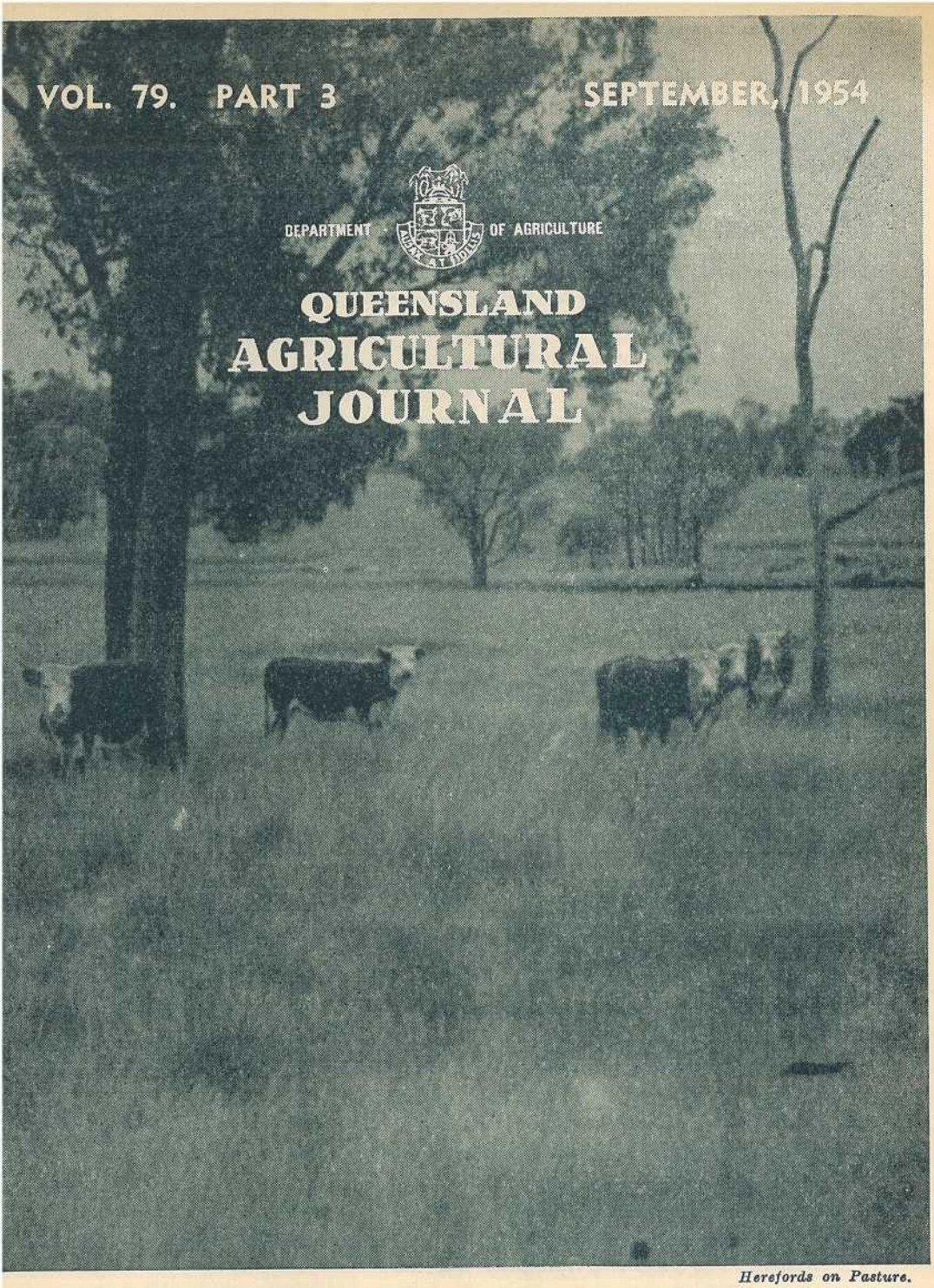
VOL. 79. PART 3 SEPTEMBER, 1954

DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL



Herefords on Pasture.

LEADING FEATURES

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

Queensland AGRICULTURAL JOURNAL

Contents

Tuberculosis-Free Cattle Herds.

TESTED HERDS (As at 20th August, 1954).

The Tuberculosis-Free Herd Scheme (which is distinct from the tuberculosis eradication scheme operating in commercial dairy herds) was initiated by the Department of Agriculture and Stock for the purpose of assisting owners of cattle studs to maintain their herds free from tuberculosis and so create a reservoir of tuberculosis-free cattle from which intending purchasers can draw their requirements.

The studs listed here have fulfilled the conditions to the date shown above.

Full particulars of the scheme and Agreement for Testing forms may be obtained from the Under Secretary, Department of Agriculture and Stock, Brisbane, or from Divisional Veterinary Officers throughout the State.

Breed.	Owner's Name and Address.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas F. H. Hutton, "Bingegang," Dingo
A.I.S.	M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy F. B. Sullivan, "Fermanagh," Pittsworth D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth W. Henschell, "Yarranvale," Yarranlea Con. O'Sullivan, "Navillus" Stud, Greenmount H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest J. Phillips and Sons, "Sunny View," Benair, *via* Kingaroy Sullivan Bros. "Valera" Stud, Pittsworth Reushle Bros., "Reubydale" Stud, Ravensbourne H. F. Marquardt, "Chelmer" Stud, Wondai A. C. and C. R. Marquardt, "Cedar Valley," Wondai A. H. Sokoll, "Sunny Crest" Stud, Wondai W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman W. H. Thompson, "Alfa Vale," Nanango S. R. Moore, Sunnyside, West Wooroolin H.M. State Farm, Numinbah D. G. Neale, "Groveley," Greenmount Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah W. D. Davis, "Wamba" Stud, Chinchilla Queensland Agricultural High School and College, Lawes C. K. Roche, Freestone, Warwick Mrs. K. Henry, Greenmount D. R. Green, Deloraine Stud, Durong, Proston
Ayrshire	L. Holmes, "Benbecula," Yarranlea J. N. Scott, "Auchen Eden," Camp Mountain "St. Christopher's" and "Iona" Studs, Brookfield road, Brisbane E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough G. F. H. Zerner, "Pineville," Pie Creek, Box 5, P.O., Gympie
Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
Guernsey	C. D. Holmes, "Springview," Yarraman A. B. Fletcher, Cossart Vale, Boonah W. H. Doss, Degilbo, *via* Biggenden
Jersey	Queensland Agricultural High School and College, Lawes J. S. McCarthy, "Glen Erin" Jersey Stud, Greenmount J. F. Lau, "Rosallen" Jersey Stud, Goombungee G. Harley, Hopewell, M.S. 189, Kingaroy Toowoomba Mental Hospital, Willowburn Farm Home for Boys, Westbrook F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line R. J. Browne, Hill 60, Yangan P. J. L. Bygrave, "The Craigan Farm," Aspley R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood E. A. Matthews, "Yarradale," Yarraman A. L. Semgreen, "Tecoma," Coolabunia L. E. Meier, "Ardath" Stud, Boonah A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango F. W. Verrall, "Coleburn," Walloon C. Beckingham, Trouts road, Everton Park W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala G. H. Ralph, "Ryecombe," Ravensbourne Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman D. R. Hutton, "Bellgarth," Cunningham, *via* Warwick J. W. Carpenter, Flagstone Creek, Helidon H. G. Johnson, "Windsor" Jersey Stud, Beaudesert
Polled Hereford	W. Maller, "Boreview," Pickanjinnie J. H. Anderson, "Inverary," Yandilla D. R. and M. E. Hutton, "Bellgarth," Cunningham, *via* Warwick E. W. G. McCamley, Eulogie Park, Dululu Wilson and McDouall, Calliope Station, Calliope

Irrigation Practice in Queensland.

Part 6. Fundamentals of Water Application for Surface Irrigation.

By A. NAGLE, Irrigationist, Agriculture Branch.

Land Preparation.

For efficient water application the basic requirements are accuracy in grading of land to give a uniform irrigation slope; correction of side fall between banks to ensure even distribution of water and uniform wetting of the land; construction of suitable head ditches designed to deliver the required volume of water at sufficient height above the land to effect efficient cover and spread of water; provision of water control outlets in head ditches to give effective control of border or furrow flow; and provision of adequate drainage facilities to convey excess irrigation and storm water to drainage channels or natural outfalls.

Efficient irrigation involves the application of water to wet the soil uniformly throughout the field to the depth required by the crop or crops being irrigated.

Water Infiltration.

An understanding of the soil type infiltration (or soakage) rate, irrigation slope (or grade of land) and rate of flow (or volume of water used in either border or furrow), and a knowledge of crop water requirements are necessary when considering the design of irrigation layout. The same factors are important during the course of irrigation.

Infiltration rate (the rate at which water is absorbed into the soil) varies widely. On sandy, coarse-textured soils with no obstructions to under-drainage, absorption will continue at a uniform rate as long as water is applied to the surface, absorbing at the rate of up to 5 feet of water in 24 hours. On finely textured soils such as clays and clay loams, a high initial infiltration rate occurs, with a slower rate of intake as the surface soil becomes wet, until after a few hours the infiltration rate is negligible.

Sandy soils require large flows of water. Where sandy soils are used for border or furrow irrigation, the length of the border or furrow should not exceed 4–5 chains, and the border width is reduced to 20 ft. This ensures that the water required can be applied in a short time, thus avoiding excessive loss of water and preventing over-watering, particularly at the top end of the run.

Heavy soils such as clays and clay loams which swell considerably on wetting require a relatively small flow or head of water flowing for a considerable time to effect thorough wetting of the soil.

Heavy impermeable soils may not be wetted to the required depth with the usual application of water, and for these soils it has been found that a supplementary watering applied 2–3 days after the first irrigation will result in deeper penetration of water.

The rate of flow and time of application of water are also governed by the slope or grade of the land; the amount of vegetative cover (that is, the density of the crop growing) also exerts an influence on rate of flow.

Relatively steep slopes bare of vegetative cover require a smaller flow than would the same slopes with a dense ground cover of pasture. This is explained by the obstruction offered by the dense pasture to the advance of water down the border. The flow used at the Bureau of Investigation's Research Station at Gatton for irrigating lucerne and pastures varies from $\frac{1}{5}$ cusec to $\frac{1}{2}$ cusec per border (5 chains long x 27 ft. wide), according to growth of pasture and moisture content of the soil, the grade being 3–4 in. per chain. It has been found there that some adjustment of the watering plan is necessary according to the growth of pastures being watered. With a dense growth, a larger flow is required; otherwise a heavier application of water than desired will occur.

A frequently quoted objection to the use of surface irrigation, both furrow and border, is that the top end of the land irrigated receives more water than does the bottom end. However, by careful design of border or furrow length according to soil type and slope of land, the actual difference in penetration of water at the top and bottom end of the "run" can be reduced to a minimum by having control of the amount or flow of water for each irrigation. Unduly long furrows and borders give uneven distribution of water; border lengths no longer than 5–8 chains are usually advisable.

Although water is applied at the top end of the border first, it does not necessarily follow that the soil at the top end absorbs more water than the soil at the bottom end of the border. There is usually a rapid infiltration rate initially which is reduced as irrigation is continued. When the surface soil becomes wetted, the fine soil particles swell, the cracks and pores in the soil become closed, while the inwashing of small particles and general puddling of the surface soil restricts the free downward movement of water and the outflow of air. The net result is that the soil in the border is wetted reasonably evenly from top to bottom of the border, when water is efficiently applied and distributed.

Another fact often overlooked is that when lucerne crops or pastures are being irrigated the heavy ground cover, particularly of pastures, banks up a considerable depth of water on the surface of the land being irrigated. Thus it is often necessary to cut off the flow when the water has reached a face within a quarter or an eighth of the border length from the bottom end. Otherwise a large volume of water would reach the tail drain and be wasted. The point of advance of water when the flow is stopped varies considerably even in the same field under different ground cover and soil moisture conditions.

After the flow ceases the pressure or head is reduced; therefore the residual water moves slowly down the border and this slow advance of water allows for a good wetting of the bottom end of the border.

In practice it has been found that the middle may receive less water than the top or bottom ends of the border.

After the initial infiltration, the intake of water is dependent on the permeability of the soil being irrigated. (Permeability is the rate of flow of water in saturated soil). In the field the lower horizons usually tend to a lower infiltration rate due to increasing clay content of the subsoil, and this is an important factor in the lowered infiltration rate as irrigation progresses.

This general principle applies to all systems, including spray irrigation. Actually, the mechanical effect of the spray droplets of water pounding the surface particles of soil may cause severe surface "puddling" of the soil, thereby reducing the intake of water into the soil.

With the furrow method of irrigation the same broad principles of water absorption apply, but as the water is distributed through furrows rather than over the surface of the land as in border irrigation, some additional regulation of water application is given by altering size of the water furrow.

Increasing the size of the furrow allows the use of a bigger flow. A rough cloddy furrow retards the flow of water and makes for increased wetted furrow area and increased infiltration. In a furrow which has not been cultivated since last watering, sealing of the soil surface makes for lowered infiltration and faster rate of advance of water. On the other hand, weed growth and trash in this type of furrow reduce the rate of advance of water and favour infiltration.

It would be ideal where furrow irrigation is employed to have a soil type with high infiltration rate at the end of the furrow. This seldom happens and more commonly the reverse is true. On most of the alluvial soils the lighter soil types are found on the high levee soils on the stream banks, while the heavier soils occur away from the banks.

Furrow spacing also has a bearing on water usage, and while furrow spacing usually conforms to the width of row of the crop irrigated, closer spacing, particularly on sandy or porous soils, will give more effective and even distribution of water.

Water penetration on sandy soils usually has pronounced vertical movement with little lateral or side movement. A profile showing distribution of water under a furrow is similar to that of an inverted cone. Continuing the flow to wet the inter-row spaces has little practical effect on such soils unless a close furrow spacing is adopted; usually about 2-feet spacing is required. On heavy, less permeable soils, the lateral movement of water is often considerable, allowing wider spacing of furrows. The penetration profile for a furrow on heavy soil is approximately spherical in shape.

Control of irrigation water on sandy soils with a slope of six inches or over per chain is difficult. The steepness of slope may demand a relatively small furrow flow to prevent erosion of the soil. A small flow results in increased usage and uneven distribution of water. As a general broad principle it may be stated that increasing the length of furrow increases the amount of water applied, while increasing the slope reduces application of water and makes for lowered infiltration, even allowing for the fact that weed growth and trash in this type of furrow tend to increase infiltration.

Efficiency in Water Application.

While a farmer can acquire efficiency in water application by experience and a study of certain soil, crop and topographical factors, a knowledge of soil moisture relationships or of the capacity of the soil being irrigated to hold water for crop growth is also essential. This ability to hold water is related to the field capacity of soils. Field capacity is the amount of water held in the soil after internal drainage is completed and is computed as a percentage of dry weight of soil.

Not all water held in the soil against gravity is available for plant growth, because growth ceases when a critical soil moisture content known as wilting point is reached. Moisture in the soil at this point is unavailable to plants and permanent wilting occurs at this stage.

Approximately half only of the total water in a soil is available to plants; clay soils with a field capacity of 40–45% and a wilting point of 20–22% have the greatest range and therefore the greatest amount of available soil water (20–25%). The highly structured black clay soils of the Lockyer district are in this class. Sandy loam soils, on the other hand, have a field capacity of 12–15% and a wilting point of 5–6%, so their range of available soil moisture is only 7–9%. Loam and clay loam soils have figures for field capacity and wilting point intermediate between the soil types mentioned. Sufficient irrigation should be applied to wet to field capacity the soil zone in which the greatest concentration of roots occurs.

Depth of penetration after irrigation can be determined in the field by the use of a soil probe, which is simply a 3 ft. 6 in. length of ½-in. round iron to which a handle is welded. The blunt end of this probe is pressed into the soil until firm resistance is met, the depth of penetration then being measured on the probe. This shows the depth of soil which has been wetted adequately. It is important that the soil auger be used before, and the soil probe after, each irrigation. Efficient irrigation and economic crop production is possible only when a knowledge of when to apply water and what amount of water is needed for the particular crop's requirements is known for each irrigation. By this means overwatering and wasteful use of water can be avoided.

The stage at which wilting point of a soil has been reached can be determined approximately in the field by pressing a small piece of soil in the hand. A clay soil which has a high wilting point may show some signs of dampness at this point and retains its shape after pressure. Sandy loam soils, on the other hand, show little or no dampness at wilting point and are crumbly under pressure.

In actual practice, irrigation water is applied before the soils are dried out sufficiently to cause stoppage of plant growth. Crops usually give definite visual indication of impending water shortage, but a knowledge of soil characteristics is desirable in order to anticipate the need for irrigation and consequent check in plant growth.

The use of a soil auger is necessary for assessing soil moisture content before irrigation. Borings should be made to the depth of effective root concentration of the crops being irrigated so that the amount of water required can be estimated from the depth of dry soil.

The approximate amount of water available for plant growth in each foot of soil according to soil type when saturated to field capacity is given as:—

Sands	¼ to ¾ in.
Sandy loams	1 to 1½ in.
Silty loams	1½ to 2 in.
Clay loams	1½ to 2 in.
Clays	2 to 3 in.

This available water must be considered in connection with the depth of penetration of irrigation water applied to various soil types.

Depths reached by a 4-inch irrigation when soils are at wilting point are given as follows:—

Sandy loam.	Loam.	Clay.
5.3 ft.	2.7 ft.	1.8 ft.

These figures are given as a general illustration of soil moisture relationships rather than figures for specific soils.

The deeper water penetration and low available moisture in sandy or sandy loam soils call for careful handling of irrigation water to prevent overwatering and soakage below the root zone of crops grown on these soils. Clay soils with high available moisture content can absorb large quantities of irrigation water into the 2–3 ft. zone, where it is usually utilized by plants.

Continuing the flow of water on clay soils for long periods when soakage has ceased or is very slow will cause ponding or waterlogging of the surface and damage to the growing crop and soil.

Frequency of Irrigations.

In any particular locality the frequency of irrigations or the interval between irrigations is controlled largely by soil type and the crop irrigated. Climatic factors such as temperature and winds also have an influence. During hot windy weather evaporation and transpiration are increased and a shorter watering interval is required to prevent occurrence of stress conditions in crops.

While plants are able to utilise soil water between field capacity and wilting point, optimum conditions for plant growth can be expected at moisture levels between these two points, so that in practice irrigation should be applied before the wilting point of soils is reached. Delaying irrigation beyond the normal irrigation interval may cause excessive and wasteful use of water in addition to a reduction in crop growth.

At the Bureau of Investigation's Irrigation Research Station at Gatton, on a heavy clay soil the interval between waterings in December and January is usually 12–14 days for clover-phalaris-cocksfoot-ryegrass pastures, an application of 3 inches usually being sufficient to replenish soil moisture to a depth of 2 ft. to 2 ft. 6 in. An extension of the watering interval to 21 days during periods of high temperatures caused drying to greater depth and the appearance of deep cracks in the soil. Due to this deep cracking it was not possible to apply a light irrigation, and approximately 8 inches of water had to be used to wet the soil to field capacity. Much of this water penetrated below the zone of maximum root concentration and was lost for crop growth.

FARMERS' INTEREST IN BETTER PASTURES.

As livestock contributes between 60% and 70% of Queensland's income from primary industry, there is every reason to improve pasture production by the development of more efficient methods of pasture management, and, where possible, by the introduction of better species, the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) said recently.

Farmers and graziers, well aware of the advantages to be gained from pasture improvement, are forming Pasture Improvement Leagues—organisations which may well become State-wide.

The Leagues seek to make greater and more economic use of natural resources by encouraging pasture improvement and water and soil conservation.

Another function of such bodies is to arrange field days at which agrostologists, irrigationists and agricultural field officers of the Department of Agriculture and Stock discuss the best pasture species for the particular area, methods of establishment and management, and fertilizer treatment.

Experimental work is encouraged and the results of any work carried out on a member's property are made available to all members of the League.

Mr. Collins said he was pleased to announce that the Upper Mary Valley Pasture Improvement League was formed recently at a meeting of farmers and graziers at Kenilworth.

