years according to the season and the locality. On some parts of the eastern Darling Downs it has the reputation of being useless to the beekeeper. The honey is pleasantly flavoured and has a medium density. Poplar box often flowers in association with river red gum and the blend of these two honeys finds a ready market.

[*To be continued.*]

PLANT PROTECTION

The Occurrence of the European House Borer In Queensland.

A. R. BRIMBLECOMBE, Entomologist, Science Branch.

SMALL longicorn larvae in samples of borer-infested pine wood received in December 1952 were identified as the European house borer*. The timber had been taken from the roof structure of a dwelling built in a Brisbane suburb from a consignment of prefabricated houses which arrived from France in 1950. Further samples of damaged timber containing almost mature larvae have since been received from the same locality, and it seems therefore that this pest has become established in Australia.

Origin and Distribution.

The European house borer, as the common name indicates, is a native of Europe, and probably the original home was one of the countries bordering the Baltic Sea. It has since spread to other parts of the continent and to overseas countries. Records of occurrence are from Siberia, Russia, Finland, Estonia, Latvia, Sweden, Norway, Denmark, Germany, Holland, England, France, Spain, Italy, Cyprus, Turkey, Northern Caucasus, United States, Argentina, and South Africa.

Host Timbers and Breeding Places.

All records show that the European house borer is confined to coniferous timbers. In Europe, pines are particularly preferred, spruces being attacked to a much less extent and firs suffering only slightly. In South Africa the following pines are listed as hosts:—*Pinus apacha, P. canariensis, P. caribaea, P. halepensis, P. palustris, P. pinaster, P. pinea, P. radiata, P. sylvestris,* and *P. taeda.* The favoured species are *radiata, pinaster* and *sylvestris.*

Originally the borer inhabited the forests but now in northern Europe it is more common in cities and towns, where it breeds in the timber of houses, factories, stores, stables and other buildings, and in pine telephone poles and fences. In parts of South Africa it is also common in houses. In both countries breeding still occurs in logs, tree stumps and logging residues, as well as in dead or dying branches, but it has never been recorded in living tissue.

Symptoms of Attack and Importance of Damage.

Normally, attacks on fresh logs, stumps and dead branches are not evident, but after the lapse of several years larval tunnels may be

* Identification as *Hylotrupes bajulus L.* was provided by the Commonwealth Institute of Entomology, London.

revealed when bark is peeled away or the timber is cut. Following the normal milling routine, boards from infested logs seldom show small larval tunnels on the rough sawn surfaces and therefore attacks on structural timbers may not be evident until some pieces collapse. Regular inspections might reveal slight amounts of borer dust or the emergence holes of the first and subsequent generations, but almost invariably the infestation is many years old before it is discovered.

Attacks may occur in new buildings; however, the liability to infestation increases up to 30 years and decreases slightly after 50 years. Reinfestation occurs from succeeding generations until there is insufficient substantial wood remaining to maintain the borer. Three or four generations are passed before collapse of damaged timber is likely, but since the insect has a long life cycle, this may not occur for perhaps 25 years.

Plate 1.
Pine Timber with a Flap Turned Down to Show Damage by European House Borer.

Detailed regular inspections in Stockholm (Sweden) have shown that more than 50% of buildings are infested, while in Germany a survey of more than 130,000 houses showed 41.5% affected, and in some regions as much as 70%-80%. In South Africa, infestation of parts of Cape Town has been determined to include up to 90% of buildings. If the borer becomes firmly established in Brisbane, an economic

problem will arise in checking rate of spread and damage to dwellings in the locality of the present infestation. Spread to other localities where European pines have been used could follow, and infestation may occur in *Pinus* timbers which are being grown and used on an increasing scale in Queensland. There is also the possibility that the native pines (namely, hoop, bunya and kauri pine) may become involved and then the timber industry in this State would be faced with a major preservation problem.

Developmental Stages and Life Cycle.

The European house borer during its life cycle passes through the usual four stages—egg, larva or grub, pupa and adult.

