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Edited by
J. F. F. REID

Associate Editor
C. W. WINDERS, B.Sc.Agr.

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Contents

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Event and Comment.

Anzac.

FOR Anzac Day this year, 25th April, Dr. C. E. W. Bean, official historian of the Australian Imperial Force in the Great War of 1914-1918, wrote this requiem:—

> On this day, above all days, we recall those who did not return with us to receive the welcome of their nation; those who still sleep where we left them, amid the holly scrub in the valleys and on the ridges of Gallipoli, on the rocky, terraced hills of Palestine, in the lovely cemeteries of France, in the shimmering haze of the Libyan desert, of Bardia, Derna, Tobruk; amid the mountain passes and olive groves of Greece and Crete, the rugged, snow-capped hills of Syria, the rich jungle of Malaya, New Guinea, and the Pacific Islands; amid loving friends in our Mother Country and in our own Far North; and in many an unknown resting place in almost every land and every sea. We think of those of our women's services who gave their lives in our own and foreign lands, and particularly of those who proved, in so much more than name, the sisters of our fighting men.
>
> We recall also those staunch friends who fought beside us on the first Anzac Day—our brothers from New Zealand, who helped to create that name; the men of the Royal Navy, and of the 29th and other British divisions, the Indian mountain gunners and our brave French Allies. We recall all those who have since fallen fighting shoulder to shoulder with us—who gave their lives in the Eighth Army, the Royal Air Force,

in all the British and Dominion forces and the ranks of the American Allies who came at our call. We think of those British men, women, and children who fell when, for the second time in history, their nation and its kindred stood alone against the overwhelming might of an oppressor until the world rallied and hurled him back. We think of the peaceful millions in prostrated Europe, in defiant Greece, Russia, and China, whose graves cry for their longed-for deliverance. We think of our loyal friends among the people of New Guinea and elsewhere. We think of every man, woman, and child who in those crucial hours died so that the lights of freedom and humanity might continue to shine.

May they rest proudly in the knowledge of their achievement, and may we and our successors in that heritage prove worthy of their sacrifice.

Farmers are Key Men.

EARLY in the war, the British Minister of Agriculture said: "We shall have to move heaven and earth to win this war, but it is no use moving heaven if we do not move the earth as well." That was done, and is still being done in Britain. Since 1939, 7,000,000 additional acres of land have been brought into production, and the result is that Britain is becoming more and more self-sufficient in food. The whole nation has become food conscious, realising that in its own soil is an insurance against want and the fear that want engenders. It sees agriculture as a key industry and recognises farmers as key men. Whether agriculture will hold its high priority in public appreciation remains at present beyond any attempt at prophesy, because so much will depend on world conditions when the world regains its sanity. Then, it is believed, food production will be among the primary considerations in peace proceedings. Already Britain is considering how far agricultural measures taken under war-time stress and bringing such striking results may be applicable to a permanent peace-time policy. Whatever that policy may be, it is obvious that it must influence the conditions of primary industry in the food-exporting Dominions for which pre-war Britain provided a constant and profitable market. Although, as yet, no official statement of Britain's post-war agricultural policy has been made, the need of a definite plan has been stressed by various responsible bodies representative of rural industry and opinion with a unanimity which is almost incredible to anyone with some experience of the variety of viewpoints in British agriculture and of its traditional resistance to change in outlook and practice. Predominant among newly accepted principles is one based on the need for international action to stabilize prices of primary products and a realisation that no country can insulate its farming industry from the economic shocks of world variation in values. It is plain, therefore, that any consideration of a post-war policy for Australian agriculture, in respect of export commodities particularly, demands our best and clearest thought and competence, courage, and far-sightedness in its application.

Silo Construction.

L. WOOD, Field Officer, Agricultural Branch.

IN Queensland, three types of silo are in use—trench, circular pit, and tower. The construction of the trench type of silo is so simple that the description already given* requires no amplification. The construction of the other two types, however, is more complicated and, in the case of the tower silo, calls for the use of reinforced concrete; the circular pit silo may have only a concrete collar, but it is preferable to have it completely lined with concrete. It therefore seems appropriate to deal firstly with the mixing of concrete, and then to discuss the construction of the tower and the circular pit types of silo in such detail as is requisite.

Selection of Concrete-making Materials.

Due care should be exercised in the selection and measuring of the sand, metal or river gravel, and water to be used in making the concrete mixture. The quality and proportions of the materials used have a definite influence on the strength of the concrete made from them. The sand should be clean and sharp and free from all vegetable matter, such as leaves and grass roots, as well as from any other foreign matter. It may be tested by rubbing a small quantity between the hands, and should doing so cause them to become dirty, the sand must be washed. It may be washed in a small trough 6 feet long and 1 foot 6 inches wide, a small cut being made at one end through which the foreign matter is carried off by a flow of water. The sand should be stirred round with a shovel, and the flow of water maintained until all foreign matter has been removed. Very fine sand is not as suitable as that which is classed as medium fine. If fine screenings from crushed rock are procurable they may be used instead of sand. The term metal is applied to the coarse aggregate which is actually crushed rock, and for general concrete work any hard rock may be used; it should range in size from about 1½ inches in diameter to small screenings about half that size. It is sometimes imagined that very large stones tend to strengthen concrete but, while they may be used in thick walls and foundations with a view to saving cement, they should not be used where the thickness of the concrete is not sufficient to give at least 1½ inches of material between the "plums," as they are called, and the outer face of the concrete. Where river gravel is used instead of metal, the sand naturally occurring with it will have to be screened from it because river-run gravel usually contains a large percentage of sand. The correct quantity of sand required for the concrete mixture will then have to be added to the river gravel

* *Queensland Agricultural Journal* for April, 1944, p. 206.

which has been freed from the unknown proportion of sand which it contained when it was dug from its bed. It is important that only clean water, free from oil and dirt, be used.

Proportions, Mixing, and Placing of Materials.

A measuring-box should be employed to ensure that the correct proportions of the materials for the concrete mixture are used. When the proportions in which they are to be mixed are 4-2-1—i.e., 4 parts of metal or river gravel, 2 parts of sand, and 1 part of cement—a bottomless box with sides measuring 2 feet 1 inch by 2 feet and 1 foot deep, inside measurements, should be constructed with a division in the middle. This will hold exactly 4 cubic feet of metal when the whole of the box is filled level. Two cubic feet of sand is then measured out, by filling one-half of the box, and one paper bag of cement is added to the other two materials. This gives a conveniently sized batch to mix by hand. Cement is now supplied in paper bags which hold 1 cubic foot, twenty-four of which weigh 1 ton.

When mixing by hand the work is facilitated by constructing a proper mixing board, which should be about 10 feet by 10 feet. The dry material should be mixed thoroughly until it is all of a uniform colour. The water should be added by using a watering-can with a rose attached, the dry materials being gradually wetted as the mass is being turned. The water should not be allowed to run off the mixing board because, if it does so, it carries away a large proportion of the cement with it. The materials should be thoroughly mixed after the water has been added, and the concrete placed in position as soon as possible after mixing. It should be well rammed as it is being placed in the moulds, and the surface should be roughened before finishing the layer off in order to form a key, and so ensure a good bind for the next layer. The joint must be strengthened with cream of cement before adding fresh concrete to that which is set; this can be prepared by adding sufficient water to some neat cement to bring it to the consistency of thick cream. Green concrete will not stand a bump, and care and patience is necessary when removing the moulds. All working tools, such as buckets and shovels, and the mixing board should always be attended to when mixing is finished, and should be thoroughly washed before the concrete sets on them.

Reinforcement of Concrete.

It is sometimes necessary—and, indeed, in the case of a tower silo it is essential—to strengthen the concrete by embedding within it steel in the form of rods, wire-netting, or some other type of metal mesh. The steel is elastic and extremely strong in tension, while concrete is strong in compression, but comparatively weak in tension. The combination of the two materials with their opposite characteristics, therefore, gives an ideal product, known as reinforced concrete.

Size of Silo.

One of the first points to be considered when preparing to build a tower or circular pit silo is the size that will meet the requirements of the farm on which it is to be erected. In determining the required size, consideration must be given to the number of head of stock it is intended to feed, and to the duration of the feeding period. As each cow is fed at the rate of approximately 30 lb. of silage daily, it is a simple matter to arrive at the required size on a dairy farm. The following table of capacities will be useful in determining the size to build, allowing 51 to 56 cubic feet of silage to the ton, the smaller figures being applicable to the larger silos. These calculations are based on the assumption that the silos are completely full of consolidated silage, which, of course, is rarely possible as some allowance must be made for subsidence. However, if the material is well trampled during the whole time filling operations are in progress, only a small allowance need be made for subsidence.

APPROXIMATE CAPACITY OF ROUND SILO IN TONS.

Inside Height.	Inside Diameter of Silo.						Cubic Feet of Silage to the Ton.
Feet.	10 Feet	11 Feet.	12 Feet.	13 Feet.	14 Feet.	15 Feet.	
20	28	34	40	47	55	63	56
21	29	36	42	50	58	66	56
22	31	38	45	53	61	71	55
23	33	40	47	55	64	74	55
24	35	42	50	59	68	78	54
25	36	44	52	61	71	82	54
26	38	46	56	65	76	87	53
27	40	48	58	68	78	90	53
28	42	51	61	71	83	95	52
29	44	53	63	74	86	99	52
30	46	56	67	78	91	104	51

The following table shows the quantities of materials required in the construction of each foot of a concrete silo wall of 4-inch thickness when using a 4-2-1 mixture; it also gives the materials required for the foundations of a tower silo:—

Diameter in Feet.	Portion of Silo.	Metal or River Gravel.	Sand.	Cement.
		Cubic Feet.	Cubic Feet.	Cubic Feet.
10	Wall	9·36	4·68	2·34
	Floor	23·12	11·56	5·78
	Foundations ..	49·20	24·60	12·30
11	Wall	10·28	5·14	2·57
	Floor	27·40	13·70	6·85
	Foundations ..	54·12	27·06	13·53
12	Wall	11·00	5·50	2·75
	Floor	32·00	16·00	8·00
	Foundations ..	58·80	29·40	14·70
13	Wall	11·92	5·96	2·98
	Floor	38·20	19·10	9·55
	Foundations ..	63·52	31·76	15·88
14	Wall	12·88	6·44	3·22
	Floor	44·52	22·26	11·13
	Foundations ..	68·20	34·10	17·05
15	Wall	13·80	6·90	3·45
	Floor	51·08	25·54	12·77
	Foundations ..	72·64	36·32	18·16

Tower Silo Construction.

Details for the construction of a tower silo are given in the following paragraphs, quantities of materials, moulds, and construction being discussed in considerable detail.

Quantities of Materials.

The following materials are required for the construction of a tower silo 14 feet in diameter and 28 feet in height, with walls and floor 4 inches thick, and designed to hold approximately 83 tons of silage:—

		£	s.	d.
Concrete—				
Metal or river gravel, 17⅛ cub. yds., at 12s. 6d. per yd.		10	15	0
Sand, 8⅜ cub. yds., at 10s. per yd.		4	6	0
Cement, 116 bags, at £4 14s. per ton		22	17	4
Reinforcement, comprising—				
Round bars, ⅜ in., 6 cwt. at 17s. per cwt.		5	2	0
Tie wire, 5 lb., at 6d. per lb.		0	2	6
Door Frames (3)—				
5 in. x 4 in.—6/2 ft. 10 in. to cut 12 bevelled pieces, 3 in. x 2 in. x 4 in. 2 in. x 2 in.—12/2 ft. 6 in. 4 in. x 1 in.—14/2 ft. 6 in.		1	7	0
6 lengths ⅜ in. x 1 ft. spikes with end hooked for holding frame in position		0	1	6
Roof Timber—				
Rough Hardwood—				
Bearers, 5 in. x 3 in.—2/12 ft. 6 in., 2/17 ft. Collar ties, 4 in. x 2 in., 4/8 ft.	98 super ft., at 43s. per 100	2	1	4
Rough Pine—				
Rafters, 4 in. x 2 in.—14/9 ft. Braces, 3 in. x 1½ in.—2/18 ft. Battens, 3 in. x 1½ in.—8/17 ft. Ridge Board, 7 in. x 1 in.—1/17 ft. Fascias, 7 in. x 1 in.—2/9 ft.; 2/17 ft.	184 super ft. at 35s. per 100	3	4	0
Bolts, Corrugated Iron, &c.—				
Anchor bolts and screws, 8/1 ft. 6 in. x ½ in., for securing plates to top of wall, at 2s. each		0	16	0
Bolts for collar ties, 6/4½ in. x ⅜ in. at 3d.		0	1	6
Hoop iron strips, 14/1 ft. 6 in. long, to strap rafters to bearers, at 2d. per lb.		0	4	5
18 sheets 9-ft. iron, at 5s. 5d. per sheet		4	17	6
3 lengths ridge capping, at 1s. 9d. each		0	5	3
3 lb. springhead screws, at 2s. lb.		0	6	0
Nails—				
3 in. x 9 gauge (5 lb.) 4 in. x 8 gauge (3 lb.) 2 in. x 11 gauge (2 lb.)	at 4d. lb.	0	3	4
Ladder—				
Rough pine, 3 in. x 2 in., 2/30 ft., at 35s. per 100 super. ft.		0	10	6
Rungs—				
Bolts, 4/1 ft. 6 in. x ½ in., at 1s. 6d. each		0	6	0
21 lengths iron, 14 in. long, at 2d. per length		0	3	6
Paint		0	5	0
Cost of materials		£57	15	8
Cost of labour—				
Excavation for foundation, &c., approximately 3 ft. below ground level, 26 cub. yd., at 4s. per yd.		5	4	0
Mixing and placing all concrete, &c., 1 man 10 days at £1 2s. 8d. and 3 men 10 days at 17s. 8d.		37	16	8
Constructing roof, doors, ladder, &c., 1 man 2 days at £1 2s. 8d. and 2 men 2 days at 17s. 8d.		5	16	0
Cartage, &c., on moulds, timber, &c.		3	0	0
Cost of labour		£51	16	8

The total cost is thus £109 12s. 4d., but this figure will naturally be subject to considerable fluctuation from year to year and from locality to locality.

Moulds.

In the construction of the tower silo it is necessary to use moulds or forms of some description when placing the concrete mixture in position in the gradually rising wall of the silo. These moulds are made in sections and usually consist of eight inside and eight outside sections about 3 feet high (Plate 120). If the moulds are set up level at the commencement of construction little difficulty is experienced in keeping the wall of the silo plumb and in a true circle. A wooden frame covered with flat galvanised iron is the type of mould recommended as the most suitable, because it is light and easily handled. The galvanised iron facing gives a smooth finish to the work, which is necessary on the inner surface of the silo to prevent settling of the silage being retarded. With a view to assisting farmers in the construction of silos the Department of Agriculture and Stock has made a number of sets of moulds of this type, which are lent to farmers on application.

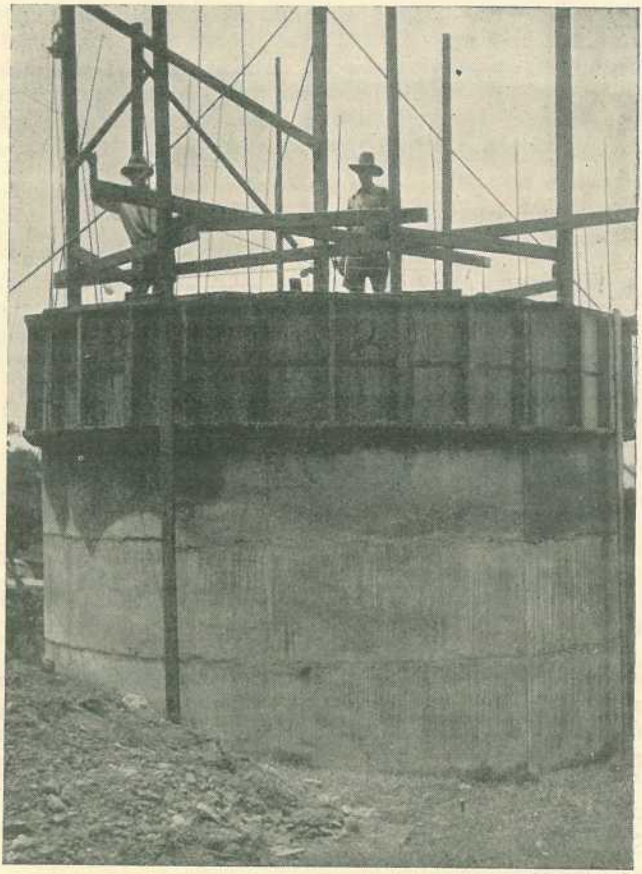


Plate 120.

TOWER SILO IN COURSE OF CONSTRUCTION.—Showing Moulds in Position for Filling.

Marking Out the Site.

All that is required to mark out the site for the silo is a piece of string and two pegs. One peg is driven into the ground at the spot which is to be the centre of the silo. A piece of string is then fastened to this by a loop, the other peg being attached to the string at a distance from the centre peg equal to half the outside diameter of the foundations. A circle is then described, which will be the outside circumference of the silo.

Foundations.

The weight of the materials required to build a tower silo of the dimensions given amounts to approximately 30 tons, and it is therefore evident that a solid foundation is necessary; otherwise settling will occur which will have the effect of cracking the wall and causing considerable damage to the structure. The foundations should be 2 feet wide and 1 foot deep, and every care should be taken to ensure that the wall is constructed in the middle of the foundations so that the weight of the wall will be evenly distributed. The soil should be excavated to a depth of approximately 3 feet, and deeper still if a compact soil is not reached at this depth. By excavating, the height above ground is reduced and a solid foundation below the frost line is assured. If in doubt about the soil formation, it is advisable to obtain advice from some person experienced in concrete construction so that sound foundations will be laid. Steel reinforcing rods $\frac{3}{8}$ inch in diameter should be placed in the foundations spaced about 9 inches apart and connected by No. 8 fencing wire.

Floor and Reinforcement.

The floor, which is usually 4 inches thick, should also be reinforced with $\frac{3}{8}$-inch diameter rods, placed at 1 foot 6 inch centres, hooked and tied to the rods of the foundations. In placing the concrete, the foundations and floor are laid in the one operation, but before pouring the concrete, provision should be made to place the vertical reinforcing rods in position. These rods, which should be placed at intervals of 2 feet, are hooked and tied to the reinforcement in the foundations. Horizontal reinforcement should be wired to the vertical rods already set when the concrete is placed for the foundations. Where it is necessary to join horizontal reinforcement, the rods should be lapped at least 1 foot 3 inches and tied together with tie wire. For vertical reinforcement a lap of 1 foot 6 inches is necessary. The first horizontal ring of rods should be placed about 3 inches above the floor, and from there upwards to a height of 8 feet 3 inches the rods should be spaced at foot intervals; for the next 7 feet 6 inches they should be spaced at 1 foot 6 inches intervals, and from that height to the top of the silo every 2 feet. The closer spacing towards the bottom of the silo is necessary to withstand the pressure exerted by the settling of the silage. Provision should be made in placing the rods in position to allow for doors, which are spaced 5 feet apart, the first being at $2\frac{1}{2}$ feet from the ground and the other two at 5 feet intervals, one above the other. All reinforcing should be well covered with concrete, as any rusting due to exposure of the steel will weaken the structure.