The formation of this League and the appointment of a provisional Committee followed addresses by the Department's Senior Agrostologist (Mr. S. Marriott), and Messrs. A. Hegarty (Adviser in Agriculture, Brisbane) and G. Cassidy (Adviser in Agriculture, Gympie district) on the problems of pasture improvement and the results so far achieved in trials in southern Queensland. The talks were illustrated with lantern slides depicting results obtained from Departmental plots in south-eastern Queensland.

Mr. D. K. Price, Secretary of the Brisbane Valley and South Burnett Pasture Improvement League, explained to an audience of 70 farmers and their wives the aims of the pasture improvement movement, and assisted in the inauguration of the new body. The Chairman of the meeting was Mr. E. O. De Vere, of Kenilworth.

EXPANDING SOIL CONSERVATION SERVICE.

A soil conservation officer, Mr. T. G. Kidston, took up duties at Bundaberg recently to give on the spot advice to landholders in the district who are establishing soil conservation programmes on their properties. This was announced by the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.), who said it was the first appointment of a soil conservation officer to the Bundaberg area.

Mr. Kidston, an Adviser in Agriculture who has specialised in soil conservation work, has had considerable experience in the Bundaberg district's soil erosion problem during recent years, and has been largely responsible for starting the conservation projects now under way.

Cane farmers in the Childers and Isis districts have been concerned for some time at the erosion in the sloping cane lands of the area, and soil conservation officers have been giving a great deal of attention to these districts.

The work has now expanded to such an extent that it has become necessary to station a full-time officer in the Bundaberg district to serve the shires of Miriam Vale, Woocoo, Kolan, Gooburrum, Woongarra, Isis and Burrum.

Bundaberg district farmers are taking a keen interest in the soil conservation work already begun, and are impressed with the efficiency of the control measures established.

The Department recognises the desirability of stationing trained soil conservation officers in districts where there is an erosion problem of some consequence, and is making appointments as the officers become available and as the problems arise.

Row Lucerne for Grazing.

By W. G. ROBERTSON.*

This article records the results of many years' work on the row cultivation of lucerne pastures. Row cultivation has long been a standard practice for many crops, but its adoption as a form of pasture husbandry is something new.

Lucerne is being grown now without irrigation as far west as the 22 inch rainfall country of southern Queensland and New South Wales. However, in these low rainfall areas you need to modify the normal environment so as to conserve soil moisture. This can be done by reducing the number of plants in a given area by growing lucerne in rows, and cultivate between the rows. Then the real value of lucerne will be apparent and the total yield will be about the same as the yield from a sward, but instead of being restricted to short periods after good rains, growth will be active over a much greater part of the year.

Cultivation between the rows permits considerable reserves of moisture to be built up in the ground, and consequently plants in the rows flourish, even through a dry period. Virtually no available soil moisture is conserved under the sward; therefore growth in the case of the sward will be largely governed by the quantity and frequency of rainfall.

Observations have shown, for example, that a dry spell of 6 weeks will remove all available moisture from 4 feet of soil in a lucerne sward. On the other hand, a dry spell of 3 months is barely sufficient to reduce soil moisture to the same level in rows 3½ feet apart.

Native pastures in Queensland make vigorous and bulky growth for a short period following summer rains. They deteriorate quickly during autumn and winter, so that by spring the feeding value is not much better than that of straw. All classes of grazing stock lose condition, at times, if grazed solely on such pastures, and deaths are common. Any worthwhile improvement in our pastures must depend on introduced species—witness the widespread use of paspalum, Rhodes grass and numerous others.

It is extremely unlikely that a satisfactory winter growing grass will be found. It would need to withstand the competition of our vigorous summer growing species, and then make growth during the winter on an erratic rainfall. Even if such a grass were discovered, many years would elapse before it could be thoroughly tested and seed made available in commercial quantities.

Scrobic (*Paspalum scrobiculatum*) is a substitute for a winter growing grass, beause it retains a high degree of palatability and a relatively high feed value during the winter months

* Formerly a Research Officer with C.S.I.R.O., Mr. Robertson is now farming "on his own" in the Wandoan district.

even when mature or frosted. However, it is relatively low in protein, and for the grazing districts of the State lucerne is recommended. A great many legumes have been tried. Among them only lucerne is deep rooted, drought-resistant and green in the dry winter (if not frosted) and spring. Lucerne presents you with the opportunity to put an end to the annual starvation of your stock.

Recent trials with sheep have shown that animals fed small amounts of lucerne daily will consume larger quantities of dry grass than those not fed the lucerne supplement. Sheep need to digest approximately 6 lb. of dry grass daily to obtain sufficient nutrients to survive. During a dry winter, the animals are unable to handle this amount, and a gradual loss of condition results. If, however, they are fed a small quantity of lucerne daily they are able to consume sufficient grass to meet their requirements. This small lucerne supplement makes all the difference. With it the animals stay in good condition, without it they lose condition and perhaps die.

Soils and Districts.

Someone has said that "the only place where lucerne does not grow is where it has not been tried!" Deep loams, clay loams and clay soils generally produce good crops of lucerne without the addition of fertilizers. There are large areas of these soils on the Darling Downs, in the brigalow country, and on the river and creek flats of the Burnett and Fitzroy Basins.

Although best results can be expected from deep, highly fertile soils, as on the Darling Downs and river flats, very good stands can be grown in less favoured localities. Sands and other light soils are generally of low fertility and on these the success of lucerne may depend on fertilizers, particularly superphosphate. It may also be necessary to apply sulphur to lucerne on some soils.

Generally speaking, the establishment of row cultivated lucerne pastures is to be most strongly recommended for the better rainfall grazing areas. This applies particularly to the brigalow and open plains which occur in a broad belt extending from Goondiwindi to the Clermont-Nebo districts.

Area Required.

The area of row lucerne required on any property will depend primarily on the number and class of stock carried. Dry stock require less lucerne than breeding animals. At Lawes and on the Darling Downs, row lucerne has consistently carried 3 sheep per acre for a number of years. However, a pure lucerne diet is too rich and the animals should have access to some grass to balance the diet.

For breeding ewes and cows there should be approximately 1 acre of lucerne to 2 acres of grass, while dry stock need 1 acre of lucerne to 8 acres of grass. Where sown pasture is available, or where the native pasture contains burr clover and similar plants, the proportion may be increased. Then 1 acre of lucerne to 3 of grass for breeding stock, and 1 to 12 for dry stock, will do.

In districts where land is regarded as "a sheep to the acre country," 1,000 breeding ewes would require 200 acres of lucerne and 400 acres of grass. Likewise, 1,000 wethers would require about 90 acres of lucerne and 700 acres of grass to maintain them in good condition all the year. When estimating areas for breeding cows and bullocks, take one beast as being the equivalent of 6 sheep.

It may be impracticable for a 15,000 acre breeding property to have 5,000 acres of lucerne. However, 500 acres on such a property could be the means of saving large numbers of stock. Today in the brigalow country, one 10,000 acre cattle breeding property has approximately 250 acres of row lucerne. The technique is to muster the breeders regularly for

animals low in condition. These are placed on the lucerne until they are strong enough to go bush again. In other words, the lucerne is used for hospital paddocks and so drought losses are minimised.

When row lucerne is used, not only is the overall carrying capacity of a property increased, but the animals are carried in better condition throughout the year.

Seedbed Preparation.

The results achieved from sowing lucerne will depend largely on the preparation given to the land before sowing. A good seedbed as for wheat or sorghum is most desirable. The initial cultivation should be carried out at least six months before sowing. This allows all trash to decompose and conserves the moisture from pre-planting rains. Weed growth should be controlled to conserve soil moisture and to reduce the number of weed seeds in the ground, but unnecessary working of the soil should be avoided.

Virgin land should be cropped with annuals for at least a year before sowing to lucerne. This is necessary to reduce the number of native pasture plants that persist when grassland is brought into cultivation. It also aids uniformity in the seedbed by levelling out rises and depressions caused by trees, stumps, melonholes or gilgais. The important thing is to conserve water in the subsoil from previous summer rains and so provide deep moisture for later growth. This fallowing process is most necessary for success. The preparatory winter crop of oats or wheat should be grazed off early and not allowed to use up much of the soil moisture.

Sowing.

March, April, May and June are generally suitable months for sowing, but April and May are to be preferred. Spring sowings are often unsuccessful because of lack of rain or competition from spring and summer growing weeds. In Central Queensland, there is less likelihood of winter rain than in South Queensland, and there are often severe heatwaves between March and May. The only remedies are to select deep, moisture-retaining soils, fallow well before sowing and sow immediately the rain comes. Do not wait!

Lucerne seed is generally readily available from seed merchants. You should insist on seed conforming to legal standards for germination and purity. Fresh seed should be mainly yellow or yellowish-green in colour, with a minority of brown seeds. A sowing rate of 1 lb. per acre is adequate for row lucerne.

The best spacing between rows at Lawes and on the Darling Downs is 3 ft. 6 in. In areas of lower rainfall, like the Maranoa, Dawson Valley and Central Highlands, the row spacing may be extended to 5 ft. The seed should be sown at a depth of ½–1 in. On soils which tend to form a hard surface crust, good strikes have been obtained by sowing on the surface. On the other hand, for soils which dry out rapidly, such as sands and sandy loams, it is often better to sow 2 in. deep.

Lucerne is best sown through a lucerne box attached to a combine or wheat drill. The machine should be set for 6 lb. per acre, but using every sixth run of the drill gives an actual planting rate of 1 lb. per acre. Sowing with wheat or oats helps to pay for establishment, keeps down weeds and protects the young lucerne if the winter is severe.

Generally, lucerne is sown shallower than wheat or oats. If the tubes are allowed to hang free, leaf harrows or brush harrows dragged behind the combine will cover the seed to a satisfactory depth. It is important when sowing with wheat or oats that the sowing rate of these be reduced. For most soils 20 lb. of oats or 30 lb. of wheat per acre should be the maximum quantity sown.

Experienced farmers prefer to sow their row lucerne without a cover crop. If a cover crop is used the lucerne plants are weaker during the first summer and in a dry winter may not be able to survive competition with the cereal crop. The risk of injury through competition outweighs the advantages of using a cover crop, though competition can be reduced by early removal of the cover crop by grazing or mowing.

On flat ground the method of sowing adopted is immaterial except perhaps for square paddocks. Here, if it desired to sow round and round, it is better to divide the paddock into two or more lands. Sowing round and round has the advantage that there is no wasted land on the headlands. On the other hand, there is a tendency to cultivate out plants on the corners during subsequent cultivations.

As a general rule row crops are not recommended for sloping ground except where slopes are gentle. The Department of Agriculture and Stock offers a free advisory service on such matters and this advice should be sought. Even on very gentle slopes the rows should run across the slope and for preference should follow the contour of the land. This means that sowing should be done back and forth across the paddock and not round and round.

Seed Inoculation.

Lucerne gives best results when grown in association with the appropriate strain of nodule-forming bacteria on its roots. These bacteria make the nitrogen of the air available to the plants, and result in better growth and increased soil fertility. The nodules are more or less cylindrical in shape with rounded ends and are approximately an eighth of an inch long.

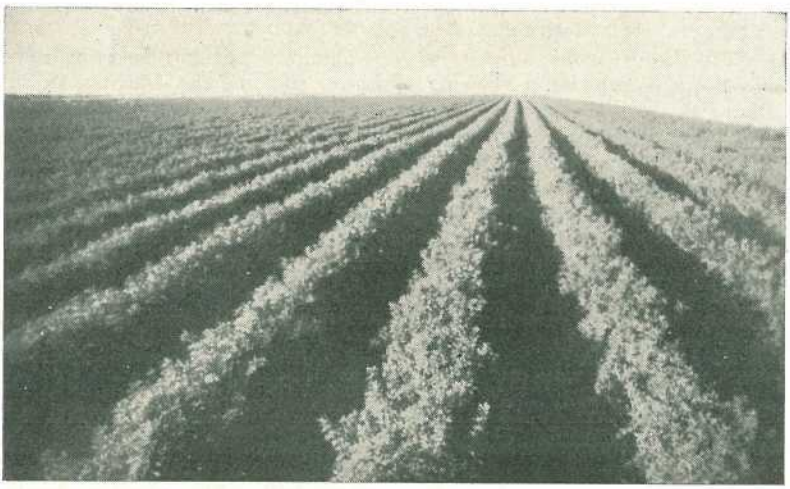


Plate 1.

Row Lucerne at "Anchorfield," Darling Downs. Planted with wheat in May, 1943; photographed September, 1944.

Nitrogen-fixing bacteria are not universally present in soils but they can be added by inoculating the lucerne seed before sowing. It is always advisable to do this. Inoculum is obtainable, free of charge, from the Department of Agriculture and Stock, William Street, Brisbane. The grower should notify the Department of the amount of seed he intends to plant and the approximate date of planting.

Row Cultivation.

Control of weeds at all times is important. The whole idea of row cultivation is to reduce the number of plants competing for moisture. Any

benefits will be lost if weeds are allowed to grow unchecked. Three or four cultivations per year are generally needed. One successful owner on the Darling Downs claims that it is economical to cultivate after every grazing, or approximately six times a year. He contends that loosening the soil after it has been compacted by the animals allows better moisture penetration and results in better lucerne growth.

Most common cultivation implements can be adapted for row cultivation, but tandem disc harrows are very satisfactory. You can remove pairs of discs at intervals in both the front and rear banks of discs in order to straddle the rows, and attach ordinary peg tooth harrows behind the discs so that each row is covered by a leaf of harrows. This serves the double purpose of levelling off earth thrown up onto the row by the discs and removing weeds from within the rows. The best time to cultivate is as soon as possible after grazing (or mowing), when the stubble is short and therefore easiest to cultivate.

A disadvantage of disc harrows is that their continual use forms a hardpan a few inches below the surface. A tined implement should be used periodically in conjunction with disc harrows to break this hardpan. Scarifiers and other heavy tined implements with appropriate tines removed are satisfactory. Scarifiers which have the tines attached separately to the frame are better than the bridle draught type.

Generally speaking, combines are too lightly constructed for cultivation after the ground has been packed down by grazing animals. For small areas, the modern tractor with readily fitted attached tine cultivator is very satisfactory.

Costs will vary with the type of equipment used and the size of the areas cultivated. They will also vary enormously from year to year and from one property to another. For a medium sized tractor pulling tandem discs the cost has been estimated at approximately 3s. 6d. per acre per cultivation for the Darling Downs in the year 1952. This combination would cultivate approximately 40 acres in an 8-hour day. The cost would be higher for properties further west and further from railways.

Grazing Row Lucerne.

The popularity of lucerne has suffered much in the past from overemphasis of the dangers involved in grazing it. Animals may be grazed safely on pure lucerne provided a little care is exercised. On many properties lucerne has been grazed for years by hundreds of animals without loss.

When stock are placed on the crop for the first time the following simple precautions should be taken:—

(1) Ensure that the animals have full stomachs.

(2) Restrict grazing to short periods at first.

(3) Avoid very young and succulent stands.

(4) Avoid grazing when the lucerne is wet with dew or overnight rain.

(5) Inspect stock periodically for the first few hours.

Lucerne bloat is comparatively rare in sheep. Should it occur in cattle it may be treated in the early stages by administering a suitable drench.

In extreme cases the paunch may be punctured to allow the escape of accumulated gases.

Any new stand of lucerne should be grazed very carefully. If sown with a cover crop the feed should be allowed to reach a height of 9–12 inches each time before grazing and then grazed quickly. If young lucerne plants are grazed heavily, they form poor root systems and fail to survive dry spring and summer months.

In a winter of good rainfall, row lucerne will not carry as many animals per acre as oats. Nevertheless, lucerne has many advantages

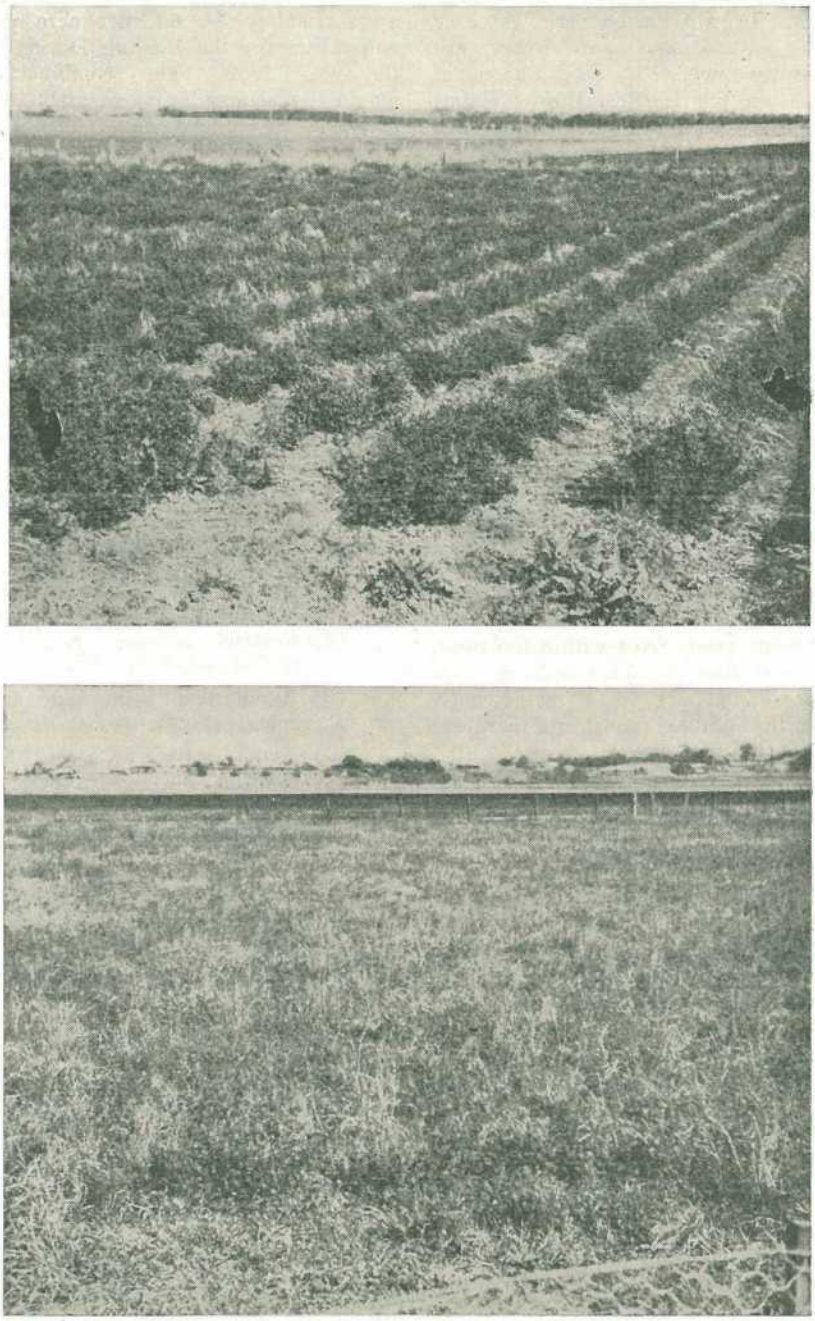


Plate 2.

Comparison of Row Lucerne with a Sward at Lawes, Lockyer Valley. Both were planted in October, 1947, and grazed from October, 1948. The photographs were taken in October, 1953, after a long dry spell. Note the weed growth and the low yield of lucerne in the sward.

over oats for winter grazing. Oats depend on rains during the autumn for planting and later rains for growth. Grazing is not available until approximately six weeks after planting rains fall. Frequently autumn and winter rains are below average and oat crops are a failure.

Row lucerne, because it can make growth on moisture conserved in the soil from earlier rains, can produce good feed during a dry period. After rain falls it makes rapid new growth and can be grazed within a few days.

has shown that under these conditions stock do not graze only on the lucerne, but return regularly to the dry grass for additional feed.

On the Darling Downs properties where large areas of lucerne are grazed in conjunction with natural pasture, bullocks graze the lucerne in the late afternoon and camp on it during the night. During the day they graze the natural pasture. When the lucerne is young the animals leave the area at daybreak but as the crop matures they remain on it till later in the morning.

