THE

QUEENSLAND AGRICULTURAL JOURNAL,

ISSUED BY DIRECTION OF

THE HON. THE SECRETARY FOR AGRICULTURE.

EDITED BY A. J. BOYD F.R.G.S.Q.

NEW SERIES.

VOLUME X.

JULY TO DECEMBER, 1918.

BY AUTHORITY:
ANTHONY JAMES CUMMING, GOVERNMENT PRINTER, BRISBANE.

1918.

QUEENSLAND AGRICULTURAL JOURNAL.

VOL. X. PARTS 1 TO 6.

GENERAL INDEX.

INDEX TO ILLUSTRATIONS.

QUEENSLAND AGRICULTURAL JOURNAL

VOL X. JULY, 1918. PART 1.

Agriculture.

RICE—THE COMING POWER.

Last April we received from Mr. J. F. Keane, of Carbeen, Mareeba, N.Q., who is a successful enthusiast on the subject and practice of rice-growing in North Queensland, the following article on "Paddy Rice for the Distillery," for the manufacture of spirit fuel, a subject he dilated on in this journal in October, 1914. He now writes:—

"There is much more—very much more—to be said about it. Rice spirit is to-day the cheapest spirit in the world, aquadenti in Brazil, arack in India, samshoo in China, sake in Corea. All neat O.P. rice spirits seldom run the ultimate consumer, on the very last turnover, much more than a penny a pint. Between the latitudes of Cape York and Cape Capricornia, we have nearly 3,000 miles of longitude and 1,200 miles of latitude uninhabited, more than half of which, on a very conservative estimate, is capable of yielding 70 bushels of rice to the acre. All the implements for sowing and harvesting already exist in very perfected forms. The mechanical operation of producing alcohol from the raw material is very simple and requires little plant. The denaturing of it for industrial purposes presents no difficulties. So that Northern Australia holds an everlasting fount of liquid fuel for all the world.

"The disproportion in bulk between the finished product and the raw material, the value and uses of the residues, and the necessity of having a little of the fuel produced for operating the works, make it advisable that the manufacturing be done in the locality in which the material is grown. Circumstances which appeal to me only for the best in these great 'loan' lands.

"In more than one place in the report the above conditions are stressed as disadvantages.

"In discussing molasses, an objection raised is that 'A great quantity is produced in outlying parts of Queensland, and it hardly seems feasible to regard this raw material in the northern districts of Queensland as a profitable source of liquid fuel for use in parts of Australia far distant from Queensland.'

"With an extract from a weighty English trade journal, I shall close:—

"'One of the most disturbing factors in the commercial world to-day is the petrol famine. Should further developments of its use continue at the pace they have been doing, petroleum fuel will soon become exhausted for ordinary commercial purposes.'

"A last word to the farmer. Tropical Australia only differs from all other tropical rice countries in that, like the Deccan Plateau, which it resembles in every minutest particular, it is one of the very best of them. Tropical countries are the most delectable and the most prodigally fruitful on the face of the earth. Grow rice and start a co-operative or private still."

Mr. Keane mentions that he had received from the Secretary to the Commonwealth Advisory Council of Science and Industry a copy of an interim report of a special committee on alcohol fuel and engines:—

"On the first showing, molasses looked promising, but, it appears, if all the molasses in Australia were taken for alcohol, it would only make one-sixth of the motor fuel at present being used. Maize is next considered in this wise. 'Allowing that 5,000,000 gallons could be obtained from molasses, it would require 283,000 acres of maize with an average yield of 25 bushels per acre at 2s. a bushel (in New South Wales, it is mentioned, for some reason not at once apparent) to provide raw material for the remaining 15,000,000 gallons required, at the present price of petrol.'

"All the other possible sources of supply dealt with, and their name is legion, are hopeless from a business point of view.

"Which brings me to the quite inexplicable omission, the provoker of this letter. Not once does the word rice appear between the covers of the book."

In a letter dated 18th April, Mr. Keane says that during the late cyclone all the long grass on the savannahs up North was laid as flat as if a steam roller had been over it. On the third day after the cyclone it was all standing up as erect as ever. Precisely the same thing happened to the rice. He saw several paddocks where the rice crop was looking well and just bronzing.

RUST IN WHEAT.

Replying to a correspondent, writing from World's End Creek, for information respecting smut in wheat, the Director of Agriculture (Professor Arthur J. Perkins) said:—"I notice that you complain that in your district smut was very prevalent in the crops last year, even in the case of those that were pickled, and you wish to know whether any reason can be given for this unfortunate condition of affairs. In the first place, it would be necessary to know whether you are referring to ' loose smut,' which appears early in the season, before the grain is ripe, or to what is more generally known as ' bunt,' which is easily recognised by the characteristic of a disagreeable odour which it emits. Generally speaking, pickling is without effect against ' loose smut,' since it is not so much the grain that is affected as the land on which the crop is sown. ' Bunt,' however, can, in my experience, be completely checked by an efficient pickling, and if, in this direction, you and your neighbours have failed, apparently, in the past season, I can only attribute it to defective pickling. It would be interesting to know in this connection how you proceeded. The question of pickling has been referred to so often in the pages of the journal, and by officers of the Department of Agriculture in different parts of the State, that it seems almost unnecessary to refer to it again. I shall, however, indicate briefly the precaution that should be taken when wheat is pickled. In the first place, pickling by immersion of a bag in a tub of bluestone solution is not effective. It is absolutely essential that the grain be thoroughly stirred up whilst in contact with the pickle, and I know of no more efficient method for the purpose than the old-fashioned floor pickling carried out thoroughly. I have very little confidence in the various pickling machines that are now in the market, because, in my view, they do not stir up the grain sufficiently for the purpose. In order to secure good results, you should, in my opinion, proceed as follows:—Place the grain to be pickled on a wooden floor, and pour over it a 1 per cent. solution of bluestone (1 lb. of bluestone to 10 gallons of water) until the solution runs freely away from the grain. The wheat should be turned over vigorously with wooden shovels, and, if necessary, a little more solution may be added from time to time. I must point out that for effective action it is not strength of pickle that counts, but the quantity you use in the mixing-up process. If your grain is somewhat badly affected with smut, do not increase the strength of the pickle, which would only have the effect of injuring the germinating powers of the grain, but use the 1 per cent. solution very freely. I am perfectly satisfied that if you follow out these instructions carefully, and if, in addition, you do not put your wheat back into dirty bags, and if your drill is clean and free from germs of smut, you will have no reason to complain of your crops next year. As a matter of precaution, it is wise to immerse old bags, into which the pickled seed is placed, into the pickle solution before filling them with grain."—"Journal of Agriculture of South Australia."

CASTOR OIL.

The castor oil plant will thrive almost anywhere on the coast-lands of Queensland. In and around Brisbane and other coast cities it may be seen growing and bearing heavy crops of seed in all sorts of out-of-the-way places—on the river banks, in quarries, on unoccupied allotments, &c.—and this applies as well to other coastal localities in Central and North Queensland. No attention, however, has been given to it with a view to turning this valuable plant to profitable account. The plant is exceedingly hardy and will stand a wide range of climate. The seeds, unlike most oil seeds, have extraordinary vitality. Seeds known to have been kept for fifteen years in a bottle have been sown by the writer, near Brisbane, and have produced healthy plants.

In a tropical, or even in a sub-tropical climate, the plant becomes a perennial tree instead of an annual, often attaining a height of from 15 to 20 ft. The plant should thrive well at Thursday Island.

The best soil for castor is much the same as that required for the cotton plant—a rich, well-drained, sandy loam. It will not thrive on heavy, wet, clay soils. As the roots penetrate very deeply, the land must be deeply ploughed and well worked. The seed is planted in rows 6 to 8 ft. apart each way, three or four seeds being planted in a hole. Before planting, they should be softened by having hot water poured over them, and then being left to soak for twenty-four hours. In ten days after sowing the seeds will germinate, and when the plants are 8 or 10 in. high, the three weakest must be taken up where four seeds have been planted together. They grow very rapidly and begin to bear in about four months. Like coffee plants, the castor plant would grow to an inconvenient height if left to itself. It should, therefore, be kept low by pinching back the main stem. This will have the further effect of causing the plant to throw out many more fruit spikes than it otherwise would do. When the tree gets old, the usual scale insect (the *Coccus*) attacks the bark. These have to be dealt with by spraying with kerosene emulsion.

HARVESTING.

When the capsules turn brown, it is time to begin the harvest. This is done by cutting off the spikes and removing them as soon as possible to the barn. The work of harvesting must be done rapidly, for if the seeds are allowed to ripen on the tree, the pods burst open and the seeds fly in all directions. This "popping" of the capsules makes the work of freeing the seeds a very simple one. All that has to be done is to prepare a drying ground either in a shed or in the open. The ground should either be boarded or swept clean. When the spikes are brought in, they should be spread out on the drying ground to the depth of from six inches to a foot, according to the heat of the weather. Should rain occur when out-of-door drying is being carried on, draw the spikes into heaps and cover with a tarpaulin. Turn the spikes over frequently to let all get the benefit of the sun. The capsules will soon begin to burst, and in four or five days they will have shed all their seed. All that now remains to be done is to sift and winnow out the husks. When drying in the open, it is well to surround the drying spikes with a low rampart of galvanised iron or bagging, for the reason that many seeds fly out very violently, and without some such precaution would be lost.

The return from an acre is about 20 bushels, a bushel of seed weighing 46 lb.

EXTRACTING THE OIL.

Those who would venture to embark in the production of castor or other oil seeds have to face the fact that the market is too far distant to leave a margin of profit after deducting the cost of production, freight and other charges. The only remedy, therefore, is to bring the market nearer, and this can only be done by bringing the

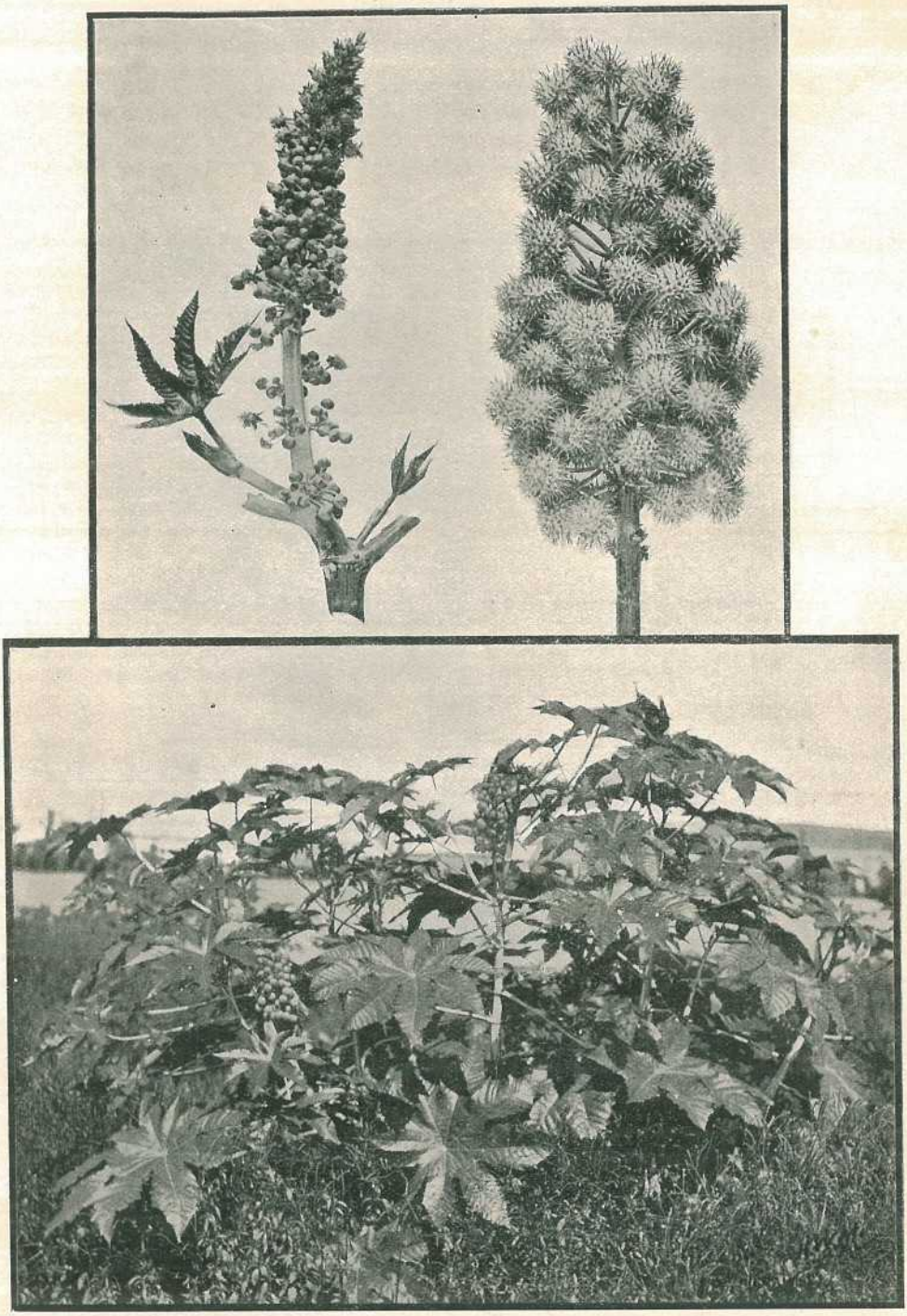


PLATE 1.—CASTOR OIL PLANT. FLOWER AND SEED SPIKES.

oil-miller alongside the raw material. The actual outlay in erecting an up-to-date oil mill is not large, as will be seen by the following (pre-war) estimates:—

Capacity of Mill.	Cost. £
30 to 45 cwt. of castor per day	750
40 to 70 cwt. of castor per day	1,050
100 to 150 cwt. of castor per day	2,400
160 to 200 cwt. of castor per day	3,000

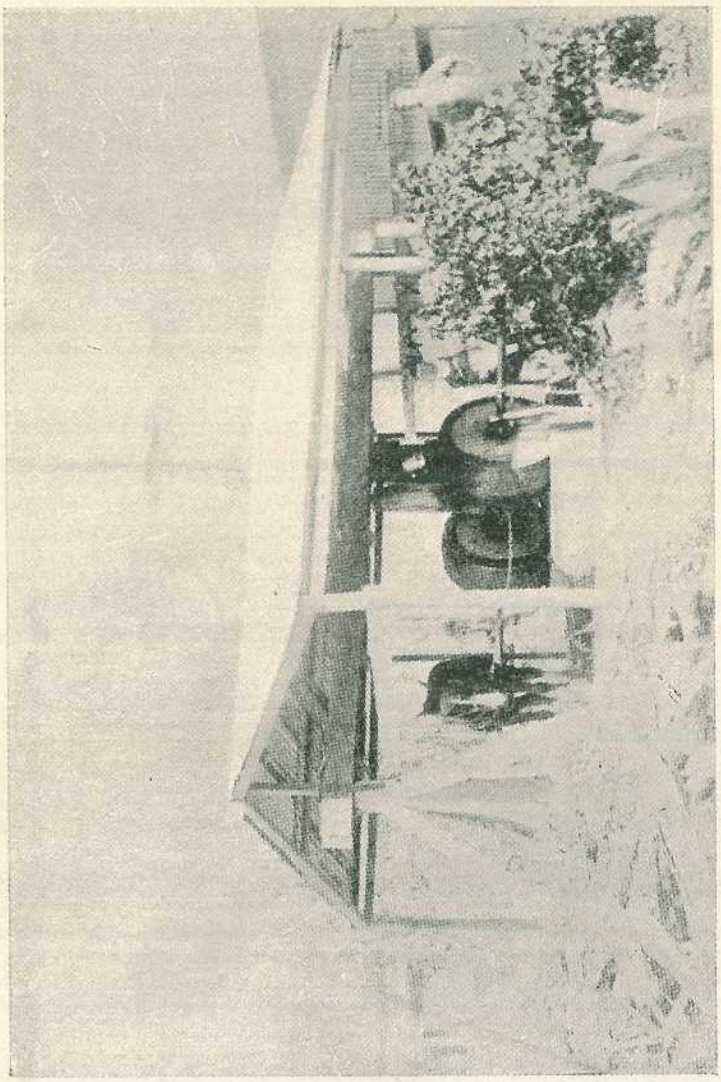


PLATE 2.—CASTOR OIL MILL.

Skilled labour would be required to make the oil. A comparatively simple process can be tried, however, with good results. It is as follows:—

First cleanse the seeds from fragments of the husks and from dust, and submit them to a gentle heat, not greater than can be borne by the hand, which process makes the oil more fluid and more easily expressed. A whitish oily fluid is thus obtained, which is then boiled with a large quantity of water, and all impurities

are skimmed off as they rise to the surface. The water dissolves the mucilage and starch, and the albumen is coagulated by the heat, thus forming a layer between the oil and the water. The clear oil is then removed, and boiled with a small quantity of water until steam ceases to rise, and a small quantity taken out in a phial remains perfectly transparent and cool. The effect of this is to clarify the oil and rid it of volatile acid matter. Care is necessary not to carry the heat too far, as the oil would acquire a brownish colour and an acid taste. Cheap wooden rollers would serve the purpose of crushing, the seed being placed in hempen bags.

A MARKET

would be probably found for oil seeds in Melbourne or Sydney. There are no oil mills in Queensland.

THE WHEAT PLOT.

We avoid having sheep-sick soil by rotating the sheep land with the wheat, breaking up each year a new 100-acre plot for the wheat. Thus the cycle gives the various parts of the farm four years in sheep and one year in wheat. After the wheat we sow turnips, and subsequently rape on part of the 100 acres, sowing down the whole field at the same time in grass. This entails some outlay for seed, and it is difficult to say whether this should be charged to the sheep (which will eat the product) or to the wheat (which has made new sowings necessary). Our best plan here is to dodge the difficulty, and leave this again to the critic to account for. A fence also is necessary for the 40-acre plot. This may be either temporary or permanent. A few 40 and 60-acre paddocks are handy things to have on a sheep farm, and they will not greatly impede the wheat growing.

A TEMPTING SIDE ISSUE.

It would be a very profitable undertaking to sow the whole of the wheat plot subsequently down to turnips and rape, with a view to buying some extra lambs for fattening. Specially prime rape crops have been known to add 4s. per head to fifty lambs per acre. If we make our expectations reasonable, and put the result at twenty lambs per acre, we get an extra £4 per acre from the spare sixty acres of rape, besides, perhaps, a similar earning from the preceding turnips—a total side income of £480. Against this we may reasonably set the cost of seed, regrassing and such manuring as we may choose to apply. It will be well agreed that this system of farming will, in all probability, cause a steady increase of fertility, even apart from the purchased manure, which, however, will speed up that increase, and more than pay its way while doing so.

COST OF A WHEAT CROP.

The laying down of wheat out of grass is fairly well standardised practice. We may outline it like this:—

	Per Acre. £ s. d.
Preparation (including skim ploughing, discings, the deeper ploughing, harrowing, sowing and rolling) ..	1 2 6
Seed, 2 bushels at 5s.	0 10 0
Manure, 2 cwt. super. at 7s. 6d.	0 15 0
Total	£2 7 6

	Per Acre. £	s.	d.
Harvesting—			
Cutting and twine	0	5	6
Stooking	0	2	0
Forking, carting, and stacking	0	10	0
Threshing, say	1	2	6
Total	£2	0	0
Cost of laying down	2	7	6
Total cost of 40 bushels wheat	4	7	6
Total value at 5s. on trucks	10	0	0
Net balance per acre	5	12	6

At 6s. per bushel the net balance shows at £7 12s. 6d. At 4s. per bushel, which is a more likely prospect for the future, the farmer has £3 12s. 6d. per acre to pay him for his own work, enterprise, risk, and rent. At that figure, he will not be hard to pursuade to give all his energies to sheep. At 3s. per bushel, and a prospective balance of £1 12s. 6d. as his slender defence against a bad season, one wonders how any man could possibly survive the temptation to resign from wheat farming.—"Farm," Sydney.

MARKET GARDENING.

SEASONABLE NOTES ON RHUBARB-GROWING.

Now is the time to plant rhubarb. Deep, rich, sandy loams provide ideal conditions for rhubarb, which, however, may be grown successfully on all types of soil put in the proper condition. The richer and deeper the soil, the quicker will be the growth. The bed ought to be trenched to a depth of 2 ft., and very heavily manured with good stable manure mixed with cow-yard manure. In the fertilising of rhuburb, the grower has four things to consider:—(1) That the plant luxuriates in soils abounding in vegetable matter; (2) that large stalks count for good prices; (3) that the early pullings are in most demand; (4) that the crop of any given year depends largely upon the care of the plants of the preceding year. Stable manure is especially valuable, because it supplies humus, conserves moisture, and furnishes plant food. In Europe, gardeners apply as much as 25 tons to the acre, equal to 350 lb. per square perch. Failing stable manure, commercial fertilisers may be used. Such should contain 4 to 6 per cent. of nitrogen, and 8 to 10 per cent. each of the mineral elements. Of this, about 1,000 lb. per acre, or about 6 lb. per perch, nitrate of soda is of great value when used at intervals throughout the growing season. With proper care plantations will produce for many years, but after the stalks become materially smaller they should not be retained. The best profits cannot be realised after five years of age.