Building the Wall.

The moulds should be well greased before use in order to prevent adhesion of the concrete and to facilitate their removal. Crude oil or soft soap is generally used for this purpose and is applied with a swab. Each time the moulds are removed they should be scraped to remove any adhering concrete and then regreased before being placed in the

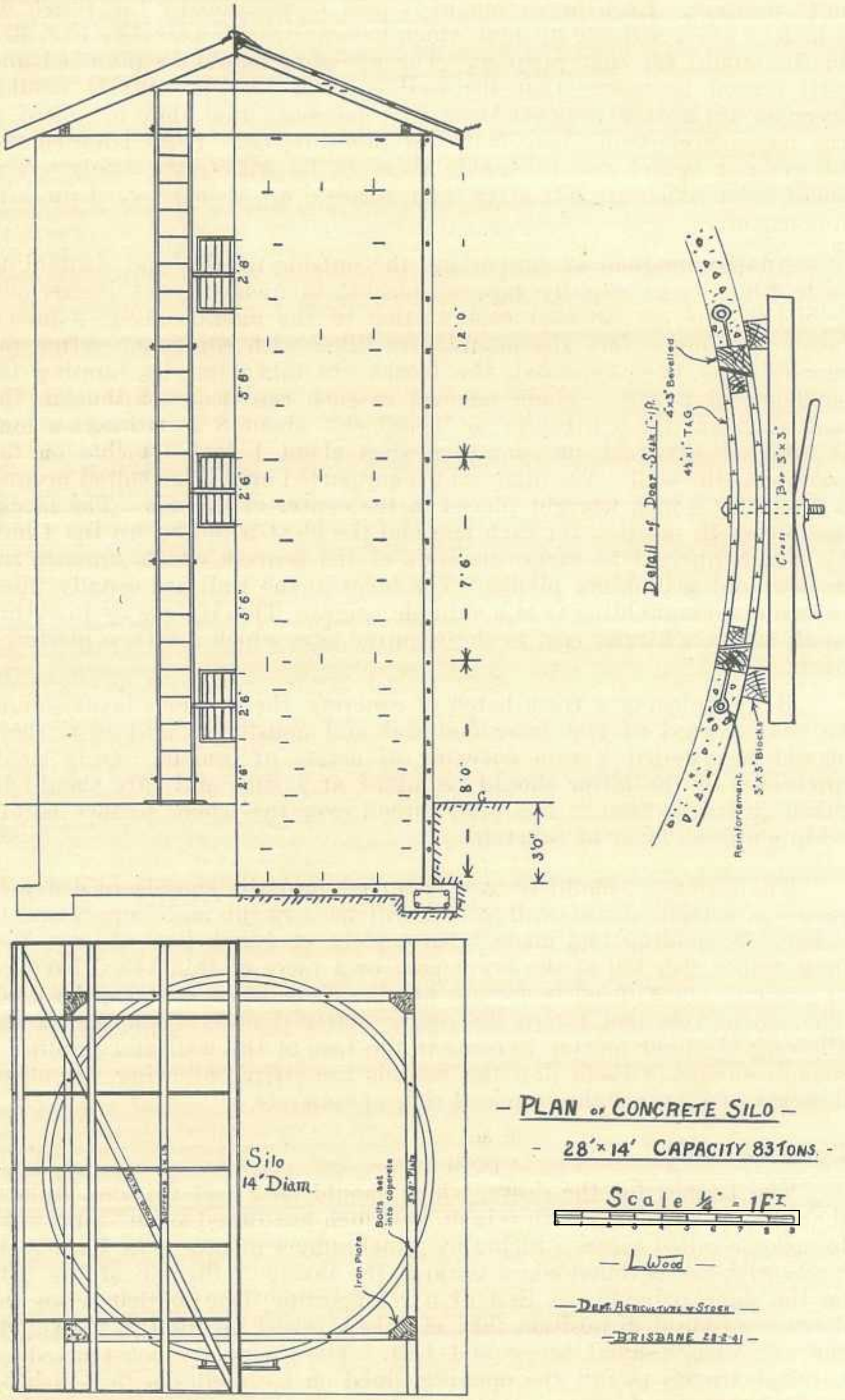


Plate 121.

PLAN OF TOWER SILO.

next position. Each inside mould is held in position by the 4-inch by 3-inch or other suitable upright which passes through a mortice provided in the mould for that purpose. The uprights should be plumbed and well braced to ensure that the wall is true. As the outside moulds have no uprights to support them it is necessary that they be bolted to the inner circle using long bolts for this purpose. These bolts should be greased before use to enable them to be withdrawn easily. The small holes which are left after their removal are then plugged up with fine mortar.

Another method of supporting the outside moulds and scaffolding is to place eight slightly tapered blocks, 4½ inches by 3½ inches and 4 inches long, in between each section of the moulds about 2 inches below the top, before the moulds are filled with concrete. After the moulds have been removed, the blocks are taken out by tapping the smaller end lightly. Their removal in each case leaves a hole in the wall through which a bearer or "pudlock" about 8 feet 6 inches long is inserted, allowing one end to project about 1 foot 3 inches on the outside of the wall. The other end is supported on a cleat bolted around a 4-inch by 4-inch upright placed in the centre of the silo. The blocks are placed in position for each rise and the cleat is moved up the 4-inch by 4-inch upright to carry the ends of the bearers which support the moulds and scaffolding planks. The holes in the wall are usually filled in while the scaffolding is at a suitable height. This is done by inserting small concrete blocks, cast to the required size, which are then plastered over.

Before placing a fresh batch of concrete, the previous layer should be well cleared of any loose material and moistened, and to it there should be applied a thin covering of cream of cement. Only small quantities of the latter should be mixed at a time and care should be taken to ensure that it has been spread over the whole surface before adding a fresh layer of concrete.

The concrete should be well rammed into the moulds in order to secure a smooth dense wall which will be airtight and impervious to water. A spading tool made from a piece of ½-inch iron about 6 feet long with a fish tail at the lower end, or a piece of thin board bevelled at one end and run off to form a handle at the other end may be used. The use of this tool forces the coarse material away from the mould, allowing the finer mortar to come to the face of the wall and produce a smooth surface. Each day the moulds are lifted, allowing for about 2 inches of a lap on the previous ring of concrete.

Door Frames.

The frames for the doors, which should be 2 feet 6 inches square, should be constructed with 5-inch by 4-inch hardwood sawn lengthways to make bevelled pieces 3 inches by 2 inches by 4 inches. The frames are made with the bevelled edges towards the inside of the silo (Plate 121) on the same principle as that of a refrigerator door so that when the doors are placed in position they may be screwed up tightly, to exclude the air, with a hand screw and bolt. The doors are constructed on bevelled frames to suit the opening, lined on both sides with 4-inch by 1-inch tongue and groove, the space between being filled with sawdust or some other insulating material; if required, the doors can be packed with felt or bagging to ensure a tight fit.

Difficulty is often experienced in keeping the silage in good condition around these doors, but if the instructions are carried out as detailed, little trouble will be encountered. Before setting the frames in position a few pieces of ⅜-inch iron about 1 foot in length should be driven into the frames at the sides, top and bottom, and connected to the reinforcing rods.

Roof.

The bearers to which the roof is fastened on the silo should be of heavy timber 5 inches by 3 inches and fastened to the top of the wall by bolts which have been set in the concrete. Anchor plates also should be bolted at each corner of these bearers; the two side bearers project 1 foot past the line of the side to allow for an overhang on the roof. Rafters 4 inches by 2 inches, spaced at 2 feet 9 inch intervals, should be securely nailed and strapped down to the bearers by 1½-inch hoop-iron straps. Four 4-inch by 2-inch collar ties are secured to every second pair of rafters about half way up. Roof braces 3-inch by 1½-inch should be nailed diagonally across on the underside of the rafters, and 3-inch by 1½-inch battens should be spaced every 3 feet. To give a finished appearance and make the silo weather-proof 7-inch by 1-inch fascias and barge boards should be securely nailed to the ends of the rafters before placing the iron in position. For securing the corrugated iron, springhead screws are preferable to nails as they withstand the elements better.

Ladder.

It is necessary that a long ladder be constructed and fixed to the silo alongside the doors. This can be made with 3-inch by 2-inch sides using lengths of ½-inch iron about 14 inches long for rungs. Four ½-inch bolts 1 foot 6 inches long should be placed about 10 feet apart to prevent the sides spreading. The inside width of the ladder should be 12 inches, thus allowing the rungs to be sunk 1 inch. Rungs should be spaced every 15 inches. The ladder is secured in position by placing it on to a sill piece and cleating the bottom, and bolting it to the roof timbers by a "bracket" or piece of timber on the top.

Scaffolding.

In the construction of the silo it is necessary that some kind of scaffolding be used and the timber required for the construction of the roof is generally made use of for this purpose. There are several methods of erecting this scaffolding, a very simple one being to place four uprights about 7 feet apart on the inside of the silo to which cross rails are secured at the height at which it is desired to erect the scaffolding. The rails are allowed to project past the uprights to about 9 inches from the wall and these projections carry the scaffolding planks, or if, as previously described, pudlock bearers are used, the planks may be placed both on the inside and outside of the silo. If a piece of heavy timber is bolted across the uprights about 8 feet above the scaffolding and allowed to project over the outside wall about 3 feet, the pulley blocks can be attached to this projection, thereby greatly assisting in the hoisting of materials.

Circular Pit Silo Construction.

As stated earlier, a circular pit silo may be either wholly concrete lined or the concrete lining may be confined to a collar 5 feet 6 inches in depth, the former type of silo being regarded as the better of the two.

The site of the circular pit silo is marked out in the same manner as adopted in the case of the tower silo, and a precisely similar type of mould is used for both. The details of the mixing and pouring of the concrete have already been fully dealt with when considering tower silo construction and further reference to them is unnecessary.

Sinking the Pit.

The sinking of the pit calls for the use of a considerable amount of labour, but much of the cost involved therein can be saved if the farmer does the work himself. To facilitate the digging of the pit, and the removal of the silage, as required, when the pit is completed and filled, a hoist (Plate 122) is so constructed as to allow it to swing over the pit. When sinking the pit, the earth or spoil is hoisted out of it in a large drum with a hinged bottom and a lever catch attachment. The drum, full of spoil, is pulled to the surface by a horse, swung clear of the pit and, while the drum is suspended in the air, the catch is released, the hinged bottom of the drum drops, and the contents are deposited on a dray or where they may be readily removed afterwards

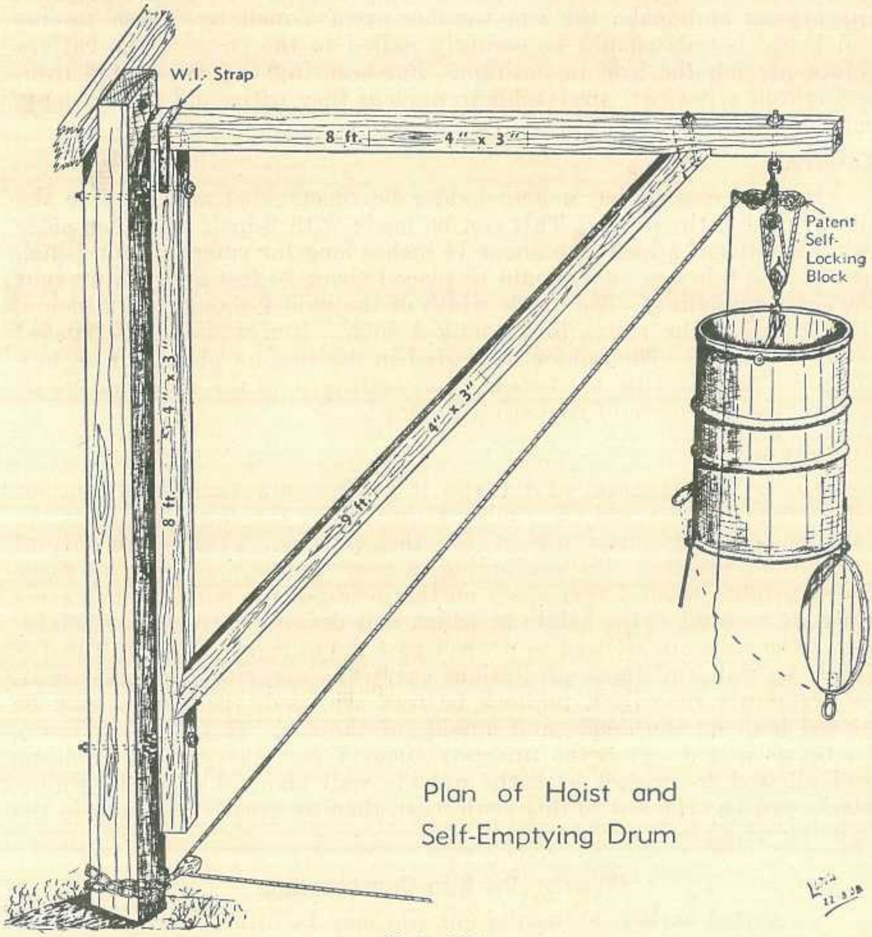


Plate 122.
HOIST.

by a horse and scoop. The hoisting gear should be provided with a patent self-locking pulley, which locks and keeps the load in any position without tying or holding the hoisting rope, the locking device coming into action the moment the rope is slackened. This self-locking block ensures the safety of the man working in the pit.

When trimming the wall of the pit, a piece of timber is placed across the diameter of the excavation, and held in position by means of pegs. Through this piece, a hole is bored to allow a length of piping to be placed vertically in the centre of the pit. A board equal in length to half the diameter of the desired excavation is then made to revolve around the pipe, which is kept plumb. This board acts as a guide or indicator, so that the wall may be trimmed perfectly true with a sharp mattock or old adze (Plate 123).

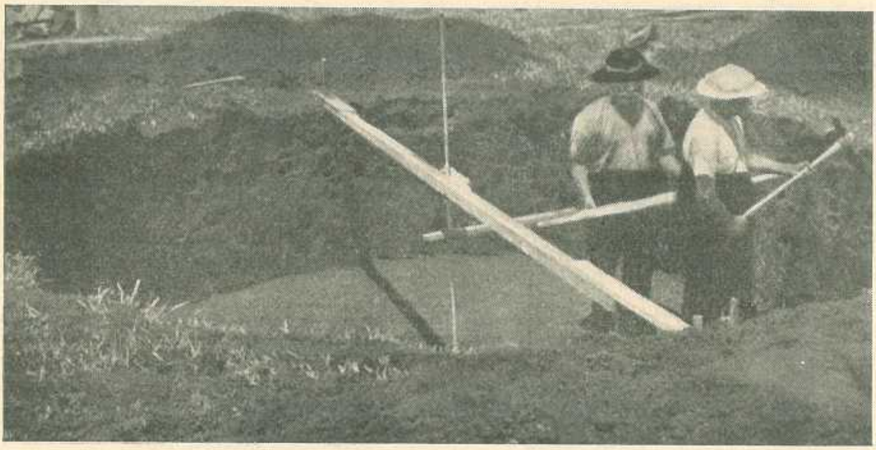


Plate 123.

TRIMMING THE PIT.

Building the Concrete Wall.

When the wall has been trimmed and the bottom of the pit levelled the inside set of moulds is placed in position and filled with concrete. If carefully handled, the moulds may be removed the following day and set up for the next lift and filled again. It is not necessary to use the outside set of moulds until the top of the pit is reached. When both sets of moulds are used, spacing pieces must be placed between them to ensure that the correct thickness of wall is maintained. The concrete wall should be continued to a height of 2½ feet above ground level.

It is here necessary to refer to the fact that, in marking out a site for a circular pit silo with an inside measurement of 14 feet, allowance must be made for the 4-inch wall and the final excavation must therefore be 14 feet 8 inches in diameter. It is, however, thought preferable to initially excavate only 14 feet, thus leaving 4 inches all round to be removed in the trimming of the wall. This trimming is carried out every few feet as sinking progresses and enables the excavator to obtain a nice even surface.

Covering the Silo.

A shed covering is as essential in a circular pit silo as in the case of a tower. It may be a permanent fixture, providing ample head room to work under (Plate 124) or it may be a sliding roof. The former is preferable, as its cost of construction is little in excess of the latter, and it affords protection from the elements when emptying or filling the pit.

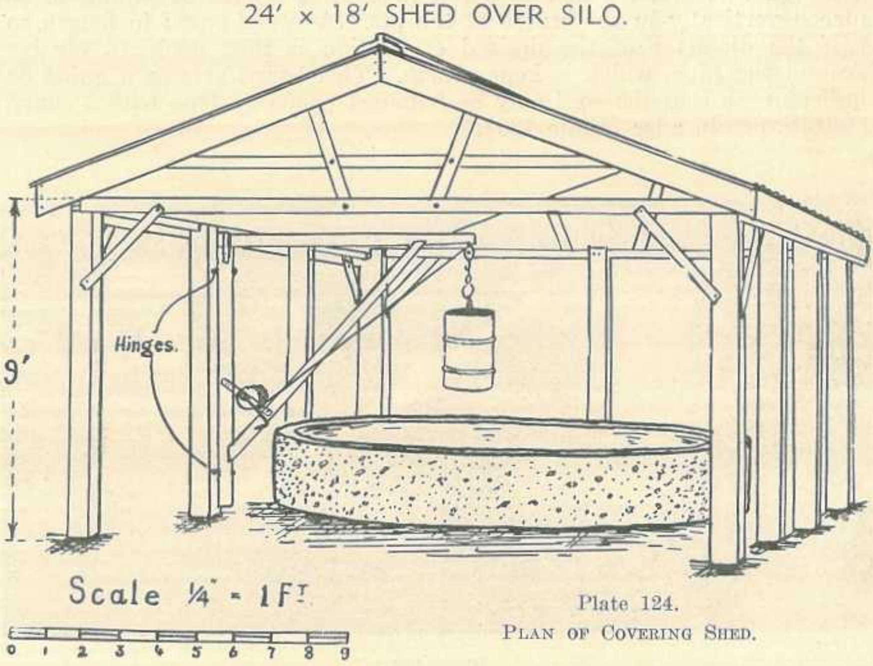


Plate 124.
PLAN OF COVERING SHED.

Quantities of Materials.

The following materials are required for a 28-foot pit silo with 25 feet 6 inches below ground level and 2 feet 6 inches above ground level, the silo to be concreted to the full depth with a 4-inch wall and floor. A 4-2-1 concrete mixture is allowed for. Provision is made for a shed 24 feet by 18 feet with a clearance of 9 feet, and for a hoist erected to assist in emptying operations, the hoist to be fixed to a convenient post by hook and eyebolt hinges.