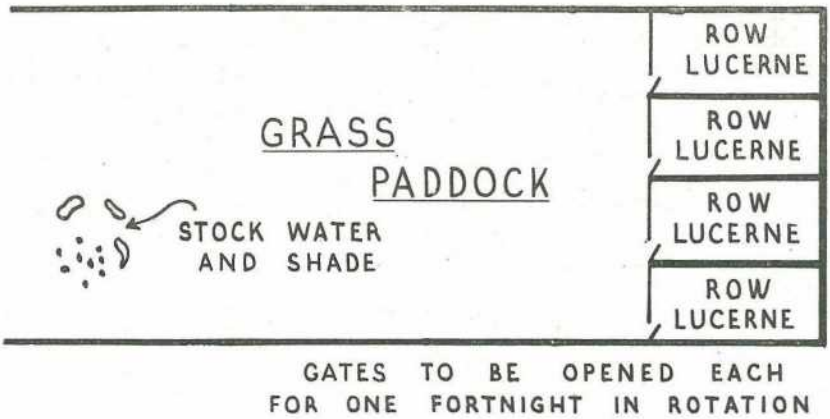


Fig. 1.

Where crossbred ewes and lambs are grazed on row lucerne the lambs mature in 10–12 weeks. On oats the average time is approximately 16 weeks. Carcase quality is directly related to rate of growth and the quicker the lamb matures, the better the carcase quality.

For convenience in handling stock it is desirable, if not always practicable, to have an area of lucerne in or near each grass paddock. Rotational grazing of the lucerne is necessary, so each area of lucerne can be divided into four sections. The simplest form of management is to cut off one end of the paddock for row lucerne and to subdivide that area into four paddocks (Fig. 1). Then the only management required is to open a new gate each fortnight. Experience

Considerable areas on the Darling Downs are continuously cropped to wheat and oats. From the point of view of correct land usage, this is undesirable, since these crops encourage similar weeds and neither makes any real contribution to soil fertility. On the other hand, growing lucerne in rows and cultivating between the rows is effective in controlling weeds, and considerably increases soil fertility.

Much of the land sown to oats for grazing could be sown to row lucerne with great advantage to the land and to the owner.

Hay.

During the summer the animals are often unable to consume all the

lucerne grown. If this occurs, the rows can be mowed and the lucerne conserved as hay in the ordinary way.

One farmer on the Darling Downs using a side delivery rake puts five rows into one for haymaking. He goes round the paddock in one direction, raking the first two rows onto the third. Then, going in the opposite direction, he rakes the fourth and fifth rows onto the third also. The windrow thus formed is large enough to keep a pick-up baler operating near full capacity and reduces the amount of travelling by the machine. Bales from the row area contain no more dirt than those from a sward area in an adjoining paddock. In addition, the bales from the row area are all lucerne as compared with the mixture of lucerne, grass and weeds in the bales from the sward.

Row Lucerne and the Soil.

Any soil is generally better after lucerne has been grown and grazed on it. This is due, in part at least, to the addition of nitrogen to the soil. Nitrogen is added directly by the lucerne plants, and indirectly by the grazing animals. For over 2,000 years the value of growing a legume and turning it into the soil has been appreciated. When a legume is grown, atmospheric nitrogen is made available to the plant through the root nodules. When the plant is ploughed into the soil, decomposition results in the nitrogen being added to the soil. Where a legume is grazed, perhaps the most important contribution to soil fertility is made by the animal. In a pasture which has a relatively low protein content and a low carrying capacity the return of nitrogen to the soil is negligible. When the carrying capacity is raised by the use of row lucerne, the total nitrogen voided by animals is increased and soil fertility is improved.

Much experimental work on the effect of legumes on soil fertility has been carried out. Nitrogen fertilizers will raise the nitrogen status of the soil and might be economical though costly. They will have no beneficial effect on soil structure. A pasture legume, on the other hand, will help restore both the nitrogen status and the soil structure. Lucerne serves admirably in this capacity, and it could well be included in rotations with wheat in districts such as the Darling Downs.

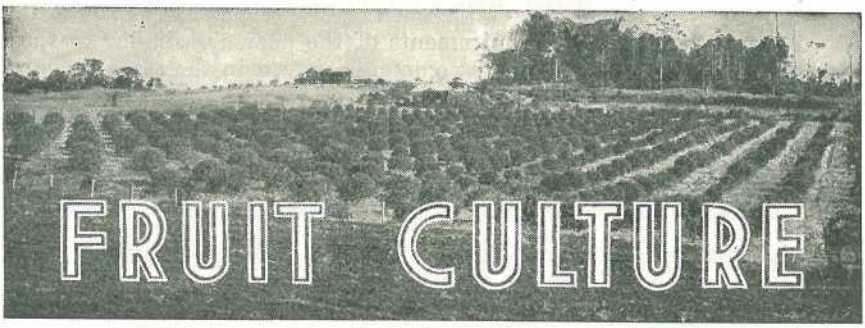
PIG-FEEDING TRIALS ON DOWNS.

A series of pig-feeding trials will be commenced soon on the Darling Downs following the establishment of a piggery at the Hermitage Regional Experiment Station, the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) announced recently.

While it is a fairly general belief in Queensland that pigs do best when fed separated milk in the ration, results overseas have indicated that producing pigs on pastures, with grain and other supplements, has decided merits. Accordingly, it is proposed to compare the effects of the two methods on both the economics of pig-raising and the type of carcase produced.

In conjunction with this work, the effect of the type of pig will also be studied. To ensure that suitable pigs will be available, a pure Berkshire stud will be maintained as an important part of the operations conducted at this centre.

So that this work can be carried out, a modern piggery with access to grazing has recently been constructed at the Hermitage Regional Experiment Station. Foundation stock for the piggery has been purchased, and as the numbers of animals increase the scope of the trials will be correspondingly enlarged.



The Pear.

By W. C. ARMSTRONG, Adviser in Horticulture.

The European pear (*Pyrus communis,* fam. *Rosaceae*) is probably native to south-western Europe and trees derived from selected seedlings have been grown for many years. One variety, Beurre Bosc, which is still an important commercial type, dates back to the 18th century.

Other species, known as Oriental pears, grow wild in China and Japan, but the fruit has little or no commercial value. Some hybrids between Oriental and European pears are, however, grown on an orchard scale, the most familiar being the varieties Kieffer and Le Conte.

Pear production in Queensland is confined to the Granite Belt, where an area of approximately 340 acres is under crop and the annual harvest is about 30,000 bushels. At present, the whole of the crop is sold on the Australian market.

CLIMATIC REQUIREMENTS.

The pear has approximately the same chilling requirements as other pome fruits (that is, 2-3 months with an average temperature below 48°F.). Warm winters are associated with late defoliation, uneven opening of the buds in spring and death of a percentage of flower buds; tree growth is then straggly and the crops are small.

Although the pear flowers later than stone fruits such as the plum and the peach, late spring frosts occasionally cause damage in the orchard. Both flowers and newly set fruits have little resistance to "freezing" temperatures, and lowlying areas which are susceptible to late frosts should therefore be avoided when land is selected for the orchard.

Weather conditions during the growing period have a considerable influence on the quality of the fruit. The requirements of the several commercial varieties differ, but in the more important types such as William's Bon Chretien, high temperatures and a relatively dry atmosphere in the later stages of fruit development improve both the palatability of the fruit and its storage properties provided soil moisture supplies are adequate for the requirements of the tree.

SOIL REQUIREMENTS.

The soil and climatic requirements of the pear are similar to those of the apple, and both fruits are commonly grown in the same orchard. The pear tree is, however, more tolerant of poorly aerated soils, and for this reason pears are often planted on the heavier soils in the orchard area. Waterlogged soils are, nevertheless, quite unsuitable for pear trees, and if the natural formation of the land does not ensure good natural drainage, sub-surface drainage will be required.

FLOWERING AND FRUITING CHARACTERISTICS.

Most pear varieties are partially self-incompatible and two or more varieties are usually interplanted to ensure cross pollination.

Young, vigorous trees may develop an excessive amount of strong leader growth with very few fruit buds. However, as the trees get older the spur-bearing habit becomes more pronounced, and spur pruning is essential in the mature tree. Fruit is also borne on lateral branches, especially of young trees. On both spurs and spur branches, the terminal bud is a flower bud, but on shoots the flower buds are lateral in position. Flower buds developing in one season open in the following spring.

VARIETIES.

Many varieties of pear have been planted in the Stanthorpe district during the past 50 years but only four—William's Bon Chretien, Packham's Triumph, Beurre Bosc and Winter Cole—are of commercial interest to-day.

William's Bon Chretien.—A dessert variety known overseas as *Bartlett*. An early variety with large, oblong fruit; skin very thin, smooth and golden yellow in colour with a soft blush on the exposed side.

Packham's Triumph.—A mid-season variety, with large fruit of excellent flavour. Fruit similar to that of *William's Bon Chretien* but holds its condition longer when cold-stored.

Beurre Bosc.—A mid-season variety. Fruit large with a long neck, russet colour and good flavour. A very heavy cropper.

Winter Cole.—A late variety. Fruit of medium size with a green skin which turns russet yellow when ripe. One of the best varieties for cold storage or export.

PROPAGATION.

Commercial varieties are propagated by budding or grafting the scion variety onto stock trees raised from seed.

In a well cultivated soil, the seedling trees should be ready for budding or grafting in one season. The whip graft is a suitable method of propagation, the scions being about 4 inches long with at least two well-developed buds.

The European pear is extensively used as a rootstock, but an Oriental pear (*P. calleryana*) has, in recent years, received some consideration as a stock on account of its resistance to fire blight (a bacterial disease), tolerance to drought and suitability for light soils.

In Queensland, orchard trees are established on pear stocks, but trees can also be obtained on quince stocks which have a tendency to produce dwarf trees. Trees on quince stocks come into bearing early and are usually relatively short-lived.

PRUNING AND TRAINING.

For the first few years after planting, pruning is concerned with shaping the framework of the tree. Most pear trees have an erect growth habit, and as the wood is somewhat brittle, the limbs must be well spaced on the trunk.

One-year-old trees are planted as single rods in winter and early spring and the top is immediately cut off about 15 inches from the ground. When the top three buds commence growth, all the other buds should be rubbed off. In the following winter, each leader is shortened to approximately one-third of its length so that all three are at much the same height. Where possible, the cut is made just above two buds situated on the outer side of the leader. The six leaders which subsequently arise are again pruned in the same manner in the third year.

The 4-year-old tree will thus have 12 leaders. If more are needed to complete the framework of the tree, they can be obtained by retaining a healthy lateral on one of the existing leaders.

Pear trees tend to produce an excessive number of lateral branches. Shortening of these laterals often accentuates the habit and causes the tree to become a mass of vegetative shoots. Tipping the laterals to fruit buds is therefore good practice, for it forces the development of fruit buds and spurs. Where the unwanted lateral carries no fruit buds, it should be removed entirely; shoots developing later from base buds near the main limb can be pruned to a fruit bud. Trees with an adequate number of fruiting spurs assume the normal growth habit of bearing trees.

Trees in full bearing usually develop an excessive number of fruit-bearing spurs. Individual spurs rarely bear two years in succession, and in a well pruned tree some spurs bear one year and the others in the next. Pruning consists mainly of removing unwanted laterals, thinning out spurs, shortening back a proportion of the spurs and tipping the leaders to preserve a balanced tree shape.

Methods used in re-working pear trees are similar to those used on apple trees.

TREE NUTRITION.

Soil management in a pear orchard is similar to that in an apple orchard. Green manuring and regular fertilizer applications are necessary for the maintenance of soil fertility, and control measures may be required for disorders caused by zinc, copper and boron deficiencies in the soil.

HARVESTING.

Pears harvested when full-grown but slightly green will often develop satisfactory flavour. Fruit harvested prematurely tends to shrink, but fruit which is left too long on the tree may ripen quickly and develop internal defects. Harvesting should normally begin when the ground colour of the fruit is changing from green to a pale yellowish-green; the lentical dots then stand out prominently, giving a speckled appearance to the fruit. Softening of the fruit is a good indication of the degree of maturity required for local markets, but fruit harvested for cold storage or shipment to distant markets must be picked by colour standards.

PLAN TO TURN OFF FATS EARLIER.

The merits of removing cattle from the far northern and western breeding country at a much earlier age than is now the custom are being investigated by the Department of Agriculture and Stock at two properties in North Queensland.

The trials will also demonstrate the fattening capacity of introduced pasture grasses and legumes on the coast.

Results are expected to show that it is possible to turn cattle off at less than three years of age instead of between four and five years as is often the practice at present.

Announcing this recently, the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) said his Department was buying 94 British-breed steers for use in the feeding trials. The steers, which were bred in the Normanton District, were between 12 and 18 months old.

Twenty-four of the steers will be fattened at Utchee Creek, near South Johnstone, where they will be grazed on sown pastures of introduced grasses and legumes under natural rainfall conditions. These pastures will include molasses grass and stylo, molasses grass and centro, para grass, para grass and centro, para grass and centro, guinea grass and centro, Rhodes grass and stylo, guinea grass and stylo.

The remaining 70 head will be fattened at the Ayr Regional Experiment Station on irrigated pastures. The grass-legume mixtures under study are para grass and centro, guinea grass and centro, Rhodes grass and stylo, guinea grass and stylo, and para grass and clitoria pea. During the past 12 months the leading mixtures have carried over two bullocks per acre.

RANDOM SAMPLE TRIAL WITH POULTRY.

The first random sample production trial with poultry in Queensland is being conducted at the poultry section of the Department of Agriculture and Stock's Rocklea Animal Husbandry Research Farm.

Random sample testing will supply a long-felt need in the poultry industry because the size of present-day flocks does not permit egg-laying competitions to give a true indication of the average quality of the birds on a farm. For this reason, Government sponsored egg-laying competitions were discontinued in Queensland some years ago. The decision to conduct the trial followed representations by the Poultry Advisory Board.

For the trial, eggs will be drawn at random from those about to be set by hatchery owners, and then hatched by the Department. The resulting chickens will also be reared by the Department. All birds taking part in the trial will be given the same conditions of feeding, management and accommodation from time of hatching until the end of their first laying year. Most features that are important in commercial production will have a bearing on the final result; these include hatchability, rearability of young stock, egg production, and livability of adult stock.

Egg production of individual birds will not be recorded but the numbers and bulk weight of eggs laid by each group will. In scoring, one point will be awarded for each 2 oz. weight of eggs produced.

Because accommodation at Rocklea is limited, the trial this year is open only to registered stock suppliers who hatched for sale a minimum of 5,000 chickens last year, and it is being confined to pure breeds.

Agricultural Chemistry

The Role of Iron in Plant Nutrition.

By B. J. CRACK, Assistant to Soils Technologist.

Iron is important for the healthy growth of plants and animals, and although only small amounts are required serious disorders may be caused by its lack.

Iron deficiency was recognised over 100 years ago and iron was the first of the trace elements to be found necessary for plant growth. However, most soils contain some iron, mostly in the form of oxides, and these are responsible for red and brown soil colours. The usual problem therefore is not that iron is lacking in the soil, but that it may be in a form unavailable to the plant.

Function of Iron.

In the plant, iron is necessary for the formation of chlorophyll (the green colouring matter) and helps in the assimilation of nitrogen. Chlorophyll is essential for the conversion of nitrogen into protein. Iron not only helps in the formation of chlorophyll, but also prevents its later breakdown. Iron taken up by the plant, but not used for chlorophyll formation, goes into the formation of plant cells and is most concentrated in the growing regions.

In the soil, iron assists in the fixation of nitrogen by soil micro-organisms. It also acts as a cementing agent in some soils.

The amount present in plants varies greatly with age and general growth conditions; more is found in the leaves than in the stems. It is most important in the young leaves and growing parts, where it is used rapidly; it tends to accumulate in the older leaves.

Apart from its effect on actual growth, the iron content of the plant is important in animal and human health. It is necessary for the formation of haemoglobin, a constituent of red blood corpuscles, and its deficiency results in anaemia. A type of bush sickness in cattle is related to low iron content of pastures.

Symptoms of Deficiency.

Iron deficiency symptoms are rare in field crops and pastures. Fruit crops appear to be the most susceptible to deficiency, the symptoms being a marked chlorosis or loss of normal green pigmentation in the leaves. In Queensland the main crops affected are pineapples and citrus.

In citrus and other fruit trees, the tip leaves become strongly chlorotic and in the early stages the veins stand out green. The deficiency is noted first in the younger tissue because of the relative immobility of iron in the plant.

In pineapples, the yellowing is first noticeable at the growing point and later extends throughout the leaf.

Iron chlorosis is due both to the lack of chlorophyll in the leaf and the presence of nitrogen which cannot be converted into protein.

It should be realised, however, that iron deficiency, although an important cause of chlorosis, is not the only cause of this condition. For example, nitrogen deficiency may also result in a yellowing of leaves, but in this case the older leaves are affected first and the veins do not remain green as is the

case with iron chlorosis. Shortage of other plant nutrients may also induce chlorosis.

Cause of Deficiency.

In most cases of deficiency, the disorder is not due to absence of iron in either the soil or plant but is caused by its unavailability. It is thought that iron can only be used by plants for chlorophyll when in the soluble ferrous state. Thus it is possible to get lime-induced chlorosis where there is iron in the plant which has been rendered insoluble because of a rise in the pH value or alkalinity of the plant sap brought about by lime.

Furthermore, soluble ferrous iron cannot exist for long in soils with high lime content. Particularly under moist conditions, any soluble iron is converted to relatively insoluble oxides of a form that cannot be taken up by plants.

The effect of manganese on the uptake of iron is of particular importance in Queensland. These two elements show an antagonism, and in soils with excess manganese, iron uptake is prevented. In this case we have manganese-induced iron chlorosis, which is important in some of the pineapple soils of the near North Coast, particularly in the Dagun district.

Other elements, too, play their part in the use of iron by the plant. Excess zinc and copper have been thought to cause iron deficiency under certain conditions. Potash may assist in the transport of iron in plants and potash deficiency can result in the accumulation of iron in the stems and a shortage in the leaves.

Treatment.

Satisfactory and lasting treatment of iron deficiency provides many problems. Addition of soluble iron compounds to the soil is not entirely satisfactory because they are soon converted to insoluble forms and so become unavailable.

In the case of fruit trees some success has been achieved, mainly overseas, by the injection of soluble salts such as ferric citrate into the trunk of the tree.

With citrus in Queensland, the usual method of treatment is to apply up to 4 lb. of ferrous sulphate to the soil about each affected tree.

With pineapples, the application is made as a foliage spray of a soluble iron compound, but care must be taken or leaf damage may be caused. A 3% solution of ferrous sulphate is recommended, the application being made at intervals through the growing period.

In the treatment of any vegetable crops a strength of 1% ferrous sulphate should not be exceeded.

More recently, outstanding success has been achieved in the United States with a complex organic compound of iron of a type known as a chelate. This iron chelate is able to maintain iron in solution in the plant, so from a single application a substantial amount is available for plant assimilation throughout the growth cycle. The application may be made either to the soil or as a leaf spray. Research is continuing with these compounds, which are not at present available in Australia.

The effect of iron deficiency can be lessened to some extent by cultural practices. There is less likelihood of deficiency trouble where there is good drainage and soil aeration. Organic matter also has a beneficial effect as it leads to the formation of soluble iron humus compounds available to the plant.

Importance of Manganese in Plant Growth.

By I. F. FERGUS, Analyst, Chemical Laboratory, Division of Plant Industry.

Manganese occurs in nature as widely distributed as iron, but in much smaller amounts. It is found in rocks, soils, plants, water and animals.

It is an essential element in the growth of plants, and has been shown to be necessary in the metabolism of some marine organisms as well as domestic animals. It helps in the breakdown of carbohydrates in the plant and in nitrogen metabolism. There is also some evidence to suggest that manganese influences the formation of vitamin C.

MANGANESE DEFICIENCY.

Most soils contain an adequate amount of manganese in a form which is available to plants. Deficiencies are most likely to occur in alkaline soils, or soils which have received a very heavy application of lime. Neutral soils rich in organic matter are also likely to be low in available manganese.

Chemical analysis of plants and soils gives a reliable guide to their manganese status, although different species contain quite different amounts of manganese. Even the manganese content of the same variety of plant will vary considerably, depending on the soil type on which it is grown.

Symptoms.

Plants affected by a deficiency of manganese in the soil develop fairly characteristic signs. The most general effect is the development of small yellowish-green patches in the areas between the veins of the leaves. The form these patches take depends on the plant species. In grasses, they tend to an elongated form similar to the shape of the leaf. In beans or potatoes, the patches give a spotted or mottled effect to the leaf. In severe cases, brown necrotic areas associated with reduction or cessation of growth develop.