The egg is about one-fifteenth of an inch in length, creamy-white in colour and almost oval in shape. After an incubation period of about two weeks it hatches into a small, elongate, creamy-white grub provided with transverse body folds which aid movement in the tunnel. Eventually the grub grows to a length of about an inch (Plate 2)

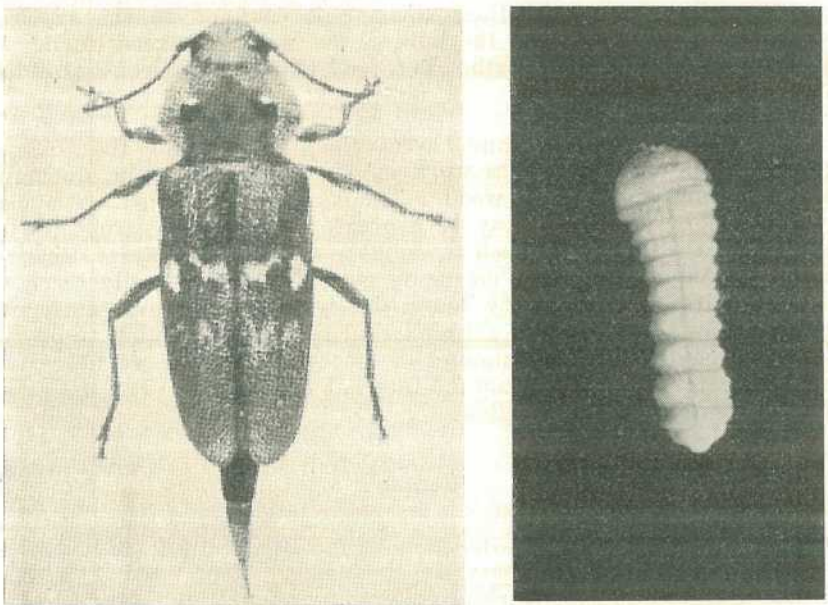


Plate 2.

European House Borer. Left, beetle showing ovipositor extended. Right, larva. Beetle illustration after Craighead.

before changing to the pupa. The period required for larval development is influenced by climatic conditions. In South Africa it may last from one to three years and in northern European countries from three to 11 years. The pupa is creamy coloured and about three-quarters of an inch in length. After a few weeks it changes to the adult beetle (Plate 2), which averages about half an inch in length. It is dark in colour, but appears greyish due to a pale pubescence, which is intensified on the elytra to give the appearance of four spots, while on the prothorax are two shining black prominences.

The mature beetles may not emerge from the pupal cells for several months, but as soon as they do mating occurs and egglaying follows in a few days. The whole life cycle therefore occupies an average of three years in South Africa and four or more years in northern Europe.

Habits and Behaviour.

The adult beetles are strong fliers and may disperse over a wide area. They show a tendency, however, to remain in the vicinity of the timber from which they emerged and to reinfest that timber. The females deposit the eggs singly or in small groups into cracks and crevices in the wood, preferably on rough surfaces. During the female life of about two weeks more than 100 eggs may be laid. In the cold countries of northern Europe the insect is most common in maritime areas, where it shows a distinct preference for warmed buildings or roof structures. In warmer climates infestations can occur in all parts of buildings.

Attacks are mainly on dry timber of pines, particularly those with large annular rings. In these damage is confined to the sapwood, which, however, constitutes the bulk of the wood produced during the first 20 or 30 years of growth. The food of the grubs consists chiefly of digested cell walls.

Young grubs prefer to tunnel across the grain in spring tissue of new growth, and the older grubs work mostly along the grain, damaging both spring and autumn wood. The tunnels are filled with loose granular borer dust and may be a quarter of an inch across. When full-grown the larvæ approach the surface and then penetrate deeper to make the pupal cells. The emerging beetles therefore easily reach the exterior surface, where they leave the typical small oval emergence holes. Since the insect has a long larval life, during which tunnelling is almost continuous, the number of emergence holes may not give a true indication of the amount of internal damage, or even the extent of the infestation in a building.

Control.

Control measures attempted in overseas countries have involved fumigation, which appears to have been discontinued, roof heating and the application of preservative materials. Roof heating, with oil or coke burners, to a temperature averaging about 150°F. for 12 hours has been successful in killing all stages of the borer, but reinfestation can occur. Preservatives have been used to check damage in infested timbers and to protect non-infested timber. With these older methods complete control has not always been achieved, and more recent experiments have been directed towards immunising timber by an impregnation treatment, though recommendations for commercial use have not been finalised.

Where European pine timbers have been used in Queensland it is especially urged that inspections should be made for signs of European house borer damage. If any are found the affected timber should be removed and destroyed or given a liberal application of 5% pentachlorophenol in dieseline oil. Regular inspections should then become routine practice, with further chemical treatments as required.