	£	s.	d.
Concrete—			
Metal or river gravel, 15¼ cub. yds., at 12s. 6d. per yd.	9	10	7
Sand, 7 5/9 cub. yds., at 10s. per yd.	3	15	6
Cement, 102 bags, at £4 14s. per ton	19	19	6
Reinforcement (floor and portion of wall above ground level only), 32 yds. K wire	0	18	0
Shed and Hoist—			
Posts, 5 in. x 5 in., or round bush timber—9/11 ft., at 9d. per ft. ..	3	14	3
Rough Hardwood—			
Plates, 4 in. x 3 in.—2/24 ft., 2/18 ft.; Corner, 4 in. x 2 in.—4/6 ft. ..; Post bracers .. .. } at 43s. per 100 super. ft.	2	3	0

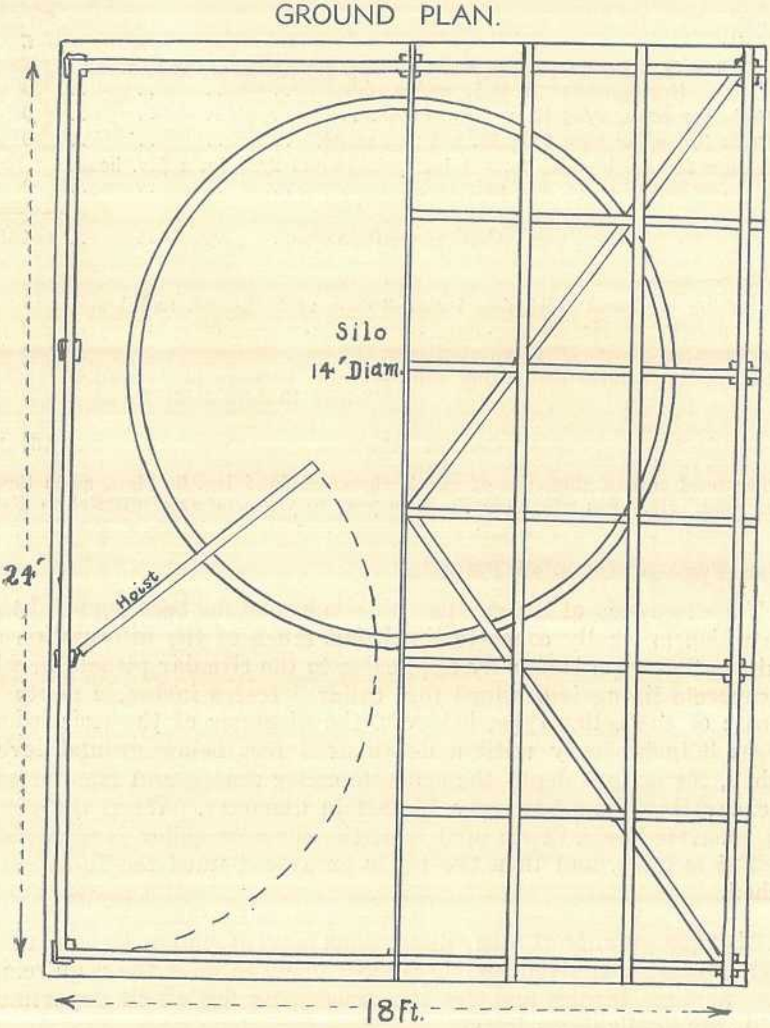


Plate 125.

GROUND PLAN OF COVERING SHED.

Rough Pine—

		£	s.	d.
Rafters, 4 in. x 2 in.—14/10 ft. .. Collar ties for roof, 4 in. x 2 in.—3/12 ft. .. .. Struts for roof, 4 in. x 2 in.—4/3 ft. Braces for roof, 3 in. x 1½ in.—4/15 ft. .. .. Battens for roof, 3 in. x 1½ in.—8/25 ft. .. .. Fascias for roof, 7 in. x 1 in.—2/25 ft., 4/10 ft. .. .. .. Ridge Board, 7 in. x 1 in.—1/25 ft.	at 35s. per 100 super. ft.	5	1	6
Rough Hardwood—Hoist, 4 in. x 3 in.—2/8 ft., 1/9 ft., at 43s. ..		0	10	9
Iron, 28/10 ft. sheets, at 5s. 8d. sheet		7	18	8
Ridge capping—5/6 ft. lengths, at 1s. 9d. per length		0	8	9

10

	£	s.	d.
Nails—			
3 in. x 9 gauge (5 lb.), at 4d.; 4 in. x 8 gauge (3 lb.), at 4d.; Springheads (5 lb.), at 1s. 2d.	0	8	6
Bolts for posts, 9/8½ in. x ½ in., at 6d.	0	4	6
Bolts for collar ties, 6/4½ in. x ⅜ in., at 3d.	0	1	6
Hinges for hoist—2/4½ in. x ⅝ in. eyebolts and 2/8½ in. x ⅝in. hooks for same, at 4s. 6d. pair	0	4	6
Cost of materials	£54	19	6
Labour—			
Erecting shed and hoist, &c., 1 man 3 days at £1 2s. 8d. and 1 man 3 days at 17s. 8d.	6	1	0
Excavating pit 25 ft. 6 in., at £1 per ft.	25	10	0
Setting up moulds and filling same—2 men 10 days at 17s. 8d. 1 man 10 days at £1 2s. 8d.	29	0	0
Cost of labour	£60	11	0

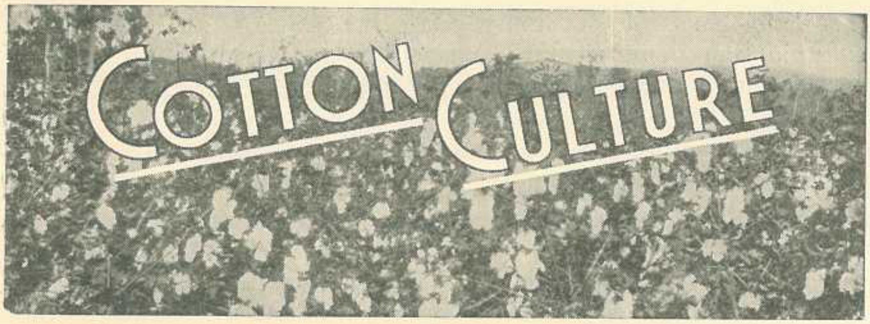
The total cost of this type of silo is therefore £115 10s. 6d., but, as in the case of the tower silo, costs will fluctuate from year to year and from district to district.

Collar Type of Circular Pit Silo.

The discussion of the circular pit silo has so far been confined to the type which is wholly concrete lined, but much of the information supplied for that type is equally applicable to the circular pit silo in which the concrete lining is confined to a collar 5 feet 6 inches in depth. In the case of the collar type, however, the diameter of the excavation is 14 feet 8 inches only until a depth of 3 feet below ground level is reached, for at that depth the concrete collar ceases, and from there on the excavation should be only 14 feet in diameter. When the pit has been excavated to a depth of 3 feet, the concrete collar is constructed, the shed is built, and then the pit is excavated until the full depth is reached.

Circular pit silos of other dimensions may, of course, be constructed, but the dimensions given are those most likely to meet the requirements of the average farmer and are the dimensions for which departmental moulds are available on loan.

It has previously been stated that the approximate cost of the fully-lined circular pit silo is £115 10s. 6d., and this compares with an approximate figure of £75 for the collar type. The combined cost of the shed, the hoist, and the excavation are virtually identical, the difference in price being due to the lesser quantity of concrete used.



Commercial Cotton Varieties in Queensland.

R. W. PETERS, Research Officer.

THE varieties of cotton grown in Queensland are all of the American Upland type, as this class of cotton appears to be the most suitable for the main cotton-growing areas, the climatic and soil conditions of which are somewhat similar to those ruling in many parts of the United States, where this type of American cotton is grown. Also these cottons, with their large bolls and coarse fibre, can be picked and ginned much cheaper than the small boll, fine-diametered, long-stapled types of cotton, which is most important, for the cost of production and harvesting is one of the main problems connected with cotton-growing in this country.

Since 1923 a large number of varieties of the American Upland type have been tested in Queensland. Many of these cottons yielded little if any promise of being suitable for the conditions here. Others appeared promising in the first few seasons after their introduction but eventually exhibited serious faults, which finally resulted in their withdrawal from distribution to farmers. It has been possible, however, to discover suitable varieties for each of the major soil types on which cotton is grown in the main cotton-growing districts. By means of a comprehensive breeding programme, as outlined in the September and October numbers of this Journal, improved types have been evolved in several of these varieties and are being commercially grown. More recently developed strains of them now in the breeding and testing plots give promise of further improved stocks of seed being available soon for distribution.

The importance of a farmer growing the most suitable variety for his conditions cannot be overstressed. Accordingly, the following descriptions of the main varieties grown in Queensland and their suitability for the cotton-growing districts south of Mackay are given to assist growers in selecting the best variety for them to plant. It is stressed, however, that if at all possible groups of farmers with comparable conditions should endeavour to grow only the same variety. The merits of one-variety communities, and of having as few varieties as possible for the State, have been described in the April number of this Journal. It is suggested, therefore, that each community obtain the advice of the local district officer of the Department of Agriculture and Stock to assist in the development of one-variety community-growing.

Lone Star.

This variety was introduced in 1923 but for a number of years it showed little evidence of being suitable for conditions here, and it was not until the 1929-30 season, when it was transferred to Mundubbera and planted on an ironbark slope interspersed with patches of brigalow, that the variety gave indications of being of much value here. Suitable strains were developed for the conditions of that district and were then distributed throughout the Central Burnett, where the variety became most popular and still remains the predominant cotton. Actually, Triumph is the only other variety grown in this particular district, and is confined to fertile alluvial flats and softwood scrub areas.

Lone Star, when introduced, was very vigorous in its habit of growth with usually four strong basal vegetative branches, while the foliage was very coarse. Continuous breeding has changed the type considerably, however, so that the description of a typical Lone Star plant at present is as follows:—

Growth vigorous and of medium height, with two to four basal vegetative branches, two of which are usually large but fruit well. The internodal distance between the joints on the main stem is somewhat short. The fruiting branches are numerous with a well-defined alternation of the internodes giving the branch a zig-zag type of growth. The lower fruiting branches are horizontal but the upper ones, which naturally become shorter are slightly acute of horizontal, giving the plant an open habit which allows of good ventilation and sunlight penetration. Foliage is medium to large and very dark-green in colour. The bolls are well spaced on the fruiting branches and are large to very large with five locks predominating. In shape they are broadly ovate with short, blunt points. They usually open well and are decidedly stormproof.

The fibre of bulk stocks of the variety has an average length of a full inch; but usually where Lone Star is grown under good conditions or under irrigation, a length of $1\frac{1}{16}$ inch may be reasonably expected. The fibre characters—drag, body, and strength—are all good. The percentage of lint approximates 36·5. This type of cotton is very suitable for the requirements of the Australian spinners and there is always a ready market for good grades of this variety of cotton. Years of selective breeding have materially improved the suitability of the variety for Queensland conditions; not only have the general characteristics of the plant, such as structure, size of bolls, uniformity of length and strength of the fibre, percentage of lint, and lint index been improved but what appears to be the most important is the increased drought-resistant qualities of the variety. Strains of Lone Star are, therefore, being grown successfully under a wide range of conditions, which may be summarised for the districts south of Mackay as follows:—

Northern Darling Downs and Maranoa—

The clays to clay loams or even loams, of the plains originally under box forests.

Upland clay loams of the rising lands and foothills of the Dividing Range, and which originally carried box forests as the predominating timber.

Decomposed sandstone areas originally timbered with cypress pine, bulloak spotted gum, and ironbark.

The heavier clay loam types of soil of the brigalow scrubs.

The clay loams of the belah flats.

Red loams to clay loams originally covered with a range of flora varying from forest to scrub.

Alluvial clay loams on main creeks and in the folds and valleys of the Main Range.

Southern District—

The brown to black clay loams of the box forest series.

The brown to red-brown clay loams of the slopes originally timbered with both the broad and narrow-leaf ironbark forests.

South Burnett—

The brown and red-brown clay loams originally timbered with the broad-leaf and the narrow-leaf ironbark, and the gum-top box forests.

Central Burnett—

The brown and red-brown clay loams as in the South Burnett.

The grey and grey-brown clay loams originally timbered with box forests.

The loams overlying a clay subsoil, such as in the Moreton Bay-box forest series.

The brown and grey-black heavy clay loams of the brigalow scrub series.

Upper Burnett and the Central Districts—

The Lone Star variety was grown extensively on the forest and scrub heavy clay loams of these districts for several years. In recent seasons, however, there has been an increasing tendency to replace the variety with Miller, which is slightly quicker maturing and, therefore, has outyielded Lone Star in seasons of late planting. As Miller is also more suitable than Lone Star for the fertile alluvials and softwood scrubs of these districts, its use on the harder soils assists in bringing about one-variety community-growing, and it is recommended that growers in these districts do not plant Lone Star unless there is clear-cut evidence that it outyields Miller on their soils.

[TO BE CONTINUED.]

Vegetable-growing in North Queensland.

S. E. STEPHENS, Northern Instructor in Fruit Culture.

PART 3.

Pest and Disease Control.

BECAUSE of the tropical climate of most of the North Queensland area, pests and diseases present a major problem to the vegetable-grower. Pests such a aphids, bean fly and the corn ear worm and diseases such as anthracnose, fusarium wilt, and mildews must be continually guarded against. Winter mildness allows the life cycle of pests and diseases to continue uninterruptedly throughout the year, so that unceasing vigilance on the part of the grower is necessary. Four methods of minimising their ravages are available; firstly, the growing of quick-maturing varieties; secondly, the use of disease-resistant varieties; thirdly, the use of disease-free seed; and, fourthly, the regular use of disinfectants dusts, sprays, &c. The use of the first method limits the period during which the plants can be attacked by curtailing to a minimum the period of growth of the crop. The growing of quick-maturing varieties must, however, be limited to those crops for which a local market is available. Such varieties are usually tender and poor shippers, and, consequently, cannot be grown successfully for distant markets.

During the past fifteen or twenty years a considerable amount of work has been carried out on the breeding of varieties resistant to one or more of the diseases to which the particular vegetable is particularly subject. Some success has been achieved in the development of strains resistant to wilts, mildews, mosaics, and other diseases. Such varieties should always be planted if they are available.

When shortage of seed forces the grower to use whatever he can obtain, there is a great risk that the seed he does procure will carry disease spores with it. Whenever the grower has the opportunity of securing certified disease-free seed he should do so even though the cost may be higher. When a good, disease-free crop has been raised by a farmer it is well worth his while to mark several of the best plants from which to save his own seed. Plants showing good growth, good cropping habit, and the characteristics of the variety should be selected during the growth of the crop and marked with stakes. When the crop reaches maturity the staked plants should be carefully looked over and the best of them finally selected for seed purposes. This practice has been followed by many of the most progressive tomato farmers in the Bowen district for a number of years and has led to the development of the wilt-resistant types grown in that district. The same practice is followed with other vegetables by many of the leading growers throughout the North.

The fourth control method—disinfection, dusting, and spraying—must be faithfully and systematically practised at all times and throughout the life of the crop, commencing with the disinfection of the seed if certified seed cannot be secured. Subsequent treatment must be commenced in the early stages of growth of the plants and repeated at frequent intervals. Treatment must be sufficiently frequent to ensure that all the vegetative portions of the plants are coated with the spray or dust. Under the growing conditions which obtain in the North, this entails almost weekly treatment. When rain supervenes, extra treatment may be necessary. Both dusts and wet sprays are available for the control of pests and diseases, and hand or power equipment suitable for all areas from the smallest home garden to the largest farm is manufactured. Plate 126 illustrates a power-dusting machine mounted on a wooden frame attached to a tractor. This machine dusts four rows at once and will cover an acre of land in fifteen to twenty minutes. Identification of pests and diseases is carried out by officers of the Entomological and Plant Pathology Sections respectively, of the Research Division of the Department of Agriculture and Stock, and information regarding control measures is obtainable from those officers.

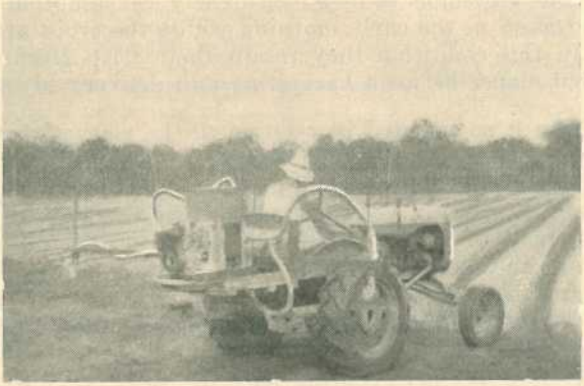


Plate 126.

A POWER-OPERATED FOUR-ROW DUSTER MOUNTED ON A TRACTOR.

Harvesting and Marketing.

These operations entail as much care and skill as any other item in the production programme. A visit to any market most unfortunately reveals that many farmers fail to realise the importance of presenting their product to the buyers in the best possible condition. Too often the farmer fails to reap the reward of painstaking production of a good crop through inefficient harvesting or marketing methods. The farmer who is producing at a distance from his market and has to employ rail or other transport to deliver his crops may learn much by holding back an odd case or bag of vegetables from his consignment and subjecting it to as nearly as possible the same treatment and conditions as the consignment would probably receive. By examining the package after the period of time which the consignment should take to reach the market, some idea of the likely condition of the vegetables on being offered for sale will be obtained. With this information to guide him, the farmer can amend or improve his methods until his sample shows that the presentation of his product should be satisfactory. Actually the most satisfactory test of harvesting and marketing practices is the inspection of the consignments on the market floor, but as few growers can leave their farms in the midst of harvesting a crop to follow their consignments to market the retention of a test package will form a very useful guide.

Harvesting: The harvesting of a vegetable crop requires some skill in the selection of the individual fruits, heads, or roots, at the correct stage of maturity. Greens and root crops are most tender and palatable when young, but if they are harvested before reaching maturity they rapidly wilt and shrivel, and lose their attractive appearance. Harvesting too young also means a considerable reduction in weight of crop harvested per acre. If, on the other hand, the crops are allowed to become too mature the vegetables will be found to be tough, woody, and unpalatable. Only practice will enable a farmer to judge correctly the time when a vegetable is in the best stage for harvest.

Actual harvesting practices must be varied somewhat according to the marketing arrangements. Where a farm is situated close to the market and the vegetable is to go into early consumption, harvesting may be undertaken in the early morning whilst the crops are still moist with dew. In this condition they retain their crisp freshness for the few hours that elapse between harvesting and delivery to the customer.

If the farm is so situated in relation to the market that some time elapses between harvesting and delivery, as for instance when rail transport is involved, harvesting and packing of the vegetables in a moist condition must be avoided, because the moisture sets up heating and the rapid development of fungous diseases, which in the course of a few hours will cause the complete breakdown of the vegetables. Under these conditions harvesting must, therefore, be delayed until the moisture has evaporated from the plants. If wet harvesting cannot be avoided, as sometimes occurs in the wet belt, then the vegetables should be spread out under cover to dry before being packed. Root crops should be dug only when the soil is in such a condition that it can be easily shaken off. Washing of the roots must be avoided.