The oat plant displays very prominent signs, the disorder being known as "grey speck." Spots of a greyish colour develop, generally on the third or fourth leaf. These tend to coalesce and form elongated streaks which finally turn brown. A line of withering and weakness then develops across the leaf blade, often 1–2 inches from the base. The upper part of the leaf falls over with a sharp kink at the line of weakness, and a tendency to twist occurs.

A disorder known as "marsh spot," which occurs in peas, is due to manganese deficiency. The seeds in the pod exhibit brown or black spots or cavities. The plant itself is yellowish-green and some leaf mottling is usually obvious.

Affected wheat and barley plants have pale-green leaves, with white lesions between the veins. Maize shows similar signs to those of oats.

Beans behave typically, with yellowing between the veins of the leaves, followed by necrotic spotting in the centre of the yellowish portion.

Treatment.

The deficiency can be remedied quite simply with manganese sulphate, which can be applied either direct to the soil or used as a spray on the leaves. For most deficient soils, an application of 50–60 lb. per acre is sufficient, while for spraying purposes a 0.2–0.5% solution of manganese sulphate in water should be used.

An alternative method of dealing with the trouble is to treat the soil with sulphur or sulphate of ammonia. This results in the formation of pockets of less alkaline soil, where the manganese present is more available to the plant.

MANGANESE TOXICITY.

As with some of the other micronutrients, excess manganese adversely affects plant growth. The trouble is

only likely to occur in very acid soils rich in manganese. So far the only soils in Queensland which have been shown to give rise to manganese toxicity problems are a red soil occurring near Dagun, 14 miles from Gympie, and a soil found near Coolabunia, 5 miles from Kingaroy.

Symptoms.

The symptoms of excess manganese in the plant are fairly characteristic and can be confirmed by laboratory analysis of either soil or palnt.

In French beans, the first symptoms in younger leaves appear as marginal and later interveinal yellowing. When older, the leaves become somewhat crinkled, and small brown necrotic spots appear. In severe cases the plants are very stunted, and produce few flowers.

Potatoes develop dark-brown streaks on the lower stem, and a pale yellow colour develops in areas between the veins on the lower leaves. Quite often small brown necrotic spots are present between the veins near the midrib. The affected parts of the plant become very brittle, and the yellowish leaves finally dry and fall from the plant.

In the case of lucerne, growth is reduced and there is a marginal paling of the mid-stem leaves, followed by pale brown spotting near the margins; younger leaves are distorted at the tips. Later a yellow green or gray green colour is noticeable at the leaf tips.

Manganese Toxicity and Iron Deficiency.

The excessive uptake of manganese by plants frequently results in a reduced uptake of iron, so part of the trouble may be due to iron deficiency. In the Dagun area, for example, pineapples grown on the manganese-rich acid soil have very yellow leaves, due to a lack of iron. Normal leaf colour can be restored by spraying the plant with iron sulphate.

Curing Toxicity.

To cure the disorder, it is necessary to alter the manganese in the soil to a form which is unavailable to the plant. This can be done by applying a fairly heavy dressing of lime, sufficient to alter the reaction of the soil from very acid to slightly acid. An application of 2 tons per acre may be necessary.

PEDIGREE IN SEEDS IS IMPORTANT.

Pedigree in seeds is just as important as pedigree in stock, but in spite of the progress made in agriculture in Queensland, many farmers have not yet realised the importance of using high quality seed.

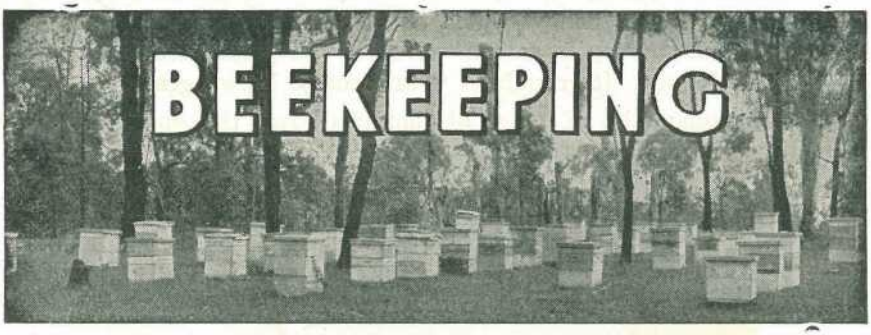
Stating this recently, the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) pointed out that the organisation of certified seed production has been one of the important contributions made by officers of his Department to post-war agriculture in Queensland. He stressed the value of using certified seed, which makes possible the production of heavier yields of higher quailty, minimises the risk of introducing weeds and diseases onto the farm and ensures good stands of crops.

The importance of seed for crop production has been recognised for many years, but it was not possible to form a Seed Certification Committee until early in 1947. Since then, the committee has worked steadily to improve the Seed Certification Scheme and increase the quantity of certified seed available.

Certified seed is true, clean seed and germination is guaranteed. It is produced under the close supervision of the Seed Certification Committee and Seed Certification field officers of the Department of Agriculture and Stock. Before it can be certified, the seed has to reach a high standard.

Hybrid maize, grain sorghum, fodder sorghum, Sudan grass and cowpeas are among the crops for which certified seed can be obtained. Work has been concentrated on these crops because of their special need for high quality seed.

The Minister added that local advisers in agriculture would readily tell farmers the most suitable variety of a particular crop for their district and sources of certified seed.



The Honey Flora of South-eastern Queensland.

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

(*Continued from page 92 of the August issue*).

Broad-leaved Ironbark.

Botanical Name.—*Eucalyptus siderophloia* Benth.

Other Common Names.—Black ironbark, red ironbark.

Distinguishing Features.—An ironbark with fairly broad stiff dirty green leaves, nearly round green sucker leaves, buds with a long lid and seed-capsules with protruding valves (Plates 89-90).

Description.—This is a tree up to more than 100 ft. high with the hard black furrowed bark characteristic of ironbarks, but also somewhat flaky, and often brownish in the furrows on the younger parts. The leaves are scattered along the twigs; they are dull, somewhat dirty green, thick in texture, stiff, straight or curved, about 3-6 times as long as wide, about 4½-7 in. long and ¾-1¾ in. wide; those on the sucker shoots are larger, nearly as wide as long and often greener. The flowers are stalked and borne in bunches at and near the ends of the twigs; they are about ¾ in. wide when fully open. The lid is much longer than the rest of the bud and usually tapers to a point. The seed-capsules are nearly top-shaped with protruding valves, about ⅓ in. long and about as wide.

Distribution.—Moreton, Wide Bay and Burnett Districts in forest country on stony ridges, sometimes as pure stands, sometimes associated with spotted gum or other trees. It is also found in the Port Curtis District and in north-eastern New South Wales.

Usual Flowering Time.—December-January.

Colour of Honey.—Medium amber.

Importance as Source of Honey.—Minor.

Importance as Source of Pollen.—Medium.

General Remarks.—Honey from this tree is obtained usually as a mixture with lighter honeys which tend to improve the colour. Broad-leaved ironbark honey is golden coloured, has medium density and a mild sweet flavour. It granulates with a coarse brown grain.

Useful quantities of pollen are obtained from this species to assist in maintaining colony strength.

Plate 89.

Broad-leaved Ironbark (Eucalyptus siderophloia). Branchlets with leaves, buds and seed-capsules.

Plate 90.

Broad-leaved Ironbark (Eucalyptus siderophloia). Mount Cotton.

Dusky-leaved Ironbark.

Botanical Name.—Eucalyptus nubilis Maiden & Blakely.

Other Common Names.—Mountain ironbark, broad-leaved ironbark, bluetop ironbark.

Distinguishing Features.—An ironbark with fairly broad grey leaves, large rounded silvery leaves on sucker shoots, long tapering lids to the buds, and long, protruding valves to the seed-capsules. Except for its grey or silvery leaves and buds it often looks very like the broad-leaved ironbark (*Eucalyptus siderophloia*) (Plates 91-92).

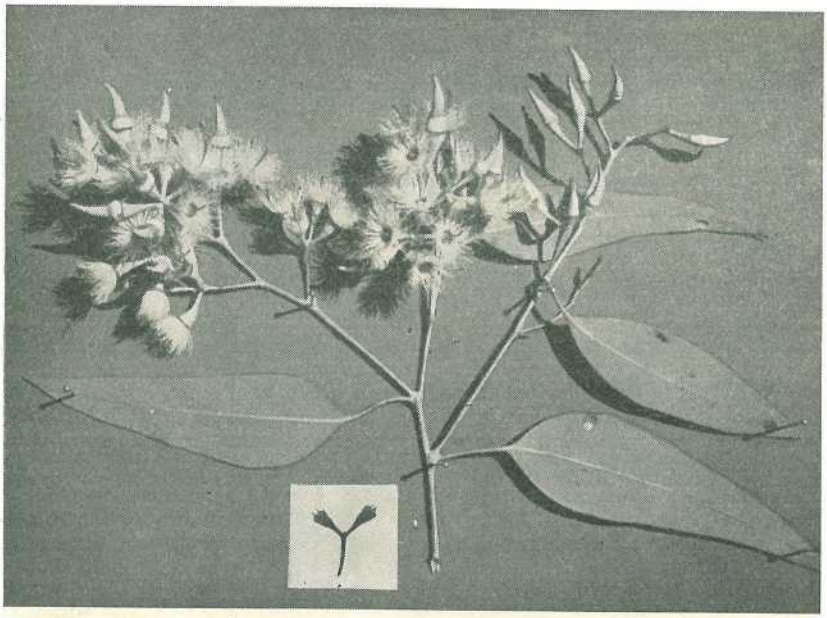


Plate 91.

Dusky-leaved Ironbark (Eucalyptus nubilis). Branchlet with leaves, flowers and buds. Inset shows seed-capsules.

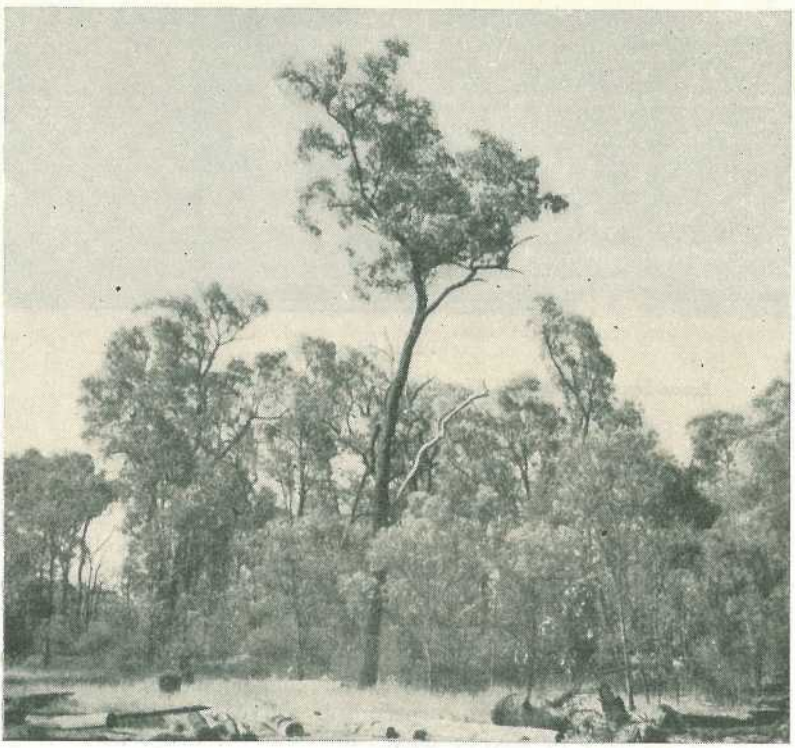


Plate 92.

Dusky-leaved Ironbark (Eucalyptus nubilis). Inglewood.

Description.—This is a tree 40-60 ft. high with the hard black furrowed bark characteristic of ironbarks. The leaves are scattered along the twigs, grey or somewhat silvery in colour, thick and stiff, straight or curved, about 3-5 times as long as wide, about 3-5 in. long and $\frac{3}{4}$-$1\frac{1}{2}$ in. wide; those on sucker shoots are large, rounded and silvery. The flowers are stalked and borne in bunches at and near the ends of the twigs; they are about $\frac{3}{4}$ in. wide when fully out. The buds are silvery grey in colour with the tapering lid longer than the lower part. The seed-capsules are nearly top-shaped or somewhat cup-shaped, with protruding valves, about $\frac{3}{8}$ in. long and $\frac{1}{4}$ in. wide.

Distribution.—Darling Downs District, chiefly on stony ridges, often as nearly pure stands or associated with spotted gum; also found in northern inland New South Wales.

Usual Flowering Time.—June-September.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Medium.

Importance as Source of Pollen.—Minor.

General Remarks.—Although this tree flowers profusely, only moderate yields of nectar are gathered. Primarily this is due to the main blossoming occurring when over-wintering colonies are still weak. Once in every five or six years, however, a heavy honey crop is harvested from dusky-leaved ironbark. The small amount of pollen obtained is useful, as it prepares colonies for early spring brood-rearing.

The flower-buds on this tree are rapidly and adversely affected by frost and dry weather.

The honey, which has good density and an excellent flavour, is one of the choicest produced in Queensland.

Mallee Box.

Botanical Name.—*Eucalyptus pillagaensis* Maiden.

Other Common Names.—Narrow-leaved box, ribbon box, gum-topped box, molly box.

Distinguishing Features.—A gum-topped box with narrow shining green leaves, small flowers, and small seed-capsules (Plates 95-94).

Description.—This is usually a tree 40-80 ft. high, but it is sometimes shrubby. The bark on the lower or greater part of the trunk is thick, grey and scaly, while on the upper part of the tree it is smooth, greyish white or brownish, and shed in long ribbons that often remain attached at the junction with the rough part. The crown is comparatively narrow. The leaves are shining green, very narrow, usually about 3-5 in. long and about $\frac{1}{4}$-$\frac{1}{3}$ in. wide. The flowers have short stalks and are borne in bunches at and near the ends of the twigs; they are white and about $\frac{1}{3}$ in. wide when fully open. The lid is conical in shape and about as long as the rest of the bud. The seed-capsule is cupshaped and only about $\frac{1}{8}$ in. long and wide.

Distribution.—Darling Downs District, often around the edges of brigalow scrub, but also widely spread in forest country on sandy or loamy soils. It is also known from the Maranoa District and northern inland New South Wales.

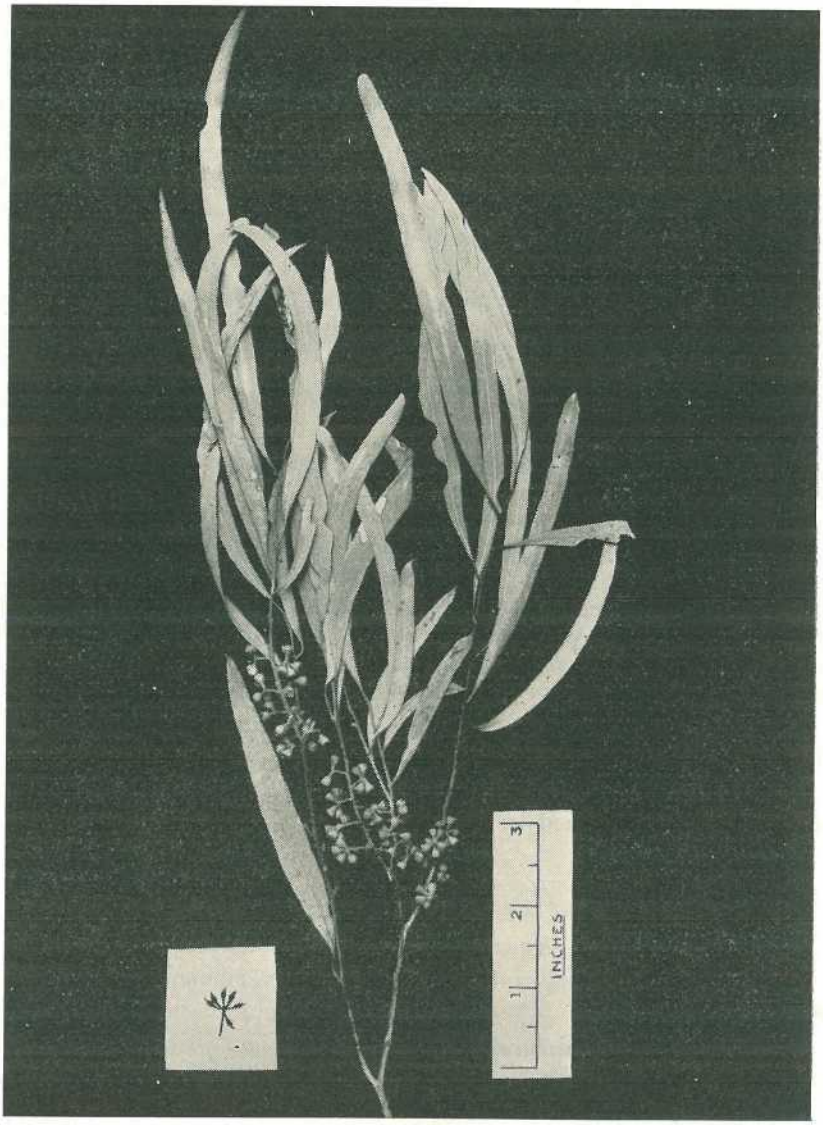


Plate 93.

Mallee Box (Eucalyptus pillaganensis). Branchlet with leaves and seed-capsules, Inset shows flower buds.

Usual Flowering Time.—February-April.

Colour of Honey.—Light amber.

Importance as Source of Honey.—Medium.

Importance as Source of Pollen.—Nil.

General Remarks.—This species does not produce sufficient pollen to stimulate brood-rearing at this time of the year. The older bees are not replaced as they die. The colonies dwindle alarmingly and either succumb or remain seriously weakened for many months. The trouble is generally known as "mallee box dwindle", and in some winters individual Queensland beekeepers have lost up to two hundred colonies subsequently to this tree being worked.

The honey from mallee box is first grade, with good density and a mild, slightly woody flavour. It granulates with a smooth whitish grain. Often, when packed in faulty containers this honey develops a dark streaky discolouration and beekeepers who have experienced the trouble pack this honey in new tins.

Plate 94.

Mallee Box (Eucalyptus pillagaensis). Graysholme.

Mexican Poppy.

Botanical Name.—Argemone mexicana L.

Other Common Names.—Prickly poppy, Chinese thistle, Californian thistle.

Distinguishing Features.—A greyish prickly plant up to 3 ft. high with prickly-toothed leaves, yellow juice and large cream or yellow flowers (Plate 95).

Description.—This is a plant up to about 3 ft. high, greyish in appearance, with prickly stem. The leaves are irregular in shape, up to 6 in. long, usually without a definite stalk, partly divided into a number of prickly lobes, with the midrib and chief veins whitish. The flowers are about 2–3 in. wide, with 5 cream or yellow petals, a large number of stamens and a prominent, somewhat oblong ovary. The seed-capsule is oval and spiny.

Distribution.—Widely spread in Australia as a weed on patches of sand or gravel on recently disturbed soil. It is a native of Mexico.

Usual Flowering Time.—Spring and summer months.