The plants are readily produced from seed sown under glass or in the open, but as only a small proportion of such plants are true to type, the system should not be generally practised. Root division is the method ordinarily employed. A piece of root containing a strong eye will grow, and under favourable conditions, produce a good plant in one season. Roots should be one or, preferably, two years old. In planting, the rows should not be less than 4 ft. apart, and the plants 3 ft. apart in the rows. The ground should be kept well cultivated and free from weeds, and all flower stalks should be cut off as soon as they appear. No plant responds more liberally to judicious watering than rhubarb. Enormous amounts of water are used by the large leaves and succulent stems. Liquid manure applied occasionally is of great benefit.

By purchasing crowns and dividing them, rhubarb fit for use can be obtained in two or three months instead of having to wait for two years for seedlings to come to maturity. Hence, it will be found more profitable to purchase strong, sturdy crowns than to go to the trouble of raising seedlings, which will probably not be very strong or vigorous.

A CHEAP FERTILISER.

Mr. B. Jewitt, Buderim, sends the following note on a fertiliser which he has used successfully for many years for growing florist flowers and vegetables:—"Collect a dray load of cow dung, not too wet, from a paddock, and make it into a round heap, covering it with a layer of sods. Then set fire to it to char the dung. The charring destroys all seeds. When cool it is fit for use. It must on no account be allowed to get wet before using. If not wanted at once, put it into bags and keep dry. Any rough bones charred with it will be also beneficial to plant life."

A FARMER'S REMEDY FOR THE FRENCH BEAN FLY.

Referring to Mr. Jarvis's article on the Bean Fly, Mr. R. J. Scott, of Wanda, Walla (Mount Perry district), says:—

"My first experience of this fly in the Brisbane district was in the autumn of 1893-4, ten years before the dates mentioned in the article; and I would like to add, for the benefit of unfortunate growers, my plan for combating the fly. Four days, say, after planting the seed, cover the rows with a light layer of sawdust. Then wet this with a dressing of kerosene emulsion with a watering-can. When the plants are in the second leaf, again dress with the emulsion. To make kerosene emulsion, I use 1 lb. of ordinary soap, cut up, and dissolved in about 2 gallons of boiling water. When dissolved, add cold water to 4 gallons and three-quarters of a pint of kerosene, well stirred in with a flat piece of board. The emulsion must be warm when used, and kept well stirred."

[This is a very simple remedy, and well worthy of a trial by gardeners and others who frequently suffer the loss of an entire crop owing to the ravages of this fly.]

SPRAY WASH FOR VEGETABLES.

The following spray, or wash rather, was stated by Mr. S. C. Voller, Instructor in Fruit Culture to the Department of Agriculture, to be an infallible means of destroying aphis and other insect life on vegetables. With Paris green the trouble is that it will not stick to the glossy leaves of cabbages and cauliflowers, but collects at the base of the stalk and at the junction of the stalk and leaves. Sprays are open to the same objection. The wash here recommended, however, will stick like varnish, and, in an instant, destroy all animal life on the plants:—

TO MAKE THE WASH

take 20 lb. of resin, 4 lb. of caustic soda (98 per cent.), or 6 lb. (70 per cent.), 3 pints of fish oil, or 2½ lb. whale oil soap, and 140 to 150 gallons of water. Place all these ingredients in a boiler, first, with 20 gallons of the water, and let the whole simmer for three hours. Then add hot water slowly, and stir well till there are at least 40 gallons of solution. Then add cold water to make up the 140 or 150 gallons. Never add cold water when cooking. This wash, using only 80 gallons of water, will destroy the mussel, glover, and white scales on citrus trees, and the mussel scale of the apple. The weaker solution in 140 to 150 gallons of water may be used on all vegetables with safety.

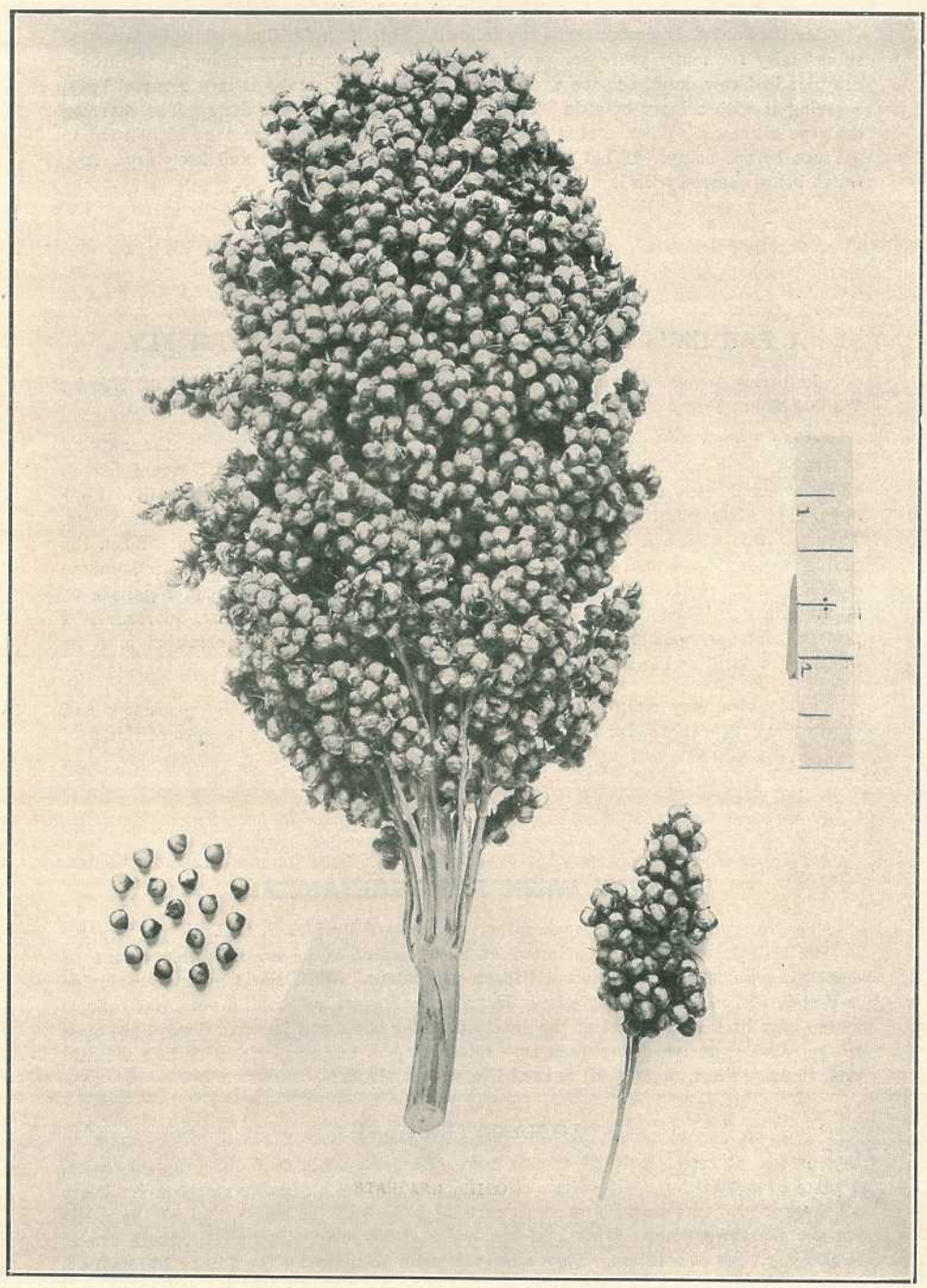


PLATE 3.—STANDARD MILO.

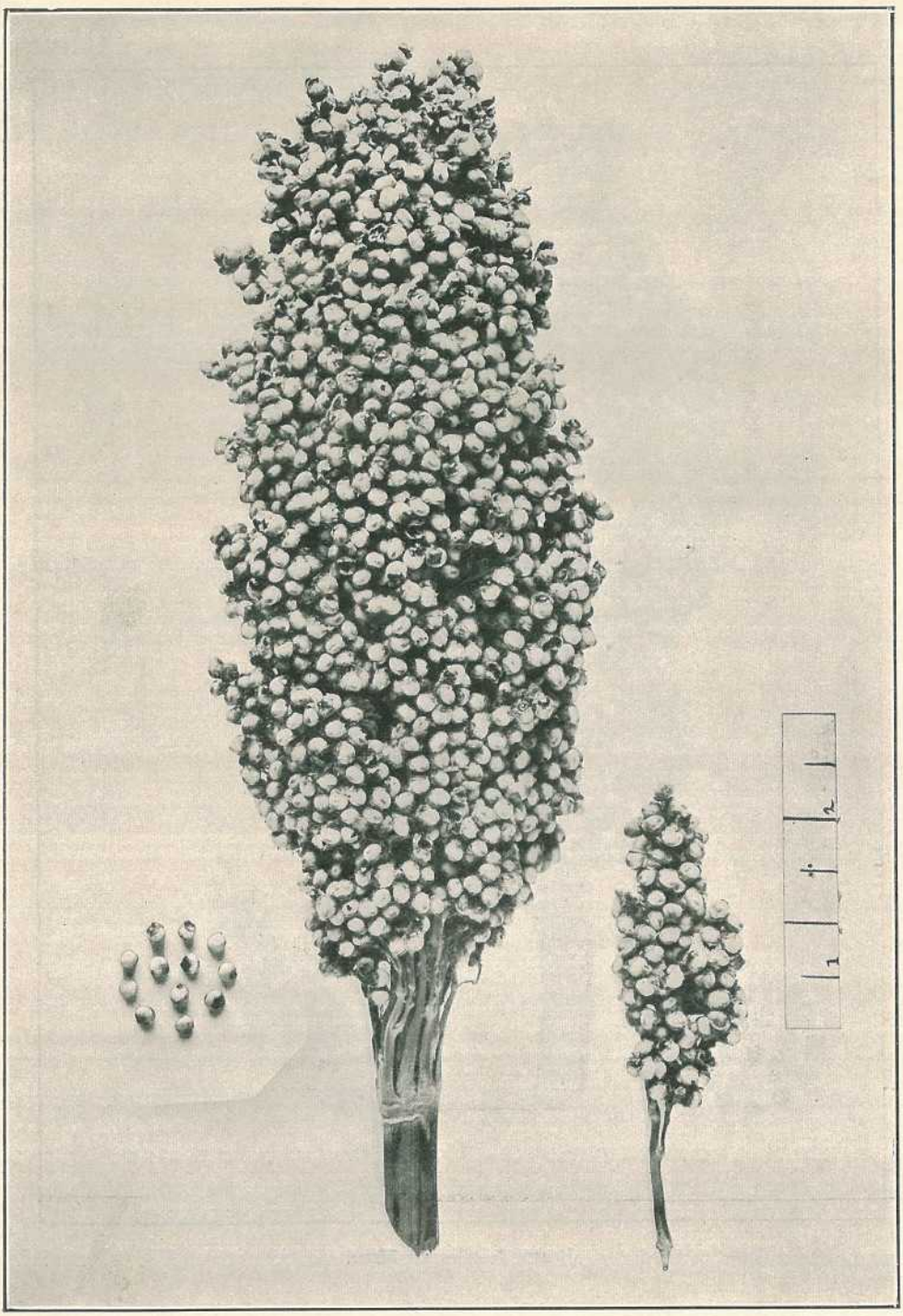


PLATE 4.—FETERITA (SOUDAN DHOURA).

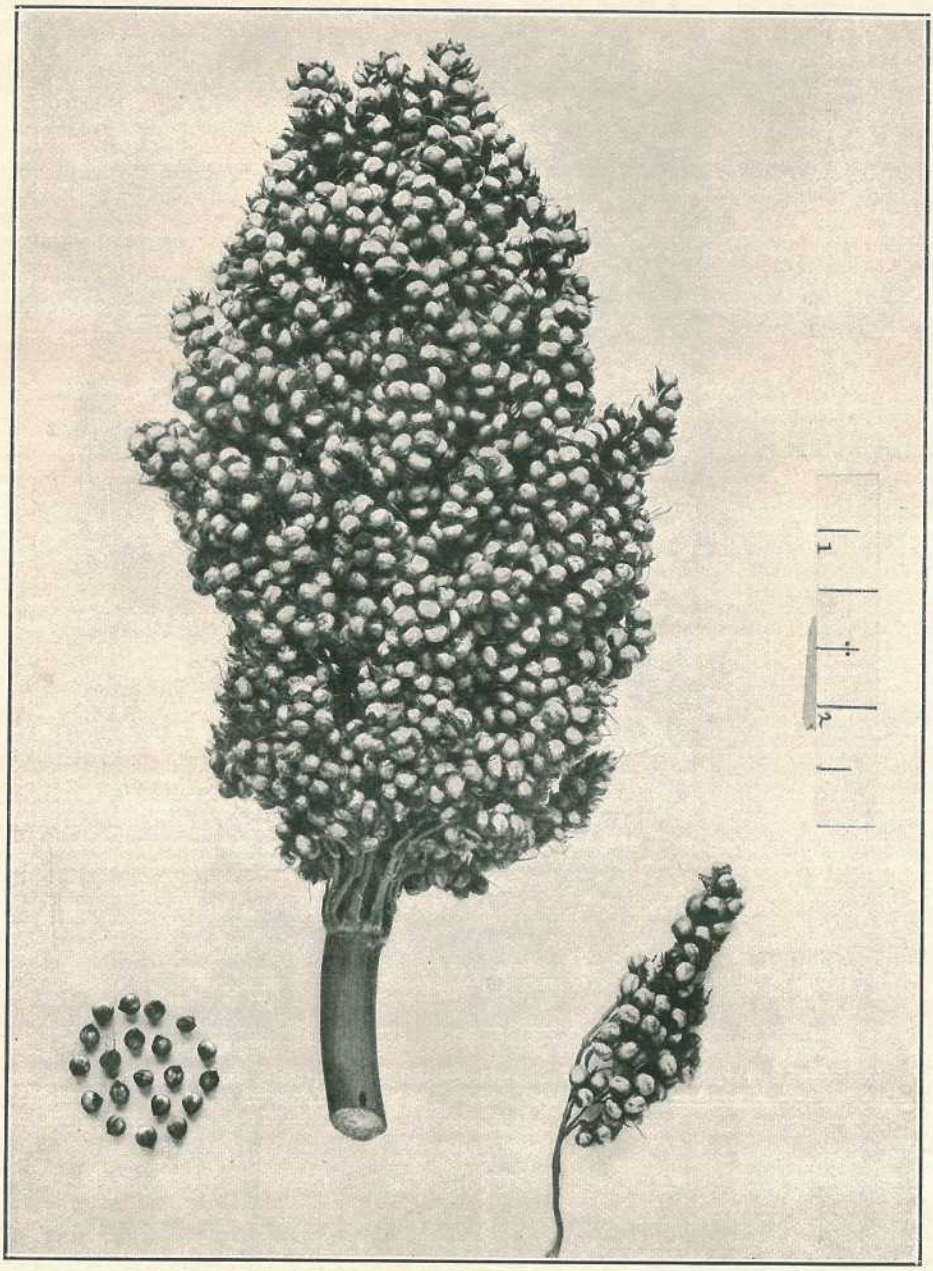


PLATE 5.—CREAM MILO.

Pastoral.

BREEDERS OF PUREBRED STOCK IN QUEENSLAND—BEEF AND DAIRY CATTLE.

The Office of the Secretary of the undermentioned Herd Books is 303 Queen street, Brisbane:—

The Australian Hereford Herd Book;
The Shorthorn Herd Book of Queensland;
The Jersey Herd Book of Queensland;
The Illawarra Herd Book of Queensland;
The Ayrshire Herd Book of Queensland;
The Milking Shorthorn Herd Book of Queensland;
The Holstein-Friesian Herd Book of Australia.

NOTE.—Animals registered in the Commonwealth Standard Herd Book are not necessarily eligible for entry in the Jersey Herd Book of Queensland.

Name of Owner.	Address.	Number of Males.	Number of Females.	Herd Book.
	DAIRY BREEDS.			
	AYRSHIRES.			
L. H. Paten	"Jeyendel," Calvert, S. & W. Line	8	21	Ayrshire Herd Book of Queensland
J. H. Paten	Gwandalan, Yandina	6	21	Do.
Queensland Agricultural College	Gatton	4	40	Do.
State Farm	Warren	3	83	Do.
J. W. Paten	Ayrshire Park, Wanora, Ipswich	10	42	Do.
J. H. Fairfax	Marinya, Cambooya	9	55	Do.
J. Holmes	"Longlands," Pittsworth	6	20	Do.
H. M. Hart	Glen Heath, Yalangur	7	21	Do.
F. A. Stimpson ..	Ayrshire Stud, Fairfield, South Brisbane	7	77	Do.
M. L. Cochrane ..	Paringa Farm, near Cairns	5	21	Do.
John Anderson ..	"Fairview," Southbrook	7	34	Do.
	JERSEYS.			
T. Mullen	"Norwood," Chelmer	3	20	Jersey Herd Book of Queensland
Queensland Agricultural College	Gatton	2	31	Do.
M. W. Doyle	"Oaklands," Moggill	4	12	Do.
G. A. Buss	Bundaberg	1	15	Do.
R. Conochie	Brooklands, Tingoora	9	21	Do.
W. J. Barnes	Millstream Jersey Herd, Cedar Grove	10	37	Do.
W. J. Affleck	Grasmere, N. Pine ..	6	31	Do.
J. N. Waugh and Son	Prairie Lawn, Nobby	3	28	Do.
W. J. H. Austin ..	Hadleigh Jersey Herd, Boonah	2	11	Do.
State Farm, Kairi ..	Kairi, *viâ* Cairns ..	4	16	Do.
H. D. B. Cox	Sydney (entered in brother's name)	3	16	Commonwealth Standard Jersey Herd Book

BREEDERS OF PUREBRED STOCK IN QUEENSLAND—*continued.*

Name of Owner.	Address.	Number of Males.	Number of Females.	Herd Book.
	DAIRY BREEDS—*continued.*			
	GUERNSEYS.			
Queensland Agricultural College	Gatton	2	2	Eligible, but no Guernsey Herd Book of Australia
	HOLSTEINS.			
Queensland Agricultural College	Gatton	2	9	Holstein-Friesian Herd Book of Australia
George Newman ..	"St. Athan," Wyreema	12	47	Do.
F. G. C. Gratton ..	"Fowlerton," Kingsthorpe	1	15	Do.
R. S. Alexander ..	Glenlomond Farm, Coolumboola	1	3	Do.
Ditto	Ditto	1	..	Holstein-Friesian Herd Book of New Zealand
S. H. Hoskings ..	St. Gwithian, Toogooloowah	..	..	Holstein-Friesian Herd Book of Australia
C. Behrendorff ..	Inavale Stud Farm, Bunjgurgen, Q.	3	9	Do.
E. Swayne	West Plane Creek, Mackay	1	2	Do.
	ILLAWARRA.			
A. Pickels	Blacklands Stud, Wondai	4	62	Illawarra Herd Book of Queensland
J. T. Perrett and Son	Corndale, Coolabunia	3	43	Do.
W. T. Savage	Ramsay	2	22	Do.
Hunt Bros.	Springdale, Maleny ..	3	62	Do.
	MILKING SHORTHORNS.			
P. Young	Talgai West, Ellinthorp	2	42	Milking Shorthorn Herd Book of Queensland
W. Rudd	Christmas Creek, Beaudesert	2	10	Do.
A. Rodgers	Torran's Vale, Lanefield	1	9	Do.
W. Middleton	Devon Court, Crow's Nest	3	27	Do.
	BEEF BREEDS.			
	SHORTHORNS.			
T. B. Murray-Prior ..	Maroon, Boonah ..	2	37	Queensland Shorthorn and Australian Herd Books
C. E. McDougall ..	Lyndhurst Stud, Warwick (2)	25	100	Queensland Shorthorn Herd Book
Godfrey Morgan ..	"Arubial," Condamine	3	6	Do.
W. B. Slade	E. Glengallan, Warwick	2	20	Do.

BREEDERS OF PUREBRED STOCK IN QUEENSLAND—*continued.*

Name of Owner.	Address.	Number of Males.	Number of Females.	Herd Book.
	BEEF BREEDS—*continued.*			
	HEREFORD.			
A. J. McConnell ..	Dugandan, Boonah	19	36	Australian Hereford Herd Book
E. M. Lumley Hill ..	Bellevue House, Bellevue	45	127	Do.
Tindal and Son ..	Gunyan, Inglewood	50	400	Do.
	SUSSEX.			
James T. Turner ..	The Holmwood, Neurum	2	4	Sussex Herd Book of England

SHOWER SHEEP DIP ON CASHMERE WEST.