All harvesting operations must be carried out with care, as even root crops which appear hard are nevertheless capable of being bruised when roughly handled. Bruising means damaged cells and a point of entry for fungus spores, which, under the humid conditions of North Queensland, develop with great rapidity and quickly cause the decay of the whole vegetable.

Harvested crops must not be allowed to lie in the sun, but must be gathered immediately and placed under shade to avoid scalding, which will occur in a very short space of time under the hot tropical sun. If the crops are hot when harvested they should be spread to cool in the packing shed before further handling.

Grading and Packing: In preparing for packing, all deformed or damaged specimens and all those showing any insect or fungous damage must be discarded. Any tendency to retain specimens showing only small damage must be rigorously checked. The inclusion of a tomato with a small caterpillar hole in it will most probably mean a wet case on the market, with a consequent reduction in its price by possibly one-half. The place for all damaged specimens is the pig bucket or waste dump on the farm, not the cases or bags for market.

Good vegetables should be graded into their various sizes and only specimens of the one size packed into each container. Whatever type of container and whatever the vegetable, it is essential for satisfactory transport that the container be filled to the limit of their capacity. Publications on the packing of various kinds of vegetables are available on application to the Department of Agriculture, Brisbane.

Containers: The type of container to be used for some vegetable crops has been laid down in *The Fruit and Vegetables Act*, and for such vegetables the stipulated container must be used. Where no special container is specified the farmer should pack in one that will allow ample ventilation and be of such a size that it can be easily handled, and will not hold such a bulk as to damage the contents by their own weight. For example, beans should be packed in a special open mesh bag of about sugar bag size, which holds approximately 24 lb. Corn sacks are not suitable because the weave of the bag is too close to permit ventilation, and chaff bags, whilst being of sufficiently open mesh, hold too great a bulk, which may cause heating in transit. Lettuce packed in large crates damage one another by their own weight, and are also liable to heat and sweat. Damage to the heads is increased by the rough handling a heavy crate receives. Generally speaking, containers should never be heavier than can be handled by one man.

All containers must be marked clearly and legibly with the full name and address of the grower. Cases should be so branded on one end and bags should be marked on one side near the top. In addition cases should be branded on both ends and bags on both sides with the recognised shipping brand of the consignee. Ineffective marking of containers is directly responsible for considerable damage to both fruit and vegetables, because in the rush that is usually attached to unloading a number of large mixed consignments, packages poorly branded are liable to receive much turning over, probably by a number of carters, to discover the consignee's brand on them, and such handling is seldom gentle.

The Fruit and Vegetables Act stipulates that every container of vegetables must bear the full name and address of the grower in letters not less than half an inch high. It also directs that all old brands on the containers must be obliterated. Attention to these matters will ensure that the grower is credited with his produce. Failure to observe the requirements causes confusion and frequently results in the grower having to prove that a certain consignment was his before he can obtain payment for it. A stencil is the most easily applied, the most legible, and the most durable type of brand to use. Metal stencils can usually be obtained through the various farm produce agents and the agents will also supply their own shipping stencils on request.

[TO BE CONTINUED.]

PLANT PROTECTION

Diseases of the Papaw.

E. W. B. DA COSTA, Assistant Research Officer.

THE papaw, unlike most commercial species of fruit, has been cultivated on a plantation scale only within recent years and, since much of the requisite information regarding the incidence and control of disease in a tree crop can be obtained only as a result of many years of experience, much still remains to be learned about papaw diseases and particularly about their control. During the last few years, however, as a result of increased attention to the problems of papaw production in Queensland, a great deal of information on the diseases of this plant has been obtained by Departmental officers and this forms the basis of the following review of the disease position in the State.

In discussing the diseases affecting papaws in Queensland it must be remembered that for many plant diseases the most important control measure is the provision of the best practicable growing conditions, and that this applies particularly in the case of the papaw. Many of the districts in which the crop is grown on a commercial scale in Queensland are in the south-eastern part of the State and, in these districts, the papaw is near the limit of its geographic range, and the winters are generally severe enough to check the growth of the trees and to cause extensive defoliation, even in the most sheltered situations. This widespread winter injury, usually caused by cold, dry winds rather than by low temperatures, greatly increases the susceptibility of the plants to various diseases, and any cultural methods helping to maintain the trees in vigorous growth throughout the winter will materially reduce losses from disease. In addition, papaws are exceptionally sensitive to any deficiencies in soil aeration or drainage, and much loss is caused by diseases connected with adverse soil conditions.

To assist in the identification of papaw diseases a key to the more important diseases is given below. It should be emphasized that any diagnosis made by means of this key must be confirmed by reference to the more complete descriptions of symptoms given in the separate discussion of each disease. When examining diseased papaws it is essential that all parts of the tree be inspected, as some diseases which are apparently confined to the upper part of the plant are actually caused by injury to the base of the trunk or to the roots.

KEY TO PAPAW DISEASES.

A. Diseases affecting the plant as a whole.

Crown leaves turn brown and die and trunk dies back from tip; mature leaves may be yellow, but otherwise not immediately affected. .. **Dieback**

Older leaves turn yellow, bend down, and drop off; tree finally reduced to a bare pole with a small cluster of deformed leaves at the tip .. .. **Yellow Crinkle**

Older leaves suddenly shrivel and dry out; finally crown dies out as well; rotted areas on trunk, usually near base .. .. .. **Trunk Rot**

Older leaves suddenly collapse and hang limply around the trunk; crown leaves wilt and quickly die .. .. **Root Rot**

Younger leaves develop irregular, yellowish patches which dry out and die; white, powdery mould on underside of leaves, on leaf stalks, and on young fruit .. .. **Powdery Mildew**

B. Diseases chiefly affecting the fruit.

Sunken, circular, soft spots, brown to black in colour, usually lifting out readily to leave a basin-shaped hole in the fruit; on ripe or ripening fruit only .. .. **Fruit Spot**

Large, black, sunken, circular lesions; on fruit of all stages **Black Spot**

Rapidly-spreading, soft, watery rot with little or no discolouration, later producing masses of white or grey mould; on ripe fruit only .. .. **Rhizopus Fruit Rot**

Hard, light grey, slightly-sunken, superficial scars, often extending irregularly over most of the fruit .. .. **Powdery Mildew**

Plate 127.

DIEBACK.—Early stage showing yellowing of foliage and withering of crown leaves.

A. DISEASES AFFECTING THE PLANT AS A WHOLE.

DIEBACK.

Dieback is probably the most serious disease affecting papaws in Queensland, and it has caused very severe losses among bearing trees in some seasons. The first indication that a plant is affected by dieback is the appearance at the edge of one of the crown leaves, usually on one 3 to 6 inches across, of a light brown, water-soaked area. This area shrivels up and dies and death of the rest of the leaf and of the leaf stalk rapidly follows. At the point where the leaf stalk joins the trunk there appears a characteristic lesion, 2 to 4 inches across, at first water-soaked, then turning brown, and finally drying out to a hard, black, superficial scab. The other crown leaves turn brown and die and the trunk dies back rapidly for two feet or more from the apex. These symptoms are usually accompanied by a pronounced yellowing of the older leaves, which is commonly the first thing to attract the attention of the grower (Plate 127). The older leaves often remain on the tree for a considerable time, forming a fringe around the dead tip (Plate 128). Where large

Plate 128.

DIEBACK.—Healthy tree on left; affected tree on right, showing yellow colour of old leaves and brown decay of crown leaves.

fruit are present, they usually become shrunken, wrinkled and flabby, and finally rot. Young trees affected with this disease may die right out, but with trees bearing their second or third crop it is more usual for healthy side branches to develop rapidly after the death of the top of the main trunk. The symptoms of dieback bear some resemblance to those of certain types of trunk rot and insect injury, but it may generally be distinguished from other diseases by the browning and death of the young crown leaves before any other tissue is greatly affected, and by the hard black scab near the tip of the stem.

The occurrence of dieback is markedly sporadic and, although isolated trees may be affected by it throughout the warmer months of the year, most of the losses are experienced in severe outbreaks lasting only a few weeks. These outbreaks occur simultaneously over large areas and are apparently due to weather conditions being unusually favourable to the development of the disease. Dieback occurs in all parts of south-eastern Queensland, but the severity of its incidence varies markedly, not only as between districts but also from farm to farm in an affected district.

Although the symptoms of dieback suggested that it might be a parasitic disease of the top of the plant, investigation has shown that no parasitic organism is present in the affected top and that the death of the crown is apparently caused by some general disturbance in the health of the plant. Present information on the subject supports the view that the symptoms are produced by the failure of the roots to absorb sufficient water for the needs of the plant, this failure leading to a breakdown in the young, tender tissues of the crown. Dieback is often accompanied by a fungous rotting of the roots, but this appears to be a consequence of the weakening of the root system by adverse conditions, rather than a primary cause of root failure.

It seems that the root failure leading to dieback may be produced by a number of unfavourable environmental factors, including prolonged drought and inadequate nutrition, but that the commonest cause is deficient aeration of the soil, usually due to poor drainage. It has been observed that dieback is especially severe where there is a fairly compact subsoil close to the surface and that plantings on gravelly or stony soil are comparatively free from the disease. Also, outbreaks of dieback generally occur after periods of wet weather during which soil aeration is very poor.

Control.

Measures for the control of dieback consist essentially of the improvement of cultural conditions and of the encouragement of the recovery of affected trees. In selecting sites for papaw plantings, ground known to be badly drained should be avoided, as also should sites with a clay subsoil coming close to the surface. The physical condition of the soil should be improved by drainage, liming, and—most important of all—by the incorporation of organic matter. Where irrigation is possible, judicious use of water will do much to minimize losses from dieback, but care should be taken not to water trees too frequently, especially during the spring months.

As has been indicated, affected plants, especially those which are more than two years old, will very often recover from the disease and produce healthy side branches, and this process may be encouraged by cutting back the trunk as soon as the trouble is noticed. If small side branches are already present, the trunk should be cut back to a point about 9 inches above them; whilst, if no side branches are present, it may be preferable to cut back the trunk to 18 inches or so above ground level. If the trunk is cut through at one of the partitions, and a tin placed over the cut end, there will usually be few losses from rotting of the trunks.

Plate 129.

YELLOW CRINKLE.—Affected tree showing yellowing and drooping of older leaves and cluster of dwarfed leaves at tip of stem.

YELLOW CRINKLE.

Yellow crinkle is a very widespread disease in south-eastern Queensland and, in many districts, losses from it constitute a limiting factor in the commercial life of a plantation. Usually the first noticeable symptom is a pronounced yellowing of the old leaves, the stalks of which bend down slightly where they join the trunk, as shown in Plate 129. Finally these older leaves dry out and drop off, leaving only a small tuft of crown leaves on the tree. In the younger leaves, transparent areas develop between the leaf veins, and finally drop out, giving an irregular, "shot-hole" appearance to the leaf. These leaves also turn yellow, curl in from the margins, and become claw-like in appearance, before dropping off. In the very young crown leaves, the leaf blade may be greatly reduced, often to an extremely small fringe around the leaf stalk (Plate 130). The flowers are also affected, coarse, green, leaf-like structures being produced in place of the female flowers. Young fruit are shed in the early stages of the disease, but fruit of appreciable size usually remain on the tree, and often exude a pink, gummy substance. Finally the tree becomes a bare pole with a cluster of very small, deformed leaves at the top, and possibly a few large fruit, and may remain more or less in this condition for months or years, making no growth and eventually dying.

Although yellow crinkle may occur in trees of all ages, young trees which have not yet flowered are only rarely affected. In branched trees, only one of the branches, most frequently the uppermost, is normally affected in the first place, the spread of the disease to the other branches being often slow and irregular. Yellow crinkle develops chiefly during the summer months and appears to spread most rapidly in periods of hot, dry weather. It occurs in all papaw-growing districts and on practically every farm, and there seems to be no specific connection between the district and the importance of the trouble.

The exact nature of this disease has not yet been determined. The symptoms and the scattered mode of occurrence, however, strongly suggest that it is a virus disease, although so far no direct proof of this by artificial transmission to healthy trees has been obtained. Owing

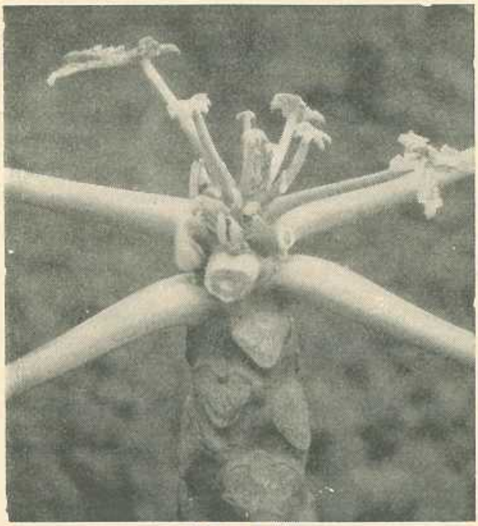


Plate 130.

YELLOW CRINKLE.—Close-up of affected tip of stem of tree in Plate 3 showing dwarfed crown leaves.

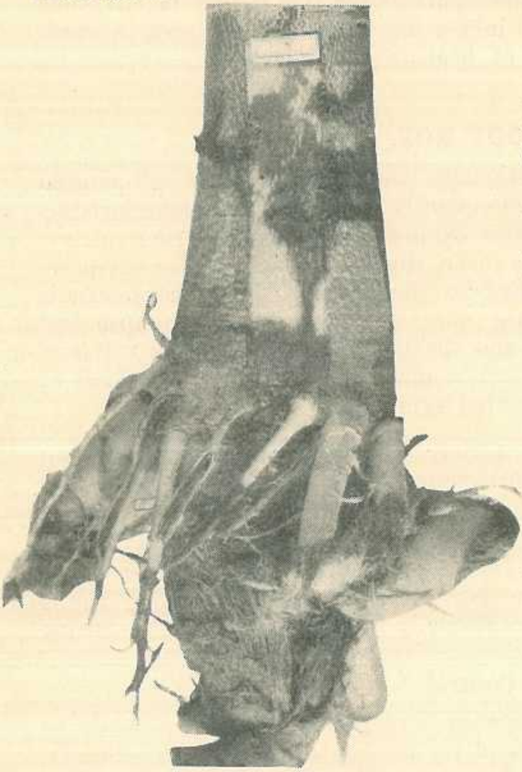


Plate 131.

TRUNK ROT.—Trunk of affected tree, with strip of bark removed to show soft, wet rot beneath.

to the serious effects of yellow crinkle, it is advisable to treat it as a transmissible virus disease, and the measures recommended for its control are based on this assumption.

Control.

The control of yellow crinkle involves the prompt and thorough eradication of all affected trees. These will not yield any further crop and there is a distinct possibility that the disease will spread from them to healthy trees. Also, any abandoned plantings should be cut down, because neglected trees will serve as a reservoir of infection from which this and other diseases may spread to younger plantings, even where these are a considerable distance away.

TRUNK ROT.

The soft, fleshy stem of the papaw is very subject to fungous rots, which may be so severe as to cause the death of the plant. In mild cases, the main symptom is an unthrifty development of the top of the plant, accompanied by shedding of the older leaves and often of the young fruit. If the trunk is examined, it will be found that a portion of it, usually several feet from the ground, is affected with a dry, dark rot, frequently penetrating to the central cavity of the stem. In another, more severe, type of rot, the older leaves shrivel up and dry out very suddenly and this may be accompanied by wilting of the crown leaves followed by the death of the plant. In such a case, an examination of the trunk discloses a soft, wet rot beneath the almost intact bark, usually just above ground level (Plate 131).

Trunk rot is caused by a number of different fungi*,

* Including *Ascochyta caricae* and *Pythium* spp.

which usually gain entrance at weak points, such as cultivation injuries to the base of the tree or through the point of attachment of dead leaves or rotting fruit. In young plants, injury due to sun scald may provide a suitable region for the entry of the fungus. However, the primary cause of the disease is to be found in the lessening of the resistance of the plant to infection induced by adverse growing conditions, such as poor drainage or imperfect nutrition.

Control.

An improvement in the general health of the plant by suitable cultural methods is the best way in which to control trunk rot. The physical condition of the soil should be improved by drainage and by the incorporation of organic matter, and the trees should receive adequate supplies of nutrients, particularly of potash. In addition, care should be taken to avoid injury to the bases of the trunks of the trees during cultivation operations.

Where only a small portion of the trunk is affected, it may be possible to arrest the spread of the trouble by cutting out the diseased tissue and painting the cut surface with Bordeaux paste or Stockholm tar. If the rot occurs in the upper part of the tree it may be advisable to cut back the trunk to several inches below the affected area in order to encourage the development of healthy side branches.

ROOT ROT.

Papaws require an exceptionally well-drained and well-aerated soil for healthy growth, and consequently in most Queensland producing areas the majority of the trees exhibit some degree of root rotting. It is only in a few situations, however, that this is sufficiently extensive to cause any noticeable damage to the plants. The characteristic symptom of root rot is that the older leaves suddenly collapse and hang limply around the trunk and the younger crown leaves wilt and quickly succumb. Usually the whole plant dies within a few days of the appearance of the first external symptoms.

Root rot is caused by a variety of soil-inhabiting fungi*, but primarily the trouble is brought about by an unsatisfactory physical condition of the soil. The disease is commonly associated with deficiencies in drainage and often occurs in restricted patches in low-lying parts of the plantation. It is much more prevalent after heavy rains than at other times. The damage is most serious among young seedlings, but older trees may occasionally be affected, especially during wet seasons.

Control.

The control of root rot depends largely on soil improvement by measures similar to those advocated for the control of dieback. Sanitation is also important, and all affected seedlings should be dug out and burned, after which replanting in the same hole should be avoided, if possible, or at least delayed for some time.

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* Including *Pythium* spp. and *Fusarium* spp.

POWDERY MILDEW.

Powdery mildew is a fungous disease which causes losses to the grower in two distinct ways; firstly, by injuring plants of all ages and by killing young seedlings during the winter months, and, secondly, by causing surface blemishes on the ripe fruit. Numerous small, water-soaked dots about one-sixteenth of an inch in diameter develop on the underside of the leaves, and, under moist conditions, these water-soaked areas become covered with a white, powdery fungous growth. The areas on which this fungus grows develop into irregular, yellowish patches, ½ inch to 3 inches across, which constitute the first conspicuous symptom of the disease. These patches rapidly turn brown and dry out, giving the leaf a scorched appearance. In severe infections, almost all the young leaves may be destroyed and, in the case of seedlings, this often results in the death of the plant. The white, powdery fungus may also develop abundantly on the young fruit, where it forms spreading, circular, white patches, which may coalesce so as to cover most of the fruit surface (Plate 132). As the fruit develops, the mould disappears, but it leaves a hard, light grey scar on the surface, and the growth of the underlying tissues is checked, causing a malformation of the mature fruit (Plate 133). On ripe papaws the hard, grey, irregular, slightly-sunken scar is still conspicuous, and the appearance of the fruit is spoiled. The eating qualities of attacked fruit are usually unimpaired, although occasionally the flesh is harder and drier than is normally the case.