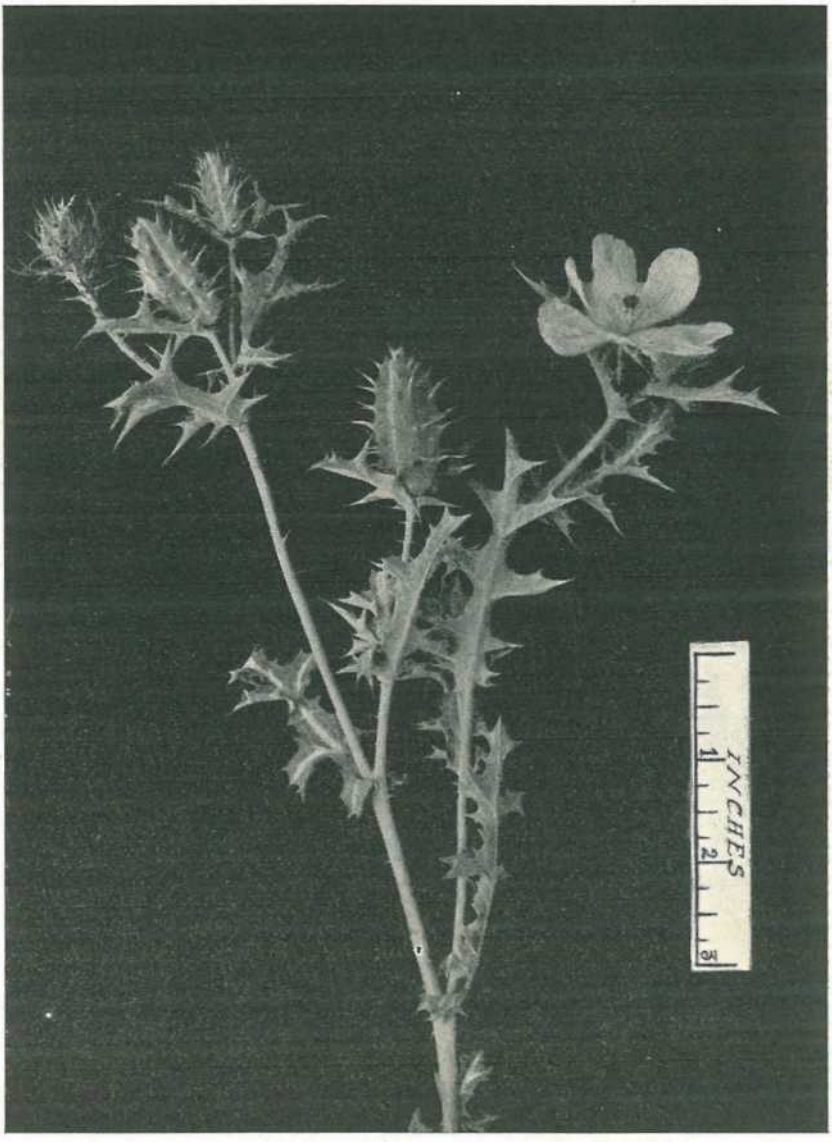


Plate 95.

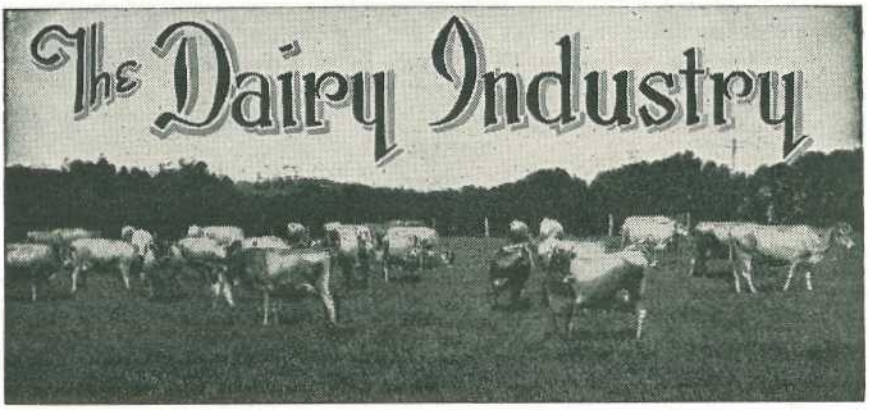
Mexican Poppy (Argemone mexicana). Leaves, seed-capsules and flower.

Colour of Honey.—Light amber.
Importance as Source of Honey.—Nil.
Importance as Source of Pollen.—Medium.

General Remarks.—This plant is much sought by beekeepers for the reliable pollen supplies obtained during its lengthy flowering period. To stimulate broodrearing and to strengthen weak colonies, migratory beekeepers on the Darling Downs move apiaries to locations where Mexican poppy is plentiful. The river flats near Texas are used extensively for this purpose.

Only insignificant quantities of honey are obtained from Mexican poppy.

[TO BE CONTINUED.]



Use and Loss of Milk and Cream on Dairy Farms.

By S. E. PEGG (Chief Adviser, Herd Recording) and R. E. PAUL (formerly Director of Field Services, Division of Dairying).

What is the "effective production" of milk and cream on a dairy farm? In other words, how much of the herd's production, as measured by the Herd Recorder, is delivered to the factory?

A survey of records from 382 farms, covering the period July 1952 to June 1953, was recently carried out to determine the difference between production as shown by herd recording figures and the amount of milk or cream delivered to dairy produce factories.

Considerable differences occur from farm to farm and from district to district. There is also an appreciable difference according to whether the supply is to a butter or a milk factory.

The figures from the 382 farms show that the average amount of produce supplied to factories is 93·3% of the recorded production. For 289 farms which supply butter factories the percentage is 91·5%, and for 93 farms supplying cheese or milk factories the percentage is 96·6%.

A similar survey carried out by the New Zealand Dairy Board in the 1949–50 season gave the "effective production" (that is, factory supply) as 89·4% of the production of the herd recording total.

The difference is accounted for by the dairy produce used in farmers' homes as milk and cream, the wholemilk used for calf rearing, fat losses in separation, and spillages of milk and cream.

Table 1 shows the comparison according to herd size. The figures indicate that the difference between the factory and herd recording figures is much the same for all herds ranging in size from 20 to 99 cows. In other groups variations are much wider, but this may be accounted for by the comparatively small number of herds in these groups.

It is intended to continue this study, and it will be interesting to see if these wider differences persist as the number of farms increases in the "under 20 cows" and "over 100 cows" groups.

It is rather significant that from farms which supply milk for either cheesemaking or market milk, the percentage of produce supplied to the factories is higher than from those farms supplying butter factories.

TABLE 1.

COMPARISON OF PRODUCTION AND FACTORY SUPPLIES, ACCORDING TO HERD SIZE AND TYPE OF SUPPLY, FOR THE YEAR 1952–53.

Herd Size.	Type of Supply.	Number of Herds.	Factory Supplies as Percentage of Herd Recording Figures.
			Per Cent.
Under 20	Butter ..	2	83·0
	Milk ..	1	94·0
	Total ..	3	88·1
20–39	Butter ..	63	91·1
	Milk ..	13	98·4
	Total ..	76	92·5
40–59	Butter ..	90	92·7
	Milk ..	30	95·5
	Total ..	120	93·5
60–79	Butter ..	72	92·2
	Milk ..	23	93·9
	Total ..	95	92·6
80–99	Butter ..	39	91·8
	Milk ..	19	99·1
	Total ..	58	94·4
Over 100	Butter ..	23	88·5
	Milk ..	7	97·4
	Total ..	30	90·8
All Herds	Butter ..	289	91·5
	Milk ..	93	96·6
	Total ..	382	93·3

Table 2 shows the comparison of herd recording and factory figures according to districts. The difference varies from 2·4% on the Atherton Tableland to 15·3% in the Port Curtis district.

Of the farms surveyed on the Atherton Tableland, 64% are supplying milk for the liquid milk trade, and this probably accounts for the small difference, since these farms use only a limited amount of milk for calf rearing.

The farms in districts with the greatest differences are all supplying cream to butter factories.

TABLE 2.

COMPARISON OF HERD RECORDING AND FACTORY RETURNS, ACCORDING TO DISTRICTS, FOR THE YEAR 1952–53.

District.	Number of Herds.	Factory Supplies as Percentage of Herd Recording Figures.
		Per Cent.
Atherton Tableland	50	97·6
Mackay	8	92·8
Port Curtis	11	84·7
Upper and Central Burnett ..	24	92·3
South Burnett	57	94·4
South-eastern Queensland ..	166	93·3
Eastern Downs	42	94·8
Western Downs	24	86·0
All Queensland	382	93·3

DAIRY FARM COMPETITION.

The Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) said recently that it is proposed to conduct a dairy farm competition during 1954-55 to be financed from the Commonwealth Dairy Extension Grant. This competition will be restricted to farms on which the herds are production recorded under the Group Herd Recording Scheme and the competition will differ from those previously conducted in that it takes the form of a production improvement competition. No competition will be held in any herd recording group from which less than eight entries are received.

The aim of the competition is to encourage dairy farmers to increase their dairy production by good husbandry and the prizes will be awarded on the basis of creditable increases in total production having regard to the conditions under which such increases were obtained and the extent to which sound husbandry methods and business principles were observed.

It is proposed after the competition has been finalised to hold Field Days on prize-winning farms at which farmers may see and discuss practical means whereby dairy farm production can be economically increased. The prizes to be awarded in each group will be:—First—£15 and trophy, Second—£6 and trophy, Third—£4 and trophy.

Entry to the competition is free and Mr. Collins stated that application forms which will contain full details of the competition, will shortly be available from local officers of the Department of Agriculture and Stock and full details of the competition will also be published in "*The Queensland Dairyfarmer,*" the official journal of The Queensland Dairymen's Organisation.

Entry forms should be returned to any officer of the Department of Agriculture and Stock after completion by any farmer who wishes to enter the competition. The closing date for receipt of applications will be 30th September, 1954.

Bacteriological Aspects of the Farm Cooling of Milk.

By W. F. SCHUBERT, Biochemist, Division of Dairying.

There is no mystery about the production of clean milk. It is now universally recognized that the two basic essentials are:—

(1) The prevention of bacterial contamination.

(2) The checking of the activities of any bacteria which may enter the milk supply.

The first requisite is satisfied if the milk is drawn from a healthy herd in a hygienic manner. The second, if the milk is promptly and efficiently cooled.

Losses Due to Souring.

Failure to cool milk promptly and efficiently is one of the main reasons underlying milk rejections, especially during the summer months. Passing heat waves during the cooler months of the year also result in rejections from this cause. Where tanker transport of milk is used from farms to factories, as in some countries, the failure of a few farmers to cool their milk thoroughly may result in the bulk of 2,000 gallons or more being rejected.

Need for Cooling Farm Milk.

Bacteria, which are responsible for the souring and development of off-flavours in milk, reproduce by each cell dividing to give two. The rate of division depends upon circumstances. If the temperature is favourable the generation time may be as low as 10 minutes. The most practical way of controlling the activities of bacteria in milk is by reducing the temperature until reproduction is suspended. The effect of temperature on bacterial reproduction is well illustrated in Table 1 published by J. G. Davies.

It will be observed that above 70°F. the rate of multiplication is extremely rapid. The numbers reach astronomical figures within 24 hours.

TABLE 1.
TEMPERATURE AND BACTERIAL NUMBERS.

Milk held at Temp. °F.	Plate count per ml. after 24 hrs.
32	2,400
39	2,500
41	2,600
43	3,100
50	11,600
55	18,800
61	180,000
68	450,000
86	1,400,000,000
95	25,000,000.000

A can of uncooled milk would have a temperature of approximately 90°F. This is well within the temperature range of rapid multiplication. Thus souring and off-flavours would be expected to develop in the uncooled milk. The ideal temperature below which milk should be cooled would appear to be 50°F. This, of course, is unattainable without some form of mechanical refrigeration on the farm.

Effect of Cooling.

The cooling of milk does not kill the bacteria but it does retard their growth. To illustrate, a piece of steak may be kept in the refrigerator for a week or longer without spoiling, but putrefaction soon sets in if the meat is left at room temperature for any length of time. Refrigeration has merely kept the bacteria in check.

Thus dairy farmers cannot rely on cooling to kill bacteria which may have entered the milk supply from unsterile utensils, etc. The milk *must* be clean before it is subjected to cooling. If the count of bacteria is high before cooling because the milk has been carelessly produced, then the count will be high subsequently; no amount of cooling (or refrigeration) will reduce the count. If the types of bacteria present are those which resist the conditions of pasteurization (that is, thermoduric bacteria), then the plate count of the pasteurized

product will be high. Thus cooling is not a corrective of unhygienic practices on the farm.

Cooling on the Farm.

If milk is to be efficiently cooled on Queensland dairy farms, then special cooling devices have to be installed. The mean atmospheric temperature of Brisbane does not fall below 58.6°F. Thus, at no period of the year can it be assumed that ordinary water cooling is adequate. It may be asserted that refrigeration is essential in warm weather if the ideal is to be achieved. The following table gives the screen temperature data for Brisbane:—

——	Mean.	Mean Max.	Mean Min.
January ..	77·2	85·3	69·1
February ..	76·5	84·3	68·6
March ..	74·4	82.3	66·4
April ..	70·1	78·8	61·4
May ..	64·6	73·6	55·6
June ..	60·3	69·3	51·1
July ..	58·6	68·5	48·7
August ..	60·7	71.3	50·1
September	65·1	75·4	54·8
October ..	69·7	79·1	60·0
November	73·3	82·3	64·3
December..	76·1	84·7	67.4

Farm refrigeration units would appear to be the only method of cooling milk for the liquid milk trade, although milk quality will be benefited by cooling to approximately 70°F.

Technique of Cooling.

Whatever system of cooling is adopted it is essential that the milk be first shock-cooled over a surface-type tubular cooler. The top coils should be preferably water-cooled whilst several at the bottom may be cooled with chilled water from the refrigerator. Such a practice affords greater efficiency in cooling, with economy.

The cooled milk in cans should then be stored in the refrigerator cabinet or other water-cooling trough provided.

Unsterile Milk Coolers.

Whatever form of cooling unit is used, it is essential that it be kept in a clean and sterile condition, otherwise the milk will pick up contamination during cooling. Unsterile milk coolers are often incriminated as the cause of low quality in market milk.

Leaking Coolers.

Leaking coolers are a double hazard. They permit water of doubtful bacteriological quality to enter the milk and also render the farmer liable to prosecution for adulteration.

Cooling and Defective Methods of Production.

As mentioned previously, cooling is not a substitute for hygiene. When inefficient hygiene is combined with efficient cooling the following complications may arise:—

(1) The development of off-flavours may result owing to the activities of low-temperature organisms.

(2) The breakdown products of bacterial action may accumulate in the milk and result in rejection.

(3) Some bacteria actually become more active after a period of dormancy. Thus the cooling of milk may result in a more rapid deterioration should the temperature rise at a later time.

(4) Bacteria that have experienced a period of dormancy are often more difficult to kill than those which are vegetating. This may have an influence on the bacteriological efficiency of the pasteurizing process.

The Cleansing of Milking Machines.

By Officers of the Division of Dairying.

The successful operation of a milking machine depends on the care and time given to it. Any neglect in keeping it clean will be reflected in the quality of the milk or cream supplied to the factory. The method detailed here has proved efficient for the cleansing of the milking machine, and in order that the method may be simply yet thoroughly applied the following are essentials:—

(1) An adequate supply of pure water.

(2) An electric hot water unit or a steam sterilizer.

(3) Caustic soda or other approved cleaning mixtures.

(Details of the preparation and use of satisfactory alternative mixtures can be obtained from the local Dairy Officer.)

(4) A complete set of brushes for cleaning all parts of the machine.

CLEANING COMPOUNDS.

The caustic soda solution is prepared by dissolving 1 level dessertspoon of caustic soda in 4 gall. of hot water.

An alternative cleaning compound which can be used to advantage with hard water supplies can be prepared by thoroughly mixing the following:—

Soda ash	11 lb.
Ardesy (sodium metasilicate)	4 lb.
Calgon (sodium hexa-meta-phosphate) ..	2 lb.
Wetting agent	3 lb.

This mixture is used at the rate of 1 teaspoon per gallon of boiling water after each milking from Monday to Saturday (inclusive). On Sunday, use 2 teaspoons per gallon of the following mixture:—

Citric acid	3 lb.
Wetting agent	1½ lb.
Water	5½ lb.

The suggested alkaline and acid cleaners are used alternately to reduce the build-up of milkstone on dairy equipment, especially when hard water is used.

Another alternative cleaning mixture suitable for use with soft water supplies can be prepared by dissolving 1 lb. 10 oz. of soda ash in 4 gall. rain-water and adding 6 oz. of a wetting agent, such as Teepol, Atlantic, Comprox, Santomerse, etc., and using 1 cupful to each gallon of hot water used for cleaning after both morning and evening milkings.

To use the preparations indicated a routine system should be adopted, and the following has been found satisfactory in actual practice.

TREATMENT BEFORE USE.

A few minutes prior to milking, give the machine (and all utensils) a cold water rinse to which a chlorine compound (used in accordance with instructions on the label) has been added (chlorine is not a cleanser, but a germicide). The used chlorine solution may be retained for washing udders, also floors, and for similar purposes.

TREATMENT AFTER USE.

Milk System.

(1) Immediately after each milking wash all dirt from the exterior of the rubbers and teat cups, using a vessel and brush kept exclusively for this purpose.

(2) Draw 1 gallon cold or lukewarm water through each set of teat cups; while doing this, withdraw the cups from the water several times, thereby causing a surging effect, which flushes the pipes and rubbers more thoroughly and ensures more effective removal of milk residues than a steady flow. Always start on the set of teat cups farthest away from, and work towards, the releaser.

(3) Draw through each set of teat cups at least 1 gallon of hot cleaning solution, which has been prepared as outlined above. (Proprietary cleansers may be used instead of the preparations mentioned; if so, use them according to the instructions on the label of the package.) While drawing the hot cleaning solution through the teat cups furthest from the released, the torpedo brush supplied with the machine or a ball of horsehair is run through the milk pipe. The vacuum will carry this through with sufficient momentum to remove traces of milk from the interior of the pipe. If a torpedo brush is used, the attached cord should be just long enough to enable the brush to travel the full length of the milk line, but not so long as to allow it to hit against and damage the metal of the releaser. Retain the cleaning solution for using on the air line.

(4) Next draw through each set of teat cups at least 1 gallon and preferably 2 gallons of clean boiling water in order to remove all traces of the cleaning solution. This is important, for if the cleaning solution is not rinsed off with plain water the tinning will gradually be removed from the metal equipment. Do not surge the cups while the boiling water is being drawn through the machine, otherwise the effectiveness of the heat treatment is reduced.

(5) Where an electric hot water service is available, and provided the final rinse is copious, it can be considered to sterilize the machine effectively. Otherwise, sterilize the entire milk system with steam for 2-3 minutes. It should always be remembered that the efficiency of steam or hot water sterilization depends on the effectiveness of the prior cleansing operations. If applied to the machine before thorough cleansing, heat will bake the milk remnants onto the interior of the pipes. This residue forms a hard deposit, known as milkstone, which makes cleansing and near-sterilization difficult.

Air System.

Cleanse the air line at least once daily by flushing with hot cleaning solution, followed by clean, hot water. (The cleaning solution and hot water previously used for the milk lines may be used). Because of the differences in the way of cleaning the airline of different machines, the manufacturer's instructions should be carefully followed.

In the event of a farmer not knowing how to clean the airline of his machine, he is advised to contact the manufacturer or the local Dairy Officer.

Note: It is important to thoroughly cleanse at each milking the rubber connection from the bottom chamber of the releaser attached to the releaser pulsator.

Sundries.

After all operations have been completed, dismantle the releaser, thoroughly cleanse, and sterilize with steam or boiling water. Then remove the vacuum tank, cleanse, sterilize, and store both it and the releaser in some dust-free position.

Take the teat cup assembly and long rubbers off the down drops, and hang in a cool place. Remove all rubber plugs, or throw open flaps.

After each milking, remove the glass observation bowls and rubber washers under them and place in a position to dry.

WEEKLY DISMANTLING OF MACHINE.

At least once a week completely dismantle and clean the machine. Take down the observation bowls, rubber washers, teat cups, claws, air and milk droppers and top rubbers (in fact, every part of the plant that will come asunder), and thoroughly wash inside and out with hot cleaning solution, then boiling water.

At least once a week place all rubberware in a clean hessian bag, suspend in water to which has been added one level tablespoonful of caustic soda for each 4 gallons, and boil for 10 minutes. This prolongs the life of rubberware.

All rubberware should be checked closely and any which is perished, fat-saturated or otherwise damaged should be replaced, as rubberware so affected leads to serious contamination during milking.

SUMMARY.

Summarised, the procedure in the cleaning of milking machines is:

(1) A few minutes before each milking flush the milk system with cold or lukewarm water containing a chlorine compound in the proportion indicated by the manufacturer.

(2) After use, rinse each unit with at least 1 gallon of pure cold water.

(3) Run through the milk system a hot cleaning solution, using 1 gallon of the solution to each set of teat cups.