Mr. W. G. Brown, Instructor in Sheep and Wool, supplies the following directions for the construction of a shower sheep dip, which he saw in action at Cashmere West, on the Balonne River, near St. George, and which, he says, will doubtless interest a good many pastoralists. It differs in some respects from the specifications issued by this Department. It is, so to speak, double-barrelled, and is the first of the kind he has seen. It will be interesting to those who are thinking of dipping, because it is being used by a hard-headed, practical man. Mr. Brown adds: "I do not know whether corrugated iron is better than flat iron for the shower. In any case, I believe the shower dip to be the best medium for the work."

SPECIFICATION.

Capacity.—4,000 sheep per day.

Measurements.—30 x 24 ft., in two separate dips, each 30 x 12 ft., each of which can be worked independent of the other.

Roofing.—This is of galvanised corrugated iron, with a fall each way of 1 in. from the centre, made in two separate trays 30 x 12 ft. Holes in the trays 3 in. x 3 in. apart are made with a punch the size of No. 10 wire.

Flooring.—Cement 4 in. thick, set on a foundation of stones 10 in. thick. The floor has a slight fall to the centre for drainage.

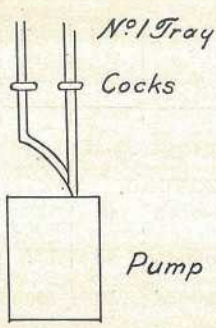
Supports.—8 x 4 in. posts, each post 7 ft. out of the ground, and 7 ft. 6 in. apart.

Rafters.—On supports only 7 ft. 6 in. apart.

Walls.—Closed in with galvanised iron, except in the centre, where the top sheets are kept down for observation.

Pump.—Three-inch Tangye centrifugal, driven by a 4 h.p. Walesby petrol engine.

Supply Pipes.—Three-inch pipes leading from pump to each separate tray as



and pipes over trays bored with ½-in. holes 1½ to 3 in. apart.

Reservoir.—Round in shape; walls 4-in. concrete, 9 ft. across, 4 ft. deep at sides and 4 ft. 10 in. in centre. Two 2-in. pipes 6 in. from top of reservoir, with bagging strainer to let in clean water from bore drain.

Straining.—Many methods were used which proved useless on account of the heavy flow of liquid. The trouble was mastered in the end by using an ordinary cheese-cloth bush mosquito net, which had to be cleaned out every couple of runs.

Although the flow of water was supplied by 3-in. pipes, it took a full flow in a 6-in. pipe to take it away off the floor to the tank, and even then there would be 3 in. of liquid in the centre of the pen, which was a danger to sheep getting down and drowned if the pens were too full.

Working.—Gates on both ends of each pen, while the supply pen, before entering the dip, was floored with battens to prevent dirt being carried in.

After draining, the sheep are let out into the drying yard. It was found necessary to discontinue dipping at about 2 p.m. on account of the cold nights, which were very severe on sheep dipped late in the afternoon.

DIPPING AS A PREVENTIVE AGAINST INTERNAL PARASITES OF SHEEP.

The subjoined extract from "The Veterinary Record," London, contained in the Annual Report of the Government Veterinary Bacteriologist, Southern Rhodesia, S.A., for the year 1916, has a strong bearing on the conclusions drawn by the Department of Agriculture and Stock in this State *in re* the dipping of sheep. These experiments in Rhodesia are almost identical in method with those of some of our Departmental experiments on Gindie State Farm and Dalmally, Roma District. Mr. W. G. Brown, Instructor in Sheep and Wool, says:—"I have long been of the opinion that dipping in a poisonous dip has a beneficial effect in cases where stomach worms are prevalent, and am glad to get corroboration from so excellent a source as the above well-known journal. The following is the extract above alluded to:—

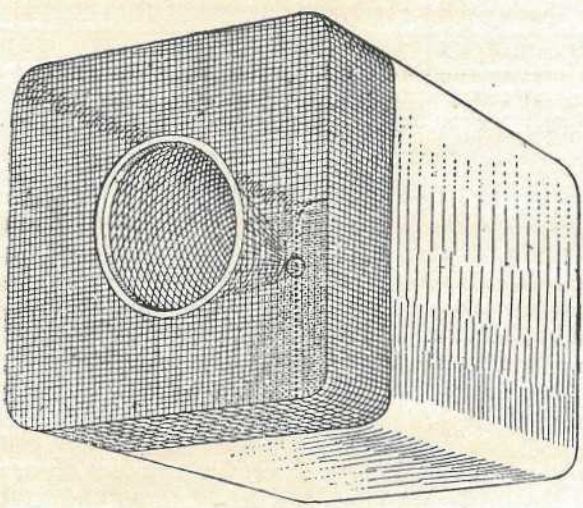
DIPPING OF SHEEP.

"Reference may be made to an experiment carried out at the request of the Chief Veterinary Surgeon to ascertain the effects of 'short interval clipping' upon sheep and lambs. A small flock made up of 39 sheep and lambs of mixed breeds,

the majority being half-bred Persians, but six of long-woolled varieties, was purchased for the purpose. All these animals were in a most emaciated condition, and suffering from fluke, wire-worm, tape-worm, and nodular worm of the intestines. It was with difficulty that they were driven from the farm from which they were purchased to the laboratory. On the 5th February dipping was commenced in Cooper's dip, 1 in 300 strength, in which they were immersed three times in ten days, the strength of the dip then being increased to 1 in 250. Dipping was carried on regularly twice a week in this strength until the 16th April, making 19 dippings in all. During this period, ten animals died—namely, four sheep (one woolled), and six lambs, these being the weakest of the flock. The rest of the flock improved markedly in health. The experiment was then discontinued, but the result is still apparent in that the survivors are still alive and in the best of condition, and the ewes have given birth to lambs, which have thriven and grown out in spite of the fact that most of them have been born during the dry season. The experiment was originally intended to determine to what extent small stock could be dipped with safety in areas which have to be freed from African Coast fever. It is possible that such drastic measures could not be applied in a damp atmosphere, or to woolled varieties—because of damage to the fleece; but, in practice, this would not be necessary. The experiment has, however, gone further; it affords support to the observation of officers in the field that dipping exerts a beneficial action upon sheep infected with worms. The results have been so remarkable that when opportunity arises, further experiments of a more exact nature will be carried out.''

A SIMPLE TYPE OF BLOWFLY TRAP.

The question of destroying sheep-maggot flies by trapping them before they have time to deposit their eggs upon the sheep has been advocated by the New South Wales Department of Agriculture for some time, and a number of sheepowners have been trapping flies in various ways, with very marked results.



A number of different traps have been advertised, and placed on the market by dealers, some at a price almost prohibitive where large numbers are required. Mr. J. L. Froggatt, B.Sc., officer in charge of the N.S.W. Government Sheep-fly Experi-

ment Station, has been experimenting for some time with a view to producing a simple trap, at a very low cost, that can be set and looked after by any station hand.

The illustration shows one that can be made on any homestead by a handy man with an empty petrol or kerosene tin, and some wire gauze.

HOW TO MAKE THE TRAP.

The end is removed from a kerosene tin and the open space covered with galvanised wire gauze which overlaps the sides of the tin about two inches, and around which it is bent. Let into the wire gauze covering is a funnel four inches across at the top and five inches in length, the opening at the apex (*i.e.*, into the tin) being about the size of a threepenny piece. The inside of the tin is painted white with cold-water paint; if the outside is also painted the life of the trap will be prolonged considerably.

This type of trap has been tested at the Government Sheep-fly Experiment Station, and has also been used by many pastoralists with excellent results.

For a bait any offal (although the heart, liver, and lungs are the best), putrid meat, dead rabbits where obtainable, or milk which has been left to go sour and then putrefy, can be used with very satisfactory results.

This trap is to be used upright, not on its side, as in the illustration, which is only to show the type of funnel, &c.—"Pastoral Review."

SPRAYING CATTLE IN TRANSIT.

Several years ago we ("Pastoral Review") advocated a system of spraying cattle in hot weather *en route* in the railway trucks, as in Argentina and other countries which are in advance of Australia in the matter of stock-conveying methods. In hot weather in those countries the trains are run under showers, the roofs of the trucks slide open, the cattle get a shower, and the train passes on with little delay, and no shunting. However, we cannot expect anything so sensible here, so must get the next best method available. A Mr. G. S. Davis, of Sydney, has been for several years conducting experiments with this object. His scheme is to fix an iron tank on each cattle wagon. The tank is filled with water at the starting point, and is expected to last a whole journey, even up to 500 miles. The spray is regulated, and can be turned on by the driver in charge at any time.

The spraying keeps the cattle fresh and cool. It means a cool truck in the hottest day of summer. The cattle consequently suffer less, waste less, and don't fall down. It is profitable as well as humane. The cattle are better, and look better.

On a long journey in summer fat cattle waste a good deal. This spraying saves a lot of that, and in this way alone it should mean a considerable gain to the owner and the country. Then, again, it is claimed that the cattle are much less likely to go down. In eight big trips with the sprayed truck not a single beast was lost. On the same trips, in the unsprayed trucks cattle did go down. The cattle in the sprayed truck don't get so leg weary, and they remain fresh.

Dairying.

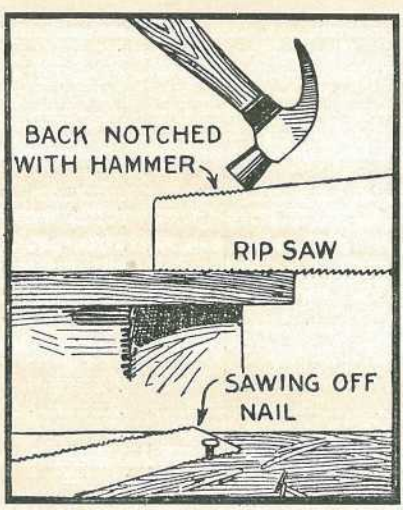
THE DAIRY HERD, QUEENSLAND AGRICULTURAL COLLEGE, GATTON.

MILKING-RECORDS OF COWS FROM 30TH APRIL TO 29TH MAY, 1918.

Name of Cow.	Breed.	Date of Calving.	Total Milk.	Test.	Commercial Butter.	Remarks.
			Lb.	%	Lb.	
Lady Melba ...	Holstein ...	31 Mar., 1918	1,177	3·3	42·91	
Lady Margaret ...	Ayrshire ...	28 Dec., 1917	558	4·6	28 87	
Constancy	,, ...	7 April, 1918	677	3·6	27·08	
Charming Damsel	,, ...	1 May ,,	558	4·3	26·90	
Lady Peggy ...	,, ...	30 Mar. ,,	573	4·0	25·60	
Leading Lady ...	Jersey ...	26 Dec., 1917	378	6·0	24·88	
Charity	,, ...	24 April, 1918	439	4·9	24·25	
Lady Spec... ...	Ayrshire ...	19 Feb. ,,	640	3·4	24·08	
Dawn of Warragaburra	Jersey ...	4 May ,,	463	4·6	23·95	
Jeannie	Ayrshire ...	13 Dec., 1917	504	4·2	23·70	
Hedge's Nattie ...	Holstein ...	1 Feb., 1918	584	3·5	22·66	
Leda's Jessie ...	Jersey ...	25 Mar. ,,	433	4·5	21·89	
Royal Mistress ...	Ayrshire ...	13 Mar. ,,	518	3·7	21·31	
Yarraview Ida's Hope	Guernsey ...	5 May ,,	405	4·6	20·95	
Belinda	Ayrshire ...	14 Jan. ,,	469	3·9	20·39	

SAWING NAILS.

When working up old timber it often happens that nails buried in the wood are encountered, to the detriment of the saw. This difficulty can be overcome as shown in the accompanying sketch published in the "S. A. Farmers' Advocate":—



The nails may be sawn through without injury to the saw, by notching the back edge of the saw with a hammer as here shown, and using this edge to saw through the nails. If the notches are made small, this will merely add to the saw's usefulness.

Poultry.

REPORT ON EGG-LAYING COMPETITION, QUEENSLAND AGRICULTURAL COLLEGE, MAY, 1918.

The total number of eggs laid during the month was 5,979. The Dixie egg plant again wins the monthly prize in light breeds with 154 eggs, while Nobby Poultry Farm wins amongst the heavies with 154 eggs also. It has been a good month for egg production. Although westerly winds were prevalent during the second week, it is pleasing to note that they did not in any degree affect either the birds or their productiveness. The following competitors have had cases of broodiness:—W. Smith (2), A. E. Walters (2), H. Puff (2), W. H. Reilly (3), W. J. Mee (1). There are still a few stray cases of moult. The health of the birds has been excellent. The following are the individual records:—

Competitors.	Breed.	May.	Total.
	LIGHT BREEDS.		
*Dixie Egg Plant	White Leghorns ...	154	293
*Mrs. L. Henderson	Do.	122	236
*E. Chester	Do.	136	231
*G. Prince	Do.	140	230
*G. W. Hindes	Do.	141	226
*C. P. Buchanan	Do.	138	224
*C. Knoblauch	Do.	130	223
*T. Fanning	Do.	119	223
H. Fraser	Do. ...	116	219
*O.K. Poultry Yards	Do.	124	216
*G. Howard	Do.	136	212
B. Casweil	Do.	108	209
*W. Becker	Do.	116	207
*Dr. E. C. Jennings	Do.	109	204
*Range Poultry Farm	Do.	102	201
*Oakland Poultry Farm	Do.	126	193
*G. H. Turner	Do.	118	192
*W. Lyell	Do.	127	191
*L. G. Innes	Do.	91	186
J. J. Davies	Do.	114	181
G. W. Williams	Do.	99	181
O. W. J. Whitman	Do.	109	180
*T. Taylor	Do.	107	177
*Quinn's Post Poultry Farm	Do.	100	162
*R. Holmes	Do.	124	160
Progressive Poultry Pens	Do.	56	160
*C. Porter	Do.	88	159
*J. Zahl	Do.	106	158
*E. A. Smith	Do.	96	156
Mrs. A. G. Kurth	Do.	94	144
G. Trapp	Do.	90	142
S. Wilkinson	Do.	62	142
*T. B. Hawkins	Do.	78	139
*Mrs. A. T. Coomber	Do.	76	139
H. F. Britten	Do.	75	139
R. T. G. Carey	Do.	96	137
*J. W. Newton	Do.	72	134
Mrs. L. F. Anderson	Do.	64	133

EGG-LAYING COMPETITION—*continued.*

Competitors.	Breed.	Map.	Total.
	LIGHT BREEDS—*continued.*		
*J. M. Manson	White Leghorns ...	83	123
*Himalayan Poultry Farm	Do.	63	112
H. B. Stephens	Do.	65	109
Shaw and Stevenson	Black Leghorns	92	100
*Mrs. R. Hunter	White Leghorns ...	69	89
P. O. Oldham	Do.	49	83
A. W. Walker	Do.	55	68
W. A. Wilson	Do.	48	51
B. Chester	Do.	8	45
	HEAVY BREEDS.		
*Nobby Poultry Farm	Black Orpingtons ...	154	243
T. Hindley	Do.	132	199
*W. H. Reilly	Chinese Langshans ...	103	198
*W. Smith	Black Orpingtons ...	75	180
*A. E. Walters	Do.	87	179
*E. F. Dennis	Do.	101	152
W. J. Mee	Do.	99	150
*E. Morris	Do.	87	135
E. M. Larsen	Do.	107	131
*J. W. Macrae	Do.	32	122
*Mars Poultry Farm	Do.	90	102
H. Puff	Rhode Island Reds ...	31	80
*R. Burns	Black Orpingtons ...	67	77
*D. Fulton	Do.	28	63
Th. W. Lutze	Do.	43	43
A. Shanks	Do.	42	42
*F. A. Claussen	Rhode Island Reds ...	38	38
J. Fitzpatrick	Do.	22	26
Totals	...	5,979	9,979

* Indicates that the pen is engaged in single hen test.

RESULTS OF SINGLE HEN PENS.

Competitor.	A.	B.	C.	D.	E.	F.	Total.
LIGHT BREEDS.							
Dixie Egg Plant	45	48	53	44	50	53	293
Mrs. L. Henderson	44	42	38	20	45	47	236
E. Chester	28	44	35	46	47	31	231
Geo. Prince	20	41	43	45	41	40	230
G. W. Hindes	53	43	37	40	30	23	226
C. P. Buchanan	39	28	40	31	46	40	224
T. Fanning	39	41	42	19	43	39	223
C. Knoblauch	33	28	44	33	43	42	223
O.K. Poultry Yards	41	39	40	27	38	31	216
Geo. Howard	32	32	41	31	35	41	212
W. Becker	34	34	26	41	31	41	207
Dr. Jennings	27	41	41	40	38	17	204
Range Poultry Farm	22	44	25	39	31	40	201
Oakland Poultry Farm	30	33	41	37	24	28	193
G. H. Turner	5	27	40	37	47	36	192
W. Lyell	40	39	38	31	23	20	191
L. G. Innes	19	45	46	27	10	39	186

RESULTS OF SINGLE HEN PENS—*continued.*

Competitors.	A.	B.	C.	D.	E.	F.	Total.
LIGHT BREEDS—*continued.*							
Thos. Taylor	22	38	38	18	27	34	177
Quinn's Post Poultry Farm ...	40	27	18	25	39	13	162
R. Holmes	42	30	18	21	21	28	160
C. Porter	0	31	30	26	35	37	159
J. Zahl	35	29	25	30	25	14	158
E. A. Smith	4	44	30	42	34	2	156
T. B. Hawkins	30	18	36	8	34	13	139
Mrs. A. T. Coomber	10	33	23	24	10	39	139
J. W. Newton	28	37	1	17	30	21	134
J. M. Manson	41	29	40	1	11	1	123
Homalayan Poultry Farm ...	37	32	8	0	35	0	112
Mrs. R. Hunter	9	30	2	11	15	22	89
HEAVY BREEDS.							
Nobby Poultry Farm	48	42	37	30	38	48	243
W. H. Reilly	30	42	37	25	26	38	198
W. Smith	43	35	18	19	31	34	180
A. E. Walters	30	41	25	33	43	7	179
E. F. Dennis	43	18	20	0	45	26	152
E. Morris	6	38	40	37	14	0	135
J. W. Macrae	0	0	39	12	34	37	122
Mars Poultry Farm	9	23	32	16	11	11	102
R. Burns	10	7	0	1	37	22	77
D. Fulton	3	3	4	2	1	50	63
F. A. Claussen	10	7	0	4	17	0	38

DUCKS AND THEIR MANAGEMENT.

By J. BEARD, Poultry Instructor.

There are many varieties of domestic ducks, amongst which, the best known are the Aylesbury, Pekin, Rouen, Blue and Buff Orpington, Indian Runner, and Muscovy. Generally speaking, ducks are hardier and more easily reared than fowls. They are comparatively free from disease, and seldom troubled with insects. They stand confinement well, especially the heavier breeds, and for this reason alone duck-rearing might be taken up on a much larger scale in Queensland than is the case at present.

In most countries the breeding of ducks ranks on an equality with any other branch of poultry-keeping. In America there are some very large duck farms which produce many thousands of ducks that are sent away in carloads to the central markets.

The Indian Runner is the smallest of the duck family, and is not a desirable duck for market, but, on the other hand, it is one of the most profitable egg-producing ducks that we have in Queensland and can be depended upon for its excellent laying qualities. There are three varieties of the Indian Runner duck—fawn and white, white, and black, the first named being the most popular at present. The white variety, so far, does not find many admirers and is seldom seen on the show benches. The blacks, so far as I know, have not made their appearance in Queensland.

Indian Runners are hardy, easily reared, and are grand foragers. They do well with little swimming water. For the size of the bird, the egg is remarkably large, of good shape, and mild in flavour.

The standard weight for drakes is 4½ lb. and for ducks, 4 lb. The weight in either sex should not exceed 5½ lb., nor be less than 3½ lb.

The Aylesbury is the premier table breed in England, and is of European origin, generally believed to have originated in England. The plumage of the Aylesbury is white, and does not show so much of a yellowish tinge as that of the Pekin. The Aylesbury matures very quickly, faster than any other breed; and ducklings, if properly fed, should weigh 5 lb. to 6 lb. at ten weeks. In the Aylesbury district in England, where this breed is largely kept to supply the London market, one does not find the somewhat exaggerated type familiar in the show pen. The bird, as bred there, is more upright in carriage than the exhibition type, with little or no keel. They weigh considerably less, too, and are consequently more active. Some strains of the Aylesbury lay well, but, generally speaking, they are not so prolific as the Indian Runners or Pekins. Their eggs are of fair size, and vary in colour from white to green. The Aylesbury and Pekin make a very good cross for table purposes.

The standard weights are:—Drake 10 lb., duck 9 lb., although exhibition specimens often scale more. The colour should be pure white with dark eyes, pink-white bill, legs and feet bright orange. The carriage should be horizontal with the keel (*i.e.*, the vertical part of the breast bone and the dependent flesh and skin below it), practically parallel with the ground.