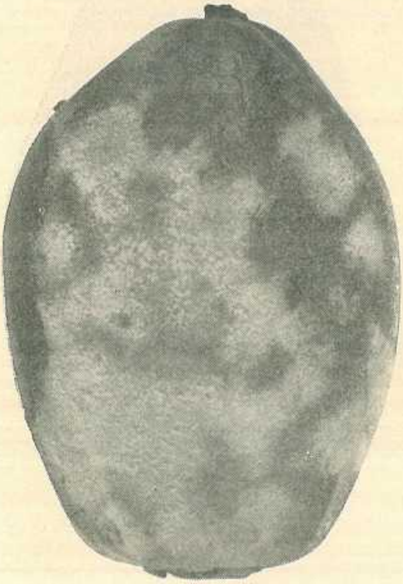

Plate 132.

POWDERY MILDEW.—Young fruit showing patches of white powdery fungus.

Plate 133.

POWDERY MILDEW.—Full-grown fruit showing irregular grey scars and malformation caused by early infection.

Powdery mildew is caused by a fungus*, which grows almost entirely on the surface of its host plant, producing the white, powdery mould referred to above. As the development of the fungus is favoured by high humidities and relatively cool weather, the disease is most severe in sheltered situations or where the trees are very closely planted. The fungus is most active during the winter months, but fruit harvested in mid-summer may show scars due to attacks of the disease in the early stages of its development.

Control.

Owing to the superficial nature of the infection, powdery mildew may readily be controlled by the use of a sulphur fungicide. Dusting is usually more convenient than spraying, and either dusting sulphur or a mixture of dusting sulphur and hydrated lime is used; where a wet spray is preferred, colloidal sulphur, wettable sulphur, or lime sulphur will prove effective. Applications should be made at intervals of 3 to 4 weeks from late May to October, care being taken to ensure that the spray covers the young fruit and the underside of the young crown leaves.

B. DISEASES CHIEFLY AFFECTING THE FRUIT.

FRUIT SPOT.

Fruit spot, or ripe rot, is the term usually applied to a type of shallow, fungous rotting of ripe papaws, which causes severe losses in harvested fruit, especially in those consigned to southern markets. The spots first appear as irregular, brown, superficial discolourations of the skin, from ⅛ inch to ½ inch across. These develop into circular spots, ½ inch to 2 inches in diameter, with a sunken surface. The surface colour varies from the normal skin colour through various shades of brown to charcoal-black; under moist conditions some spots may develop a salmon-pink incrustation of spores over most of their surface.

The affected flesh is rather dry and, although it may sometimes show irregular greenish-black areas, there is usually little discolouration. With most of these spots, the affected portion of the flesh may readily be lifted out, leaving a basin-shaped hole in the fruit. Fruit spots tend to occur in groups on the upper side of the fruit, and, in advanced stages, these may coalesce until a large part of the fruit surface is affected (Plate 134).

Plate 134.
FRUIT SPOT.—Showing numerous shallow, sunken lesions on ripe fruit.

* *Sphaerotheca* sp.

Fruit spot normally occurs only on ripe or partially ripe fruit, and, whilst it is fairly common in the field, the great majority of the spots develop only after the fruit is harvested, especially on fruit destined for the more distant markets, which is necessarily picked at an early stage of ripening. The seasonal incidence of fruit spot varies with climatic conditions, but usually losses are most severe in early spring and diminish as the season advances. The disease occurs wherever papaws are grown and its importance varies from time to time rather than from district to district.

Fruit spot may be caused by any one of a number of different fungi*, but, no matter which one is responsible for the trouble, the lesions caused are very similar, as are the modes of infection and the control measures to be adopted. All of these fungi are present in large numbers on decaying leaves and leaf stalks, and it is chiefly from these that the infection spreads to the fruit, particularly during wet weather. Some of the fungi concerned are capable of producing latent infection, in which the fungus enters the young fruit but remains dormant just below the surface until the ripening of the fruit produces conditions favourable to the rapid development of the organism. Thus most of the fruit spot occurring in September and October represents the final phase of development from infections which took place during the rainy season of February and March, and this makes control of the disease very difficult.

There appears to be a marked variation in the inherent susceptibility of different strains of papaws to fruit spotting, and this variation may be connected with differences in the duration of the final stages of the ripening process. In addition, environmental factors have a strong influence on the incidence of the disease. Where the fruit has been exposed to sun and wind, as by the loss of most of the older leaves of the tree through winter injury, the upper part of the fruit often develops "scald." This is a dark brown, "varnished" appearance of the surface accompanied by premature ripening, and, as the fruit ripens, the "scalded" area develops numerous fruit spot lesions. The development of fruit spot in packed fruit in transit is favoured by high temperatures and by lack of ventilation.

Control.

Complete control of fruit spot is very difficult to obtain, but losses may be minimized by the adoption of the following control measures. All rotting fruit and as many dead leaf stalks as possible should be removed from the trees and destroyed. Exposure of the fruit should be minimized by planting in sheltered situations and by maintaining the trees in vigorous growth during the winter months. When selecting trees for seed purposes, their susceptibility to fruit spot should be taken into consideration. When harvesting, the fruit should be picked as ripe as possible, having regard to its destination, and fruit should be kept cool and well ventilated in storage and transport.

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* Including *Gloeosporium* spp., *Ascochyta caricae* and *Phomopsis* spp.

Should these measures fail to reduce losses from fruit spot sufficiently, the application of a protective copper fungicide to the developing fruit may be adopted. Owing to the long period over which infection may take place and to the rapid development of papaw fruit during the summer months, it is not practicable to obtain complete control by this means, but the spray schedule recommended will eliminate all but a small proportion of the fruit spots. The spray used should be home-made cuprous oxide mixture, or a suitable proprietary substitute, at a strength of ·1% copper, which is equivalent to a 2-2-40 Bordeaux mixture; Bordeaux mixture itself should not be used on papaws as it may cause serious injury to the young crown leaves. The addition of potash soft soap, at the rate of 2 lb. to 40 gallons of spray, or of a proprietary spreader, may be necessary to obtain a good cover on the waxy surface of the young fruit. The spray should be applied at intervals of three weeks from early January to late April, and again at monthly intervals from early August to October. In spraying for fruit spot control it is essential to keep the young fruit covered from the time of setting; if this is done, effective control may be obtained without having to cover the leaves or the trunk.

BLACK SPOT.

Although black spot is not a disease of major importance, it may occasionally cause severe losses of immature fruit on individual trees throughout the plantation. The first symptom of the disease is the appearance of a small, brown, water-soaked spot, which develops into a sunken, black, circular lesion, from 1 inch to 3 inches in diameter; young fruit, when attacked, may wither and drop off, especially if infected near the stem end (Plate 135). Although fruit may be attacked at any stage of its development, the most extensive losses occur in fruit one or two inches long.

The causal agent* of black spot is one of the fungi which are responsible for trunk rot. The fungus usually gains entrance to the fruit either at the point of attachment or where the fruit is in contact with a dead leaf stalk or with another fruit. This disease is especially common on trees which have produced a densely-crowded crop of small fruit. Black spot occurs in all parts of south-eastern Queensland, losses being most severe during winter and early spring.

Plate 135.

BLACK SPOT.—Showing young fruit infected at point of attachment to stem.

* *Ascochyta caricae.*

Control.

Where the trees are maintained in vigorous growth, black spot rarely causes any serious loss. Its incidence may be reduced by removing dead leaf stalks and rotting fruit, and by thinning out overcrowded fruit as soon after fruit-setting as possible. Should losses from black spot become serious, effective control may be obtained by the application, at monthly intervals from May to October, of a protective copper fungicide of the type recommended for fruit spot control.

RHIZOPUS FRUIT ROT.

Rhizopus fruit rot starts as a small, water-soaked spot and spreads very rapidly until the greater part of the fruit is involved in a soft, watery rot, with little or no discolouration. In advanced stages, strands of a coarse, white or grey mould may cover the surface of the fruit (Plate 136). Usually only ripe, harvested fruit is affected, losses being heaviest during the summer months.

The rot is caused by a fungus* which is very common on rotting fruit and on dirty cases and equipment. Infection usually takes place through injuries of some type, old fruit spot lesions being a common point of entry.

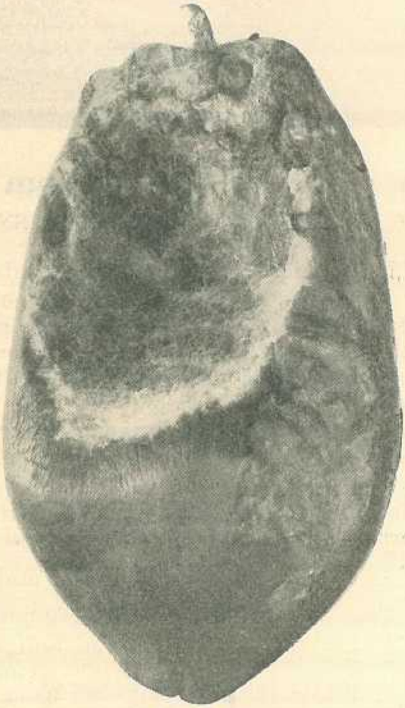

Plate 136.

RHIZOPUS FRUIT ROT.—Showing thick growth of fungus on soft, water-soaked, affected area.

Control.

Rhizopus rot may be effectively controlled by strict attention to sanitation and by careful handling. The packing shed, picking baskets, and cases must be kept clean and free from rotting fruit, and fruit should be handled carefully to avoid injury. Injured or spotted fruit should not be consigned for any long distance, and all packed fruit should be kept cool and well ventilated in transit.

* *Rhizopus nigricans.*

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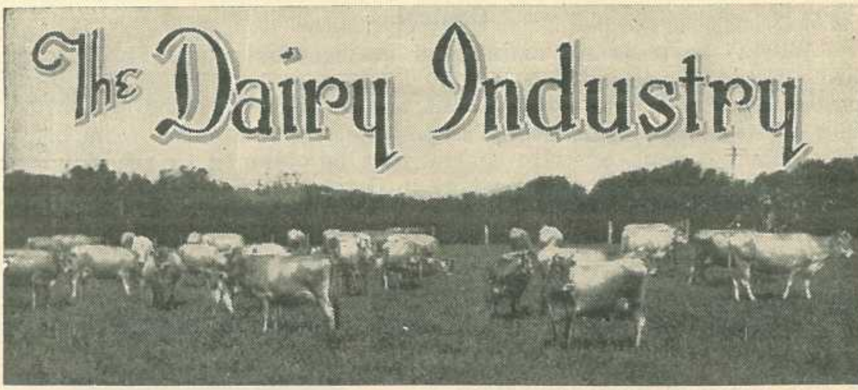
Address all renewals and other correspondence to the Under Secretary, Department of Agriculture and Stock, Brisbane.



Lessons from Herd Testing.

L. ANDERSEN, Dairy Instructor.

IN the pioneering phase of the dairying industry in Queensland, such matters as the establishment of the farm and its improvement, the provision of habitable living quarters for the settler and so on, were necessarily given priority over herd improvement. This still applies in some more recently opened dairying districts, but in the older settled areas the stage has now been reached when the industry is becoming of a more intensive character, with the necessity for a changing outlook on stock improvement. The quality of a dairy herd, as measured by productive ability rather than numbers, must henceforth be given the attention it deservedly merits. The main factors in any progressive policy of herd improvement are:—

(*a*) Testing for milk and/or butterfat yield of all cows;

(*b*) Culling of unprofitable cows;

(*c*) Use of superior bulls capable of raising herd yields.

While the necessity for using a pure-bred sire to head the dairy herd is now recognised by most dairymen, there is still insufficient appreciation of the fact that only bulls with a production background can bring about any marked general uplift in production levels. Constructive herd improvement depends primarily on the influence of the bull; the old adage "The sire is half the herd" is a truism. The only true test of a bull is a comparison of the production of his daughters with their dams. Until herd testing is widespread it will be impossible to determine which bulls are capable of transmitting high productive capacity and to ensure a sufficient number of them to effect improvement generally in herds.

In Denmark.

Herd testing is practised in all countries with an organised dairying industry, but its full national value in the elevation of the quality of the dairy stock of a country has been mainly recognised in Denmark and New Zealand. As a result of an intensive campaign conducted over a period of forty years in Denmark, the average production per cow in that country has been built up to a figure far in excess of that of any other country. No doubt the war has, for the time being, put an end to all this progressive work in Denmark, but annual reports of pre-war years indicated that up to 650,000 cows, representing as much as 40 per cent. of the aggregate cow population, were tested annually. At the beginning of the Danish testing campaign, the average production per cow was about the same as the existent average production in Queensland, but through patient and continuous application of the lessons to be learned from herd testing, the Danish farmers before the German occupation of their country could boast of an average of more than 300 lb. of butterfat per cow. While this excellent average for the herds of the whole country had been attained, some provinces had accomplished even better results. It is reported that on the island of Funen, 100,000 cows under test had a record of 375 lb. of butterfat per cow. Not only had the average fat yield been increased, but by constant culling and selection, the average fat content of the milk of Danish cows had been increased from 3·3 to 3·9 per cent.; many owners had a herd fat test of nearly 5 per cent.

In New Zealand.

In recent years, New Zealand farmers have tackled with determination the problem of herd improvement by the application of testing results. One association, for instance, which commenced operations in 1924 with 630 herds, comprising 31,000 cows, with an average yield of 207 lb. per cow, had, in a period of 10 years, increased the number of cows under test to 62,300, with an average yield of 255 lb. of butterfat per cow. That the farmers realise the value of this service is reflected in their willingness to pay for the cost of the recording work at the rate of 5s. per cow. Before the war approximately 300,000 cows were tested annually in New Zealand.

In Australia.—Victoria.

In Australia, Victoria has led the way in herd recording, approximately 100,000 cows having been tested in one year. The growth and influence of the movement in that State has resulted in its average production per cow being lifted considerably above that of the other Australian States. In 1939-40 the Victorian average production per cow was 533 gallons, the Australian average 390 gallons, and that of Queensland 322 gallons. Some figures available for Gippsland, one of the leading dairying districts of Victoria, show that in the first year of testing operations in that district, eight associations were formed, and the average butterfat production per cow was computed as 179 lb. Following the application of regular testing, the average cow production was lifted to 268 lb. in a period of five years—an increase of 50 per cent. Many owners in Victoria have brought their average up to more than 400 lb. of butterfat per cow.

In Queensland.

Because of the industry being still largely in the developmental stage, herd testing associations have not been formed in Queensland. The State Government has, however, provided a grade herd testing scheme which is entirely free of cost to the farmer. Many farmers have taken advantage of this scheme, at one time upwards of 30,000 cows being tested, and one herd at least has been tested for fifteen years continuously. Much good work has been done towards the improvement of the herds of farmers who have consistently tested under the scheme. Testing itself cannot alone improve production. However, the intelligent use of the test records in the culling of cows and selection of breeding stock and replacements, coupled with the use of successive sires capable of raising the productive capacity of the herd, can play a most constructive role in herd improvement. Until such time as herd testing is carried out continuously and systematically by Queensland dairy farmers, the average production per cow will not be likely to show any appreciable improvement. Highly productive herds, which have been built up by the use of testing results will, too, soon tend to a regression to the average of the breed, unless herd testing is continuously followed in order to enable corrective measures to be taken against such deterioration.

A Well-managed Herd.

The rapid headway possible in a well-managed herd, in which testing forms the basis of management, is well illustrated in the case of one Queensland herd. The owner of this herd was probably in better financial circumstances than the average dairyman; his herd, which included a fair proportion of pure-bred stock, was of fair conformation; feeding methods were better than average; and production was above the average for the State. Nevertheless, the farmer was not satisfied with the herd yields, and in 1938 decided to submit the whole herd of approximately 45 cows for testing. The records compiled at the completion of the first year's testing showed an average production of 183 lb. of butterfat per cow. Many of the cows which were found to be low producers, were eliminated in due course. In the intervening period of six years since testing was commenced this farmer has never missed submitting all cows for testing at each two-monthly testing periods. The herd average has now been increased to 250 lb. butterfat per cow, while the highest producer has given over 400 lb. of butterfat. The increase of 36 per cent. in butterfat yield per cow has well rewarded the efforts made. Certainly feeding methods, as well as breeding, have been improved on this property, but the objective of herd testing is to show, and to enable the farmer to put into effect, all those factors in herd management which lead to improved production. Assuming butterfat to be worth 1s. 6d. per lb., the monetary returns for 1938 and 1943 respectively on this farm would be:

1938:	45 cows produced	8,235 lb. butterfat	valued at	£617
1943:	,, ,, ,,	11,250 ,, ,,	,, ,,	£843
	Increased value of produce	..	.. ..	£226

The accomplishment on this farm which at the start of systematic herd testing had a herd well above average production shows what further improvement would be possible in a low-producing herd.

Although the season just passed through has been exceptionally favourable for dairying, testing returns of new herds submitted in the grade testing scheme indicate plainly that many cows being milked are such low producers as to be totally unprofitable in any herd, regardless of the price of butter.

Machine-milked Herds.

The widespread use of milking machines, which will no doubt continue with even greater impetus, may be regarded as a factor tending to militate against increased herd testing. In reality, testing becomes even more important in machine-milked herds. As many owners who have installed milking machines have already discovered, it is quite impossible to make any estimation of the value of any particular animal in such herds unless herd testing is practised. Resorting to hand milking of the whole herd for sampling the milk for testing purposes may be difficult for many farmers, but the difficulty can be overcome by the use of testing buckets, which are available from the manufacturers of most milking machines. The taking of samples from one portion of the herd on two successive days and the remainder on succeeding days overcomes the difficulty which may be associated with taking samples in large herds.

Testing a Free Service to Dairy Farmers.

As pointed out earlier, the grade herd recording scheme operated by the Department of Agriculture and Stock is free of cost to the farmer, all that is required of the farmer being the taking of the samples at intervals of eight weeks in the course of the lactation period. The butterfat testing and all calculations are made by the herd testing section of the Dairy ranch, and at the end of the lactation period a return showing the individual production of each member of the herd is prepared and sent to the farmer. Information concerning this scheme, together with the necessary application forms, is obtainable from any dairy officer, or by writing direct to the Under Secretary, Department of Agriculture and Stock, Brisbane.

The Cream Can.

D. S. ROBERTSON.

TOO often the cream can is regarded as an innocent container for containing cream from the farm to the factory, and because of this, only scant attention is given to the care and cleaning of it. The can is certainly a container for the conveyance of cream, but it is not a very satisfactory one unless properly cleaned and handled. Unclean cream or "metallic" cream on delivery at a factory can often be traced to dirty cans, or cans in need of retinning; and this despite the fact that scrupulous care has been taken in keeping other utensils and milking machines clean, and by practising correct dairy methods in the milking shed.

To obtain the utmost satisfaction from a cream can, three things should be remembered:—

1. The can was made to hold cream and not waste wash-up water, disinfectant solutions, meat, and other things.
2. The can was made to be kept scrupulously clean.
3. The can was tinned during manufacture, and this tinning was meant to be replaced when worn off.