TUBERCULOSIS-FREE CATTLE HERDS.
(AS AT 27th APRIL, 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
Ayrshire	L. Holmes, " Benbecula," Yarranlea
	J. N. Scott, " Auchen Eden," Camp Mountain
	" St. Christopher's and Iona " Studs, Brookfield road, Brisbane
	E. Mathie and Son, " Ainslie " Ayrshire Stud, Maleny
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

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 27th APRIL, 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," Woolvi, *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, " Cremer 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, Manneum, 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. Skerman, " 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

ASTRONOMICAL DATA FOR QUEENSLAND.

JUNE

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

TIMES OF SUNRISE AND SUNSET.

At Brisbane.			MINUTES LATER THAN BRISBANE AT OTHER PLACES.					
Day.	Rise.	Set.	Place.	Rise.	Set.	Place.	Rise.	Set.
	a.m.	p.m.						
1	6.30	5.00	Cairns	8	50	Longreach	26	43
6	6.32	5.00	Charleville	25	29	Quilpie	37	33
11	6.34	4.59	Cloncurry	36	63	Rockhampton ..	1	19
16	6.36	5.00	Cunnamulla ..	31	27	Roma	15	19
21	6.38	5.00	Dirranbandi ..	22	16	Townsville	8	42
26	6.39	5.2	Emerald	11	28	Winton	29	52
30	6.39	5.3	Hughenden ..	21	49	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Day.	Rise.	Set.
	p.m.	a.m.
1	8.21	9.34
2	9.27	10.18
3	10.32	10.58
4	11.35	11.35
		p.m.
5	..	12.10
	a.m.	
6	12.38	12.45
7	1.41	1.21
8	2.46	1.59
9	3.52	2.43
10	4.58	3.31
11	6.02	4.25
12	7.02	5 24
13	7.55	6.24
14	8.42	7.23
15	9.22	8.21
16	9.57	9.17
17	10.28	10.10
18	10.58	11.02
19	11.26	11.54
20	11.54	..
	p.m.	a.m.
21	12.24	12.46
22	12.56	1.40
23	1.33	2.36
24	2.15	3.35
25	3.04	4.35
26	4.00	5.35
27	5.02	6.33
28	6.09	7.27
29	7.17	8.14
30	8.23	8.57

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

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

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Day.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	27	11	43	26	18	1	51	29
6	19	21	34	37	10	12	39	43
11	10	30	35	44	0	20	27	53
16	14	24	29	40	4	15	33	46
21	23	15	39	31	14	7	45	35
26	30	9	46	24	21	0	53	26
30	24	14	40	29	15	4	46	33

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Day.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	48	7	63	35	48	21	40	8
3	39	16	56	41	41	26	33	15
5	27	28	49	49	33	34	23	24
7	21	39	44	57	29	42	18	34
9	11	49	38	63	23	49	10	41
11	5	53	35	66	19	51	5	44
13	5	52	35	65	19	50	5	44
15	12	45	38	60	23	46	11	37
17	20	36	44	55	29	40	18	31
19	30	26	51	47	35	33	25	22
21	39	21	56	44	41	29	33	18
23	47	11	63	38	47	23	39	11
25	54	5	67	34	51	20	44	6
27	54	4	67	33	51	19	44	5
29	45	10	61	37	46	23	37	10
30	41	15	57	41	42	26	34	14

Phases of the Moon.—Last Quarter, 5th June, 3.35 a.m.; New Moon, 12th June, 12.55 a.m.; First Quarter, 19th June, 10.01 p.m.; Full Moon, 27th June, 1.29 p.m.

On 22nd June the sun will reach its greatest angle north of the equator. It will then rise about 25 degrees north of true east and set 25 degrees north of true west. On the 5th and 19th the moon will rise and set approximately at true east and true west respectively.

Mercury.—An evening object all this month, reaching greatest angle east of the sun on the 27th. On the 1st, in the constellation of Taurus, it will set 28 minutes after the sun, and after passing Mars on the 2nd and Pollux on the 21st, at the end of the month, in the constellation of Cancer, will set about 2 hours after the sun.

Venus.—At the beginning of the month, in the constellation of Pisces, will rise 3 hours 20 minutes before the sun and on the 23rd will reach greatest angle west of the sun. By the end of the month, in the constellation of Taurus, will rise 3 hours 30 minutes before sunrise.

Mars.—Still too close in line with the sun to be seen.

Jupiter.—May be seen low in the east at morning twilight during this month. On the 21st it will pass close to Aldebaran and at the end of the month, in the constellation of Taurus, will rise nearly 2 hours before the sun.

Saturn.—In the constellation of Virgo, at the beginning of the month will set between 2.50 a.m. and 4.00 a.m. and at the end of the month will set just after midnight.