The Pekin duck, which owes its origin to China, has been greatly improved in size and quality since its introduction to other countries. Although they mature somewhat more slowly than the Aylesbury for the table, they are more active, better layers, and less liable to leg weakness, owing to the fact that their carriage is more natural. There are not many breeders who go in for the pure-bred in Queensland. In fact, there is not much demand for the pure-bred in Australia, except for show purposes. Most specimens contain a touch of the Aylesbury, and the cross seems to have taken on better with breeders. The standard weights are:—Drake 9 lb., duck 8 lb. The colour is a deep cream; eyes, dark lead-blue; feet and legs, bright orange; bill, orange and free from black marks. In carriage they are almost upright, though not so erect as the Indian Runner. There should be no keel, except just between the legs, where it shows very slightly. The breast should be broad and full, the paunch and stern, deep and broad, and carried just clear of the ground. The Pekin is a non-sitter, though some strains will give slight evidence of the maternal instinct.

The Rouen is undoubtedly the most beautiful of all our domesticated breeds of ducks and is said to originate from Rouen, in France. They resemble in colour the mallard or wild duck, from which they are directly descended. In type and size they are very similar to the Aylesbury, the horizontal carriage and deep keel being much the same in both breeds. They mature very slowly, and are only fair layers, the eggs being somewhat small. They are good roasters, the flesh of the pure kind being dark. Owing to their handsome appearance, they have of late been bred largely for exhibition purposes. In the scale of points given for drakes of a possible 100, no less than 60 are given for colour and markings. The standard weights are:—Drake 10 lb., duck, 9 lb.

The Muscovy duck, originally found in South America, materially differs from other ducks, and is generally considered to be a distinct species of duck, and not a descendant of the wild mallard. This duck is making great headway in Queensland, and owing to the great demand of the breed for table purposes it commands a ready sale at all times, being a quick grower, it is ready for the table at fourteen weeks. The Muscovy is a perfect sitter, covering from 15 to 20 eggs, according to size. If she is provided with comfortable warm quarters she will mother 50 ducklings at a time. The Muscovy is of a very hardy nature, and prefers to select its own nest in a secluded place, and hatch her own eggs. I would advise inexperienced hands not to try and hatch the eggs in incubators as failure would be sure to follow. Splendid table birds can be obtained by crossing the Muscovy with either the Aylesbury, Pekin, or Rouen. This cross, being mules, is non-productive.

HOUSING.

The housing of ducks is a simple matter. A low lean-to shed, 4 ft. high in front and 3 ft. high at the back, will answer the purpose well. The back and ends should be boarded, and the front to face north or north-east, and covered with wire netting, so that the morning sun can get inside. Ducks must have plenty of fresh air. The floor must be well raised above the surrounding ground and should be hard and dry. This is very important, as young ducks are subject to rheumatism. A wooden floor should on no account be used, as it not only becomes quickly tainted, but remains damp for a long time when once wet, and always makes a safe harbourage for insects and vermin generally. Plenty of clean bedding should be supplied—twice weekly at least. Bush hay or mill chips should be used, if available.

In the breeding season, the ducks should be kept in the house, or, at any rate, away from their swimming water until 10 a.m., as many will lay in the water, and the eggs become spoilt or lost. A good plan is to wire off part of the run next to the house, and supply the birds with drinking water only, until they have laid.

A breeding pen generally contains one drake and four or five ducks. If one has unlimited space and water, and the aim of the duck farmer is only to raise ducklings for the market, ten or twelve ducks and three drakes may be run together. The male birds soon settle down, and seldom interfere with each other.

I would not advise mating young stock birds under twelve months old. A vigorous drake about twelve months old, mated to two-year-old ducks, as a rule, gives good results. One must have maturity on one side or the other. It is very important that males and females should not be related in any way, if hardy, vigorous youngsters are required.

The first two batches of eggs laid in the season are generally unfertile, and care should be taken by those selling sittings to test all eggs for a week or more by putting a few into the incubator or under a broody hen before sending them out to customers. Duck eggs, as a rule, travel badly, and great care must be taken in packing them securely.

SHADE AND SHELTER

from the hot sun and cold winds are very necessary, as young ducks are unable to stand the hot sun on their heads for long, their skulls being very thin. Shelter from the cold winds should also be provided. The best kind of shelter is natural shelter, therefore all trees or bush should be left in the pens when possible. Some people make a great mistake by clearing all natural trees from the yards and then have to build artificial shelter afterwards.

The most convenient fence for a duck-yard is 2 ft. netting. While this will keep the ducks within bounds, it is convenient for the attendant to step over from one yard to another without having to go round to the entrance. Muscovys, of course, would require something higher, but 4 ft. would answer the purpose.

FEEDING.

Mash should be fed to ducks in troughs. It should never be thrown on the ground. In this way, there is no waste, and the runs do not become tainted with sour food. Mash for ducks should be mixed more moist than that for other kinds of poultry. For breeding ducks the following is recommended:—Two parts bran, 1 part pollard, 25 per cent. of cooked vegetables or green lucerne chaff scalded, to which should be added 10 per cent. of meat or dried blood.

It is very important that ducks should be supplied with meat. When at liberty, they pick up a lot of insect and animal life on the banks of creeks and swamps, such as slugs, frogs, &c., so if good results are required, this must be attended to. The meat can be cooked overnight, and, together with the soup, mixed in with the mash. All grain should be fed to ducks under a few inches of water. It is the most natural, and, consequently, the easiest way for them to pick it up. A half kerosene tin answers very well for the purpose. Grit should be given to them in the same manner. It is most important that ducks should be well supplied with the latter.

Ducks in the breeding pen must not be allowed to get too fat, otherwise the fertility of the eggs will suffer. Ducks are large eaters and put on condition quickly. Do not leave food before them all day long. Remove the trough after they appear satisfied. Green feed, such as chopped lettuce or green lucerne, can be given to them daily at noon; the latter should be scalded and dried off with a little bran.

Changes of food should be made gradually, especially when the ducks are in full lay. Lessening the quantity of meat will quickly cause a great falling off in the egg yield. Of the various grains, small hard wheat is one of the best. Short, plump oats are also excellent. Maize must be fed with discretion to the breeding stock, especially during hot weather. This grain is too fattening, and a laying duck should be in hard condition.

Fertility is always much better when a fair amount of water is available—not necessarily deep water. More especially is water necessary for breeding pens of the heavy varieties. Young ducks being raised for the market do not require swimming water, although a swim once or twice weekly will not do them any harm.

INCUBATION.

During the period of incubation, which is twenty-eight days, duck eggs require more moisture than do the eggs of hens or turkeys. From the sixth day, after the eggs have cooled and aired, and just before closing the drawer of the incubator, they

should be well sprinkled with tepid water. For duck eggs, the incubator should be run at a slightly lower temperature than for fowls, 102 to 102½ degrees giving the best results. Owing to the transparency of the shell, a duck egg can be tested on the fifth or sixth day. A second test should be made on the thirteenth or fourteenth day, and all doubtful eggs removed from the drawer. An addled duck egg gives off a powerful odour, which is most harmful to the remaining eggs in the incubator. The bad eggs are easily detected, as the transparent shell quickly becomes discoloured.

From the time the egg chips, the duckling takes a long time to get out of the shell. After the egg is chipped, all that requires to be done is to place the egg with the chipped part uppermost. It should then be left for about 30 hours. If not then hatched, a little of the shell may be broken round the large end. If any bleeding occurs, however small, one may be certain that the duckling is not ready to make its way out of the shell and should remain a little longer.

Duck eggs intended for incubation should not be kept longer than ten days. It should be remembered that the fresher the egg the stronger the germ. This applies to all eggs.

REARING AND FEEDING DUCKLINGS.

Young ducks require very little brooding after the first week. A warm box lined with hay or straw will answer the purpose. Care must be taken to allow plenty of ventilation. No food is required for the first 30 hours after hatching. From that time onward food should be supplied little and often. With the first feed, water should be given, and then it should always be before them. A small flat fish tin is the best. Young ducks are easily chilled, especially if their backs get wet.

A small board well sanded should be put down for them, and their soft food, which should be fairly moist, put on it, just sufficient at a time for them to readily clean up. Food should on no account be left lying about. It quickly turns sour, and does a great deal of harm to the young ducks. Boiled rice, oatmeal, pollard, stale bread soaked with milk, and a small quantity of maizemeal mixed makes a grand feed for them. After the first fourteen days a little cooked meat may be added. Chaffed lucerne, lettuce, or raw onion can be added with advantage to the above mixture.

After three weeks, if the ducklings are well grown, a little grain can be given, put in a shallow dish, and covered with water. Fine grit should always be before them in the same way, and fine charcoal, given dry, should always be at hand for them.

Young ducks are very easily knocked over by the hot sun, and, consequently, they must be well shaded, especially during the first month. This is a very important point in rearing ducks. Care must also be taken that they are not allowed out in heavy rains.

If the ducklings are being reared for stock birds, they should be allowed plenty of liberty, and naturally not so much food should be given as to those required for the table.

THE MUSCOVY DUCK.

THE GOLD MINE OF THE POULTRY BUSINESS.

By R. G. T. CAREY, Beerwah.

Originally the Muscovy duck—a wild South American duck—was caught and domesticated, and by careful breeding these ducks have been mated up to a very fine standard of perfection.

Their natural colour was black and white, or blue-black and dirty white, but fanciers have created two distinct colours—white or black. The snowy white variety is, however, much more admired for its beautiful white plumage, scarlet face, and pale orange coloured legs, and these are much more acceptable for market purposes on that account. Their flesh is of fine flavour, and in greater proportion on their breast bones than in any others of the duck family, and when in their prime they often turn the scales at 12-14 lb.

The Muscovies are noiseless, very docile, good layers, and as sitters, hatchers, and mothers are excellent. Incubators cannot equal their results as hatchers. They choose and make their own nest, lay, sit and hatch, and owners have absolutely no worry. Being small eaters, upon a free range they can practically feed themselves. That is another point greatly in their favour. Their food consists of over half greenstuff—grass, weeds, roots, and other herbage. Therefore, two meals per day and free range make them mature quickly. They commence to lay at between 5 and 6 months old, and generally desire to sit after laying from 20 to 30 eggs. Furthermore, Muscovy ducks, from birth onward, are extremely hardy and seldom ail.

The ducklings are of strong constitution from the shell. They agree very well among themselves, therefore a whole flock can be allowed to range together. Wherever Muscovy ducks are kept, they never cause any annoyance to neighbours, are never alarmed or timid, and it is practically impossible to frighten them. As travellers they make the best, sitting in their coops as contentedly as if in their own pen.

The rapidity with which this variety has leaped into favour is marvellous, and being marketable at an early age they command a high value. Hotels, restaurant and boarding-house proprietors favour them because of the high qualities of meat they possess.

They keep far easier than fowls in condition, and are always plump. There is no special season for hatching them, and the ducklings are exceptionally strong at all times, continuing so right merrily along, growing and fattening rapidly on any good food.

Duck farmers starting in a small way have three methods of making a beginning. First, hatching with incubators; second, using Muscovy ducks as hatchers and mothers; third, buying day- or week-old ducklings from some reliable breeder, whose plant is prepared for this purpose. We highly recommend the latter plan as being the most reliable for beginners.

Should Muscovy ducks be used, you will require to purchase a pen of birds, and use their eggs, or buy a setting from some reliable breeder. They are generally dispatched promptly in the season, and should arrive in good condition.

Should you decide to obtain ducklings, you will require a brooder for rearing them up to three weeks old. All young birds must have the correct food to maintain and replace waste tissue, also to enable them to create flesh, bone, feathers, and increase in size.

Always feed at regular times, laying stocks as well as breeders, giving a small mid-day meal in cold weather. Should your birds increase in fat, do not decrease the quantity of food given, but add a greater bulk of greenstuff.

Remove all foods from troughs after twenty minutes to half an hour, so that no sour food remains. If birds are confined in a limited space they are likely to go off their food, consequently the egg yield suffers.

As this class of water fowl is easily kept, reared, and quickly sold, a huge profit is assured for an enthusiast in duck farming. The writer has prepared a beautiful catalogue for everyone who desires to enter into Muscovy raising. The book may be obtained free of charge.

QUEENSLAND CITRUS IN MELBOURNE.

A leading Melbourne fruit merchant directs attention to the packing methods adopted by Queensland citrus growers, and emphasises the advantages of the "rowed in" pack against the Florodora pack. The chief advantage of the former is from the standpoint of selling. Buyers desire to know the number of fruits in the cases, because they rapidly calculate at how much per dozen the fruits will sell retail; and thus, by knowing how many dozen fruits are in the case, they know the margin at which they can operate.

With the "rowed in" pack there is an even appearance; with the Florodora (diagonal) pack each second fruit is not visible from the outside. Buyers in operating ask for the "11 doz.," "13 doz.," or "16 doz.," cases. The "13 doz." case has, on each side of the partition, 80 fruits—two outside rows with 30 fruits (6 x 5), and one centre row with 20 fruits (4 x 5)—or a total of 160 fruits to the case = 13 1-3rd dozen. The "16 dozen" case has 97 fruits on each side of the partition, thus: two outside rows each 6 x 6 = 72; one centre row 5 x 5 = 25; or a total of 194 fruits, or 16 1-6th dozen.

Buyers, on seeing the neat rows and knowing number of fruits in the case and the size of the fruits, purchase without any uncertainty.

Incidentally (though this is quite apart from the present point) it illustrates the advantages of selling all fruits by number instead of by weight—reducing the elements of uncertainty, to the mutual benefit of grower, wholesaler, and retailer. —"Fruit World."

The Orchard.

UTILISATION OF LOW-GRADE ORANGES.

In all orange-growing countries, a considerable quantity of fruit of poor quality, when sent to market, gives such small returns as to entail a loss to the grower. In the United States of America, the Federal Department of Agriculture has opened up a new use for waste fruit other than the making of jellies, marmalade, &c. This is the production of sweet-orange oil. Until recently this product was secured wholly from Italy, Sicily, and other parts of Southern Europe. From the "Journal of the Jamaica Agricultural Society," we learn that since 1911 a considerable industry has grown up in the West Indies, and a portion of the annual requirements in the United States is now supplied from that region. In 1914 more than 222,000 dollars (£44,400) worth of sweet-orange oil was imported. "With the increasing tendency to grade fruit more closely, and to better market conditions, the proportion of culls will doubtless increase rather than decrease," say the Federal investigators. "At present, this low-grade fruit, packed in so-called 'plain wraps,' is sometimes shipped to near-by markets for immediate consumption. The returns are exceedingly small, especially in years when the crop is abundant. At the present time there is, without doubt, enough low-grade fruit available to make possible the extraction of a quantity of orange oil sufficient to supply a considerable portion of the domestic demand.

In order to facilitate their experiments, the Federal workers have perfected a new machine for peeling citrus fruits—one that can be adjusted to handle all sizes from grape-fruit to limes. This machine has been given a public-service patent and dedicated to the public. The investigators found that pressing out the oil, and later, refining it by a simple process, was the method best suited to all conditions involved. The press is inexpensive, and can be made by any mechanic; the still is simple, inexpensive, and can be purchased from many dealers in pharmaceutical and chemical supplies.

Full directions for extracting and refining the oil cannot be given in limited space, but can be obtained by writing to the Federal Department of Agriculture, Office of Drug-Plant and Poisonous-Plant Investigations, Washington, District of Columbia.

After the plant is equipped the cost of producing the oil will depend entirely upon the price paid for waste fruit and the cost of labour. In the experimental work the cost was about 15 cents. for extracting the oil from a standard field box of oranges of approximately 100 lb., and it is believed that on a commercial scale the cost will be no greater for fruit delivered at the factory door.

In commercial experiments with cull fruit obtained at the packing-houses at Orlando, Florida, the average yield of oil per 100 lb. of fruit was about 5 oz. At the average price paid for orange oil during the past ten years the gross returns would be from 47 to 59 cents per field box. The gross return, as determined from actual sales in the markets, of the oil produced in the experimental work was 54 cents per field box.

The cost of extracting the oil from 100 lb. of cull fruit is estimated to be about 15 cents, and the net returns would be from 32 to 44 cents per standard field box, assuming that the fruit is delivered at the factory door.

REJUVENATING OLD FRUIT TREES.

There are numbers of orchards in which the trees have been allowed to run out and become comparatively unproductive. This has usually occurred owing to growers allowing the trees to draw too much on the sap for the development of the top branches. These trees, for the most part, are barren of laterals along the greater length of the leaders, while the top part of the tree resembles the inverted head of a straw broom more than anything else. This dense head has in the course of a few years starved out any laterals that may have been produced. Nevertheless, the great majority of these trees may be brought back by cutting to a state of usefulness in

the course of a season or two. This may be done by putting pressure on the dormant buds along the main arms, and so causing them to break out into new growth. By cutting these branches hard back to points at which considerably smaller branches form perpendicular laterals, the sap flow finds itself jammed back, the lighter growth not being able to accommodate it, with the result that this pressure is placed upon the dormant buds, thus causing them to break and in time form new laterals.

No fruit tree is more amenable to this form of treatment than the peach, and it is surprising how quickly an old tree can be refurnished with a suitable class of fruiting wood by merely cutting back the leaders hard, so as to conduct the sap flow into a new and smaller channel. Trees twenty and thirty years of age have been brought back to productiveness in this manner, but when this is accomplished care must be taken that the faults which rendered this course necessary should not be repeated.

THE ALGAROBA TREE.

We have frequent inquiries from correspondents concerning the value of the Algaroba tree, especially as to the food value of the beans it produces for stock, and several articles have appeared in this Journal on the subject. From a Hawaiian source we take the following interesting article on this valuable tree, entitled

"THE ALGAROBA TREE.

"A TREE AUSTRALIA WANTS.

"Although the algaroba, or keawe, is not a native of Hawaii—it was introduced to the islands by Father Bachelot, a French missioner, in 1828—the Hawaiian territory can claim the credit of having discovered the many extraordinary merits of this remarkable tree and of having turned its cultivation for the first time in history to the uses of man. No one knows precisely from what country the algaroba originally came. Little more, indeed, is known of its early history than that a fine ornamental specimen flourished in the Jardin du Roi de Paris in the first quarter of the nineteenth century; and it was from this very tree that Father Bachelot brought the seed which he planted beside the Catholic Cathedral at Honolulu in 1828. Of all the seeds the French missioner planted only one germinated. It rapidly developed into a fine tree, and within a few years it overtopped the cathedral, and covered all the mission buildings with its grateful shade.

"For some decades not a living soul suspected the great part this tree was destined to play in the industrial development of the Hawaiian Islands; and no attempt was made to investigate its habits or to solve the mystery of its rapid spread until algaroba forests actually threatened to displace the indigenous island growths. It was then noted by a local botanist that cattle had been the active instruments of this astonishing phenomenon. Admitted to the mission grounds, they had eaten the beans lying under the famous cathedral tree and carried the seeds up the barren hillsides of extinct craters, to be deposited in crevasses and on elevated coral beds. In these places the seeds, dropped by the mission cattle, had established thick groves of algaroba, covering the once bare lava hillsides with a thick mantle of evergreen, to act as fresh centres of wider distribution through the agency of new generations of live stock.

"Carrying his researches a little further, the botanist discovered that the seed of the algaroba is surrounded with a hard casing like that of a shark's egg, which prevents the seed from being digested by cattle feeding on the bean, and thus ensures its chance of germination when rejected in the cattle excrement in some favouring locality. The first mystery having been solved, later investigators undertook the task of determining the reason of the emphatic predilection exhibited by all sorts of live stock for the bean. The pod was subjected to chemical analysis and the secret was forthwith laid bare. It was found that the bean contains a lot of sugar and a rich proportion of protein, thus rendering it not merely a palatable, but a highly valuable, fodder for all kinds of farm stock. When this discovery was made known the cultivation of the algaroba was no longer left to the unaided and unconscious efforts of the Hawaiian cattle.

"Many settlers were prompt to plant algaroba forests on their ranches and holdings, and the success they met with started a movement which has ever since proceeded uninterrupedly, until at the present time the Hawaiian Islands afford the spectacle of an almost uniform forest covering. The supreme peculiarity of the algaroba is that it is essentially a desert growth. It flourishes best where the soil is poor, the elevation fairly low, and where the rainfall is scanty. These conditions very frequently prevail in the Hawaiian Islands—hence the remarkable spread and

cultivation of this singular tree, which in the course of a generation has converted most of the bleakest Hawaiian deserts into the most valuable land in the territory. The algaroba, however, would never have attained to its full use as a friend of man without the further aid of science.

"The collection and storage of algaroba beans for cattle food had long been an industry of respectable dimensions, when one day (only a few years ago) it occurred to a local chemist to discover if any food values resided in the seed which cattle ate with the pod, but did not digest, for the reasons already stated. The result of his experiments was a convincing demonstration that the seeds hold far more protein than the pod itself. Inventors at once set to work to construct a macerator that would break the seed within the pod, and it was the good fortune of Mr. C. W. Rennear, of Honolulu, to outstrip his competitors and to produce the ideally requisite machine. The effect of this invention was to revolutionise old methods and to turn a comparatively limited activity into a great national industry.