(4) Run plain boiling water through each set of teat cups, using at least 1 gallon (preferably 2) of boiling water for each unit.

(5) Unless the final rinse was copious and from an electric hot water system, sterilize the milk system with steam for 2-3 minutes.

(6) Once daily thoroughly cleanse the air lines.

(7) Remove and dismantle the releaser and vacuum tank, wash each thoroughly, sterilize and store in a dust-free place.

(8) Disconnect teat cups and all rubbers. Open up all flaps or remove rubber plugs on the machine.

(9) At least once a week completely dismantle the machine and thoroughly cleanse and sterilize it.

(10) Replace rubberware as necessary.

Farrowing Crates and Floors.

By F. BOSTOCK, Officer in Charge, Pig Branch.

The Pig Crop Reports prepared by the Bureau of Agricultural Economics have drawn attention to the heavy loss of sucker pigs during the period from birth to weaning. One pig in every five born dies before weaning. This loss is high and very much heavier than the industry can afford if pig raising is to remain profitable and compete successfully with other forms of meat production.

Farmers generally attribute their losses to disease, and while this may be to some extent true, it would be more correct to put such losses down to stillborns, overlaids, scours, runts, insufficient milk production by sows, pneumonia, cold, parasites and accidents. Most deaths from these causes are primarily due to faulty feeding, bad management, poor housing and poor living conditions, all of which are within the power of the farmer to rectify.

While the farrowing of a litter of pigs is a simple and natural operation, the care and preparation of the in-pig sow is very important and must be understood if healthy, vigorous pigs are to be born. Careful selection of sows which come from strains exhibiting good mothering ability will do much to assist in reducing losses, especially during the first 72 hours after birth, which is possibly the most critical period of a pig's life.

To assist sows at farrowing time, several types of aids have been developed with varying degrees of success. The chief of these are farrowing crates and the "Kentucky" or sloping farrowing floor, called after its place of origin. Such aids are used to restrict the movements of the sow during farrowing and immediately afterwards and to protect the suckers from being crushed or overlaid.

On the other hand, there are certain disadvantages which must be borne in mind, such as sows finding the crate or sloping floor strange and reacting accordingly. Others may have difficulty in lying down or rising, and the use of the same crate or floor for a number of sows may spread any infection should it occur. Aids of this nature, therefore, call for a high degree of management and hygiene.

Farrowing Crates.

Farrowing crates are long, narrow wooden crates which provide an escape outlet at each side for the newly born pigs. Sometimes a box is built to be attached to the escape outlet and it may be fitted with electric light bulbs or oil lamps which both warm the box and attract the suckers out of harm's way.

The crate should be large enough to allow the sow to stand up and lie down in comfort, but too narrow for her to turn round. It should be of sufficient length for the largest sow with about 9 inches to spare, usually about 7 ft. The length of standing room may be shortened if necessary by sliding an iron or wooden bar across the crate about 12 inches from the floor behind the sow.

and 10 inches above the floor and may be heated by an electric or oil lamp, thus providing warmth. The boards forming the floor are built in sections so that they may be placed in an existing pen and when necessary removed for cleaning. However, some farmers prefer to make the sloping floor a fixture, and keep the sow and litter in the pen for one week after farrowing, or longer if the pen is not required for other sows.

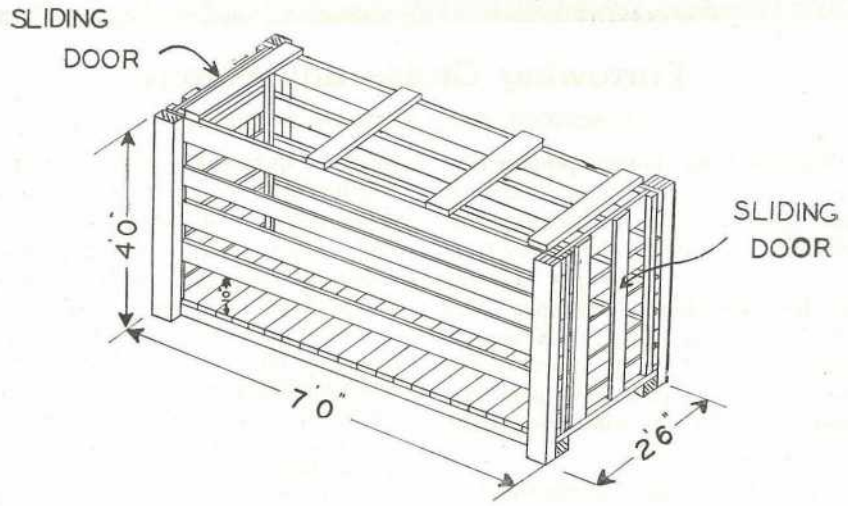


Plate 1.

Sketch of Farrowing Crate.

The width of the crate is usually about 2 ft. 6 in., but for small or young sows it should be reduced to prevent turning by fitting false sides. The sharp edges of the boards should be removed to prevent injury to the sow's sides. The crate is usually 4 ft. high and if open at the top may be covered with bags in cold weather. Hinged or sliding doors provided at each end are an advantage.

Kentucky Farrowing Floor.

The basic feature of the Kentucky or sloping farrowing floor is a movable wooden floor with a fall of 1 in 9 sloping down to a "hover board." This hover board should be 12 inches wide

The ramp shown in Plate 3 is not necessary if the young pigs are removed when about one week old. However, if a ramp is provided and the sloping floor does not occupy the whole of the pen, a hurdle will be required to keep the sow on the sloping floor, otherwise she may decide to farrow on the cold permanent floor.

A sow tends to lie with her head or back up the slope, and the suckers, taking the line of least resistance, find themselves in the warm shelter of the hover board. A sow lying in this position naturally has her udder facing the suckers congregated under the hover board.

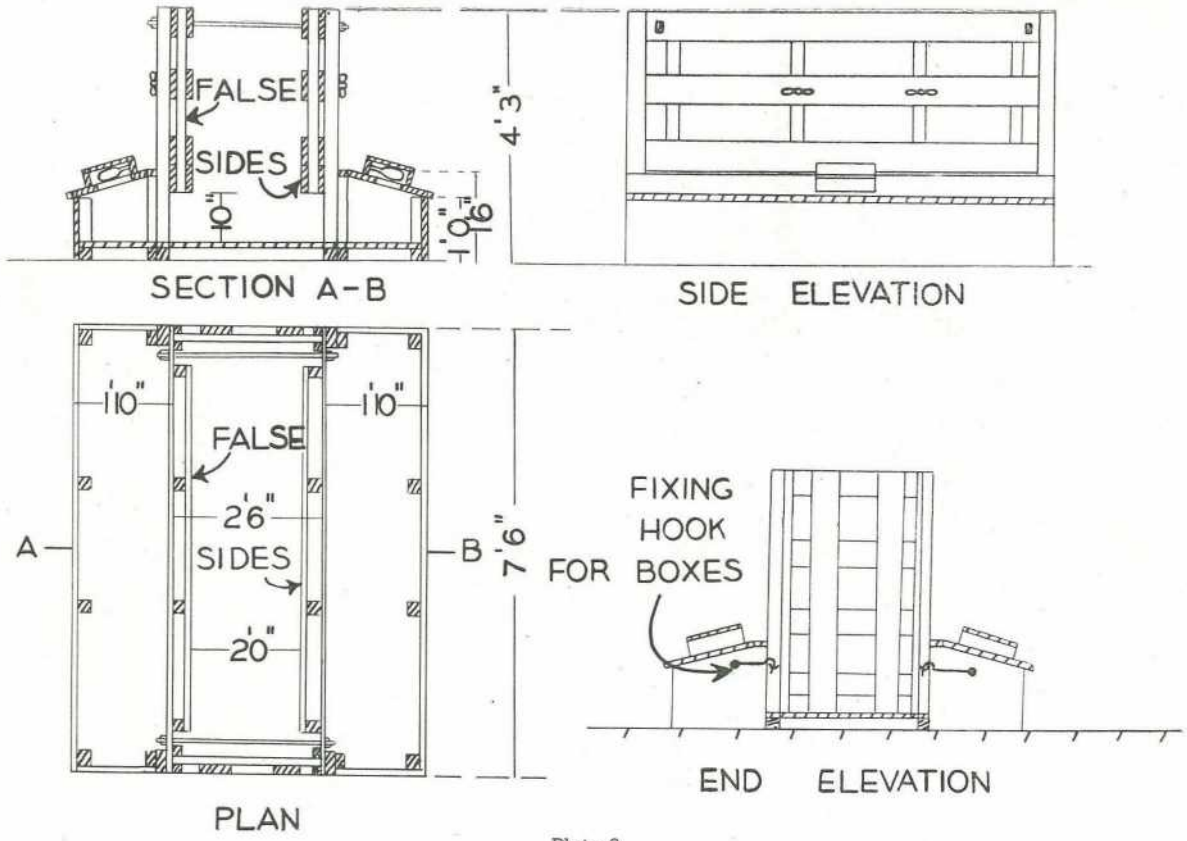


Plate 2.
Details of Farrowing Crate.

It has been found that when warmth is provided, either in the boxes attached to the farrowing crate or under the hover board, suckers learn to appreciate the protection provided more quickly than they learn that they are safe behind the farrowing rails provided in the usual type of farrowing pen.

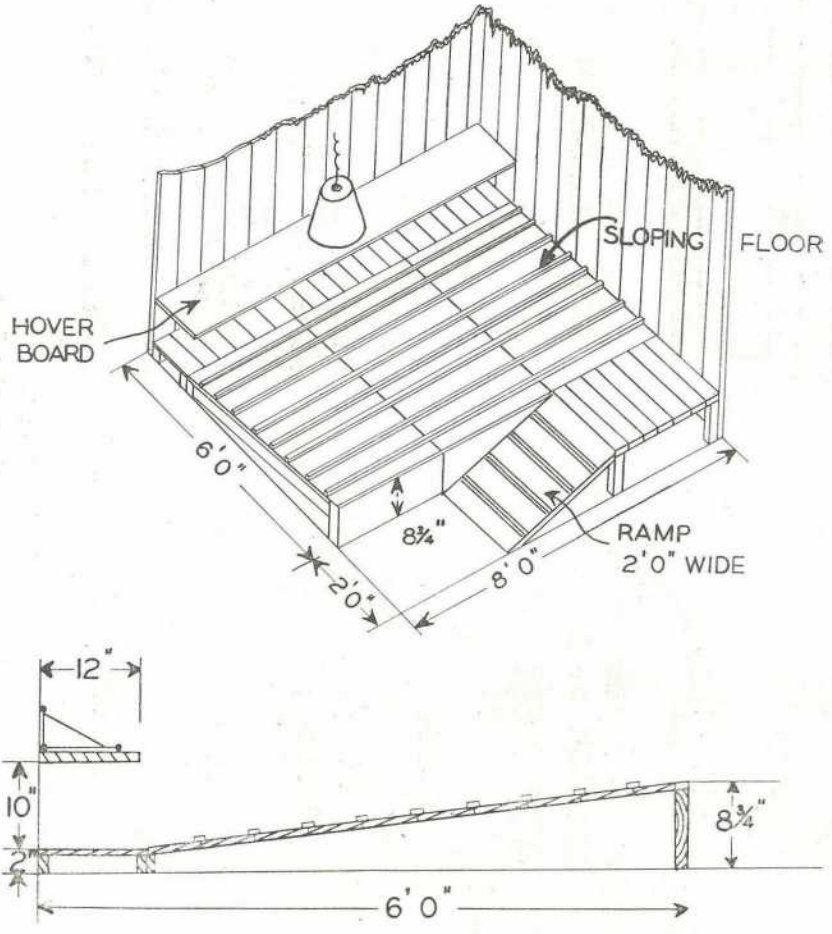


Plate 3.

Sketches of Kentucky Farrowing Floor.

Brucellosis-Tested Swine Herds.

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

TESTED HERDS (As at 23rd August, 1954).

Berkshire.

S. Cochrane, " Stanroy " Stud, Felton
G. Handley, " Handleigh " Stud, Murphy's Creek
J. L. Handley, " Meadow Vale " Stud, Lockyer
R. G. Koplick, " Melan Terez" Stud, Rochedale
O'Brien and Hickey, " Kildurham " Stud, Jandowae East
E. Pukallus, " Plainby " Stud, Crow's Nest
G. C. Traves, " Wynwood " Stud, Oakey
E. Tumbridge, " Bidwell " Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
M. K. Collins, "Kennington Stud, Underwood Road, Eight Mile Plains
H.M. State Farm, " Palen " Stud, Palen Creek
A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert
H. H. Sellars, " Tabooba " Stud, Beaudesert
D. T. Law, " Rossvill " Stud, Trouts road, Aspley
R. H. Crawley, " Rockthorpe " Stud, *via* Pittsworth
F. R. J. Cook, " Alstonvilla," Wolvi, *via* Gympie
Mrs. I. M. James, " Kenmore " Stud, Cambooya
H. L. Stark ," Florida," Kalbar
J. H. N. Stoodley, " Stoodville," Ormiston
H.M. State Farm, Numinbah
V. G. M. and A. G. Brown, " Bardell," Goovigen
R. E. Paulsen, " Crest " Stud, Binjour Plateau, M.S. 670, Gayndah
M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah
L. Puschmann, " Tayfeld " Stud, Taylor
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
W. F. Ruhle, " Felbar " Stud, Kalbar
C. E. Edwards, " Spring Valley " Stud, Kingaroy
G. J. McLennan, " Murcott " Stud, Willowvale
H. M. Wyatte, " Deepwater " Stud, Rocky Creek, Yarraman
C. F. W. and B. A. Shellback, " Redvilla " Stud, Kingaroy
R. J. Webber, " Webberberry " Stud, 35 Caxton st., Petrie Terrace
J. C. Lees, "Bridge View " Stud, Yandina
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
A. C. Fletcher, "Myola " Stud, Jimbour
Q.A.H.S. and College, Lawes
E. F. Smythe, "Grandmere" Stud, Manyung, Murgon

Large White.

H. J. Franke and Sons, " Delvue " Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, " Highfields," Murgon
K. B. Jones, " Cefn " Stud, Pilton
R. G. Koplick " Melan Terez " Stud, Rochedale
R. Postle, " Yarralla " Stud, Pittsworth
B. J. Jensen, "Bremerside" Stud, Rosevale *via* Rosewood
E. J. Bell, " Dorne " Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, " Thistleton " Stud, Maleny
H.M. State Farm, Numinbah
K. A. Hancock, " Laurestonvale " Stud, Murgon
V. P. McGoldrick, " Fairymeadow " Stud, Cooroy
S. T. Fowler, " Kenstan " Stud, Pittsworth
M. D. Power, "Ballinasloe" Stud, Swan Creek, via Warwick
H. L. Larsen, " Oakway," Kingaroy
C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
Mrs. I. G. Utting, " White Lodge," Mountain road, Cooroy
N. E. Meyers, Halpine Plantation, Kallangur
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. I. Skyring, " Bellwood " Stud, *via* Pomona
O. J. Horton, " Manneum Brae " Stud, Manneum Kingaroy
M. E. Bryant, " Maryland Brae " Stud, Blunder road, Oxley
Miss G. R. Charity, Coondoo, Kin Kin.
W. J. Blakeney, "Talgai " Stud, Clifton
F. K. Wright, Narangba, N. C. Line
O. B. Vidler, Manneum, Kingaroy
K. F. Stumer, French's Creek, Boonah
Q.A.H.S. and College, Lawes
R. S. Powell, "Kybong" Stud, Kybong, *via* Gympie

Tamworth.

S. Kanowski, " Miecho " Stud, Pinelands
N. R. Potter, " Actonvale " Stud, Wellcamp
D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun
A. C. Fletcher, " Myola " Stud, Jimbour
Salvation Army Home for Boys, " Canaan " Stud, Riverview
A. J. Surman, " Namrus " Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, " Sunny View," M.S. 90, Kingaroy
F. N. Hales, Kerry Road, Beaudesert
T. A. Stephen, " Withcott," Helidon
W. F. Kajewski, " Glenroy " Stud, Glencoe
A. A. Herbst, " Hillbanside " Stud, Bahr Scrub *via* Beenleigh
R. G. Koplick, " Melan Terez " Stud, Rochedale
H.M. State Farm, Numinbah
D. B. Alexander, " Debreczen " Stud, Kinleymore *via* Murgon
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
M. E. Bryant, " Maryland Brae " Stud, Blunder road, Oxley
G. H. Sattler, Landsborough
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
P. V. Campbell, " Lawn Hill " Stud, Lamington
H. J. Armstrong, Alhambra," Crownthorpe, Murgon
Q.A.H.S. and College, Lawes

Wessex Saddleback.

W. S. Douglas, " Greylight " Stud, Goombungee
D. Kay and P. Hunting, " Kazan " Stud, Goodna
J. Gleeson, " Iona Vale " Stud, Kuraby
C. R. Smith, " Belton Park " Stud, Nara
H. H. Sellars, " Tabooba " Stud, Beaudesert
H. Thomas, " Eurara " Stud, Beaudesert
D. T. Law, " Rossvill " Stud, Trout road, Aspley
J. B. Dunlop, " Kurrawyn " Stud, Acacia road, Kuraby
A. Curd, " Kilrock " Stud, Box 35, Jandowae
F. K. Wright, Narangba, N. C. Line
C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek
R. A. Collings, " Rutholme " Stud, Waterford
M. Nielsen, " Cressbrook " Stud, Goomburra
G. J. Cooper, " Cedar Glen " Stud, Yarraman
M. E. Bryant, " Maryland Brae " Stud, Blunder road, Oxley
A. H. Groves, " Kinvara " Stud, Ingleside, West Burleigh
J. E. Heath, "Springlea " Stud, Murgon
Mrs. R. A. Melville, "Wattledale Stud," Beenleigh road, Sunnybank

British Large Black.

W. F. Ruhle, "Felbar" Stud, Kalbar
H. W. Naumann, "Parkdale " Stud, Kalbar

Paratyphoid of Swine.

By D. W. LAVERS, Veterinary Officer, Veterinary Services Branch.

Paratyphoid is a very serious, highly infectious disease of pigs which is widespread throughout the pig-raising areas of Australia. Usually very acute in form, this disease not only causes sickness and death in young pigs, but produces unthriftiness in many of the animals which recover, making them unsuitable for market.

The chief feature of swine paratyphoid is that recovered animals become carriers of the disease, continuing to harbour and spread infection for a long period. The result is that the disease, once having entered a property, often remains there for a number of years, causing considerable financial loss.

The huge losses sustained as a result of paratyphoid make it one of the most important diseases to the pig industry of Australia. It is hoped that this article will help pig owners to become familiar with this important disease, and take the necessary steps to prevent its entry on to their property.

WHAT IS THE CAUSE?

Several micro-organisms (germs) are responsible for causing paratyphoid, and these all belong to the *Salmonella* group. Most cases are caused by the organism *Salmonella cholerae-suis,* but other members of the *Salmonella* group, including *Salmonella typhi-murium* cause trouble at times.

HOW DOES INFECTION OCCUR?

Mode of Infection.

Animals that are actively infected with paratyphoid discharge enormous numbers of organisms from the body in droppings (and possibly the urine) and thus contaminate floors, feed troughs, etc.

Animals that have recovered from the disease may appear to be perfectly healthy but are still capable of discharging infective organisms. It is these recovered animals, or "carriers," as they are called, which provide a reservoir of infection and help to keep the disease in a piggery for a long period after the original outbreak has cleared up.

The germs are not very hardy, being killed in a few hours by sunlight, dryness, heat, and disinfectants, so they do not survive long in dry, exposed situations. In moist, shaded positions, however, they may survive for many weeks.

Healthy pigs acquire the disease by eating or drinking material that has been contaminated with infective germs, or merely by coming in contact with a visibly sick pig or carrier. The organism passes into the gut, invades the bloodstream, and the animal shows signs of sickness.

Under some circumstances it is probable that other animals (for example, rats) are capable of harbouring and spreading the disease. This method of spread is not frequently encountered.

Circumstances under which Paratyphoid Occurs.

When paratyphoid occurs in a hitherto disease-free piggery, it is usually found that pigs have been purchased from a market and introduced without any attempt having been made to keep them separate from the rest of the herd. Sickness and deaths may appear among the pigs on a property that previously appeared quite healthy.