To clean cans and keep them clean, the most necessary thing is plenty of boiling water. The can should be scrubbed both inside and out with hot water containing some cleaning mixture, and then thoroughly sterilized with live steam, or, if steaming is impracticable, thoroughly scalded in boiling water. The can should then be inverted on the draining rack to drain and cool. Only when completely cooled off should the can be used for holding cream. No difficulty will be found in cleaning the cans if they are used for cream only, and plenty of boiling water is available.

Dairy officers regularly check the cans at the butter factory, and where found to be rusted and pitted, issue orders for their retinning. Apart from the fact that it is a breach of the *Dairy Produce Acts* to use such a can until the inspector's orders are complied with, the farmer should realise that, in his own interests, the can should be retinned, as the use of rusty cans can only lead to one result, a second grade, metallic flavoured cream.

Wear on cans is hastened if carelessly handled. For no reason should cans be thrown on the ground from the floors of cream wagons; nor should cans be stacked on a box in the sun at the dairy, to be blown on to the ground with the force of a stiff breeze. A clean, well-kept can with a polished name plate reflects credit on its owner as evidence of efficient dairy farming.

The responsibility of cleaning and caring for cream cans does not however, rest solely on the farmer. The butter factory also has a lot to do with it, and no matter how much care and attention is given to the cleaning of the can on the farm, poor management or faulty washing technique can undo all the farmer's efforts. Cans are frequently returned from the factory which, when the lids are removed, are found to contain small amounts of putrid smelling water. Apart from the fact that this is quite reprehensible and only adds additional work to the cleaning of the can on the farm, it also causes a feeling of dissatisfaction on the part of the farmer, who feels that the factory is not giving him the service to which he is justly entitled. Obviously, it reflects discredit on the factory management. The return of cans to the dairy in the condition described may be traced to four causes:—

1. The water in the can washer not being hot enough.
2. Banging the cans through being in a hurry, and not allowing long enough time over the steamer.
3. Using the same water in the can washer from day to day without changing it.
4. Jamming the lids down on cans immediately they are removed from the steamer.

To obtain the best results, the water in the can washer should always be very hot, and should be changed regularly. In addition, adding an alkali, such as soda ash, to the water in the washer will help to remove any deposits in the can more effectively than water without soda. After draining the washer, the reservoir should be hosed out with boiling water and the tray removed to drain.

Although very spectacular to watch, the process of racing cans through the washer is not a very efficient way of cleaning them, as each can requires at least fifteen seconds over the steamer. After removal from the washing machine, the cans should be stored with the lids off and allowed to cool. Jamming lids down on cans as soon as they are removed from the washer causes a foul smell, which is exceedingly difficult to overcome. The same care in handling applies to cans at the factory as well as cans at the dairy. Rolling cans across the floor, piling cans in heaps, or cheerfully tossing them up on the top of the racks is not likely to prolong the life of the can. The factory management can, therefore, do much to promote co-operation between itself and farmer by setting an example in always returning cans in a clean, sweet-smelling state, free from dents and other damage.

MILKING SHED HYGIENE.

It is a requirement under the Dairy Regulations for water and cloths to be used for the washing of udders and near parts of cows before commencing to milk. This, if done carefully, is a definite aid in reducing bacterial contamination from dust, hairs and manure particles which may fall into the milk bucket. It is, however, sometimes observed in the course of farm instructional visits that a tin of water is left standing after use in the bails to be used again during the next milking period. The soiled wash-cloths, too, are sometimes allowed to remain in the dirty water from one milking period to another. Such practices carry their own condemnation, for they not only nullify the advantage of washing udders, but add greatly to the bacterial contamination which their use, in the first place, was designed to avoid. So it would be better to neglect washing altogether than to use dirty water and dirty cloths.

After each milking period at least, clean cloths and water should be used. In fact the water should be changed as often as it becomes dirty during milking time. The cloths should be rinsed and wrung out, and changed, too, if they have become soiled; they should be boiled after each milking and hung to dry in a place protected from cowyard dust, yet in the sterilizing rays of the sun. A few Condy's crystals or a little of a chlorine compound added to udder wash waters would be an advantage.

—E. B. RICE.

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock, which have qualified for entry into the Advanced Register of the Herd Books of Australian Illawarra Shorthorn and Jersey Societies. Production records for which have been compiled during the month of March, 1944 (273 days unless otherwise stated).

Name.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	SENIOR, 4 YEARS (STANDARD, 330 LB.)			
Braemar Lovely	W. Henschell, Yarranlea	9,680·62	336·43	Blacklands Gay Lad
	JUNIOR, 3 YEARS (STANDARD, 270 LB.)			
Glen Idol Florrie 5th	P. Doherty Estate, Gympie	9,077·2	352·987	Blacklands Count
Rosenthal Dove 24th	S. Mitchell, Warwick	7,956·21	330·356	Rosenthal Perfection
	JUNIOR, 2 YEARS (STANDARD, 230 LB.)			
Yarranvale Empress	W. Hencshell, Yarranlea	8,809·4	332·853	Trevor Hill Bosca
Yarranvale Belle	W. Henschell, Yarranlea	7,729·76	303·171	Trevor Hill Bosca
Yarranvale Milkmaid	W. Henschell, Yarranlea	7,145·66	275·467	Trevor Hill Bosca
	JERSEY.			
	SENIOR, 3 YEARS (STANDARD, 290 LB.)			
River View Speedwell's Dove	J. T. Richardson, Oakwood	5,267·65	313·021	Rosedale Speedwell's Fox
	JUNIOR, 3 YEARS (STANDARD 270 LB.)			
Bellgarth Fairona 2nd	R. Patterson, Lavelle, Milmerran	6,100·96	328·678	Carnation Ivy's Victory
	JUNIOR, 2 YEARS (STANDARD, 230 LB.)			
Woodview Joybell	P. H. Schull, Oakey	4,300·25	254·007	Lermont Victory
Ashview Silvermine	C. Huey, Sabine	4,852·9	231·825	Trecarne Victor 4th

A Farrowing Race or Crate for Brood Sows.

E. J. SHELTON.

IT has been customary for many years for pig raisers to provide farrowing rails around the sides and back of the pen in which the sow farrows. This rail 9 inches from the wall and 7 inches from the floor provide a risk-free area into which only the piglets can go when the sow lies down. Doubtless such farrowing rails have been the means of saving many hundreds of young pigs. Even a better and more dependable arrangement is the provision of a farrowing race or crate within the sty itself.

This crate is built of strong timber, is 2 feet 3 inches wide, at floor level (the same or narrower at the open top), is 5 feet long, 3 feet high, and either has its own floor or is placed on top of the floor of the sty. The lower side rail of 10 inches by 1 inch pine or hardwood is placed 10 to 12 inches above ground or floor level. Two such side boards should suffice a 12-inch space between each board would be satisfactory. That part of the front of the crate where the sow's head would lie is closed in and at the rear there are wooden slots into which the slip-in door giving entrance to or exit from the crate is placed.

A suitable floor area for the sty would be 10 feet frontage, 8 feet from front to back wall with roof at least 6 feet above floor level. There should be doors giving entrance and exit from this sty. A long narrow sty may be preferable to a short, wide one. Short straw bedding should be provided in which the young pigs can snuggle and sleep.

The objective of this equipment is to have the sow accustomed to being locked in for a few hours each day for several days before she farrows. She should be released early in the morning—except on farrowing day when no feed should be given—and be locked in during portion of the day and night. This accustoms her to the routine and the surroundings. Sows so enclosed have ample room to stand up and lie down, but not to turn round. When the young pigs are born there is ample room for them to keep clear of the sow.

As farrowing time approaches, a warm bran mash should be given with the addition of 4 fluid ounces of castor oil or liquid paraffin, two or three days before the farrowing date; this with exercise each day and plenty of succulent green food should result in satisfactory farrowing. The food should be strictly limited at this time. The crate and sty should be kept scrupulously clean and dry.

Marketing of Pigs.

E. J. SHELTON.

THE marketing of pigs in a mud covered, lice-infested or otherwise unclean condition is bad business, although it is not always practicable to have the animals "spic and span" on arrival by rail at factories and works. It is a decided advantage to keep the animals under cover for a few days before despatch and to hose or wash them to free the skin of mud. Treatment for lice is worth while, too, seeing that these parasites are readily transmitted from one animal to another and hide in crevices of sty walls, trucks, crate or other conveyance.

Where it is possible to hose or hand-wash the animals an hour or two before submitting to auction and to allow them to dry in the sunshine shillings per head may be added to their auction value at little extra expense.

The indication of lice infestation in pigs is the white "nits" or eggs of the common hog louse, which will be noticed adhering to hair in protected parts of the body.

It is wise marketing, too, to grade or arrange for grading into suitable age, size, or condition groups, for the pigs then sell to better advantage and give greater satisfaction to purchaser. Care should be taken to avoid offering for sale any animal manifestly in ill health or about whose condition there is some doubt; it is preferable to hold these animals on the farm and to treat them as may be required, so that they may be restored to health before going before buyers or to the factory.

Trucking of large and small pigs in separate compartments and keeping calves separate from pigs is in the interests of all concerned. Every animal offered for sale, barter or exchange should be legibly branded before sale in order to comply with legal requirements.

Special care should also be taken to see that suitable advice notes respecting the animals included in consignments reach the auctioneer or factory manager in ample time before the expected arrival of the stock. Care thus taken ensures confidence, and confidence ensures success.

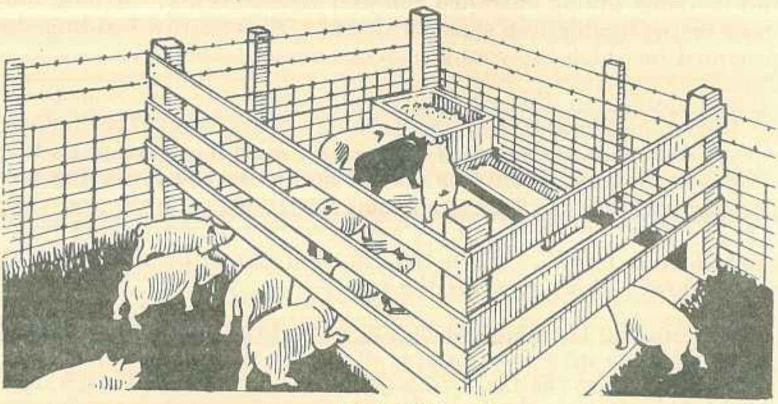


Plate 137.

MANY SUCCESSFUL PIG RAISERS FIND THAT THE CREEP SYSTEM OF FEEDING, HERE ILLUSTRATED, RESULTS IN RAPID WEIGHT GAINS BY YOUNG STOCK.

RESTING STOCK BEFORE SLAUGHTER.

The importance of resting stock, pigs in particular, before slaughter, cannot be stressed too strongly.

Much loss is incurred annually through partial and total condemnation of carcases at slaughterhouses and bacon factories for bruised and fevered conditions resulting from the slaughter of animals too early after their arrival.

Sometimes in the yarding of pigs, batons, whips or sticks are used, and a troublesome pig may receive quite a few hits before it is actually penned. Pigs are often fat and soft, and are therefore easily bruised. Very severe bruising, too, may be caused behind the jaws and the shoulders of pigs as a result of their having their heads jammed when they are being drafted into various pens. In such cases as these where the pigs are slaughtered almost immediately the slaughtering inspector may find it necessary to remove large areas of bruised flesh from the carcase, and may have to remove the head and, perhaps, cut up high into the neck, almost to the shoulder.

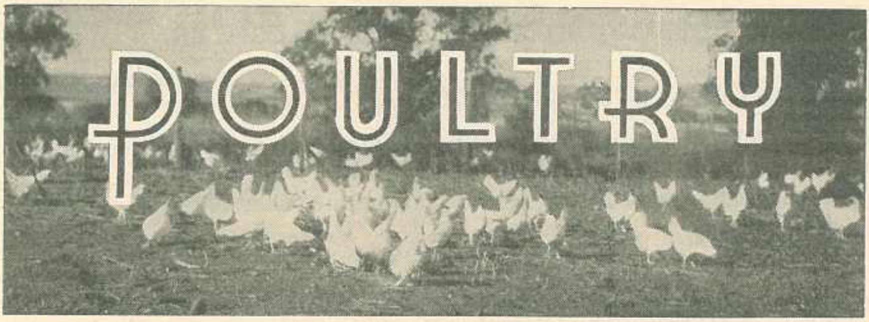
Practically all such partial condemnations of pigs would be avoided if the owners made provision for spelling animals a few days before slaughter, so that any bruising which may have occurred shall have time to absorb.

There are occasions of course, when due to fractured limbs, partial paralysis and similar causes immediate slaughter is desirable, but in such cases some loss is unavoidable, nevertheless much of it is preventable by the exercising of more care in the handling of stock en route from farm to slaughter floor.

It is particularly desirable that stock should be well rested and should undergo a temporary fast before slaughter in order that the animal will "kill out" to advantage. The provision of suitable equipment for unloading pigs from farmers' waggons and trucks to prevent "dumping" them onto the ground, a distance of anything up to three feet, and much greater care in mustering and final loading should be evident to everybody associated with the marketing of this class of stock. Every effort should be made to avoid overloading waggons, to separating large sows and stags from baconers and porkers, and to see that the animals are not overheated or partly exhausted before loading.

FEEDING CEREAL MEAL TO PIGS.

In the preparation of bacon pigs, from weaning to slaughtering age, an average of just over 4 lb. of cereal meal per pound of live weight gain is necessary. In some overseas tests in individual herds the amount of meal required to produce 1 lb. live weight of bacon pigs ranged from 3.81 lb. to 4.56 lb., this range representing a difference of one hundredweight of meal or a cash difference of approximately 8s. in the production of a 200 lb. bacon pig.



Incubation.

P. RUMBALL.

Part 2.

THERE are many reliable makes of incubators on the market which are sold with instructions for working. These instructions should be followed by the operator, as they are prepared after tests made by the manufacturer. There are, however, features which apply in a general way to most makes.

The incubator should be set up in a room in which there is little variation if any, in temperature. If a special room has to be built it should have two roofs with a space of 6 inches to 1 foot between each. The outer roof should overhang several feet on all sides. Such a roof permits of free circulation of air between them and prevents an undue increase in room temperature by the rays of the sun when overhead; the overhang protects the walls. If it is found that late in the spring the overhang is insufficient protection from the afternoon sun, a curtain may be suspended to afford greater protection.

Ventilation should be provided by windows and adjustable vents in the inner roof and bottom of the walls, to be adjusted according to the number of machines in the room and outside temperatures. Direct draughts, however, should be avoided. Where it is not desired to go to the expense of building a special incubator-room, an enclosure may be made under most dwelling-houses. When the incubators are so situated it is essential that the insurance people concerned be notified.

Heating of Incubators.

Many incubators are heated with kerosene lamps. The lamps should be thoroughly cleaned daily and the burner boiled in water, to which washing soda has been added, after each hatch. If a large flame is used when first warming up the machine, it frequently leads to smoking of the lamp. A good grade oil is essential, and in adjusting the flame, it should be turned up a little higher than necessary and then reduced to the desired height. This action makes the last pull on the wick down and guards against a flame running up. Wicks of a correct size should be used.

The lamp should be cleaned and filled early in the afternoon. By doing this at this period, all char is removed thus ensuring the maximum heat from a given-sized flame during the night, and at the same time providing for ample time to make the correct adjustments. In trimming the wick the charred crust may be rubbed off with a wooden match.

Beginning the Hatch.

The machine should be heated about two days before the eggs are set, and when it is well warmed up adjustment of the regulator should be commenced. When the operator is sure that the regulation is correct, the eggs may then be set. It is better to do this in the morning than later in the day so that the eggs may be completely warmed up before nightfall. It is too much to expect of the heating capacity of any machine to warm up cold eggs and maintain the right temperature during a cold night. When eggs are placed in an incubator, the temperature of the interior naturally falls. After a while, the regulator may be lifting and the temperature not showing; this may be because of the thermometer being nearer to the eggs than the capsule, which is affected by the coolness of the eggs to a greater degree. The regulation should not be interfered with, as when the eggs are thoroughly warmed, if adjustments have been made carefully in the first instance, the damper will only lift in the event of excessive heat. Once having adjusted the mechanical regulation, any further regulation should be made by the flame, as regulators have their limits and it is unwise to place undue strain upon them.

Thermometers.

All thermometers should be tested before the commencement of every hatch, and again at any time the action of the regulation system with the temperatures cannot be reconciled. This can be done by placing a clinical and incubator thermometer in a basin of water and gradually increasing the temperature until the clinical thermometer reaches a temperature of 102 deg., and then observe the temperature indicated by the incubator thermometer. If there is any difference, the necessary allowance can be made. If it is expected that there is any serious fault in the incubator thermometer, and no clinical thermometer is available for testing purposes, the bulb can be placed under the tongue. It should read then 98 deg. This method is not so accurate but it will indicate serious trouble.

Temperature.

Temperatures at which incubators are to be operated vary with the position in which the thermometer is situated in the machine and the type of machine. The heat of table-top incubators comes from the top of the machine—consequently, the higher in the machine the bulb of the thermometer the greater the temperature shown. The correct temperature when the middle of the bulb of the thermometer is on a level with the top of the eggs is 102 deg. A thermometer hung with the bulb free of the eggs should read about 103 deg. With cabinet machines, the temperature ranges from 99 to 100 deg.

The heat within the machine is controllable by capsules or thermostat. Occasionally these get out of order by the former leaking, or by the latter becoming bent. Very little can be done for a bent thermostat, but capsules may be repaired. The capsule system of regulation is that most commonly used. This capsule expands with heat bringing into play the regulating device, allowing surplus heat to escape from the egg chamber or preventing the intake of heated air. If the capsule is thought to be faulty and difficulty is encountered in regulating the machine, it may be tested by placing it into warm water for a few seconds. If expansion occurs it will prove that the capsule retains some of the liquid, and if no escape of gas can be detected by smell it is reasonable to assume that it is in good order.

Turning.

Turning the eggs should begin at or about 48 hours after setting and continued twice daily until the 19th day. Occasionally, if the temperature has been a little too high, the eggs will pip on the 18th day. When this happens, turning should cease as the chicken has put itself in a position to release itself from the shell.

When the eggs are placed on the egg tray they should be set at an angle of about 45 deg. with the large end up. To turn these, it is necessary to handle each individual egg unless patent turning devices are used. This may be done by simply pulling the egg over on its small end to the other side. After testing, turning may be done by gently moving the eggs over with the palm of the hand. Complete turning is not essential. All that is necessary is a movement sufficient to make the embryo seek another position in order to prevent sticking to the shell lining.

Cooling.

Cooling is a method of giving the eggs a complete airing with the consequent strengthening of the embryo. The necessity of airing varies with the make of machine because of the variation in the supply of fresh air and operating temperature. It is, however, important to remember that for the first seven days very little airing is required and that the young embryo is very subject to chill. The time it takes to turn the eggs is sufficient. After the first week the eggs may be kept out of the machine until they have lost that burning heat. The period necessary will vary with the stage of development and the outside temperature. A good plan is not to cool the eggs to that degree that the correct temperature in the machine cannot be regained within an hour. In airing, place the eggs upon a table.

Testing.