To cite a single apposite illustration there is the case of Molokai. On this island there is a grove of algaroba trees covering 8,300 acres. Before the algaroba was planted there the land was utterly valueless—a piece of bare and uninhabitable desert. The algaroba grove enabled it to support a thriving herd of cattle. The invention of the Rennear machine caused the cattle to be dispensed with and the former desert to become one of the most valuable bits of land in the world. These 8,300 acres produce annually 166,000 tons of beans, which are gathered at a cost of £1 per ton, and have a net sale value after maceration of almost £4 per ton, showing a bulk profit of approximately £600,000 a year.

"The Hawaiian Islands are already exporting large quantities of macerated algaroba beans to North and South America and Asia; some is coming to Australia; and they were beginning also to develop markets in Europe when the war broke out. The value of the algaroba as a fodder tree may be defined in a few words. It bears abundantly within two or three years from the seed, and it can produce a net revenue of £80 an acre from land that is totally and absolutely unfit for any other sort of crop. Surely Australia needs this tree; and as it can be grown with ease in almost every part of Australia from Cape York to the Leeuwin, and is capable of almost immediately transforming our vast desert spaces into profitable cattle pasturages, it is clear that we should lose no time in getting it and making it our own. We have freely given our eucalyptus to all the world; it is a fair thing to acquire the algaroba in exchange.

"But the algaroba is not only useful as a fodder tree. The Americans do not call it the 'most valuable tree in the world' merely because of its fodder uses, but because there is no other tree known to science which is useful for a greater variety of applied human purposes. The flowers of the algaroba tree furnish the most important source of pure honey known in Hawaii—famous throughout the world as 'the Islands of Flowers.'

"The production of honey is a great and growing industry in the territory. It all comes from the algaroba tree, which flowers twice a year and produces two crops of beans annually. Formerly the bee raisers of Hawaii got their bee-ranging rights over the algaroba groves for nothing, but they now have to pay heavily for the exclusive privilege of placing their apiaries in the various forest groves—thus giving the algaroba planter a brand new source of revenue.

"Algaroba wood constitutes, also, the chief source of fuel in the territory. Its growth is so rapid that planters find it highly profitable to thin out all the larger trees at least once a year for sale as fuel, thus continuously making space for the growth of new generations of trees. The wood burns slowly with a strong and steady glow, and it has a calorific value so high that it can be used in factory furnaces in place of coal or coke. The smaller branches make an excellent charcoal.

"As the algaroba is a legume and has a remarkable soil-penetrating power, it is a soil maker of first rate importance.

"The bark of the algaroba contains a large proportion of tannin, and is finding a large use in the leather industry.

"The gum of the algaroba provides a profitable use in the manufacture of varnish.

"The pods of the algaroba are largely and increasingly used in the manufacture of vinegar and denatured alcohol because of their high sugar content.

"The boles of the algaroba tree make excellent piles for use in all coastal waters, both by reason of their toughness and durability and because they are practically immune from the attack of the Toredo worm.

"Finally, the alagroba has a high artistic value as an ornamental growth and as a shade tree, for its form is extremely graceful and spreading, and its foliage is both delicate and beautiful."

Viticulture.

PRACTICAL HINTS IN ESTABLISHING A VINEYARD.—No. 2.

By P. MAHONEY.

PLANTING.

If the land has been duly prepared, the next important thing to consider is

THE SELECTION OF PLANTS.

If the land is of a heavy nature, rooted plants are the best, but cuttings are better than rooted plants in sandy soil. Plants that have been rooted in heavy soil have a decided advantage over those rooted in sandy or light soil, for they generally have more fibrous roots than the latter, which is most essential to plants which have to be transplanted. Plants rooted in sandy soil have a tendency to produce long roots devoid of many serviceable fibrous roots, simply because they can travel further than when in heavy soils.

In planting rooted vines, they require a systematic pruning, which consists in cutting off all fractured roots and making clean cuts of those intended to remain. It is advisable not to have too many strong roots, for some may die back to the detriment of the plant. Clip the points of the fibrous roots, for they might have been badly broken in uprooting. Secondary and lateral roots should never be allowed to cross one another. The top of the plant to be pruned to two buds and a base bud. In coastal districts it is beneficial to make all cuts through a node, for the reason that cutting through the internode exposes the pith, which through excessive moisture, rain or otherwise, decomposes, to the detriment of the bud below.

Roots should only be allowed to grow from the two bottom-most joints of the plant. In the event of the land being prepared, as previously described, it is not necessary to dig holes for the plant until the planting is taking place. When planting, all roots should be spread out and spaced, not permitting too many to go in the same direction. Care should be exercised in seeing that the points of the roots do not curl up, for it is very important that they should be directed downwards, so as to bring them into early contact with the subsoil, which is far richer than the surface soils.

If any fertiliser is given, it should be dug in deeply, so as to encourage the roots to go down. It is a good plan to sow slow-acting manure in the subsoiled furrow where the plant is to go before the furrow is filled in.

Roots are unlike the top of the plant, in that the top can be renovated or re-established at any time. But the roots have to receive their one and only training during the first year or two. Root training is more important than the training of the top of the plant, for it is through

the former that the plant gets its food, and unless the root system is well established the quantity of foodstuff cannot be supplied to the plant and crop, and the plant will, in consequence, never be very profitable.

In the event of cuttings being planted in preference to rooted plants, great care should be exercised in selecting and making them. They should be off thoroughly matured wood, and be made directly after the vines have been pruned. Never should cuttings be got from prunings that have been subjected to frost, for they very often fail to shoot, the frost having deprived them of a considerable amount of sap.

The cuttings should be about 9 or 10 in. long, and should contain a non-pithy septum at the bottom. That is: The cutting is cut off a rod, leaving a section of it on the cutting, thus not exposing the pithy portion, which prevents decomposition and offers no encouragement to white ants.

Cuttings should be short-jointed and consist of no more than five buds, exclusive of the node, which should be cut through to prevent decomposition.

In planting, two cuttings should be planted at the one place, so as to avoid any likely misses. They should be planted far enough apart so that one can be removed without disturbing the other in the event of both striking. Six inches apart is far enough.

A sharp, narrow spade is the best implement to use. It is more satisfactory than a crowbar, which is widely advocated. With a crowbar, very often the soil fails to come in contact with the bottom of the cutting, for it is difficult to press the soil down heavily enough so as to fill in the hole at the bottom, thus leaving air around the bottom of the cutting, which will certainly fail to send out roots from the bottom buds if those conditions prevail. A heavy rain would probably right things. But it might be some time before rain arrived, consequently the roots from the buds near the surface would be the only source of support, thus making the vine a shallow rooter, which should be avoided by using a spade instead of a bar.

The spade has many advantages over the bar; "it's quicker and surer."

To use the spade, it is only necessary to insert it at the required place, push it forward, then insert the cutting at the back, withdraw the spade, and one press of the foot is enough to consolidate the soil around the cutting. They do just as well when planted straight as they do when on the slant. It is not advisable to have the cutting too far out of the ground, for it exposes it too much to the winds and sun, especially if the cutting is slow in making a start, when it is likely to have a big portion of the sap evaporated through exposure. It is not necessary to have the top bud any higher than half an inch above the soil.

To some, all this may seem unnecessary work and useless expense, but it is to be borne in mind that a well-planted vineyard is good for more than one generation, so that it pays to do the thing thoroughly.

(TO BE CONTINUED.)

Tropical Industries.

ARROWROOT—ITS CULTIVATION AND MANUFACTURE.

BY THE EDITOR.

Although several papers on arrowroot-growing and on the manufacture of the commercial starch have from time to time been published in the earlier issues of the "Queensland Agricultural Journal," yet, as the present-day subscribers are unable to obtain copies of those journals owing to their being out of print, it is deemed advisable to collate all available information on the industry and present it in pamphlet form to intending arrowroot-growers, from many of whom inquiry is being frequently made as to the prospects of the industry in Queensland.

It is now over fifty years since the industry was first established by the late Mr. George Grimes at Oxley Creek, where he erected the first machinery for manufacturing arrowroot on a commercial scale. As soon as this took place, the writer, who had been growing arrowroot in the same district and manufactured it with most primitive appliances, as will be shown later on, entered more largely into the business of cultivating the plant, and abandoned the manufacture in favour of supplying Mr. Grimes's mill with the raw material, to their mutual benefit.

The bulbs were sold at £2 10s. per ton, and on the then virgin scrub soils between Oxley Creek and Rocklea (then known as the Rocky Waterholes), and on the Brisbane River, the yield was enormous. Two varieties were grown at that period—the Bermuda or *Maranta arundinacea;* and the large purple variety, *Canna edulis,* called in the West Indies "Tous-les-mois." These differ materially from each other both in habit of growth and in size, shape, and colour of the bulbs.

The Bermuda plant is diminutive, rarely attaining a greater height than from 3 to 4 ft. The blossom is white, and the tubers, which cluster round the roots, are also white, with a thin shiny skin and bare of rootlets. They adhere to the roots of the plants much in the same manner as potatoes, and are neither very large nor numerous. The starch yielded by the Maranta is of excellent quality, and usually commands a higher price in the English market than that of *Canna edulis.* How little actual difference there is between the products of the two varieties is indicated by the following analysis, taking the best Bermuda arrowroot at 2s. per lb. and the Queensland arrowroot (*Canna edulis*) at 3d. per lb.:—

	Bermuda Arrowroot.	Queensland Arrowroot.
Moisture	13·00 to 16·50	17.36
Starch	82·24	81·52
Ash	·124	·142
Proteids	·052	·078
Fibre	4·09 to 1.20	·90

The result is, therefore, chemically, about the same, particularly in regard to starch, which is the chief constituent. There is a little more moisture in the Canna, and more fibre in the Maranta. Under the microscope, the Canna arrowroot shows a more silky texture, and the grains are slightly coarser.

The reason why Maranta has never become popular in this State is that it does not yield one-quarter the weight of bulbs, nor is the starch content equal to that of Maranta grown elsewhere, besides which the excess of fibre in this variety makes the matter of treatment more difficult.

A remarkable point about the sale of Queensland, or "Australian Arrowroot," as it is called in England, is that it cannot be sold in Great Britain without some qualifying term attached, such as "Queensland" or "Australian arrowroot." How this has come about is rather interesting. When the Drugs and Food Act was passed by the Imperial Parliament, it was specified that "Arrowroot is the product of the plant *Maranta arundinacea.*" That is what Bermuda and Mauritius arrowroots are made from. Manufactured arrowroot from the *Canna edulis* was then practically unknown in Great Britain. I have shown above what little difference there is between the two. It has actually been stated that Queensland arrowroot is an adulterant! Whereas it is generally conceded that, so far from that, it is preferable as a food to the Bermuda product. The purple variety, which is, as said, exclusively cultivated in Queensland, grows to a great height, often rising to 8 ft. or 9 ft. It has very large, broad, ribbed leaves; and as many as 15 to 20 stalks rise from a single stool, each stalk representing a large bulb. In the flowering season the plant sends up a long, straight spike, from the head of which bursts a beautiful bunch of bright scarlet flowers, having the appearance of those of the common Canna known as "Indian Shot," but far larger. The seeds do not often mature, however, as do those of the Canna family generally. The bulbs from which the arrowroot of commerce is prepared form a compact mass on and near the surface of the soil, and so prolific is the plant that I have dug from a single stool as much as 60 lb. and even 80 lb. weight of bulbs.

METHOD OF CULTIVATION—SOIL AND CLIMATE.

It does not follow that because there are, at present, only one or two principal centres of arrowroot manufacture in Queensland, therefore the plant will thrive only in these localities, which are mainly located on the South Coast line, at Pimpama, Coomera, and Ormeau. On the contrary, it grows luxuriantly on all the coast lands—from the Tweed River in the far South to Cooktown in the far North. As to soil, it prefers the rich alluvial scrub lands on river and creek banks, but does very well also on the deep black soils of open country. This refers to the purple variety. The Bermuda plant prefers a more sandy loamy soil, deep, with no clay subsoil. The writer grew both varieties at Oxley on the newly-cleared scrub land bordering that creek, and found that the Maranta (Bermuda) did not thrive well on the rich soil, many plants producing only two or three tubers, 6 or 7 in. long and about 1 in. in diameter. The Purple Canna, on the contrary, grew most luxuriantly, and produced an

enormous quantity of bulbs, which found a ready sale at Mr. Grimes's mill, then located on the Brisbane River.

The climate and rainfall in the districts named were exactly suited to the well-being of the plants, and it is worthy of note that no insect or fungoid pests were ever observable either on leaf, stem, or bulbs. It follows that a deep, rich, well-drained soil and a moderate rainfall are all that is needed to ensure a good crop.

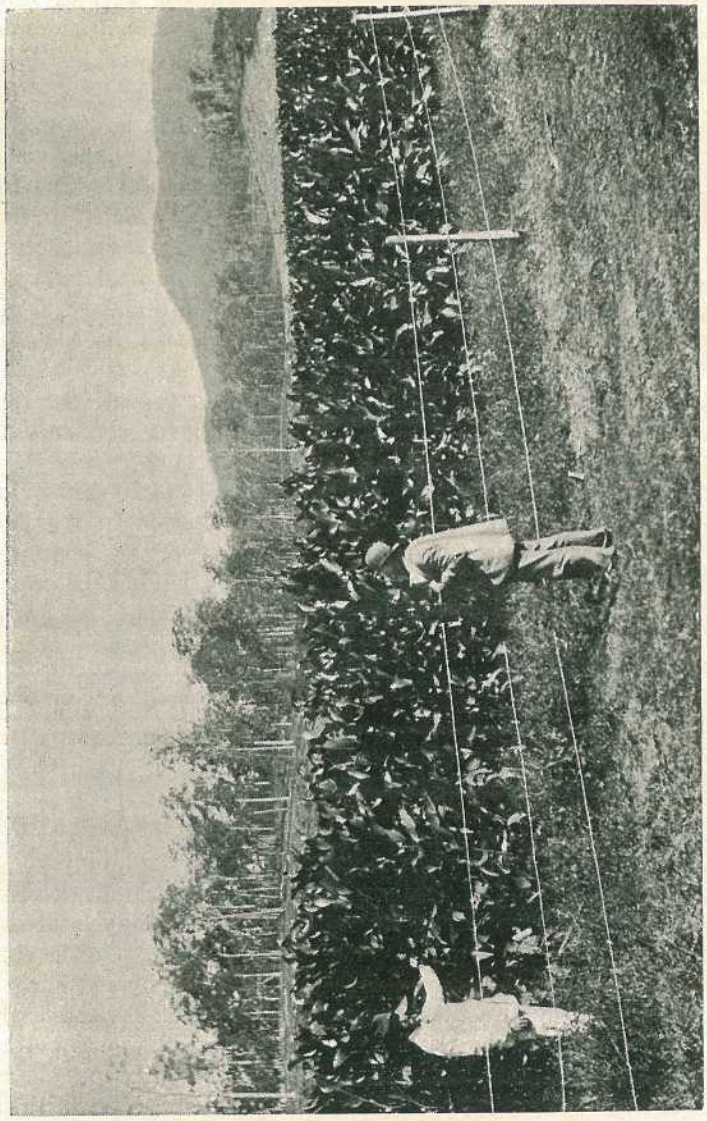


PLATE 6.—FIELD OF ARROWROOT AT PIMPAMA, SIX MONTHS OLD.

The accompanying illustration (Plate 6) represents a well-grown field on the Pimpama River (32 miles from Brisbane), on the property lately belonging to Messrs. Lahey Bros., who had a very extensive manufacturing plant, where cornflour was also prepared.

CULTIVATION.

A visit to some of the arrowroot farms serves to show that there is a similarity among them all, both in preparation of the land, planting, after cultivation, and harvesting.

Where planting takes place in newly burnt-off scrub land, the innumerable stumps, of course, occupy so much of the surface as to preclude any ploughing. It then becomes necessary to dig holes with a sharp mattock or hoe which will cut the roots of the felled trees with which the ground is matted. The rows should be about 6 ft. apart with 4 ft. 6 in. between the holes; but, owing to the presence of stumps, very little regularity can be observed, and the planter must do the best he can as to distances between plants. On open cleared land, where the plough can be used, the proper distances can be observed. The land, in the latter case, should be thoroughly well ploughed, harrowed, and pulverised. Then shallow drills are drawn with the plough about 6 in. deep, and at the regulation distance of 4 ft. 6 in. apart single small bulbs are dropped and covered by turning a furrow over them on each side. On very rich new land, the best results have been obtained by placing the rows 8 ft. apart. As the land becomes poorer, the rows may be closer together, but should not be of a less width than 6 ft. I saw a field lately at Pimpama, on what was once my old sugar plantation (Ormeau), in which the rows were 6 ft. apart, yet in the month of April the plants had spread to such an extent that it was difficult to walk between them.

When the plants are above ground, they must be kept clean as in the case of other crops, and by the time they are about 3 ft. high they will want little further cultivation beyond throwing up a furrow against the roots—hilling up, in fact, as with potatoes. From this time forward, the heavy foliage will soon have covered the ground, thus effectually preventing the growth of weeds.

The planting season extends from August, after the last frosts, to the end of November and even up to January in some late localities. When full grown, a field of Canna presents a very pretty sight, the broad leaves of dark-green giving a fine impression of richness and contrasting vividly with the numerous scarlet blossoms to be seen on the plants. From six to eight months—the latter term as a rule—bring the crop to maturity, and a little frost is then beneficial by shrivelling up the tops and concentrating the starch in the bulbs. Supposing the crop ready to harvest in July or in the beginning of August, when one or two frosts have touched the plants, the manufacture should be at once begun, and carried on until the end of October. If the work is protracted into the spring months, the bulbs begin to shoot, and the yield of starch is consequently lessened in quantity and deficient in quality.

HARVESTING.

When the bulbs have come to maturity—that is, in from eight to nine months after planting—and when the plants have, as stated above, had a touch of frost, then is the time to commence the harvest. Mr. D. Lahey, in a paper entitled "When to Harvest Arrowroot," said:—

"A good test for ascertaining when arrowroot is ready for digging is the following:—Observe the outer leaf of the bulb. A triangular slit will

be noticed pointing downwards. If the slit appears white, the bulb is still immature, but as soon as it turns purple the crop may be harvested. Arrowroot may be left to stand over for two seasons, as in the case of sugar-cane."

The latter statement is important, for it has happened in some cases that, when the crop was larger than the available mill power was capable of dealing with, the growers turned their cattle into the field. Had the crop been held over, it might have been possible to get it in during the next season, and thus avoid a great deal of extra labour.

When harvesting, the stalks are first cut down with a hoe, cane knife, or reaping hook. The stool is then dug up with a strong mattock or a stout-eyed No. 3 grubbing hoe. A spade or fork is quite useless for the work, as the stool has a strong hold of the ground, in addition to which the bulbs of *Canna edulis* cling firmly together by the masses of rootlets proceeding from each bulb. When free from the soil, the bulbs must be separated, and all earth adhering to them knocked off. As soon as dug, they must be carted to the mill; therefore, it is well not to take up more than can be operated on each day. Every day's exposure to the weather or to the hot sun has an injurious effect upon the colour of the manufactured starch.

The average return of a good crop is about 30 cwt. of starch, or five to six times the quantity in tons of bulbs. From 12 to 20 tons per acre have been dug from a field in which the plants were set at distances of 5 ft. between the plants in rows 6 ft. apart. It goes without saying that the yield will vary according to soil, locality, season, good or bad cultivation, and proper washing, grinding, and drying appliances; but, as a general rule, the yield of starch may be set down at from 15 cwt. to 30 cwt. per acre, although, under most exceptional circumstances, it is recorded that as much as 4 tons of finished arrowroot per acre have been obtained. I cannot, however, vouch for this statement.

MACHINERY AND MANUFACTURE.

The machinery employed in the manufacture of arrowroot in the very early days of agriculture in Queensland was as primitive as that used by the ancient Britons for pounding grain or by the Australian natives for crushing the seeds of nardoo. The first growers made use of a grater made by punching holes with a nail in a piece of kerosene tin. Gradually, improvement crept in, until a hand machine was constructed by the writer which much accelerated the work, but was still only a makeshift.

Since that time modern machinery has been introduced capable of turning out from 10 cwt. to 30 cwt. of commercial arrowroot per day. Such a plant may be thus described:—

Motive power, a 6 to 10 h.p. engine, root washers, carriers, grinding mills, cylinders, elevators, rotary sieves, shaker sieves (two), chute, patent circuitous trough (for which Mr. Lahey holds a patent), agitators and sieves, centrifugals for draining, tables, and calico for drying.

The whole of the work, after the tubers have been raised to the highest point of the building, is effected by gravitation. The tubers (or roots as they are erroneously called), as they come from the field, are tipped from the drays on to the carrier, whence they are automatically carried to the tuber-washing trough. Running through the centre of this is a spindle with diagonally inserted pegs of sufficient length to clear the bottom and sides of the trough by about 1 in. Here the bulbs are thoroughly cleaned of all dirt, stones, &c., and they are then passed on to the grater, which is a large, wooden cylinder covered with perforated iron, burred, on to which the bulbs drop from a hopper. A stream of water pours upon this continuously from above, and the pulp and starch held in suspension pass on to a shaking sieve. From this the farina and water pass to a second sieve, the pulp being ejected on the other side of the first sieve. On leaving this sieve, which is perforated with very fine holes, the water and farina are shot into a large trough, where the latter soon settles at the bottom.