Since it is a common practice for an owner to dispose of the surviving animals after an outbreak, the purchase of pigs from saleyards or dealers is always fraught with danger.

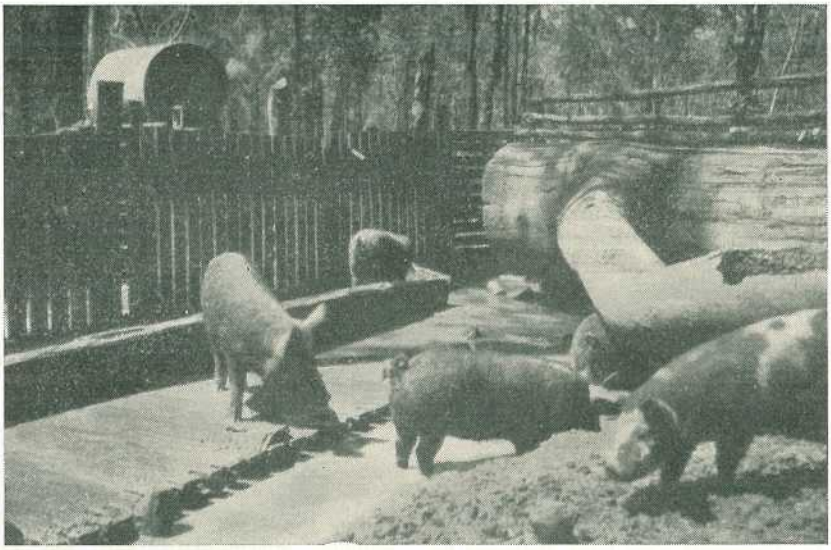


Plate 1.
Wet Yards Help the Germ to Spread.

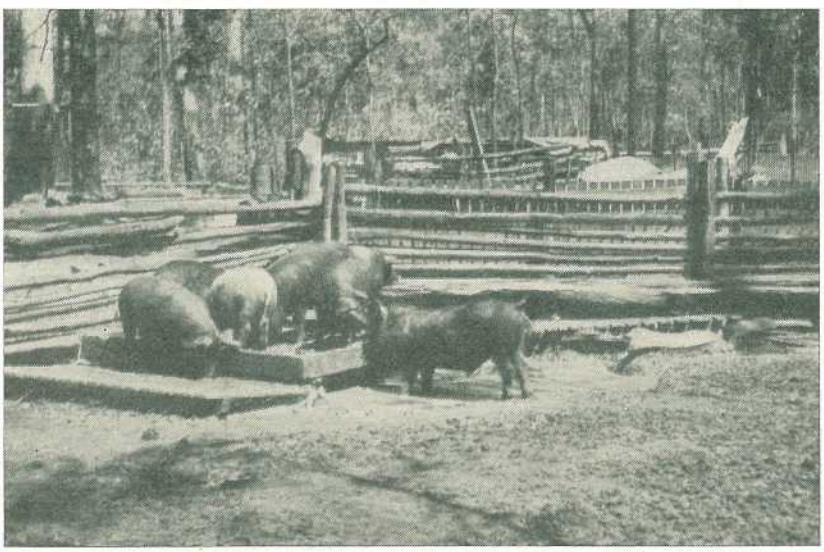


Plate 2.
These Pigs Carry Germs from the Mud to the Feeding Floor.

Sometimes only a single apparently healthy animal, usually a boar or a sow, has been introduced, but more often the disease follows the introduction of weaners or slips.

A healthy animal develops around it a barrier capable of repelling and destroying disease germs. A pig has a natural resistance to paratyphoid, but when its protective mechanism is broken down by underfeeding, overcrowding, or ill-health due to another disease, it is rendered highly susceptible to attack by the army of disease germs. Internal parasites and infectious pneumonia are diseases which may cause such a lowering of resistance.

Severe outbreaks of paratyphoid sometimes occur in a group of pigs after transport over long distances by rail or road. This has been particularly noted at abattoirs among pigs waiting for slaughter. Apparently the journey is capable of lowering the resistance of the animals.

Although pigs kept under good conditions sometimes contract the disease, there is nothing the paratyphoid germ likes better than dirty yards, troughs, shady places and wallows to assist its invasion through the piggery.

RECOGNITION.

Symptoms.

Paratyphoid affects pigs of any age, but most cases, and the greatest losses, occur in young animals about 3-5 months of age. The affected pig first appears dejected and tends to huddle in a corner breathing rapidly. This is the fever stage, the temperature being 104-107°. The animal refuses food, the skin of the belly is a reddish-purple colour, and there may be some discharge from the eyes and nose. Later, if the lungs become involved, the breathing is laboured, a cough develops, and the condition may resemble infectious pneumonia. Sometimes the infection localises in the intestine, a yellow watery diarrhoea is seen, and the pig becomes progressively weaker and dies. Symptoms in the lungs and intestine are more commonly seen in the less acute cases.

The onset of death is usually rapid, occurring only a few hours after the first signs of sickness. Pigs are often found dead in the morning after appearing quite healthy the night before. Sometimes, however, the disease is more protracted and the animals live for several days before death occurs, or they may become chronically affected, showing general unthriftiness.

Paratyphoid may appear in a piggery suddenly and severely, with deaths occurring quickly, most of the animals succumbing, and the survivors showing much loss of condition. In other outbreaks, the disease is more insidious, only a few pigs being affected at any one time; these show coughing and diarrhoea. The death rate in the latter cases is lower, but there is great wastage from retarded growth and fattening.

Post-mortem.

The chief features on post-mortem examination are numerous small haemorrhages in the abdominal cavity, particularly under the capsule of the kidney, and the liver and spleen are swollen and engorged with blood. The lungs are usually dark red and the early stages of pneumonia may be present.

Sometimes there is a characteristic inflammation and ulceration of the mucous lining of the large intestine (caecum and colon), commonly known as necrotic enteritis. This is a common feature of *Salmonella* infections overseas but is not so often seen in Australia. If death occurs very rapidly, there may be no signs on post-mortem examination.

Diagnosis.

In most cases, paratyphoid is fairly easy to recognise by the short fatal nature of the illness, reddish or bluish discolouration of the belly, and haemorrhages in the body cavity, particularly under the capsule of the kidney. The age of the animals affected, and the history of recent saleyard purchases, should give a valuable clue to diagnosis.

It is important to recognise paratyphoid early so that preventive and remedial measures can be undertaken and losses kept to a minimum.

Several conditions resemble paratyphoid, but these are readily distinguishable by laboratory examination of the organs of an affected animal. Such conditions include nitrite poisoning, acute swine erysipelas, arsenical poisoning and swine fever (the last disease does not occur in Australia at the present time).

The farmer is strongly advised to consult his nearest veterinarian or stock inspector without delay, if he is in any doubt about the diagnosis or the necessary steps to be taken to control an outbreak.

WHAT ACTION SHOULD BE TAKEN?

Treatment.

The more recent sulphonamides are very effective in treating swine paratyphoid. Sulphadimidine is the most commonly used drug, but sulphamerazine is probably just as good. Full doses should be given once daily according to the liveweight as set out in the following table, and should continue for a minimum of 3 days and a maximum of 7 days, according to the response.

Sodium sulphadimidine solution is administered with a sterile hypodermic syringe and needle under the skin anywhere on the body. Tablets are usually easy to administer to sick pigs if an assistant is available. They are simply dropped on the tongue—as far back as possible. As the pigs recover it becomes more difficult to give tablets. They can then be crushed and administered either in the food or as a drench.

Dealing with an Outbreak.

When an outbreak is not handled correctly, the paratyphoid germ has a habit, like the unwelcome guest, of remaining for a long period. Very strict attention should be paid to the following points:—

(1) Isolate all the sick pigs. This is best done by moving all the healthy ones to new quarters. It is a good plan to vacate the pens or yards adjoining the affected group, and to ensure that the infection is not carried to the healthy stock in drainage water or on boots, implements, etc.

(2) Treat pigs individually as soon as the first signs of sickness appear.

(3) Clean up pens and yards. Muddy patches and wallows should be drained, and litter and rubbish cleared away to permit the disinfectant action of sunlight. Concrete troughs may be treated with disinfectants, but wooden troughs should be burned.

——	How Administered.	1st Day.	Succeeding Days.
Sodium Sulphadimidine Solution (33⅓%)	Injection under the skin	3 c.c. per 10 lb. weight	3 c.c. per 20 lb. weight
Sulphadimidine Powder or ½-gram Tablets	By mouth ..	1 gram per 10 lb. weight	1 gram per 20 lb. weight
Sulphamerazine Powder or ½-gram Tablets	By mouth ..	1 gram per 10 lb. weight	1 gram per 20 lb. weight

(4) Destroy severely affected pigs, for even if they recover they are rarely profitable.

(5) Remove carriers. Recovered pigs will most probably be carriers of the disease, even if they are treated in the recommended manner. They should be isolated from other pigs on the property, and sold for slaughter as soon as their condition is sufficient. In fairness to other pig raisers, they should never be sold through saleyards. The sale of diseased or suspected stock without the written permission of an inspector of stock is prohibited.

(6) Protect the baby pigs. It is most important that the newly born pigs do not come in contact with the disease among older pigs. Select breeding sows that have a clean record and clean the pens thoroughly before admitting the sow at farrowing time.

Prevention.

Paratyphoid is not an easy disease to eradicate once it has gained a foothold in the piggery. There is usually a considerable wastage of money, time, and pigs before proper control is effected. The expenditure of a small amount of energy in preventing an outbreak from occurring has a great deal to recommend it.

Prevention is based on the fact that the disease is usually set up by carriers and that any recovered or in-contact animal is a potential carrier. The farmer who maintains his herd by purchasing stores indiscriminately cannot hope to escape infectious diseases for long. Pig owners should endeavour to breed their own stock and avoid all outside contact, if possible. If additional breeders are required, these should be purchased only from a piggery known to be disease-free. All introductions should be held in a quarantine pen for at least a month before being allowed to mix with the rest of the herd.

Good health should be maintained at all times, by good feeding and freedom from internal parasites, particularly the large roundworm. The large roundworm is controlled by sanitation and strategic treatment with sodium fluoride.

A pig requires a well balanced ration to provide it with maximum resistance against disease. All food elements are essential, but the most commonly undersupplied element is Vitamin A, the vitamin of green feed. A pig should have good quality grazing on green feed supplied to its full needs. If this is not possible, it should receive at least ½ to 1 lb. of lucerne chaff per day. The farmer who adopts sound management and sanitation principles, who provides his pigs with good pens, well constructed pig houses, and grazing blocks, is half-way to solving his disease problems.

COUNTRY BREAKFAST SESSIONS.

The Rural Broadcasts Section of the A.B.C. is now providing regular breakfast sessions of interest to rural people from 4QY, 4AT and 4QS, Monday to Friday from 7 to 7.15.

Harry Greaves, stationed at Cairns, handles the northern programme, and Trevor Stockley conducts the southern programme from Toowoomba.

ANIMAL HEALTH

Zamia Staggers in Cattle.

By W. T. K. HALL, Veterinary Officer, Animal Health Station, Yeerongpilly.

For nearly 80 years the plants known as zamia have been recognized as the cause of a form of staggers (usually incorrectly called rickets) in cattle. The disease has been known in Central Queensland for almost as long as stock raising has been carried on in that part of the State. Some properties have to fence off and cannot use country which carries a considerable amount of zamia.

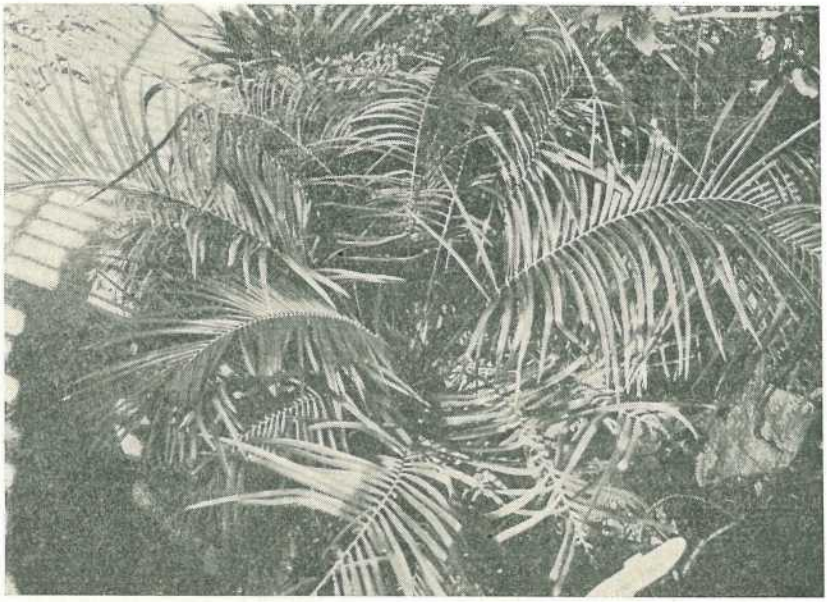


Plate 1.
Photograph of Macrozamia spiralis.

Several detailed accounts of zamia poisoning in cattle were published during the period 1890–1900. Apparently it was a great handicap to cattle raising during and prior to this period. About the same time feeding experiments which reproduced the disease were done by Mr. Norton, a grazier of Yeppoon. In 1894 Edwards in Western Australia reported positive feeding trials with *Macrozamia fraseri,* which grows in that State.

As a result of these tests the poisonous nature of *Macrozamia* and its effect on cattle became well known. During the following 50 years the plant has undoubtedly been the cause of considerable loss to the cattle industry but little further experimental work was done until recently.

A brief account of the plants concerned and their distribution, recent feeding experiments, and some comments about the disease are reported in this article.

DISTRIBUTION AND DESCRIPTION OF ZAMIA.

Zamia is the common name for *Cycas media* and for a number of species of *Macrozamia*. These palm-like plants (Plate 1) are widely distributed in Queensland and in some districts are particularly prevalent.

Four species of *Macrozamia* grow on the coastal strip of the country between Rockhampton and Brisbane. One of these, *M. spiralis,* also grows in the Brisbane Valley and in New South Wales.

On the Carnarvon Range and on the lower carrying capacity cattle country around Springsure a larger plant, *M. moorei,* is the common variety.

On the land drained by the Fitzroy River and its tributaries at least three different species of *Macrozamia* (*M. miquelii, M. moorei, M. platyrhachis*) and also *Cycas media* grow. *C. media* is more widely distributed north of Rockhampton.

Still further species of *Macrozamia* are seen amongst the rain-forest vegetation where it occurs in the mountainous regions and in the northern parts of the State.

The leaves of both *Macrozamia* and *Cycas* are divided into a number of long, narrow segments. In *Cycas* there is a midrib down each of these segments; this is not present in *Macrozamia*. A further difference between these plants is that the species of *Macrozamia* bear their fruiting bodies in cones (locally referred to as pineapples because of the shape) while in *Cycas media* the fruiting bodies are on thick forked structures.

SYMPTOMS.

The symptoms of zamia staggers are characteristic and are unfortunately well known to many stock-owners.

The following very good description was given by Dr. T. L. Bancroft in 1892:—

"The chief symptom of the disease is loss of proper control over the movements of the hind limbs. A 'rickety' animal may run several yards without showing any peculiarity whatever, when suddenly it may drag its hind limbs much like a dog sick from tick bite, or knuckle over upon its hind fetlocks, or may fall upon its haunches, immediately afterwards righting itself."

He went on to say:—

"Affected animals seem never to recover completely, the weakness of the hind quarters continuing throughout life. Although their infirmity handicaps them in obtaining food, they are capable of being fattened if placed on good feed, and the flesh of those animals in good condition appears to be quite sound."

Dr. Bancroft quite rightly pointed out that the name zamia rickets is a misnomer, because rickets is a term used to describe soft bones in young growing animals. However, it is easy to understand how the name could have arisen, because when watching some affected animals move, the impression is received that the bones are bending at the hock joints. Post-mortem examination, however, shows that the bones are quite sound.

Dr. Bancroft suggested that the disease should be called zamia poisoning. This is a correct name, but zamia staggers is more descriptive.

Broken horns and broken leg bones are two features associated with the disease, but not really part of it. The broken horns occur because the animal cannot control its movements and as a result runs into trees and knocks its horns down. Because of the lack of proper control, unnatural strains are placed on the legs of the animal.

A factor that increases the tendency for the horns to be knocked down and the legs to be broken is that much of the zamia country is phosphate deficient. As a result the bones of affected animals may be weak, not because of eating zamia but because of the phosphate deficiency.

FEEDING EXPERIMENTS.

Three different species of zamia have been fed and the experiments confirmed that the leaves when eaten will cause the typical symptoms. No feeding trials with the fruiting bodies or nuts have been done in Queensland. Some years ago it was shown in New South Wales that the nuts, when eaten by sheep, will cause damage to the liver, scouring and sometimes death.

As there is an interesting variation in the feeding trials with cattle the following summary of the results of the more important experiments is given.

Macrozamia spiralis.

In these trials *M. spiralis* from the Esk district was fed in varying amounts to four steers.

(1) A 2-year-old steer was fed the plant at the rate of 10 oz. per day for 34 days. This produced typical advanced symptoms of zamia staggers (Plate 2) and shows that *M. spiralis* is poisonous to cattle.

(2) A similar steer was fed at the same rate with the same batches of plant as the above, but after the plant had reached hay dryness. Ten ounces per day was fed for 103 days and no symptoms developed. This strongly suggests that the toxic agent in the plant is lost when it dries.

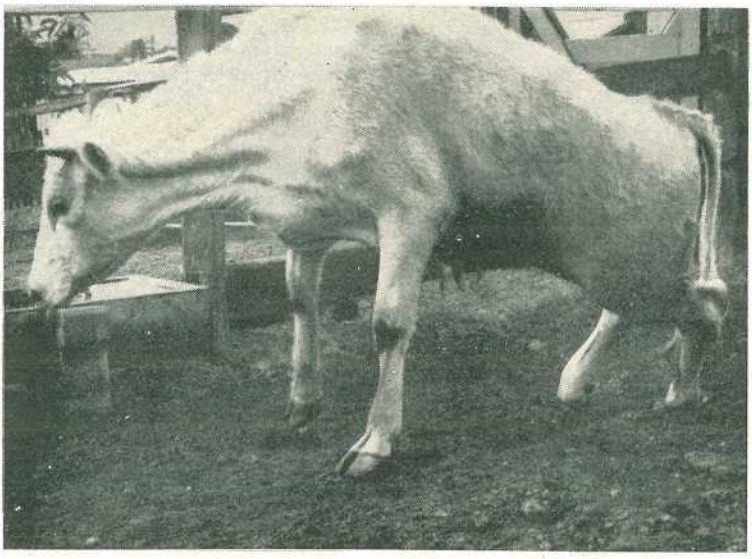


Plate 2.

A Beast showing Symptoms of Poisoning by Macrozamia spiralis.

(3) In the same series of experiments a third steer was fed 4 oz. of fresh green zamia per day for 114 days. This is a greater total amount of plant than the first steer was fed. No symptoms developed. This indicates that a minimum daily dose has to be exceeded before symptoms are produced.

(4) The other steer was fed for broken periods with fresh plant. Neither 5 lb. during 8 days nor, some time later, 7 lb. during 7 days, produced any symptoms. Later 20 lb.

fed during 20 days produced typical symptoms. This animal, during the feeding periods, was given all the zamia it would eat each day.

From this experiment it can be concluded that there is a minimum feeding time of nearly 20 days before any effect is noticed. Perhaps under starvation conditions more zamia would be eaten per day and the feeding interval to produce symptoms shortened.

M douglasii and M. spiralis.

Experiments were next done with a mixture of approximately equal parts of *Macrozamia douglasii* and *M. spiralis* from Fraser Island.

Steers similar to those used previously were fed with fresh green plant. One animal ate 4 oz. per day for 35 days and did not become affected, while another fed 10 oz. per day for the same period became affected with the characteristic staggers.

From the previous experiments it would seem that there would not have been sufficient *M. spiralis* fed to cause the symptoms in this animal. It was therefore concluded that *M. douglasii* must also be harmful to cattle.

Macrozamia paulo-guilielmi.

The following year trials with this plant collected in the Gympie district were done.