Testing should be done on the seventh day. It may be done earlier, but the time necessary to do so may result in chilling; furthermore, the germ at an earlier age is not pronounced, and in brown-shelled eggs it is almost an impossibility to discern it unless a powerful light is available. All infertile eggs and eggs in which the germ has died should be removed. This practice gives more room in the tray, facilitates turning, and avoids live eggs being affected with the colder infertile egg. To test, a piece of cardboard having a hole in it similar in shape to that of an egg but slightly smaller, and a lamp are necessary. The cardboard is held up to the light and the egg placed against the hole in it. An infertile egg will be perfectly clear, a fertile egg will have a dark movable spot, about the size of the head of a match, with numerous blood vessels radiating from it, while a dead germ will show as a blood ring or streak, and generally stationary.

Ventilation and Moisture.

Both ventilation and moisture are interlocked. If a machine has a rapid circulation of air through it, it will require more moisture than a machine in which the circulation of air is slow. The reason why moisture is supplied is to prevent a too-rapid evaporation of the moisture content of the egg. Undue evaporation of the egg content is detrimental to good hatches and to the correct development of the embryo. Enlargement of the air cell naturally occurs because of the evaporation of the moisture content and the escape of carbon dioxide through the shell. This enlargement may easily be judged when testing, and, if too great, the air circulation should be restricted or the moisture content of the air passing through the machine increased. This procedure should be reversed if the enlargement of the air cell is insufficient. Many machines are supplied with moisture trays. These should be filled at the commencement of the hatch and kept filled throughout. When moisture trays are not supplied, the air which passes through the machine carries sufficient moisture. If it is necessary to increase the moisture content of the air taken in by the machine, the floor of the incubator-room may be moistened; in some climates, this may have to be done daily.

Good ventilation is equally essential for the growth of the chicken within the egg as it is for the development of the chick when hatched. Without oxygen the changing of the egg content into a lusty chicken is impossible. It will be understood that the more advanced the embryo is the greater is the need for oxygen, and greater will be the amount of carbon dioxide given off; therefore, what may be the correct ventilation for the first few days will not suffice when the eggs are in the third week of development. The increasing of the ventilation at this period will also assist in the regulation of the temperature of the incubator.

THE SWORD BEAN (*Canavalia gladiata*).

In the *Queensland Agricultural Journal* for July, 1943, an illustrated article appeared on the Sword Bean and the Jack Bean. Dealing with the former, it was stated that it was not thought that the seeds of this variety were edible, and that they had been reported as poisonous in Java. Further, that it would be unwise to take a risk with them.

Since then I have had reports from different people to the effect that they have eaten the seeds and found them quite satisfactory. However, Mr. J. D. Ferguson, of Jimbour, writes:—

"I am forwarding per same mail, under separate cover, three red beans. These I grew from seed sent from North Queensland by a friend who recommended them. Last year I cooked many and had no ill-effects. These were taken from drying pods and cooked white inside. This year the pods were perfectly dry when I used the red beans a week ago. When cooked (soaked overnight and cooked about three hours, same as last year) the insides were much darker. Pods are large, about 1 foot long. Some hours after eating, all members of the family who ate beans were suffering from stomach pains and vomiting, also twitching of leg and arm muscles and coldness. The sickness lasted from four to twelve hours and we felt weak for a day afterwards."

The seeds forwarded were those of the Sword Bean, and the letter bears out our original advice. The young pods, before the seeds start to form, make an excellent vegetable used in the same way as ordinary French Beans, and for the first time in this State, so far as I know, they have been on sale in Brisbane fruit and vegetable shops.

—C. T. WHITE.

ANIMAL HEALTH

Risks in Trucking Cattle after Dipping.

MARSHALL R. IRVING.

RECENTLY a number of deaths occurred in a mob of fifty bulls trucked by rail immediately following dipping. The bulls ranged from eighteen months to four years of age and were in fair condition. They had been driven 14 miles to the railway siding on a very hot day, watered, and yarded at the dip over night.

Next morning they were dipped in a freshly charged, standard strength arsenical dip mixture at about 6 a.m. As the bulls had never been through a dip before they gave much trouble in the process and were well "worked-up" before the dipping was completed. The animals were trucked almost immediately afterwards, being on rail by 9 a.m. They were trucked in two K and one IC wagons, taking twenty-one head to each K wagon. The journey of 140 miles took about 12 hours through the heat of the day. It was a bad day for trucking cattle, as the meteorological data from two centres en route show that it was raining most of the day, one centre recording 137 points for the 24 hours. Humidity was 73 per cent, wind negligible, and the temperature reached a maximum of 91 degrees F. along the route.

On arrival at their destination the bulls were untrucked in the late evening and remained in the trucking yards over night. Next morning they were driven 6 miles out to a property, and the drover reported no abnormality.

For ten days they remained undisturbed in a paddock of good feed with plenty of shade and were again mustered for the next stage of their journey. They were somewhat stiff when mustered, but were put on the road on a very hot day. After travelling 9 miles they were paddocked in a bad condition of stiffness and overheating. The following morning two bulls died and about half the remainder were very sick.

On inspection, the bulls were found to be very distressed and badly scalded, particularly along the sides. Large patches of skin were stripping off the shoulders and ribs, leaving raw surfaces. Very little scald was showing on the cod or crutch. Nearly all the bulls were scouring badly and the fæces were very black, indicating the presence of much blood.

It was then too late, and individual treatment was impracticable, so they were put into a shady paddock with free access to water. No more deaths occurred, and in three days they were able to return 9 miles to their temporary paddock.

From the foregoing history, it is apparent that the scalding and poisoning were due to a combination of circumstances. The dipping in a standard strength fluid would not in itself cause the deaths. The fact that they were trucked so soon after dipping, while still wet, and were kept wet by rain throughout the day, together with the very hot humid conditions prevailing were the chief contributing causes of the mortality. This is borne out by the fact that nearly all the scald was on the sides (shoulders and ribs) where the bulls had been rubbing together.

The scald resulting from this combination of circumstances led to the absorption of arsenic through the abraided skin into the blood stream. This arsenic was excreted through the kidneys and bowels, giving rise to the blood-stained scours from which nearly all the cattle were suffering, even twelve days after the dipping.

This mortality demonstrates how necessary it is to avoid excessive handling of recently dipped cattle, particularly when weather conditions are severe. It is always risky to truck cattle within twelve hours after dipping; but they should never be trucked soon after dipping and while still wet. It is better to dip the evening before and allow the animals to dry and recover from the dipping ordeal, and truck them in the cool early morning.

Supplementary Feeding of Dairy Cattle.

C. R. TUMMON, Dairy Inspector.

EVERY year in Queensland dairying districts there is usually a period during which the body of grass available to cattle is very limited, and in order to get maximum production from milking herds, consideration should be given to the feeding of supplementary rations. For every farmer who does feed his cattle during the dry time of the year, there are usually several who do not, and arguments are frequently advanced against the value of feeding. It is desired, therefore, to discuss the advantages and disadvantages of feeding in order to find which is the more economically sound.

When to Feed.

As a general rule in Queensland, hand-feeding of stock is only necessary for about four months when the pastures have reached maturity, are dry and fibrous, and deficient in protein. It is important to commence hand-feeding before the milk yield has declined markedly and before the cows lose their condition. In most districts, the period referred to commences in autumn (April) and extends through the remainder of the lactation period. In the far North, the period of deficient pasture occurs later, and supplementary feeding is advisable, particularly in the normally dry August-November months. If early spring rains do not fall in the Southern dairying districts, supplementary feeding may also have to be resorted to at this time in order to ensure that stock which, in the main, come into profit in the spring commence their lactation under favourable conditions.

Amount to Feed.

The amount of supplementary feed given to each animal will obviously depend on the type of natural feed still available and the type and cost of supplementary foods to be grown or purchased. Supposing, for instance, there is a certain amount of dry grass available which will supply the necessary roughage, it may be more economical to merely supply the necessary concentrates, such as maizemeal, meatmeal, &c., rather than to feed ensilage as well. Using maizemeal and meatmeal as supplementary ration, it will be found that about 2 lb. maizemeal and 4 oz. meatmeal twice a day will be enough to maintain condition and give increased production. Any of the cereal grains may be substituted for maizemeal according to their availability and relative price in any particular district. These grains should be coarsely ground for feeding to dairy cattle.

However, when hand feeding is suggested it does not necessarily mean that food has to be bought. It is possible for farmers to grow their own crops, and feed them off to the dairy herd by direct grazing, or as chaff or ensilage. Of course, by good management of a dairy farm, the amount of supplementary food to be supplied during the dry period of the year may be considerably reduced. By this is meant to get the absolute maximum out of the natural pastures by the avoidance of over-stocking, the renovation of pastures by harrowing, fertilizing, or otherwise, by dividing the property into numerous small paddocks and applying rotational grazing, and the sowing of grasses which give the best results in that particular district.

Disadvantages of Feeding.

1. Extra work involved: Naturally there is extra work necessary both in providing foods in the form of crops, &c., and also in the daily feeding of same to stock.

2. More time is required: At present, owing to wartime difficulties, this is an important factor on dairy farms.

3. Cost: As the cost of stock foods is rather high at present, many farmers are not prepared to spend the money, as the immediate return does not seem to warrant such expense.

Advantages of Feeding.

1. Increased production: Increased production is immediately brought about, and this in itself is very important, particularly now when maximum production of dairy produce is demanded. This increase in production usually more than pays for the cost of the feed, so this factor may be discarded from the list of disadvantages.

2. Cattle kept in good condition: This is also important because when rain does fall the animal in good condition will respond immediately with her production, whereas the poor cow has to divide her feed between milk production and flesh forming. In addition, a cow in good condition which is carrying a calf may properly nourish the calf, which in turn will result in a better cow for the future herd. Also, cattle maintained in good condition have a greater resistance to disease than those which are under-nourished.

3. Benefit derived after feeding is stopped: Non-fed cattle may be so spent in their lactation when rain comes that they may take weeks to come back to anything like good production, and may possibly get back only to about half the quantity that the well-fed cow would be giving. It may be seen, therefore, that the benefit of feeding is often felt for months after the feeding stops.

It is very obvious that the advantages of feeding far outweigh the disadvantages, and every farmer should therefore be determined to make provision for feed to carry his stock over the dry part of the year, without any loss in production, but with considerable increase to his profits.

FARM ECONOMICS

A Note on Co-operation.

C. H. DEFRIES, Instructor in Agriculture.

CO-OPERATION is many-sided, and the word may conjure up thoughts of anything from the gigantic organisations found in Great Britain or pre-war Europe to the activities of two men who combine together for a common purpose. This latter end of the scale does not make the headlines, but it is nonetheless of importance, and it is with this aspect of co-operative effort that we are concerned at present. It is deserving of some attention by farmers because, notwithstanding the fact that many are taking advantage of the opportunity for co-operating with their neighbours to an extent much greater than previously, there still remains a tremendous field of neglected endeavour in this direction.

Every day one can see instances in farming districts where the pooling of labour or machinery on two or more farms would enable a job to be done more quickly, more cheaply, and with much less exasperation than if the individual carried on on his own. This type of small scale co-operative effort would be important enough even if it were only a minor remedy for some of the shortages that are the result of the war. Its benefits go deeper than that. Any more extensive co-operative effort such as would require an organisation for its success is based primarily on the men and women who make up the membership of the co-operative society, and if two can and do co-operate successfully in minor affairs, it is far more likely that two hundred will succeed in the larger effort. Thus, if co-operation is to develop after the war as one of the means by which farmers can protect themselves against the inherent disadvantages of primary industries in an industrialised world, as many think will be the case, then now is the time to lay the foundations and to show that such a development has a reasonable chance of success.

"There is a good deal of human nature in most men." These words from an address by Alfred Marshal, the famous economist, to the Co-operative Congress in Great Britain fifty-four years ago are a reminder that many all too human traits stand between an obvious need for co-operative effort and its accomplishment. We hear a good deal about the individualism of the Australian farmer, and that it is this factor that precludes him from co-operative effort; but, after all, if individualism means anything it denotes a capacity to rise to the occasion, and if ever there was a time when co-operation is essential it is during a period such as the present. Perhaps it is not only individualism as such that is at the root of the problem. There are all sorts of mental resistances, jealousies, and habits that are equally if not more important. Men get used to running their farm as a single unit without any but occasional help from neighbours, and the mental effort necessary to change this outlook is not always forthcoming; it is not altogether clear that individuality should be lost by the change. Some measure of adversity, financial or otherwise, might be necessary to overcome such mental sluggishness, and if this is so our present circumstances may produce some tangible benefits of this nature; in fact, they seem to be doing so. Whatever the reason, we should all be fully conscious of the fact that we are only now creating the real traditions of our agriculture, which, after all, does not go so very far back into the past. It is at least one of our duties to ensure that these traditions are formed as a response to something deeper and more substantial than the habits of selfish preoccupation and the jealousies that preclude the actualisation of co-operative effort.

To approach the matter from another angle: if we regard it as purely a problem of farm management, the arguments in favour of co-operation between farmers are just as cogent. Every farmer knows that there are some jobs in the performance of which two men working together can attain a greater output in the same time or the same output in less time than could be accomplished by two men working singly. Fencing is an obvious example. There are many farm operations—planting crops such as potatoes, sugar-cane, some vegetables, &c., harvesting, and so on, where this principle of team work applies, and there is no doubt that on thousands of farms to-day it is being put into operation, and that on as many more it could be. Similarly, in the use of tractor power the opportunities for co-operative effort are very frequent. A farmer might have only one of his tractors in working order, a light cultivation type. On a nearby farm the heavy type used for ploughing, &c., might be the only one available. The advantages of the joint use of the two machines on both farms are obvious, and usually outweigh any disadvantages that might present themselves. The transport of produce to market or railhead is another example of particular significance at the present time. No doubt a certain measure of give and take is required for the successful fruition of co-operative effort of this nature, but experience has shown that this is not beyond the capacity of most farmers.

The object of every farmer at any time and particularly now should be to use his own labour and that employed on the farm together with his machinery and equipment with the object of attaining the greatest possible efficiency. This is merely a small scale replica of the eternal economic problem of the adjustment of limited means to secure maximum results. The farmer's means are his land, his equipment, and his labour, and he does not have to be told how limited they are. The results he seeks are the maximum outputs of vital foodstuffs or raw materials. True economy would so use the means as to secure the maximum returns at minimum cost. If, then, co-operative effort can overcome the disadvantages of the limited means and reduce the cost of their utilisation, the farmer benefits by a greater profit margin and the nation gets more food.

TIMBER MEASUREMENT.

A "superficial foot" of timber is a piece 12 in. long and 12 in. wide and 1 in. thick or any combination of dimensions with the same cubical contents, such as 3 in. by 4 in. by 12 in.; 2 in. by 6 in. by 12 in.; or 6 in. by 1 in. by 24 in. To measure timber in super. feet, multiply breadth, width, and length (in inches) and divide by 144.

Knots to Know

Considering the extent to which ropes are used on the farm, a knowledge of splicing will frequently prove to be a very useful asset. Not only is the splice neater than any knot, it is also more convenient to handle, and if properly made it will still enable a broken rope to be used for pulley work.

Two types of splice are commonly used for joining rope lengths—the short splice and the long splice. The former is quite suitable for all general purposes, but where the rope is intended to pass easily over a pulley the long splice is much to be preferred. For practice work a slightly worn rope is better than a very new or a very old rope. A marlinspike is useful for opening up the rope.

SPLICING ROPES.

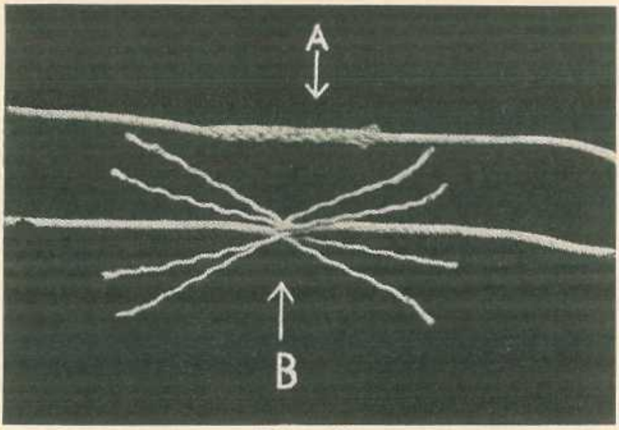


Plate 138.

SPLICING ROPES.—Short splice showing start and finished.

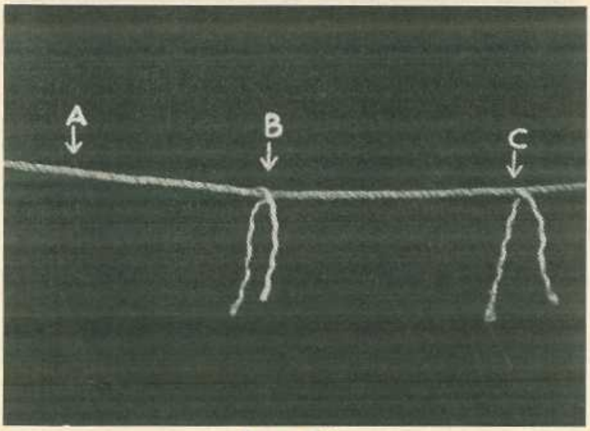


Plate 139.

SPLICING ROPES.—Long splice, showing one pair of strands completely worked in at Fig. A and two pairs cut off ready to be worked into rope at Fig. B and Fig. C.

The Short Splice.

In a short splice the work is commenced by laying the strands back a short distance according to the size of the rope. For ordinary 1¼-inch plough line, seven inches on each of the ends to be spliced will be ample. The ropes are now intermeshed, with each strand of No. 1 rope between two strands of No. 2 rope. (See Plate 138 (B.)). One set of ends should now be lashed to the opposite rope to hold them in position while the other set is being spliced.

The strands of rope 1 are now interwoven along the unwound part of rope 2 by crossing each *over* its immediate neighbour and *under* the next. The rope may be twisted so as to open the strands, but it should be turned back again to tighten it as each strand is passed through. As each strand is dealt with, the rope is turned round in position for the next. When one circuit has been completed the strands of No. 2 are woven into No. 1 and this process is repeated, completing alternately a circuit at each end, pulling the strands up tight, and twisting the rope back to its original position to prevent slackness.

Where a tidy splice is desired, the strands may be gradually reduced in thickness, but cutting out one or more yarns at each circuit. The finished splice will then taper gradually from the centre to the ends. When the splice has been completed it should be rolled underfoot on an even floor to lock the fibres. This greatly improves the appearance of the splice, and the loose ends of the strands may then be safely cut off close to the ropes.

The Long Splice.

This is more difficult to make than the short splice, but it is neater and is much to be preferred for pulley work.

Since it is three to four times the length of the short splice, the strands must be laid back a correspondingly greater distance, that for ploughline being about 2 feet. The rope ends are brought together in the same manner as when making the short splice. A strand of rope No. 2 is then laid still further back up the rope, and a corresponding strand of rope No. 1 is worked into place. In the same way a strand of rope No. 2 is worked into the place of a corresponding strand which has been laid back in rope No. 1. As each strand is laid up into position, sufficient length should be left over to work into the main rope for the finish. In a three-strand rope each pair of strands should now project from the rope at the same distance from those remaining at the centre.