When a sufficient quantity for the day's work has passed into the trough, the farina is allowed to settle firmly, and the water is gradually drawn off through a series of taps till the farina is left in a solid mass at the bottom.

Now, it will be seen that the surface of this mass is covered with a dirty slime. This is washed off and is put aside for pig food, as a certain amount of farina is removed with it during the washing. Water is then again admitted, the farina is stirred up with it, and it then passes through a fine silk sieve into the next trough, leaving the first one clear for the following day's work. After further skimming and washing, the now almost clean product passes into the circular trough which runs right round the building. In this there is an agitator, something like the paddle-wheel of a steamer, which revolves and thoroughly stirs up the whole mass.

When the agitation has proceeded for some time, the farina is once more allowed to settle, and a final superficial washing of the mass takes place.

This process does away with all hand-washing—in fact, from the time when the bulbs are emptied from the drays on to the carrier, they are not handled in any way, except to cut off any stalks which may not have been cut off close enough in the field.

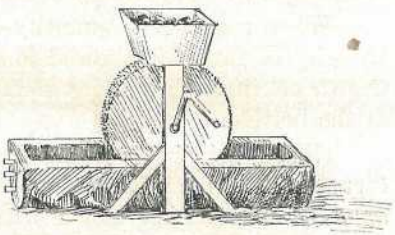
The farina is finally dug from the circular trough, and is passed through a centrifugal machine to extract all possible moisture. It is then taken to the drying ground, where it is exposed to the sun on frames covered with calico. Should a shower of rain fall upon it whilst it is drying, the rainwater has the singular effect of turning the farina brown, when it has to be rewashed. Hence the weather must be carefully watched during the drying process. After being thoroughly dried, the farina, which is now brilliantly white, is bagged and put up in various forms for export.

Most mills are constructed on the same plan, and the process is practically the same in all.

It may be interesting here to show how the earliest arrowroot-growers manufactured the farina.

The bulbs were well washed, and all roots pared off. Then they were grated by hand on a grater made of part of a kerosene tin punched full of holes, whose ragged edges served to reduce the bulbs to pulp. This was done over a tub of water. Two or three other tubs covered with calico were provided, and the pulp and farina were separated by working the hand round and round on the calico, water being poured over the mass. The pulp, having been thus separated, was sent to the pigs, and the farina at the bottom of the first tub was well stirred and the water poured off, when the farina passed to the next tub, and so on for three or four washings, when the clean farina was dried on calico frames. This process was necessarily a very slow one, but, as arrowroot was then worth 1s. per lb., it was very remunerative.

The writer improved upon this by constructing the primitive machine here depicted.



PRIMITIVE HOME-MADE ARROWROOT-MILL.

A log about 2 ft. in diameter and 8 ft. long was hollowed out by axe and adze to form a trough. At the head of this trough was fixed a framework much like the wooden stand of a grindstone. A large wheel was then cut from a sound log 3 ft. in diameter and 1 ft. wide. Tin plates, turned into graters (which required frequent renewal) by punching holes in them with a nail, were next nailed on to the edge of the wheel, to which a wooden axle and handle were fitted. The wheel, when placed in position, turned in the water with which the trough was filled. Above the wheel was a wooden hopper from which the bulbs dropped on to the wheel. This wheel was easily turned by one man, and the grated bulbs dropped into the water in the shape of pulp and farina. The latter gradually settled at the bottom, and the pulp was removed by a narrow-tined fork and by hand. After a short interval to allow the farina to settle down firmly, pegs were withdrawn from the lower end of the trough and the water drawn off. The farina was then dug out of the bottom of the trough, and was passed through calico stretched over a tub. By hand-stirring and at the same time pouring on clean water, the whole of the farina passed through the calico into the tub, leaving the gross impurities behind. This operation was repeated three or four times until the arrowroot was perfectly white and free from any foreign substance.

After the last washing, it was placed on shallow trays or calico frames and dried in the sun. The arrowroot at that time (1863) was readily sold locally at 1s. per lb., and a small quantity sent to London brought 1s. 6d. per lb.

Such a machine to-day would only prove a source of loss to the grower.

With the present up-to-date arrowroot-mills, the whole process—from the digging of the bulbs to the drying of the prepared farina—occupies about twenty-four hours.

It will easily be understood, from what I have written about the process of manufacture, that it is of little use trying to manufacture arrowroot unless there is a plentiful supply of good clean water.

One of the principal growers and manufacturers at Yatala, near Beenleigh, estimated that, when working his mill three days a week and producing about half a ton of arrowroot a day, 24,000 gallons of water were used every eight hours. The refuse fibre and pulp are carted back to the fields and utilised as manure.

Another grower stated that arrowroot gave a monetary return about equal to that from maize and potatoes; but it was a surer crop. It would stand flooding that would kill potatoes, and dry weather would not affect it so adversely as it would corn. Both these troubles I have experienced, and can quite bear out his statement.

YIELD AND VALUE OF CROP.

The yield of commercial farina may be set down at from 1 to even 2 tons per acre, and the price ranges from £16 to £20 per ton. Late market reports give the price in London at from 7d. to 8d.* per lb.; Bermuda being quoted in October, 1911, at 1s. 7d. per lb.

A considerable item of expense in the manufacture is the cost of firewood, seeing that it takes a cord of wood for each ton of tubers. The tubers contain from 20 to 30 per cent. of starch or 400 to 600 lb. of starch per ton of tubers.

COST OF MACHINERY FOR ARROWROOT AND CORNFLOUR.

Such a mill as I have described would cost, according to capacity, from £500 to £1,200, exclusive of about £200 for the necessary drying and storage sheds. Where cornflour is made, the cost of a mill may run to over £4,000, owing to additional and more complicated machinery for producing this product, although the process is much akin to the manufacture of arrowroot. Briefly, the corn (maize) is first steeped in hot water, and is then ground between large millstones, after which it passes through sieves into huge vats, when it settles, and the gluten remains on the surface. This gluten cannot be washed off without the aid of chemicals.

In the principal arrowroot-growing districts abovementioned there were, in 1916-17, 324 acres planted, mostly in small areas. According to the Government Statistician's annual report published in 1917, the yield of bulbs amounted to 3,506 tons—an average of 10·82 tons per acre—from 3,203 tons of which were produced 663,779 lb. of commercial arrowroot.

* Prices here quoted are probably higher since 1912.

SUGAR PROSPECTS IN THE NORTH.

The General Superintendent of the Bureau of Sugar Experiment Stations has received a report from Mr. A. P. Gibson, the Field Assistant, in which he states that during the month of May he visited the Mossman, Inkerman, Ayr, and Haughton River sugar lands.

At Mossman, Mr. Gibson states, cultivation is improving, but there is still room for an advance in this matter. He is of the opinion that liming and green manuring, combined with subsoiling, is essential. At the time of his visit planting was going on to some extent, the favoured varieties being HQ426, New Guinea 24B, D1135, and New Guinea 15. Subsequent cultivation was not good in many places, the resultant crop becoming entangled by weeds, necessitating burning previous to cutting. The rats have not done so much damage recently, being kept in check by poisoning—cocoanuts being split and dusted with arsenic and distributed about the infested areas. A good deal of the D1135 cane was arrowing. It was expected that 63,000 tons should be treated this season and abundance of labour is at hand for all requirements. Several Mowbray seedlings were inspected, and appeared promising. If the analytical tests are satisfactory, it is expected they will be sent to the Sugar Experiment Station.

At the Lower Burdekin good rains were experienced in the early part of the year, which caused considerable damage. Since then, however, the rainfall has been scanty. The heavy wet at the beginning of the year cut the crushing short and left unharvested about 200,000 tons.

The Inkerman district, which a few years ago was given up to pasturage, now possesses one of the largest and most modern sugar factories in Australia, and is surrounded by something like 176,000 tons of beautiful emerald green canefields. The crop is more than sufficient to keep this mill working full time during the season. It is anticipated that the whole tonnage for the Lower Burdekin district will be 580,000 tons, but it is considered that only about 384,000 tons of this can be crushed. This will, therefore, leave another standover crop of 196,000 tons. If the whole crop could be treated, it would have resulted in something like 72,000 tons of sugar, which would be the biggest yield of any one district in Queensland. Unfortunately, the estimated tonnage is being lessened by crop deterioration.

The Home Hill Government Irrigation Scheme is far from being completed, as great difficulty has been met in securing necessary requirements. The survey lines have been cleared in readiness for the poles which are to carry the electric cables. The making of concrete well-cases is to be commenced very soon, and it is anticipated that the township of Home Hill will be lit up by electricity by the end of the present year.

At Haughton River the growers have an estimated crop of 46,000 tons, 18,000 of which is standover. The growers are working for a sugar factory of their own, and are at the present time negotiating with the owners of Invicta Mill, near Bundaberg, for its purchase. Very fertile land and crops can be seen on the river lands, but Mr. Gibson thinks that this land could be improved and the yield increased, firstly by drainage, and secondly by the application of irrigation, which would have to be obtained from the many magnificent deep lagoons found hereabouts. Insufficient milling power is a drawback to this district at the present time.

KILLING WEEDS IN CANEFIELDS.

An interesting method of killing weeds in sugar-cane fields in Hawaii consists in spreading over the fields, after the dormant canes have been manured, strips of tarred or asphalted felt paper (weighing 9 lb. to the 100 square feet). The pointed shoots of the young cane grow through the paper, which is weighted with stones, and the softer-tipped weeds, failing to penetrate it, are smothered. A similar practice has been employed in England in making lawns. The seed is sown on a treated perishable fabric.

Botany.

ON A PECULAR SUBTERRANEAN FRUITING HABIT OF VIGNA LANCEOLATA, R. BR., WITH DESCRIPTION OF A NEW VARIETY.

BY C. T. WHITE, Government Botanist.

Some years ago Mr. R. E. Soutter, Manager of the State Farm, Bungeworgorai, near Roma, sent to the late F. M. Bailey specimens of a native vetch showing a remarkable subterranean fruiting habit. The specimens were placed away in the herbarium with a query as to the identification; and at the end of last season Mr. Soutter again forwarded specimens to the Department. These enable me to determine it as *Vigna lanceolata.*

Mr. Soutter sends two forms of the plant—one with the typical narrow leaves of *V. lanceolata,* and the other with much broader leaves approaching in this respect to *V. luteola;* this latter I have named *var. latifolia.**

In answer to inquiries, Mr. Soutter informs us that both forms are indigenous in his locality, and that they both produce seed above and below ground. He says:—"They produce seed above ground in a manner similar to cow-peas, only, of course, the seeds and pods are much smaller; the seeds themselves are dark (mottled), and the flowers yellow." He further states that the plants are greatly relished by stock, and are valuable native fodders.

From a botanical point of view, the observation of bimorphic fructification in *Vigna lanceolata* is particularly interesting, as showing a connecting link between the genera *Vigna* and *Voandzeia.*

In *Arachis hypogaea* (the common Pea Nut or Earth Nut) the flowers are produced above ground in the usual manner, but the pods ripen under the surface of the soil, the pedicels lengthening out after the withering of the flower and development of the ovary, and then turning down and entering the earth.

---

* *Vigna lanceolata var. latifolia,* C. T. White; varietas nova foliolis rhombeo-ovatis ad 3 cm. latis.

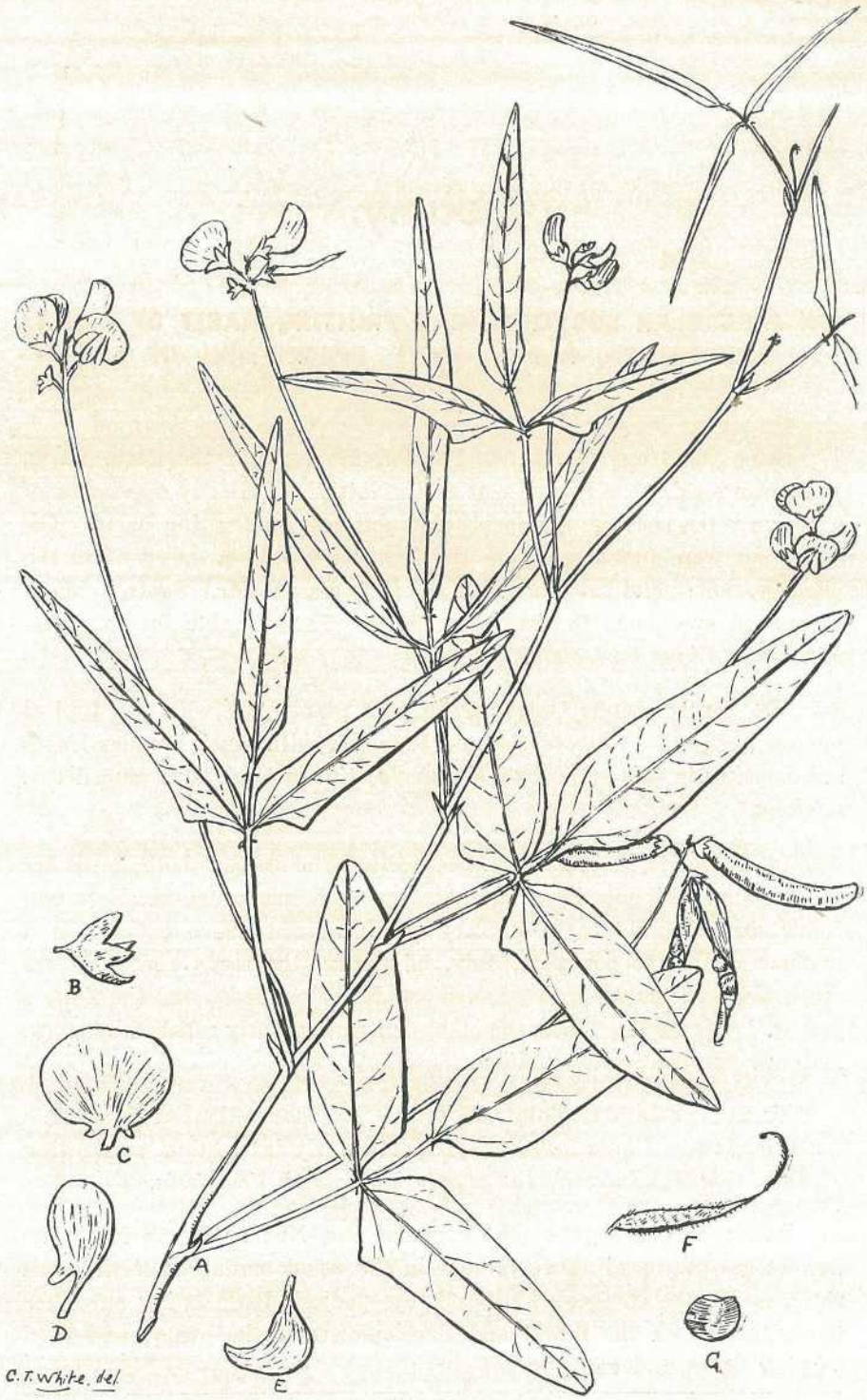


PLATE 7.—VIGNA LANCEOLATA.

A. Flowering shoot (natural size).
B. Calyx.
C. Standard.
D. Wing petal.
E. Keel petal.
F. Pistil.
G. Seed.
(B and G enlarged.)

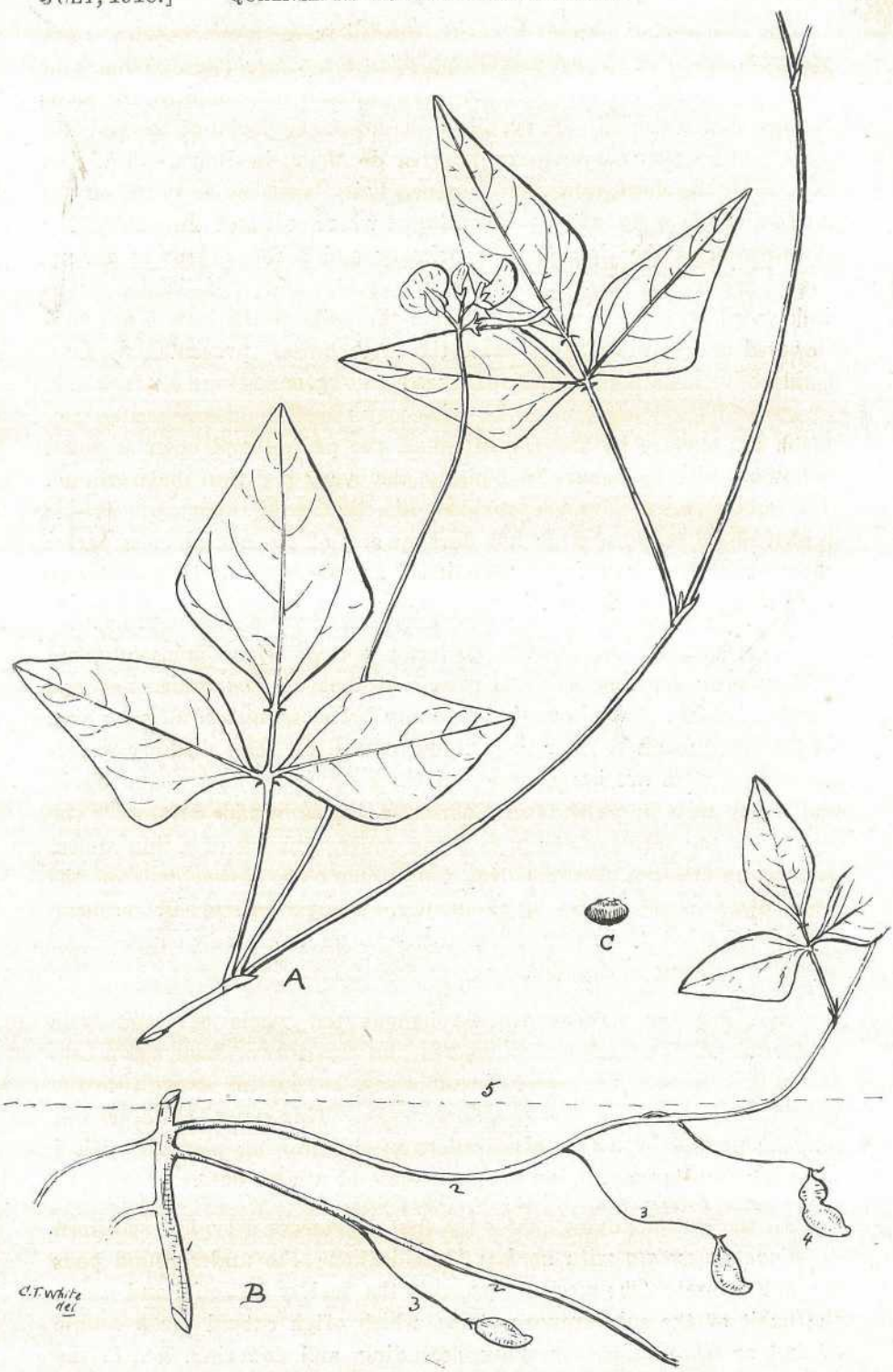


PLATE 8.—VIGNA LANCEOLATA, *var.* LATIFOLIA.

A. Flowering shoot.
B. Underground shoots.—1, Main stem; 2, Secondary subterranean stems; 3, Pedicels; 4, Pods 5, Ground-line.
C. Seed. (All natural size.)

The following account by I. H. Burkill in the Kew Bulletin, 1906, page 70, describes the habit of *Voandzeia subterranea* (the Bambarra or African Ground Nut) :—"As the name 'ground nut' implies, the seeds mature under ground. To facilitate the necessary burial of the pod, for none mature that cannot bury [Correa de Mello, in Journ. Linn. Soc. XI., 254], the short, somewhat flattened hairy branches lie prone on the surface of the earth, often penetrating it where soft and always dipping downwards at the tip. On the primary and a few of the secondary branches are a few leaves—large, erect, and trifoliolate. The inflorescences, either terminal or from the axils of the leaves, are two-flowered and invariably penetrate the earth unless prevented by some solid body. The flowers thus produced underground—one on each side of a wart-like termination to the axis—may remain subterranean or may reach the surface by the elongation of the pedicel and open as small yellow pea-like blossoms. In fruiting, the ovary is drawn underground. The subterranean flowers—provided, like the aerial, with pedicels—lie folded on to these, and do not develop any of the conspicuous parts; their petals are absent, and so reduced are the stamens that observers have thought them female."

From what I can see by specimens sent of *Vigna lanceolata*, the subterranean fruiting habit is somewhat that of *Voandzeia*—not like that of *Arachis*. Certain of the secondary branches, instead of ascending in the usual manner, enter the soil and extend for some distance underground; flowers are borne here and there on fairly long peduncles in the usual way in axils where normally leaves would develop. The texture of the valves of the pods borne underground is of a thin almost papery nature, not like the firm, tough character of the pods on the same plant borne in the usual manner. Many of these subterranean branches, after travelling some distance underground, emerge and ascend in the usual fashion.

Whether the flowers are throughout the whole of their cycle subterranean, or whether they emerge and are drawn down again into the soil as the ovary develops, I cannot say, but incline strongly to the opinion that they are always subterranean. This point, however, can only be proved by actual observation on the growing plants, which I hope Mr. Soutter will do and communicate at a later date.

In the accompanying plates the first represents a typical specimen of *Vigna lanceolata* with normal fructification; the underground pods are not figured. The second represents the variety *latifolia*, and shows the habit of the subterranean stems, which often extend for a couple of feet or more before emerging, ascending, and flowering, &c., in the normal manner.

Entomology.

CANE GRUB INVESTIGATIONS.

The General Superintendent of the Bureau of Sugar Experiment Stations has received the following report upon Cane Grub Investigations from the Entomologists, Messrs. J. F. Illingworth and E. Jarvis:—

Attention must again be called to the value of cultural methods as a factor in the control of cane grubs; at the same time correcting some of the statements that appeared, inadvertently, in reporting last month. As was then stated it is still rather early to draw definite conclusions, but the splendid appearance of certain fields, both at Meringa and at Greenhills, is encouraging.

Late planting (October) appears to be of considerable importance for infested areas. If cane is regularly cultivated, the soil is actively worked during the flight and oviposition of the beetles; and from present observations this constant stirring of the soil either deters the beetles from laying their eggs, or if they are laid, breaks up the egg-chambers, which are only a few inches below the surface, and prevents the hatching of the young grubs. At any rate, cane planted in October, this season, is in very good condition in both of the above regions; even though the fields are situated right in the midst of the infested areas, with grub-destroyed cane immediately adjoining.

By cutting these fields late, say, next November or December, it may be possible to ratoon them so as to again avoid an attack of the beetles, for the ploughing and cultivation will coincide with their period of oviposition. We are led to this conclusion from observations at Greenhills, where certain fields, which were cut during last December, situated right in the midst of the infested area, have been successfully ratooned with little apparent injury from the grubs.

We had experiments planned for planting areas at Greenhills both in November and December, this last season, but a rush of cutting and other work made it impossible to get in these experimental plots. Now, however, since the October planting looks so well, we are doubly anxious to see the results of experiments in later planting on soils which will permit working during the rainy season. We shall be very grateful for information from growers who have had any experience with late planting as a means of grub-control.

Though our experiments in summer fallowing were not as complete a success as we could have wished, in either of the districts noted above, due to the rapid development of certain grasses upon the ploughed ground, there was certainly a very decided decrease in the number of grubs turned up by the plough in these plots, as compared with areas that had not been fallowed. Undoubtedly, if the infested fields could

be well worked and kept clean during December, or through the period of oviposition of the beetles, very few eggs would be laid in them, and most of the resulting grubs would be destroyed by subsequent ploughing, preparatory to early planting. Right along this line, we recently had an excellent letter from a grower, who claims that after suffering from the ravages of the grubs for twenty-five years he has at last succeeded in raising a clean crop by having his ground well worked by December, preparatory to early planting. He states that he does not try to ratoon on this infested land, for ratooning multiplies the pest; and that all stand-over cane in the district should be destroyed. We certainly would emphasize the ploughing out of all stand-over cane, for it acts as a breeding ground for all sorts of cane pests.

The facts that allied bettles in America will not deposit their eggs in fields covered with clover led us to experiment with Mauritius beans as a cover crop here. We have not, however, found that this cover offers a complete protection, for upon ploughing the beans under during January a good many grubs turned up. The abundant humus-forming material supplied by the green-crop will, however, undoubtedly supply these grubs, so that they will not do serious harm to the cane which has been recently planted on the land. A possible explanation for the ovipositing of the beetles in these plots is that there was a rather abundant scattering of Natal grass present, and this may have attracted the insects.

LEPIDIOTA FRENCHI IN VIRGIN SOIL.

It is interesting to note the habit of this species in favouring uncultivated areas for ovipositing. One can dig almost anywhere in blady-grass, at this season, and find the grubs. Those of the present year are now in the second stage, and rather small, while last year's grubs are in the third or final stage, and are forming resting cells in which they pupate, preparatory to emergence as beetles next December. The third stage grubs have practically finished their feeding now; but those of the second stage will continue for another year yet, so it is unsafe to use grass-land immediately for cane if the small grubs are found very abundant when ploughing.

NOTES ON LEPIDIOTA ROTHEI.

In a recent report (January) mention was made of the occurence at Meringa of the small cockchafer *Lepidiota rothei,* Blackburn, in considerable numbers during December and part of January. Although of minor importance as a cane pest it was thought desirable at the time to breed *Rothei* from the egg, in order to determine the duration of its life cycle. This insect emerges about the same time as *frenchi,* from which, however, it differs in being decidedly smaller and of darker colouration. The following brief allusion to the earlier stages of its life cycle may be of interest:—

The eggs are laid from seven to twelve days after copulation, the numbers obtained from individual females confined in cages varying

from four to twelve. Like those of *frenchi*—which they resemble in general appearance—these eggs, although placed close together, are not massed in a single large chamber, but deposited separately, each egg being isolated in a tiny cavity. An interval of from nine to eleven days elapses between the acts of oviposition and emergence of the young grubs; while the first larval stage occupies a period of about ten weeks. This, however, may vary considerably, as in some instances grubs remained four months or longer in the first stage, and in one cage, for example, we found first, second and third stage larvæ derived from eggs hatched together and living under precisely similar conditions in respect to temperature, moisture, and food supply. The interval from second to third instars is about six weeks; and third stage larvæ were obtained from our breeding cages by 28th April.

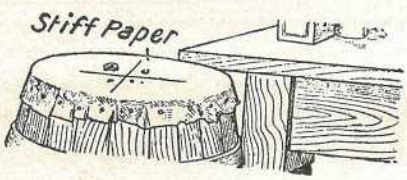
NOTES ON LEPIDIOTA ALBOHIRTA.

Investigations conducted at Meringa on volcanic land suffering from severe grub attack revealed the fact that 10 per cent. of the grubs after having eaten every root were actively devouring the last few inches of stalk still attached to the old sets, the remnants of cane that had been previously bitten off level with the ground. These pieces of stalk were hollowed out and reduced to shell-like fragments, even the hard outside rind being eaten; which would seem to indicate that instead of travelling in search of fresh succulent cane roots the grubs are content to continue feeding on such vegetable tissue as may be readily available even though less palatable.

The remaining 90 per cent. of larvæ unearthed on this occasion had formed cells in the hard soil preparatory to pupating; 70 per cent. of these being found at depths varying from 11 to 18 inches.

SELF-SETTING RAT TRAP.

The "S. A. Farmers' Advocate" says that a suburbanite successfully trapped a bunch of rats by stretching a piece of stout elastic paper on the top of an open barrel. Spreading food on this paper, he allowed



it to remain until the suspicions of the rats were allayed; then he cut two right-angled slashes in the paper with a razor. Next morning he found seven of the pests in the barrel.

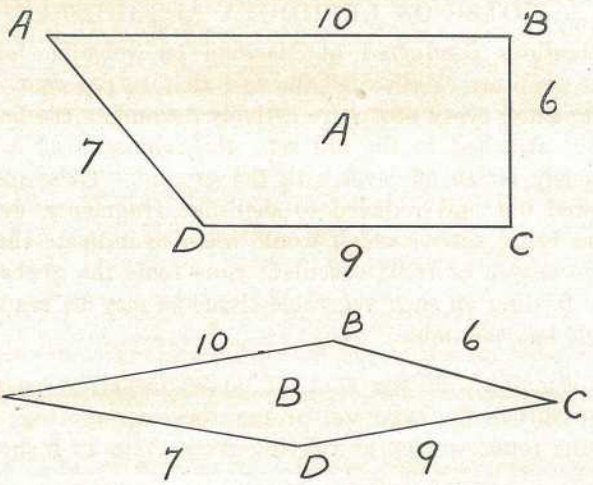
General Notes.

MEASURING LAND WITHOUT THE AID OF INSTRUMENTS.

We have received from two valued correspondents professional criticism of the instructions given in the May issue of the Journal for measuring land without the aid of instruments. Space will not admit of the publication of both explanations, showing where the original formula is faulty, in this issue of the Journal. One of our correspondents writes:—

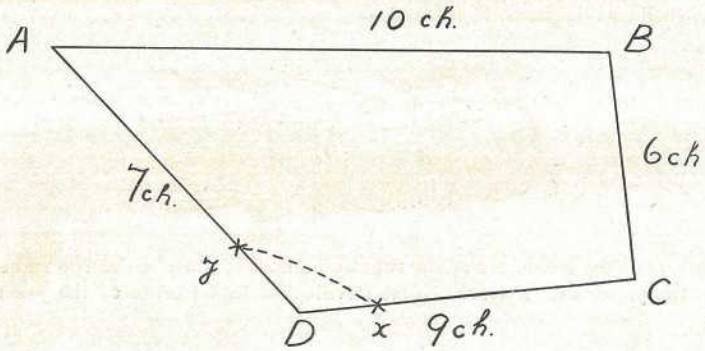
"In the notes on this subject, published in the May issue of the Journal, the writer completely lost sight of the fact that the measurements of the four sides of an area cannot accurately define the shape of that area, and consequently no formula involving the use of the four sides alone can be used to compute the area. Additional data is absolutely necessary.

"This may be seen from the following diagrams of a figure whose sides are 10, 6, 9, and 7 chains long, respectively. It will be noted that in this case 10 + 6 = 9 + 7. These figures are used designedly to illustrate the absurdity of the method referred to above:—



"It is obvious, on inspection, that the area of figure A (as near a rectangle as possible) is much greater than that of B, and the nearer the angles B and D approach one another the smaller the area enclosed becomes, until with the sides mentioned B and D can meet, and the whole forms one straight line.

"It is necessary, therefore, that (1) a diagonal be measured from either A to C or B to D (preferably both, the one to act as a check upon the other in the final calculation), or (2) one or more angles be measured. As we are still assuming that no instruments are available, other than the chain, the following method of measuring the angles may be adopted:—



"To measure the angle, say, at D, chain a convenient distance (½ chain or 1 chain) along D C to x, and the same distance along D A to, say, y, then chain x y, say, 170 links. This will enable the angle at D to be plotted on paper, but although one angle in a four-sided figure is sufficient, another should be measured to act as a check on the first.

"Such a method of measuring the angles is sometimes necessary when, owing to the presence of a crop, standing timber, or other obstruction, it is impossible to chain the diagonals.

"In cases where a fair amount of accuracy is necessary and the diagonal has been measured, the area of each triangle into which the field has been divided can be calculated (without plotting) by using the formula

$$\text{Area} = \sqrt{s\ (s-a)\ (s-b)\ (s-c)}$$

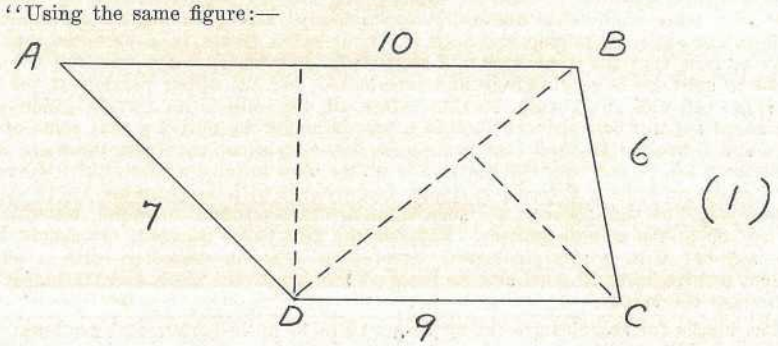
in which s = half the sum of the sides and a b c the respective sides.

"Taking a very simple case, which does not involve fractions, a triangle has sides of 26, 24, and 10 chains, respectively; s then becomes $\frac{1}{2}\ (26+24+10) = 30$. Using the figures instead of letters, we have

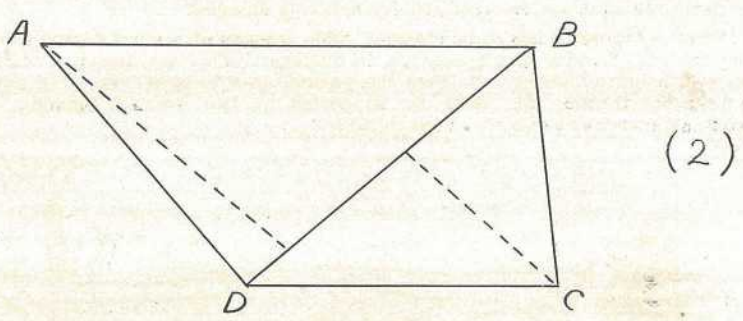
$$\begin{aligned}\text{Area} &= \sqrt{30\ (30-26)\ (30-24)\ (30-10)} \\ &= \sqrt{30 \times 4 \times 6 \times 20} \\ &= \sqrt{14400} \\ &= 120 \text{ sq. ch. or } 12 \text{ acres.}\end{aligned}$$

In cases where only an approximation of the area is required, the easiest way is to plot the figure to a known scale, drop perpendiculars to a convenient side of each triangle and calculate the area of each by multiplying the base by half the height.

"Using the same figure:—



or



Using as a base a measured line as A B in (1) will reduce the margin of error because the measured line is more likely to be accurate than a scaled line.

"There is no doubt that a better knowledge of the areas of the various paddocks and crops will enable the farmer to more correctly gauge the actual yields, and thus conduce to an increased efficiency in agricultural practice."

Answers to Correspondents.

SPLITTING SHINGLES.

SELECTING A TREE.

In reply to a correspondent asking for instruction in splitting shingles, method of placing them on a roof, &c., a splitter of the olden time writes:—

Shingles, in the days when most houses both in towns and in the country were universally roofed with them, were of Moreton Bay pine and some of the hardwoods. Of the latter ironbark was considered the best, although stringy bark and spotted gum were also used. Good shingles cannot be made from blood wood.

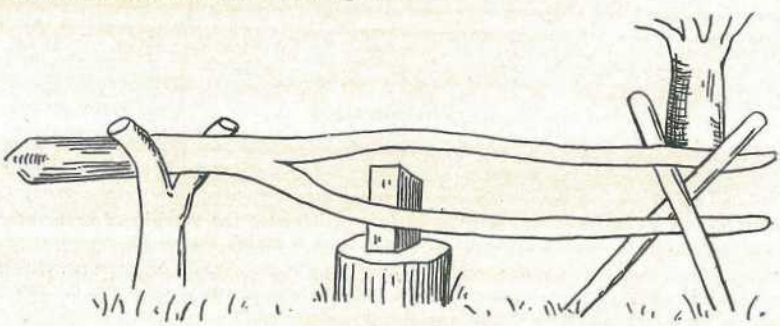
Pine shingles are preferred by some, owing to their lightness and to their not discolouring the water from the roof. Another advantage in their favour is that they do not require boring, as is necessarily the case with hardwood shingles. These latter discolour the rain water for some time after being laid, but they are far more lasting than the former.

The most important matter, and one requiring great judgment and experience, is the selecting of a tree suitable for shingle-splitting. Many old splitters can tell at a glance whether a tree will "run" freely or not by examining the bark of an ironbark or stringy-bark, and, from its corrugations, will judge of the toughness or otherwise of the timber. If the perpendicular corrugations run in parallel lines, the tree will, in all probability, be easy to "burst." If, on the other hand, the lines are interlocked, the timber will probably be the same, and take great labour to open, and then not run evenly; or, if winding, the resulting shingles would be useless, although the tree would not be lost, but might be utilised for fence posts. As a rule, a tree hard to "burst" will "run" more evenly than one which bursts freely. One good way to tell a suitable tree is to cut out a large chip and split it. If it splits freely, it is probable, but not always certain, that the whole tree will split well. It sometimes happens that the chip is hard to split, or is very stringy and interlocked, yet the upper portion of the tree may split well and run evenly, so that, after all, the chip is no certain guide. An experienced splitter can generally tell if a tree is hollow by noticing that some of the broken limbs are hollow, and that sometimes branches shoot out from the main stem almost from top to bottom. Such a tree is pretty sure to have a pipe, which makes it all the easier to split. A tree plentifully besprinkled with large round knots should not be rejected on that account, for such knots are rarely found to extend, which latter is of no use to the shingle-splitter. Suppose the tree to be selected. It should be a good-sized one with a straight barrel, from 2 to 4 ft. in diameter, with a length sufficient to give 16 to 20 good shingle blocks. The larger the girth and the longer the log, the less the labour.

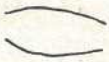
The blocks for shingles are cut off about 15 to 17 in. in length, and are burst into billets of a width of 6 in.

Some preparations are required for splitting shingles.

First, a "horse" has to be erected. This consists of a stout forked sapling with a butt about 3 ft. long and about 6 in. in diameter. This butt is supported against a tree, at a height of about 2 ft. from the ground, on a leaning fork. The two ends of the branches forming the horse are supported by two saplings standing crosswise against another tree as shown in the figure:—



A block is placed on the ground, which serves to support the billet which has to be split into shingles. The splitter has his billets lying handy, and usually piles up a dozen on the left side of the horse. With his shingle "throw" in his left hand and



wooden mallet in the right, he halves the billets, then quarters them, then halves these quarters, and so on until the whole billet is split into shingles about a quarter of an inch thick or even less. The sap shingle is usually thrown away, and no shingle under 3 in. in width is retained, the hearts and outsides being rejected.

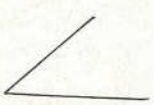
Some splitters run each shingle off separately, but this requires judgment, as, when the first shingle is off, the next may run to a thick end, and the third to a thin end, and wedge-shaped shingles are not desirable. The halving and quartering principle is undoubtedly the best.

A good splitter will run out 1,000 hardwood or often as many as 2,000 pine shingles in a day's work, but not in an eight-hour day

LAYING ON SHINGLES.

From 400 to 600 shingles will cover a square of roofing. The battens should be about 3 in. apart. The first row on the eave requires to be about half the length of the succeeding rows. The second row will cover the whole of the first. After this, each shingle of the succeeding rows should cover the space between the shingles of the row below it, thus:—

The pitch of the roof should be at about an angle of 45 degrees.



If necessary, the angles of the roof may be made perfectly water-tight by mitreing the covering shingles  in this shape, the mitred shingles being sawn in half diagonally. The lower part of these shingles must be in line with the rows on both sides.

Hardwood shingles should be bored before nailing on, but both split and sawn pine shingles need not be bored. In nailing on shingles care must be taken that the nail heads of each row of shingles be covered by the shingles in the succeeding row above it.

The Markets.

PRICES OF FARM PRODUCE IN THE BRISBANE MARKETS FOR JUNE, 1918.

Article.		JUNE. Prices.
Bacon	lb.	9d. to 10d.
Barley	bush.	3s. 6d.
Bran	ton	£6 10s.
Broom Millet	,,	£35 to £45
Broom Millet (Sydney price)	,,	£95
Butter (First Grade)	cwt.	128s. 6d.
Chaff, Mixed	ton	£6 10s. to £6 11s.
Chaff, Oaten (Imported)	,,	£6 10s. to £7 10s.
Chaff, Lucerne	,,	£5 15s. to £10
Chaff, Wheaten	,,	£5
Cheese	lb.	7½d. to 10½d.
Flour	ton	£12
Hams	lb.	1s. 3d. to 1s. 10d.
Hay, Oaten (Victorian)	ton	£9 10s.
Hay, Lucerne	,,	£3 10s. to £5 10s.
Hay, Wheaten	,,	£4 to £5 10s.
Honey	lb.	3½d. to 4d.
Maize	bush.	4s. 2d.
Oats	,,	4s 6d.
Onions	ton	£17 10s. to £18 10s.
Peanuts	lb.	4d. to 5d.
Pollard	ton	£6 10s. to £7 10s.
Potatoes	,,	£6 to £9
Potatoes (Sweet)	cwt.	2s. 6d. to 2s. 11d.
Pumpkins (Cattle)	ton	£3 15s.
Eggs	doz.	1s. 7d. to 2s. 2d.
Fowls	per pair	3s. 1d. to 12s. 6d.
Ducks, English	,,	3s. 1d.
Ducks, Muscovy	,,	3s. 8d. to 7s.
Geese	,,	6s. to 6s. 6d.
Turkeys (Hens)	,,	10s. to 11s. 3d.
Turkeys (Gobblers)	,,	15s. 6d. to 22s. 6d.
Wheat (Milling)	bush.	5s. 3d. to 5s. 6d.

VEGETABLES—TURBOT STREET MARKETS.

Beans, per sugar-bag	1s. 6d. to 3s.
Beetroot, per sugar-bag	6d. to 9d.
Cabbages, per dozen	2s. to 5s.
Carrots, per sugar-bag	2s. 6d. to 5s.
Cauliflowers, per dozen	8s. to 16s. 3d.
Chokos, per quarter-case	1s. 3d. to 1s. 5d.
Cucumbers, per dozen	1s. to 1s. 6d.
Lettuce, per dozen	1s. to 1s. 6d.
Marrows, per dozen	2s. to 3s. 6d.
Parsnips, per dozen bundles	6d. to 1s.
Peas, per sugar-bag	6s. to 9s. 6d.
Sweet Potatoes, per cwt.	2s. 9d. to 2s. 10d.
Table Pumpkins, per cwt.	3s. to 3s. 6d.
Tomatoes, per quarter-case	2s. to 5s. 9d.