Plate 139, Fig. A, shows one end of the long splice completed, and the other strands ready for knotting and interweaving. (Note the difference in the lengths of the ends.)

The splice is usually finished by taking about three-quarters of each pair of opposing strands and tying these together in the first loop of a reef knot, with the

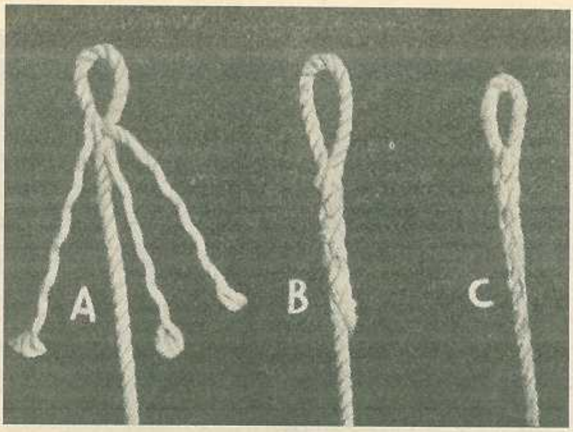


Plate 140.

EYE SPLICE: Fig. A—Start; Fig. B—Completed; Fig. C—Taper finish.

ends still pointing in these original directions. The six ends are then worked into the rope, each being gradually tapered off, the last fraction of each strand remaining being cut off and the end tucked into the rope.

The Eye Splice.

This will be found very useful on leg ropes or for a running noose. It is also frequently worked round a thimble for fixing to the end of a chain or wire, though this operation requires considerable practice.

The strands are laid in the same manner as when commencing the short splice, the rope being doubled back to make the loop (Fig. A).

Holding the loop firmly with the left hand, the strands, commencing with the middle one, are woven into the rope with the right. It should be noted that when the rope has been doubled back the central strand should come over from the top, and the work should be commenced by weaving this strand *across* and *not with* the twist of the rope. Each strand is then taken in turn and worked alternately over and under corresponding strands of the neck of the eye, working always across the direction of twist.

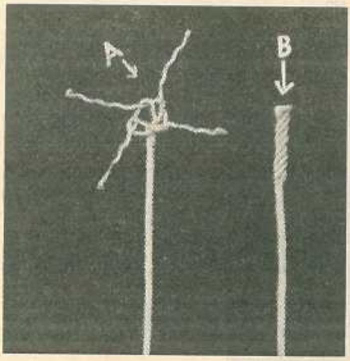


Plate 141.
CROWN KNOT: Fig. A—Start; Fig. B—Finish.

Crown Knot.

This is performed by crossing the strands above the crown as shown in Fig. A. The ends of the strands are now pulled up tight, when it will be found that they point backwards along the rope, so that they can readily be spliced in as in ordinary short splice. In practice the splicing is desirable, as a crown knot is liable to come undone. This method leaves a large knob on the end of the rope. (Fig. B.)

Spliced Crown.

In practice the best and neatest of all finishes is made by laying back about eight inches (for plough line) and then making a loop of one strand. The strand is then passed right round the rope and through the loop (Fig. A). Each strand in turn is then treated in this way—passing through the original loop and its own loop until the last strand passes through all the loops. The ends are then pulled up tightly, when they may be cut off short with no danger of their becoming undone (Fig. C).

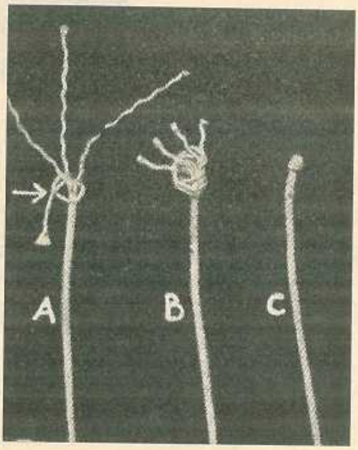


Plate 142.
SPLICED CROWN: Fig. A—Start; Fig. B—Strands looped; Fig. C—Strands tightened up and cut off.

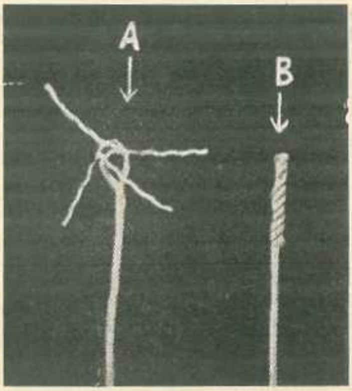


Plate 143.

END SPLICE: Fig. A—Strands looped; Fig. B—Strands pulled up and spliced back.

The End Splice.

Trouble is very frequently experienced with ropes unravelling from the end. While this may be prevented by lashing the ends or by tying a knot, neither of these is quite so satisfactory as simply capping the end.

To obtain an end splice the strands are laid back a few inches, and a turn of each is taken round its neighbour (Fig. A). In a three-strand rope the third strand, after being turned round the second, is passed upwards through the loop formed by the turn of the first strand. The ends are now pulled tight and cut off about half an inch from the knot. They should not be cut too close or the knot will tend to loosen (Fig. B).

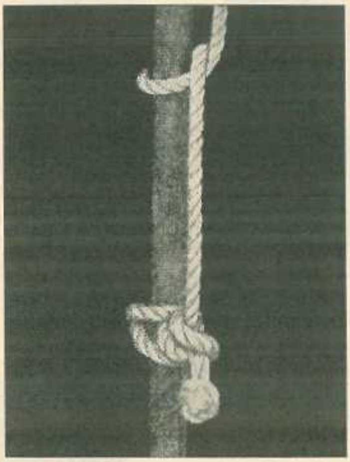


Plate 144.

WELL PIPE HITCH.

GADGETS AND WRINKLES

WOOD VISE JAWS.

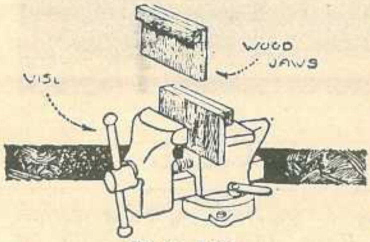


Plate 145.

Most farm shops are equipped with a metal vise, but such a vise is not suited to wood work. The jaws of a metal vise are small and sharp and cut into wood badly. The purpose of the wood jaw pads illustrated here is to enlarge the clamping surface and afford a cushion for the jaws, making the vise suitable for wood as well as for iron work.

These pads are made of hard wood, their size depending upon the size of the vise they are to be used in. The grain should run up and down. A cleat about an inch and a-half wide is fastened along the top of each of the wood pads. Wood screws are used for this purpose. This cleat keeps the pad from splitting and also holds it in place when the vise is opened up, for it rests along the top of the vise jaw. A metal vise equipped with these pads will hold a board firmly without injury to the surface.

TO MEASURE DISTANCE.

To measure the length of a drain, a paddock, or a fence line, tie a piece of white rag round the rim of a wheel of a vehicle, drill, or spreader, and drive along the proposed line or route, counting the number of the revolutions of the wheel. Then measure the circumference, or the distance covered by one complete turn of the wheel on the ground, and multiply the result by the number of revolutions of the wheel already counted to get the total distance of the proposed line or route.

INTEREST TABLE AND CALCULATION.

2½ per cent. is 6d. in £	12½ per cent. is 2s. 6d. in £
3 per cent. is 7¼d. in £	15 per cent. is 3s. in £
4 per cent. is 9½d. in £	17½ per cent. is 3s. 6d. in £
5 per cent. is 1s. in £	20 per cent. is 4s. in £
6 per cent. is 1s. 2½d. in £	22½ per cent. is 4s. 6d. in £
7½ per cent. is 1s. 6d. in £	25 per cent. is 5s. in £
10 per cent. is 2s. in £	

At 5 per cent. per annum, the amount of interest on £1 for every month is 1d.; having ascertained what this amounts to, other rates may be reckoned by adding to or dividing it.

2½ per cent. is one-half.

3 per cent. is six-tenths.

3½ per cent. is seven-tenths.

4 per cent. is four-fifths.

Thus 5 per cent. on £60 for ten months would be £2 10s., because sixty pennies equal five shillings, multiplied by ten give fifty shillings.

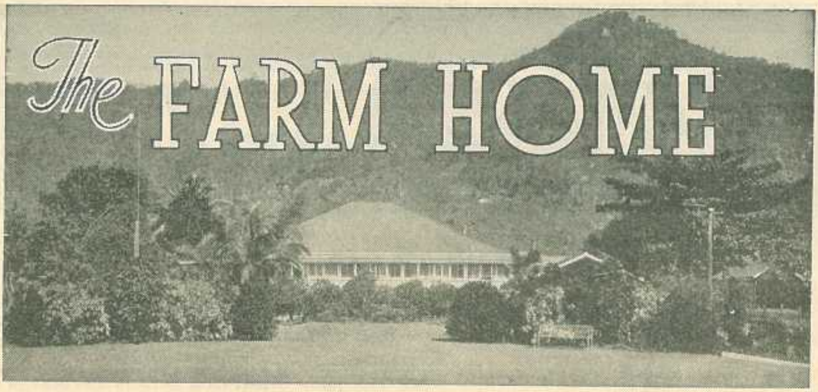
£60 at 2½ per cent. is £1 5s. for ten months.

£60 at 3 per cent. is £1 10s. for ten months.

£60 at 3½ per cent. is £1 15s. for ten months.

£60 at 4 per cent. is £2 for ten months.

If the rate of interest be more than 5 per cent., the fraction must be added. Thus, to reckon 6¼ per cent. add ¼; 7½ per cent., ½.



Care of Mother and Child.

Under this heading an article supplied by the Maternal and Child Welfare Service of the Department of Health and Home Affairs, dealing with the welfare and care of mother and child, is published each month.

BABY'S MILESTONES.

Learning to Walk.

MOST of us have watched at some time or another the first staggering steps of a one year old—and no doubt appreciated the charm of his pride in the new achievement, as we waited for the inevitable bump at the end of the performance. But how many of us realise what a complicated mechanism walking is and that its success depends on a whole series of activities which have preceded it as well as on the strength of baby's structure of bone and muscle?

A baby should not walk unless he has previously learnt to hold on and pull himself up, and also to crawl—as crawling is very useful for all-round development and should be encouraged. He must have co-ordination of his eye muscles so that he can direct his steps as well as a sense of balance and firm, elastic leg muscles.

The average baby develops his own mechanisms with very little help and the mother should assist—not by sitting or standing baby up or trying to make him walk before he is ready, but by providing the necessary incentive to development, as well as, very importantly, the right foods.

Do not hamper a baby with too many clothes or too tight napkins or panties. Buy or make a play-pen for him, in which he will first exercise his muscles by vigorous kicking and rolling about and stretching out for his playthings. The sides of the play-pen are excellent for a baby to learn to pull himself up and, if brightly coloured toys (strings of painted cotton-reels do quite well) are hung on the sides he is encouraged to move around and examine them one by one. Later, he will learn to sidle along from rail to rail, and so very gradually the whole mechanism is built up and baby takes his first steps by himself!

Now is the time when the mother should be patient. Remember, it is the baby who is learning, and so let him shoulder his own responsibilities and face up to his own mistakes.

Do not be sentimental over his tumbles—they have to come. A baby has to learn not only to get his balance on the straight but to negotiate corners, climb elevations, and so on; he even has to allow for the unexpected presence of a slippery patch, a moving rug, or a strolling cat. We all learn by doing the wrong thing and finding the result a little painful—a baby will develop much more normally if he is allowed to learn that way, too. So, while taking reasonable precautions, do not overprotect him but rather encourage him. He will not be afraid if he is allowed to realise that it is his own lack of practice which is at fault and that he really is improving. One cannot but be impressed by the perseverance of a child in spite of his falls and setbacks. He may well prove an example to many who are older.

Questions on this or any other matter concerning Maternal and Child Welfare will be answered by communicating personally with the *Maternal and Child Welfare Information Bureau,* 184 St. Paul's terrace, Brisbane, or by addressing letters: "Baby Clinic, Brisbane." These letters need not be stamped.

IN THE FARM KITCHEN.

The Makings of a Square Meal.

In present circumstances, recommendations are subject, of course, to the availability of the ingredients mentioned or of suitable substitutes.

Haricot Bean Soup.

Soak 4 oz. haricot beans overnight, then place them in a casserole dish with enough stock or water to cover. Cover with a tight-fitting lid and cook until tender. Turn into a saucepan with 1 lb. sliced tomatoes, 2 minced onions, 3 or 4 stalks of chopped celery. Add more stock to more than cover vegetables and simmer until vegetables are tender. Rub through a sieve and keep hot. Melt 1 dessertspoon butter in a saucepan, add 1 dessertspoon flour; cook a little, add puree, and stir until it thickens, then add hot milk to the required thickness. Season with pepper, salt, and a little grated nutmeg.

Cream of Spinach.

Cook 1 bunch spinach in the usual way and rub through a fine sieve. Melt 2 level tablespoons butter in a saucepan, add 2 level tablespoons plain flour and cook a little, add 2 cups stock and bring to boil and then simmer for 5 minutes. Now add 2 cups hot milk and spinach, salt and pepper, and if liked a little grated nutmeg. A little cream may be added just before serving.

Stuffed Tomatoes.

All sorts of tasty little odds and ends may be used for stuffing tomatoes. Use firm tomatoes, cut a slice from the top, and scoop out some of the pulp. Mix with the pulp some grated cheese and breadcrumbs, minced meat, chicken, or ham, smoked or free cooked fish, mushrooms, or celery. Flavour with pepper and salt, refill the tomatoes, sprinkle with fine breadcrumbs, and place on the top of each a small piece of butter. Bake in a moderate oven for twenty minutes.

Tomato Toast.

Take 1 ripe tomato, 1 egg, 1 oz. cooked ham, ½-oz. butter, a flavouring of onion, salt, and pepper. Peel the tomato, cut up, and mince the ham and onion. Melt the butter, add the tomato, and cook for a few minutes, stirring all the time. Take from the fire to cool slightly, add the beaten egg, stir over the fire till it thickens, and serve on hot buttered toast.

Tomatoes with Cheese Cream.

Take 3 or 4 tomatoes, 1 gill cream, 1½ oz. grated parmesan cheese, 2 tablespoonsful aspic jelly, salt, and pepper. Cut the tomatoes in half, remove some of the pulp, and drain them. Whip the cream stiffly, season with salt and pepper, whisk in the aspic jelly, which should be liquid, but cold. Add the grated cheese, fill the tomato shells, and pipe a pretty border with a rose-pipe. Garnish with cress and serve very cold.

Eggs and Tomatoes.

Take the required number of fresh eggs, firm tomatoes, slices of fried bread, salt and pepper, salad.

Cut a slice off the end of each tomato, scoop out some of the pulp, and season the inside of the tomatoes with salt and pepper. Into each one carefully break an egg, put on the lids, and bake in a moderately hot oven until the eggs are set. When cold, serve garnished with salad.

Pork Pie.

Take 1 lb. minced pork, 1 pig's foot (for jelly), and prepare as follows:—Take 1 lb. self-raising flour, melt ½-lb. lard, pour over flour and work into a dough. Line a cake tin, fill with minced pork, and cover with remaining dough. Bake in moderate oven for one hour. Cover pig's foot with water, bring to boil, and allow to simmer for one and a-half hours. Strain and season to taste. Allow stock and pie to cool a little then pour pig's foot stock into the pie and allow to cool and set.

This is a very nice dish and is readily prepared. If available, two pig's feet may be used instead of one to provide for a richer stock and jelly.

Baked Cabbage.

Shred a fairly large cabbage finely and soak in cold salted water until crisp. Drain well and put in a large saucepan with a tablespoon butter, pepper, and salt to taste. Cover well with a tight-fitting lid and cook until tender. Stir now and again during the cooking to prevent burning. Allow to cool then add 2 well-beaten eggs, 1 tablespoon shredded and fried bacon, a little grated nutmeg. Well grease an ovenproof dish or basin and sprinkle thickly with brown breadcrumbs. Fill centre with the cabbage and cover with more breadcrumbs. Bake in a hot oven for half an hour, turn out and serve with brown sauce or as a vegetable to serve with roast meat.

Baked Rhubarb Pudding.

Stew 1 bunch rhubarb in the usual way, using as little water as possible. Remove the crust from stale white bread and weigh 1 lb. Cover this with just enough milk and when quite soft squeeze out until almost dry. Mix this with 2 oz. of finely-grated suet, 2 oz. sugar, and 1 beaten egg. Line a well-greased round cake tin with this mixture, reserving enough for top. Fill with rhubarb, then cover with the remaining bread mixture. Bake in a moderate oven for 1½ hours. Turn out carefully and serve hot.

Steamed Wholemeal and Honey Pudding.

Pour 1 cup hot water over 2 cups fine white breadcrumbs (or wholemeal). Allow to soak for a few minutes, then add ½-cup finely-chopped suet, 1 cup sultanas, 1 cup wholemeal flour, ½-cup honey, 1 well-beaten egg, a little grated nutmeg, ground cinnamon, and a little mixed spice if liked. Dissolve ½-teaspoon bicarbonate of soda in 1 tablespoon hot water and add to mixture. Beat well together and steam in a well-greased mould for 3 hours. A little sugar may be added if needed a little sweeter. Before serving, stud with blanched whole almonds.

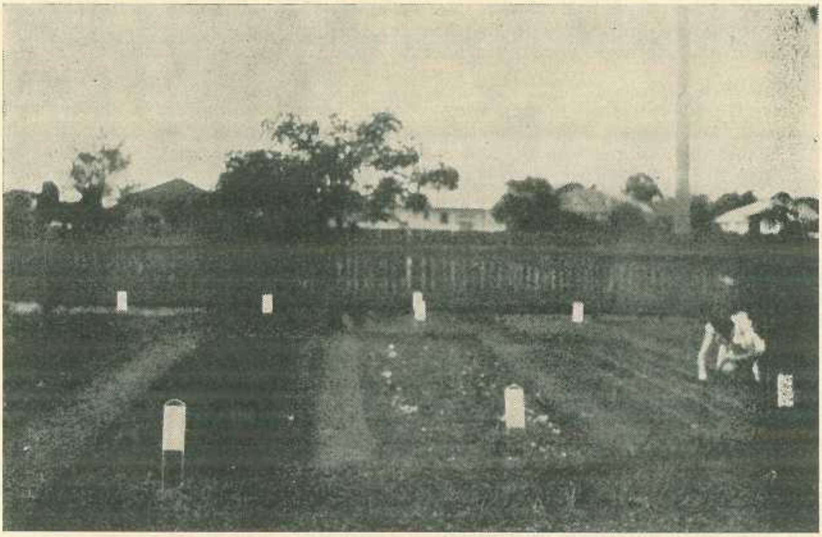


Plate 146.

BACKYARD FOOD PRODUCTION.—A Brisbane housewife anticipates a vegetable shortage and prepares for it. Every plot has a "signboard" with all relevant data duly set out on it.

A. H. TUCKER, Government Printer, Brisbane.