SOUTHERN FRUIT MARKETS.

Article.	JUNE. Prices.
Bananas (Queensland), per case	12s. to 17s.
Bananas (Tweed River), per case	14s. to 21s.
Bananas (Fiji), per bunch...	7s. to 8s. 5d.
Bananas (G.M.), per bunch	7s. to 8s. 5d.
Bananas (G.M.), per case	20s. to 23s.
Lemons (local), per bushel-case	5s. to 6s.
Mandarins, per bushel-case	8s.
Oranges (Navel), per case	2s. 6d. to 9s.
Papaw Apples, (Queensland), per quarter-case	8s.
Passion Fruit, per half-case	11s.
Persimmons, per half bushel-case	2s. 6d. to 4s. 6d
Pineapples (Queens), per double-case	9s. to 11s.
Pineapples (Ripleys), per double-case	8s. to 9s.
Tomatoes (Queensland), per half-case	2s. to 4s.

PRICES OF FRUIT—TURBOT STREET MARKETS.

Article.	JUNE. Prices.
Apples, Eating, per case	7s. to 10s. 6d.
Apples, Cooking, per case...	8s. to 10s. 6d.
Apricots, per case	...
Bananas (Cavendish), per dozen	2d. to 5½d.
Bananas (Sugar), per dozen	4d. to 5½d.
Cape Gooseberries, per small box	...
Citrons, per hundredweight	8s.
Cocoanuts, per sack	15s. to 25s.
Cumquats, per quarter-case	3s. to 3s. 6d.
Custard Apples, per tray	2s. to 5s. 6d.
Lemons (Lisbon), per quarter-case	3s. 6s. to 8s.
Mandarins, per case	7s. 6d. to 10s.
Mangoes, per quarter-case	7s. to 12s.
Oranges (Navel), per case	6s. 6d. to 8s. 6d.
Oranges (Seville), per case	14s.
Oranges (Other), per case	3s. to 4s. 6d.
Papaw Apples, per quarter-case	2s. to 3s.
Passion Fruit, per half-bushel case	6s. to 7s. 6d.
Peaches, per quarter-case	...
Pears, per half-bushel case	...
Peanuts, per lb.	4d. to 5d.
Persimmons, per quarter-case	1s. 8d. to 2s. 6d.
Pineapples (Ripley), per dozen	1s. to 2s.
Pineapples (Rough), per dozen	6d. to 1s.
Pineapples (Smooth), per dozen	1s. to 2s. 6d.
Plums, per quarter-case	...
Pomeloes (poor man's orange) per case	9s. to 13s.
Rockmelons, per dozen	...
Rosellas, per sugar bag	3s. 6d. to 5s.
Tomatoes, per quarter-case	2s. to 3s. 6d.
Strawberries, per dozen boxes	4s. to 10s.

TOP PRICES, ENOGGERA YARDS, MAY, 1918.

Animal.	MAY. Prices.
Bullocks	£18 to £23
Cows	£13 7s. 6d. to £18 2s. 6d.
Cows (Single)	...
Merino Wethers	41s. 3d.
Crossbred Wethers	49s. 6d.
Merino Ewes	35s.
Crossbred Ewes	37s.
Lambs	40s. 3d.
Pigs (Baconers)	...
Pigs (Porkers)	45s. 9d.
Pigs (Slips)	24s. 6d.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF MAY, 1918, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALLS DURING MAY, 1918 AND 1917, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	May.	No. of Years' Records.	May, 1918.	May, 1917.		May.	No. of Years' Records.	May, 1918.	May, 1917.
North Coast.	In.		In.	In.	*South Coast*—continued:	In.		In.	In.
Atherton	2·13	17	2·24	3·26					
Cairns	4·49	36	3·81	2·39	Nambour	4·91	22	6·59	3·60
Cardwell	3·60	46	2·01	3·56	Nanango	1.67	36	0·48	0·46
Cooktown	2·96	42	1·18	1·47	Rockhampton ...	1·54	31	1·02	1·09
Herberton	1·65	31	0·91	3·83	Woodford	2·90	31	2·75	0·66
Ingham	3·48	26	2·20	3·75					
Innisfail	12·45	37	7·36	17·49					
Mossman	2·52	10	1·18	4·70	*Darling Downs.*				
Townsville	1·39	47	0·01	2·40					
					Dalby	1·35	48	0·24	0·03
					Emu Vale	1·21	...	0·31	0·11
Central Coast.					Jimbour	1·28	...	0·16	Nil
					Miles	1·70	33	0·32	0·06
Ayr	1·20	31	0·04	2·66	Stanthorpe ...	1·98	45	0·27	0·15
Bowen	1·39	47	0·26	1·51	Toowoomba ...	2·35	46	0·78	0·37
Charters Towers ...	0·82	36	Nil	1·35	Warwick	1·67	31	0·23	Nil
Mackay	3·89	47	2·04	1·65					
Proserpine	5·35	15	5·08	2·39					
St. Lawrence ...	1·87	47	1·33	1·01	*Maranoa.*				
					Roma	1·57	44	0·06	Nil
South Coast.									
					State Farms, &c.				
Biggenden	1·97	...	0·76	0·92					
Bundaberg	2·78	35	1·01	1·84					
Brisbane	2·90	67	2·49	0·48	Bungeworgorai ...	0·65	4	0·05	0·02
Childers	2·44	23	1·01	1·69	Gatton College ...	1·87	...	1·02	0·15
Crohamhurst ...	5·00	25	5·09	2·47	Gindie	1·10	...	1·84	0·10
Esk	2·14	31	0·53	0·25	Hermitage ...	1·30	...	0·23	0·02
Gayndah	1·63	47	0·54	1·09	Kairi	1·69	4	1·65	2·95
Gympie	3·09	48	1·91	1·61	Kamerunga ...	4·32	...	3·45	2·55
Glasshouse M'tains	3·33	10	3·33	2·18	Sugar Experiment Station, Mackay	3·68	...	...	2·99
Kilkivan	2·02	39	0·98	0·77	Warren	0·37	4	0·53	0·17
Maryborough ...	3·12	47	1·95	2·54					

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for May this year, and for the same period of 1917, having been compiled from telegraphic reports, are subject to revision.

GEORGE G. BOND, Divisional Officer.

Farm and Garden Notes for August.

This and the following two months are about the busiest periods of the year so far as work in the field is concerned; and the more activity now displayed in getting in the summer crops, the richer will be the reward at harvest time. Potatoes should be planted, taking care to select only good, sound seed that has sprouted. This will ensure an even crop. Yams, arrowroot, ginger, sisal hemp, cotton, and sugar-cane may now be planted. Sow maize for an early crop. If the seed of prolific varieties is regularly saved, in the end it will not be surprising to find from four to six cobs on each stalk. This has been the experience in America, where the selecting of seeds has been reduced to a fine art.

In choosing maize for seed, select the large, well-filled, flat grains. It has been shown that, by constantly selecting seed from prolific plants, as many as five and six cobs of maize can be produced on each stalk all over a field. A change of seed from another district is also beneficial. Sow pumpkins, either amongst the maize or separately, if you have the ground to spare. Swede turnips, clover, and lucerne may be sown, but they will have to contend with weeds, which will begin to vigorously assert themselves as the weather gets warmer; therefore, keep the hoe and cultivator constantly going in fine weather. Tobacco may be sown during this month. If vines are available, sweet potatoes may be planted towards the end of the month. In this case also it is advisable to avoid too frequent planting of cuttings from the old vines; and to obtain cuttings from other districts. If grasses have not yet been sown, there is still time to do so, if the work be taken in hand at once. Sugar-cane crushing will now be in full swing, and all frosted cane in the Southern district should be put through the rollers first. Plough out old canes, and get the land in order for replanting. Worn-out sugar lands in the Central and Northern districts, if not intended to be manured and replanted, will bear excellent crops of sisal hemp. Rice and coffee should already have been harvested in the North. The picking of Liberian coffee, however, only begins this month. Collect divi-divi pods. Orange-trees will be in blossom, and coffee-trees in bloom for the second time. As this is generally a dry month in the North, little can be done in the way of planting.

Kitchen Garden.—Nearly all spring and summer crops can now be planted. Here is a list of seeds and roots to be sown, which will keep the market gardeners busy for some time: Carrots, parsnips, turnip, beet, lettuce, endive, salsify, radish, rhubarb, asparagus, Jerusalem artichoke, French beans, runner beans of all kinds, peas, parsley, tomato, egg-plant, sea-kale, cucumber, melon, pumpkin, globe artichokes. Set out any cabbage plants and kohl-rabi that are ready. Towards the end of the month plant out tomatoes, melons, cucumbers, &c., which have been raised under cover. Support peas by sticks or wire-netting. Pinch off the tops of broad beans as they come into flower to make the beans set. Plough or dig up old cauliflower and cabbage beds, and let them lie in the rough for a month before replanting, so that the soil may get the benefit of the sun and air. Top dressing, where vegetables have been planted out, with fine stable manure has a most beneficial effect on their growth, as it furnishes a mulch as well as supplies of plant food.

Flower Garden.—All the roses should have been pruned some time ago, but do not forget to look them over occasionally, and encourage them in the way they should go by rubbing off any shoots which tend to grow towards the centre. Where there is a fine young shoot growing in the right direction, cut off the old parent branch which it will replace. If this work is done gradually it will save a great deal of hacking and sawing when next pruning season arrives. Trim and repair the lawns. Plant out antirrhinums (snapdragon), pansies, hollyhocks, verbenas, petunias, &c. Sow zinnias, amaranthus, balsam, chrysanthemum, marigolds, cosmos, coxcombs, phloxes, sweet peas, lupins; and plant gladiolus, tuberoses, amaryllis, pancratium, ismene, crinums, belladonna, lily, and other bulbs. In the case of dahlias, however, it will be better to place them in some warm moist spot, where they will start gently and be ready to plant out in a month or two. It must be remembered that this is the driest of our months. During thirty-eight years the average number of rainy days in August was seven, and the mean average rainfall was 2.63 inches, and for September 2.07 inches, increasing gradually to a rainfall of 7.69 inches in February.

Orchard Notes for August.

THE SOUTHERN COAST DISTRICTS.

The remarks that have appeared in these notes during the last few months respecting the handling and marketing of citrus fruits apply equally to the present month. The bulk of the fruit, with the exception of the latest ripening varieties in the latest districts, is now fully ripe, and should be marketed as soon as possible, so that the orchards can be got into thorough order for the spring growth. All heavy pruning should be completed previous to the rise in the sap; and where winter spraying is required, and has not yet been carried out, no time should be lost in giving the trunks, main branches, and inside of the trees generally a thorough dressing with the lime and sulphur wash.

Where there are inferior sorts of seedling citrus trees growing, it is advisable to head same hard back, leaving only the main trunk and four or five well-balanced main branches cut off at about 2 ft. from the trunk. When cut back, give a good dressing with the lime and sulphur wash. Trees so treated may either be grafted with good varieties towards the end of the month or early in September; or, if wished, they may be allowed to throw out a number of shoots, which should be thinned out to form a well-balanced head, and when large enough should be budded with the desired variety.

Grafting of young stock in nursery, not only citrus but most kinds of deciduous fruits, can be done this month. It comes in useful in the case of stocks that have missed in budding, but for good, clean-grown stocks budding is to be preferred.

In the case of working our Seville orange stocks to sweet oranges, grafting is, however, preferable to budding, as the latter method of propagation is frequently a failure. The Seville stock should be cut off at or a little below the surface of the ground. If of small size, a single tongue graft will be sufficient; but if of large size, then the best method is the side graft—two or more grafts being placed in each stock, so as to be certain of one taking. In either case the grafts are tied firmly in place, and the soil should be brought round the graft as high as the top bud. If this is done, there will be few missed, and undesirable Seville stocks can be converted into sweet oranges.

In selecting wood for grafting, take that of the last season's growth that has good full buds and that is well matured; avoid extra strong or any poor growths.

Seville oranges make good stocks for lemons. In case it is desirable to work them on to lemons, it is not necessary to graft below ground, as in the case of the sweet orange, but the stock can be treated in the same manner as that recommended in the case of inferior oranges—viz., to head hard back, and bud on the young shoots.

Where orchards have not already been so treated, they should now be ploughed so as to break up the crust that has been formed on the surface during the gathering of the crop, and to bury all weeds and trash. When ploughed, do not let the soil remain in a rough, lumpy condition, but get it into a fine tilth, so that it is in a good condition to retain moisture for the trees' use during spring. This is a very important matter, as spring is our most trying time, and the failure to conserve moisture then means a failure in the fruit crop to a greater or less extent.

Where necessary, quickly acting manures can be applied now. In the case of orchards, they should be distributed broadcast over the land, and be harrowed or cultivated in; but in the case of pines they should be placed on each side of the row, and be worked well into the soil.

The marketing of pines, especially smooths, will occupy growers' attention, and where it is proposed to extend the plantations the ground should be got ready, so as to have it in the best possible condition for planting, as the thorough preparation of the land prior to planting pines is money very well spent.

The pruning of all grape vines should be completed, and new plantings can be made towards the end of the month. Obtain well-matured, healthy cuttings, and plant them in well and deeply worked land, leaving the top bud level with the surface of the ground, instead of leaving 6 or 7 in. of the cutting out of the ground

to dry out, as is often done. You only want one strong shoot from your cutting, and from this one shoot you can make any shaped vine you want. Just as the buds of the vines begin to swell, but before they burst, all varieties that are subject to black spot should be dressed with the sulphuric acid solution—viz., three-quarters of a pint of commercial sulphuric acid to one gallon of water; or, if preferred, this mixture can be used instead—viz., dissolve 5 lb. of sulphate of iron (pure copperas) in one gallon of water, and when dissolved add to it half a pint of sulphuric acid.

THE TROPICAL COAST DISTRICTS.

Bananas should be increasing in quality and quantity during the month, and though, as a rule, the fruit fly is not very bad at this time of the year, still it is advisable to take every care to keep it in check. No over-ripe fruit should be allowed to lie about in the gardens, and every care should be taken to keep the pest in check when there are only a few to deal with, as, if this is done, it will reduce the numbers of the pest materially later on in the season. The spring crop of oranges and mandarins will be now ready for marketing in the Cardwell, Tully, Cairns, and Port Douglas districts. For shipping South see that the fruit is thoroughly sweated, as unless the moisture is got rid of out of the skins the fruit will not carry. Should the skins be very full of moisture, then it will be advisable to lay the fruit on boards or slabs in the sun to dry; or, if this is not possible, then the skin of the fruit should be artificially dried by placing same in a hot chamber, as the moisture that is in the skin of our Northern-grown citrus fruits must be got rid of before they will carry properly.

Papaws and granadillas should be shipped South, and the markets tested. If carefully packed in cases holding only one layer of fruit, and sent by cold storage, these fruits should reach their destination in good order. Cucumber and tomato shipments will be in full swing from Bowen. Take care to send nothing but the best fruit, and don't pack the tomatoes in too big cases, as tomatoes always sell on their appearance and quality.

THE SOUTHERN AND CENTRAL TABLELANDS.

All fruit-tree pruning should be finished during the month, and all trees should receive their winter spraying of the lime and sulphur wash.

All new planting should be completed, orchards should be ploughed and worked down fine, and everything got ready for spring.

In the warmer parts, grape pruning should be completed, and the vines should receive the winter dressing for black spot. In the Stanthorpe district grape pruning should be delayed as late as possible, so as to keep the vines back, as it is not early but late grapes that are wanted, and the later you can keep your vines back the better chance they have of escaping spring frosts.

Towards the end of the month inferior varieties of apples, pears, plums, &c., should be worked out with more desirable kinds; side, tongue, or cleft grafting being used. In the case of peaches, almonds, or nectarines, head back and work out by budding on the young growth.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S.

TIMES OF SUNRISE AND SUNSET AT BRISBANE.

1918.	MAY.		JUNE.		JULY.		AUGUST.	
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Sets.	Rises.	Sets.
	6·13	5·17	6·30	5·0	6·39	5·3	6·30	5·18
	6·14	5·16	6·30	5·0	6·39	5·3	6·30	5·18
3	6·14	5·15	6·31	5·0	6·39	5·4	6·29	5·19
4	6·15	5·14	6·31	5·0	6·39	5·4	6·29	5·19
5	6·15	5·13	6·32	5·0	6·39	5·4	6·28	5·20
6	6·16	5·13	6 32	5·0	6·39	5·5	6·27	5·20
7	6·16	5·12	6·33	5·0	6·39	5·5	6·27	5·21
8	6·17	5·11	6·33	5·0	6·39	5·6	6·26	5·21
9	6·17	5·11	6·34	5·0	6·39	5·6	6·25	5·22
10	6·18	5·10	6·34	4·59	6·39	5·7	6·24	5·22
11	6·19	5·9	6·35	4·59	6·39	5·7	6·23	5·23
12	6·19	5 9	6·35	4·59	6·39	5·8	6·22	5·24
13	6·20	5·8	6 36	4·59	6·38	5·8	6·21	5·24
14	6·20	5·8	6·36	4·59	6·38	5·9	6·20	5·25
15	6·21	5·7	6·36	5·0	6·38	5·9	6·19	5·26
16	6·21	5·6	6·37	5·0	6·38	5·10	6·19	5·26
17	6·22	5·6	6·37	5·0	6·37	5·10	6·18	5·27
18	6·23	5·5	6·37	5·0	6·37	5·11	6·17	5·27
19	6·23	5·5	6·38	5·0	6·37	5·11	6·16	5·28
20	6·24	5·4	6·38	5·0	6·36	5·12	6·15	5·28
21	6·24	5·4	6·38	5·1	6·36	5·12	6·14	5·29
22	6·25	5·3	6·39	5·1	6·36	5·13	6·13	5·29
23	6·25	5·3	6·39	5·1	6·35	5·13	6·12	5·30
24	6 26	5·3	6·39	5·1	6·35	5·14	6·11	5·30
25	6·26	5·2	6 39	5·1	6 34	5·14	6 10	5·30
26	6·27	5·2	6·39	5·2	6·34	5·15	6 9	5·31
27	6·27	5·2	6·39	5·2	6·33	5·15	6 8	5·31
28	6·28	5·1	6·39	5·2	6·33	5·16	6·7	5·32
29	6·28	5·1	6 39	5·2	6·32	5·16	6·6	5·32
30	6·29	5·1	6 39	5·3	6·32	5·17	6·5	5·33
31	6·29	5·0	...	...	6·31	5·17	6·4	5·33

PHASES OF THE MOON.

The Phases of the Moon commence at the times stated in Queensland, New South Wales, Victoria, and Tasmania.

			H.	M.	
4	May	☽ Last Quarter	8	26	a.m.
10	,,	● New Moon	11	1	p.m.
18	,,	☾ First Quarter	6	14	a.m.
26	,,	○ Full Moon	8	32	a.m.

The Moon will be nearest the earth on the 8th, and farthest from it on the 20th.

2	June	☽ Last Quarter	2	20	p.m.
9	,,	● New Moon	8	3	a.m.
16	,,	☾ First Quarter	11	12	p.m.
24	,,	○ Full Moon	8	38	p.m.

The Moon will be nearest the earth on the 5th, and farthest from it on the 17th. It will be 12 times its diam. north of the planet Uranus on the 1st at 7·30 p.m.

There will be a very partial Eclipse of the Moon on the 24th June, commencing about 7·46 p.m. and ending about 9 10 p.m.

1	July	☽ Last Quarter	6	43	p.m.
8	,,	● New Moon	6	22	p.m.
16	,,	☾ First Quarter	4	25	p.m.
24	,,	○ Full Moon	6	35	a.m.
30	,,	☽ Last Quarter	10	14	p.m.

The Moon will be farthest from the earth on the 15th, and nearest on the 27th.

7	Aug.	● New Moon	6	30	a.m.
15	,,	☾ First Quarter	8	16	a.m.
22	,,	○ Full Moon	3	2	p.m.
29	,,	☽ Last Quarter	5	27	a.m.

The Moon will be farthest from the earth on the 12th, and nearest to it on the 24th.

For places west of Brisbane, but nearly on the same parallel of latitude—27½ degrees S.—add 4 minutes for each degree of longitude. For example, at Toowoomba the sun would rise and set about 4 minutes later than at Brisbane if its elevation (1,900 feet) did not counteract the difference in longitude. In this case the times of sunrise and sunset are nearly the same as those for Brisbane.

At St. George, Cunnamulla, Thargomindah, and Oontoo the times of sunrise and sunset will be about 18 m., 30 m., 38 m., and 49 minutes, respectively, later than at Brisbane at this time of the year.

At Roma the times of sunrise and sunset during May, June, and July, and to the middle of August may be roughly arrived at by adding 20 minutes to those given above for Brisbane.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night, when at the first quarter the moon rises somewhere about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.