A 2-year-old heifer weighing 800 lb. was fed with freshly chaffed green plant, 116 lb. of zamia being fed during 121 days. On the 66th day the cow calved normally. The calf was left on its mother and did well during the remaining 55 days of the trial. The cow showed no evidence of zamia staggers.

A steer of about 600 lb. liveweight was fed with the same batches of plant. This animal was given as much zamia as it would eat up to a maximum of 2 lb. per day, and during 100 days 148 lb. was fed. Mild symptoms were noticeable on the 86th day, and became marked during the next 14 days (Plate 3).

The effect on the second animal shows that this plant is poisonous, but it was surprising to find that so much had to be fed to produce symptoms. This would indicate that it is less toxic than the species fed previously. At the same time it should be emphasised that this feeding trial was done in a different year from the previous ones and it is possible that climatic conditions and particularly the stage of growth of the plant are factors that could affect the toxicity.

All of the animals in these feeding trials were fed lucerne chaff with the zamia and all gained weight during the experimental feeding.

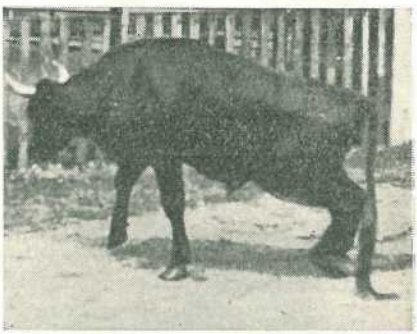


Plate 3.

Marked Staggers After Feeding on Macrozamia paulo-guilielmi.

POST-MORTEM FINDINGS.

Post-mortem examinations have been done on affected experimental animals. The brain, spinal cord and nerves have been examined in detail, but the methods that have been used so far have failed to reveal the damage that is the cause of the symptoms.

There is often some straining of the ligament of the hip joint, some straining and bruising of the ligaments around the hock joint, and in advanced cases bruising, particularly to the front of the fetlock, but these are caused by the animal's inability to control its movements properly.

DISCUSSION.

The questions which arise are: What can be done for affected animals? What can be done to prevent animals from becoming affected? What methods can be used to clear the plant?

No very optimistic reply can be given to the first question, because apparently the nerves are permanently damaged before animals show symptoms. Perhaps further experimental work and field reports will show that at certain times of the year or at a certain stage of the growth of the plant it can be safely grazed by cattle.

In 1894 the methods of destruction of the plant were discussed at length by Edwards in Western Australia. He suggested using a crowbar with a chisel-end 4 in. wide to split the large underground or the aboveground trunk of the plant. This requires too much labour for it to be of practical use on large holdings or where the zamia is thick.

The practice in Queensland has always been to fence off the badly affected areas. However, in dry seasons this country often has to be used, and it is then that zamia is a cause of serious economic loss. The country is often burnt before use and following the burn young zamia shoots come away. As these are fresh and green they are readily eaten by the stock and in a short time many animals become affected with the disease.

The animals less severely affected can be moved back to zamia-free country. A few days after no more plant is eaten, the disease will not become any worse. There may be slight apparent recovery, but this is mainly or solely due to the animal becoming used to its disability. These animals are therefore a nuisance amongst stock being worked, particularly at dipping. Even if they are well enough to fatten, there then comes the problem of getting the animals to market.

If stock are run permanently on country where there is only a small amount of zamia there are usually a few animals that become affected. If the land is far from rail or a slaughterhouse these animals that cannot be driven gradually accumulate on the property as useless grass eaters, which it seems a pity to shoot. If any of them are killed it should be remembered that the meat is quite wholesome.

Affected animals can be marketed and will pass inspection if the problem of transporting them can be overcome. Because the animals may get down during travelling there is often some slaughtering condemnation due to bruising.

OVERSEAS MARKETING PROBE.

The marketing of primary products in other countries is to be studied by the Director of Marketing in the Department of Agriculture and Stock (Mr. H. S. Hunter).

The Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) said the Queensland Council of Agriculture had asked that an officer should be appointed to make an overseas investigation into various aspects of marketing Queensland primary products.

For this purpose commodity organisations constituting the Council of Agriculture were prepared to levy themselves to the extent of paying the cost of the mission with the assistance of a £500 grant promised by the Commonwealth Trading Bank.

Cabinet agreed to an officer being made available under these conditions.

Matters to be inquired into would include—

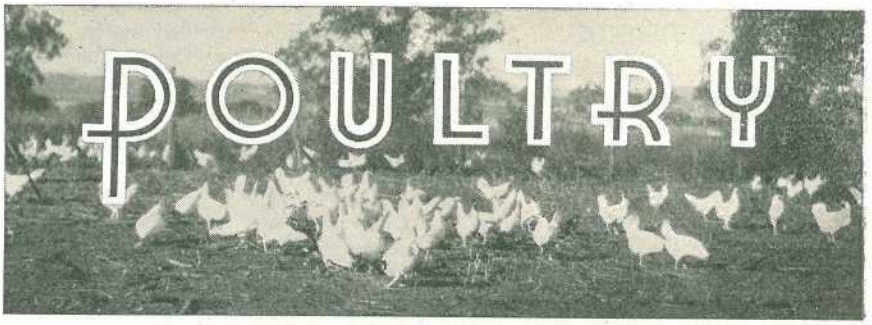
Methods of marketing tobacco leaf in the United States and other countries, packing and grading methods adopted, and any aspect related to tobacco leaf marketing problems in this country.

Marketing of peanuts and peanut products overseas.

The outlook on the overseas markets for Queensland agricultural products generally.

Modern developments in co-operatives.

Wholesale and retail marketing and the distribution of eggs and egg pulp, including marketing practices and grade standards.



Sorghum for Layers.

By B. W. MOFFATT, Assistant Adviser, Poultry Branch.

Poultry feeds are composed largely of cereals and their by-products, the main grains used being wheat, maize and sorghum.

The least used of these grains is sorghum. Many farmers are prejudiced against its use as a poultry food as they are under the impression that the feeding of sorghum is not conducive to good health, that it increases mortality, and that lowered production is associated with it. Actually there is no foundation for this prejudice, as by experiment it has been proved that when fed to layers, sorghum is equal to wheat in a properly balanced ration, and it has the added advantage of being one of the cheaper grains.

Wheat in particular, and maize to a lesser extent, are in demand for human consumption, the surplus only being used for stock feeding. Sorghum is not used in Australia for human consumption. It is produced as a stock food and sold at a price much less than that ruling for wheat and maize. It is a grain that can play an important part in the nutrition of poultry and economy of production.

Nutritive Value.

The chemical analysis of sorghum is very similar to that of other grains. Its protein content is approximately 10%, which is slightly higher than maize although not as high as wheat. All rations have to be supplemented with protein-rich foods whether the base is wheat or not; consequently sorghum suffers little by comparison in this respect.

It has a similar fibre content to wheat and maize and therefore could be substituted for either of these grains without affecting the fibre content of the ration.

Not a Balanced Ration.

Although sorghum is recommended as a poultry feed, it is pointed out that sorghum, like other grains, is not a balanced ration for fowls. A balanced ration must contain adequate amounts of protein, carbohydrates, minerals and vitamins. It is for this reason that poultry rations are made up of a variety of feedstuffs supplemented with vitamins and minerals when necessary.

How Much Can be Used?

Although sorghum is used in some proprietary mashes at the present time, there is much scope for its further use as the grain portion of the ration. It has been proved in New South Wales that sorghum meal can replace wheatmeal in the mash and can also be used as the grain portion of the ration.

In one particular experiment where sorghum meal was used at the rate of 46½% of the mash and sorghum was fed as grain, there was no significant

difference in egg production between birds on this ration and birds that were fed a mash containing the same amount of wheatmeal and wheat fed as grain.

From the results of this experiment, from overseas work and also from field trials in Queensland, there is no doubt that sorghum can replace wheat or maize in a ration for layers.

Sorghum Feeding Trials.

In an effort to encourage the greater use of the grain sorghum available in this State, trials under farm conditions were carried out during 1953 and 1954 to demonstrate its value. The trials or field demonstrations were carried out on farms in the Brisbane and Caboolture areas.

The farmers who undertook the demonstrations each made available 400 birds of the one breed, of approximately the same age, even in quality and housed under similar conditions. The birds were divided into two groups each of 200 birds of the same breed and quality. The only difference in the management of the two groups was that one group was fed sorghum as grain and the other fed wheat. Records of egg production over a period of 26 weeks are set out in Table 1.

TABLE 1.

EGG PRODUCTION OVER 26 WEEKS.

Farm.	Sorghum.	Wheat.
1	100·2	94·3
2	95·5	109·1
3	73·1	79·9
4	98·3	90·2
Average ..	91·8	93·6

Although the production on the individual farms on wheat and sorghum varied, this was only to be expected. Production on each farm could be influenced by factors such as the breed of bird, date of hatching, standard of housing and, particularly, intensity of laying when the tests commenced. Nevertheless, the important part is that the average production on sorghum on all farms was only 1.8 eggs less than that obtained on wheat.

The systems of housing on the four farms varied. Farms 1, 2 and 4 housed birds intensively whilst the remaining farm kept birds under the semi-intensive system.

On three farms proprietary mashes were fed, whilst the owner of farm 1 mixed his own mash.

Table 2 gives a comparison of the rates of culling from the two different groups. These groups correspond with the group of the same number in Table 1. On some of these farms broody birds were classed as culls and were removed from the pens. You will notice that the difference between the rate of culling of sorghum groups and the rate of culling in the wheat groups is negligible.

TABLE 2.

CULLING RATES ON SORGHUM AND WHEAT.

Farm.	Sorghum.	Wheat.
	%	%
1	25½	27½
2	42	38½
3	35	29
4	30	36
Average ..	33	32¾

Table 3 shows that there was no noticeable difference in the death rates of the two groups. This is important, because many farmers are under the impression that sorghum will kill fowls. Surely the results obtained should convince those people who have

TABLE 3.

DEATH RATES ON SORGHUM AND WHEAT.

Farm.	Sorghum.	Wheat.
	%	%
1	1½	3
2	6	3
3	4	6
4	2½	5
Average ..	3½	4¼

feared the consequence of feeding large quantities of sorghum that such fears are without foundation!

Changing from Other Grains.

Much of the prejudice against sorghum has arisen from the fact that birds have not taken readily to the sorghum. Birds are habit-forming and do not take kindly to any change of feed or conditions unless the change is brought about gradually. In the case of the demonstrations mentioned previously, no trouble was encountered in making the change from wheat to sorghum. The change was made over a period of two weeks by supplying a small amount of sorghum with the wheat for the first day and increasing the amount of sorghum daily until the grain ration consisted of all sorghum. In this way, the bird's daily intake of food was maintained and production did not suffer.

Economics of Sorghum Feeding.

On present prices sorghum is by far the cheapest grain available for poultry feeding. The price of wheat and maize is likely to remain higher than that of sorghum because these two grains are in demand for human foods as well as stock foods.

Table 4 illustrates the economy possible by substituting sorghum for wheat as the grain portion of the fowl's ration. It must be remembered when dealing with these grains that a bushel of sorghum weighs 56 lb. (40 bushels to ton) whilst a bushel of wheat is 60 lb. (37⅓ bushels to ton). However, for ease of working, the figures for this table have been calculated from the price of the grain per ton (2,240 lb.).

For the purpose of this table, I have assumed that each bird will consume 45 lb. grain per year in addition to the mash. As an illustration, if the price of sorghum is £2 a ton less than the price of wheat, then the saving on 1,000 birds per year by feeding sorghum as a grain in place of wheat would be £40 3s. 4d.

TABLE 4.

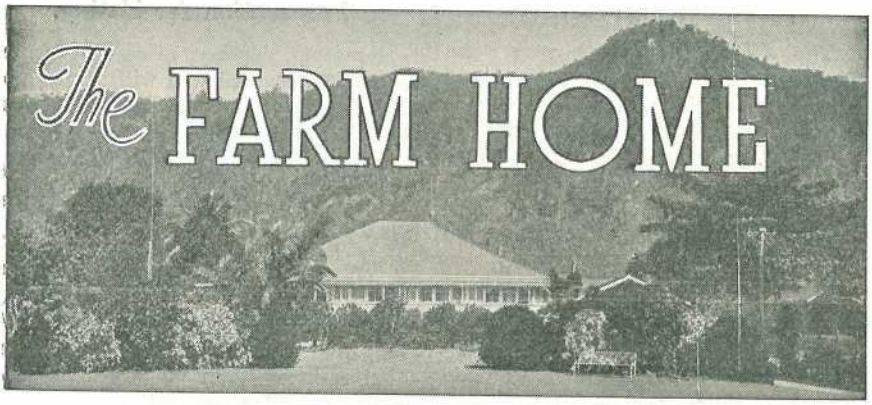
ECONOMY OF SORGHUM FEEDING.

Cost of Sorghum per Ton below Cost of Wheat.	Saving per Bird per Year.	Saving per 1,000 Birds per Year.
£	*d.*	£ *s.* *d.*
2	9·64	40 3 4
4	19·28	80 6 8
6	28·92	120 10 0
8	38·56	160 13 4
10	48·2	200 16 8
12	57·84	241 0 0

From the table the saving to be made by substituting sorghum for wheat is clearly indicated. It is also clear that the grain can and will play an important part in the economy of poultry feeding.

Summary.

From the field work that has been carried out it has been shown that sorghum can be used to the same extent in the feeding of layers as can other grains. The price factor can then be regarded as perhaps the main point to be considered when selecting grain to be used. In this respect there is no reason why farmers should not use more of the lower priced grain (sorghum). This would mean lower production costs, and more profit per bird would result.



Drying Fruits and Vegetables for Home Use.

By R. E. LEVERINGTON, Horticulture Branch.

The drying of fruits and vegetables removes sufficient moisture to prevent the development of rots. Vegetables should be thoroughly washed and the edible portions prepared as for normal cooking. Fruits should be similarly washed and the edible portions prepared into pieces as indicated in the detailed instructions.

A pre-cooking or blanching process in boiling water or steam is required to prevent subsequent deterioration in quality and appearance of vegetables. To prevent over-blanching, the product must be cooled immediately in running cold water.

The product is spread on trays in layers not more than ½ inch deep and dried either in the sun or in an oven or evaporator at a temperature of approximately 150°F. The pieces should be turned frequently to ensure even drying. The temperature for drying is about 200 degrees less than that for normal cooking and should therefore be checked with a thermometer. It may be necessary to leave the oven door slightly open to prevent the temperature rising above 150°F.

If wood stoves are available it is probably more satisfactory to construct an evaporator of wood and angle iron equipped with shelves to hold wooden trays. This structure may either be placed directly on top of the stove or hung in the vicinity of it so that hot air that rises from the stove can pass over it.

Drying, which may take several days in the sun or 24 hours or more in the oven or evaporator, is continued until the product is crisp. The dehydrated material is then cooled and packed in airtight containers.

Sulphuring.

Sulphuring is necessary to prevent the discolouration during storage of dried fruits such as peaches, apples, pears, apricots and bananas. Fruits treated by sulphuring are improved in colour and texture. Sulphuring may be omitted in home drying but the dried fruit will be slightly dark in colour.

The process is carried out by placing the fruit on wooden trays which can be covered with a box. The trays can be fitted to the sides of the box if necessary. Flowers of sulphur are placed in a suitable metal container at the bottom of the box, lit with a match and the fruit subjected to the fumes for the necessary length of time as given in the table. One ounce of sulphur is required for every six cubic feet of air space. After this treatment, the fruit is ready for drying.

Drying.

The drying time will vary with different fruits, sizes of pieces and weather conditions if sun drying is used. If the trays of drying fruit are sun-dried they should be placed under cover during the night or on rainy days. The fruit should be dried until it is no longer mushy but firm and pliable.

After drying, the fruit should be heaped together and conditioned by placing it in boxes to allow over-dried pieces to absorb surplus moisture from those not quite dry enough.

Preparation for Eating.

Apricots, peaches, pears and apples should be covered well with water and allowed to soak about 12 hours, then cooked until soft.

Bananas should be soaked for several hours before use in salads, custards, etc.

Vegetables are soaked for about half an hour in cold water, using only enough water to cover them. A longer boiling may be required than for fresh vegetables in order to yield a more tender product.

INSTRUCTIONS FOR DRYING FRUIT.

Fruit.	Size of Pieces.	Sulphuring Time.	Other Instructions.
Apricots	Whole or halves	3–12 hours	
Apples	¼-inch slices	10–15 mins.	Drop into brine 2 tablespoons per gallon prior to sulphuring (cooking apples are most suitable)
Bananas	Cut into halves lengthways and then cut into 1-inch pieces	2–3 hours	Use Lady Finger in preference to Cavendish variety
Peaches	Halves	3–12 hours	Use Freestone variety for preference
Pears	Skin if desired, cut into halves	8–16 hours	William's Bon Chretien variety is very suitable
Pineapples and Papaws	Cut into segments ½-inch thick		

INSTRUCTIONS FOR DRYING VEGETABLES.

Vegetables.	Size of Pieces.	Blanching Time in Boiling Water.
Cabbage	¼-inch strips	4 min.
Carrots and Parsnips	Shreds or cubes	4 min.
Cauliflower	Cut into 1-inch pieces	3½–4½ min.
Celery	Stalks and dark-green leaves	4–5 min.
Onions	¼-inch slices	No blanching required
Peas and Beans	Shelled peas, sliced beans	1 min. (peas), 4 min. (beans)
Spinach	Trim off waste	1½–2½ min.
Potatoes	Slice into strips 3/16 inch square	7 min.

If it is desired to steam blanch, the time required will be 1–2 minutes longer than for boiling water blanching.

Crystallized Fruits.

By R. E. LEVERINGTON, Horticulture Branch.

Crystallizing merely involves saturating the fruit with sugar, but because sugar penetrates slowly into fruit, the method can be time-consuming.

Almost any kind of fruit can be crystallized, but those which give the best results are pineapples, papaws, cherries, apricots, figs, peaches, pears, plums and cumquats.

Choose only sound fruit which is firm and ripe. Wash it and remove any inedible portion. With the exception of pineapples and papaws, fruits do not require peeling. The process of crystallization involves a gradual stepping up of the concentration of sugar each day. Do not use short-cut methods, as the fruit will shrivel and remain hard and tough. Sugar also acts as a preservative, and unless sufficient of it is absorbed, the fruit quickly becomes mouldy.

There are two methods recommended for home use, one involving frequent boiling in syrup, and the other heating in an oven or home evaporator.

Method 1 : Soften the fruit by boiling it in water. It takes about a pint of water for each pound of fruit. Then allow it to drain, keeping the water. To each pint of water add ½ lb. of sugar and one heaped teaspoon of sodium benzoate. Then bring it to the boil. Pour the hot syrup over the drained fruit and allow it to steep for 24 hours. Then drain it off, bring the syrup to the boil, and add 6 oz. of sugar to each pint of water used at the commencement. Boil for about 5 minutes and then pour it hot over the fruit.

Strengthen the syrup in this way for three successive days. This makes a total of 2 lb. sugar to a pint of water. Then let the fruit remain in the syrup for at least 3–4 days. After the final steeping, lift the fruit out carefully and put it on a wire frame to dry. When well drained, place it in a cool oven at a temperature of about 120°F., and dry till free from stickiness.

The final process involves coating the fruit with sugar. There are a number of ways of doing this but perhaps the simplest method is as follows:—Dissolve 3 lb. sugar and ½ ib. of gelatin in 1¼ pints of water. Heat the solution to boiling point over a near-boiling bath and dip dip the fruit into it for a few seconds until thoroughly coated. Now drain for several minutes, then roll the fruit in sugar several times till it is well coated and allow to dry on a screen for a day or so before packing.

Method 2 : This method is somewhat similar to the first, but rather quicker. In this case a high concentration of sugar is obtained by withdrawing water from the fruit by dehydration. Soften the fruit by partial cooking and place it in a hot solution of syrup prepared by dissolving 3 lb. of sugar in a pint of teaspoon of sodium benzoate in a pint of hot water. Allow the fruit to steep overnight, then drain it. Then dry it in an oven or home evaporator (temperature 140°F.) until the fruit is no longer sticky and has an attractive glossy appearance. Then coat it with sugar as described previously.

Crystallized fruit should be packed either in airtight containers or in moisture-proof paper.

Ginger may be preserved by Method 1, but requires cutting into ½–¾ inch cubes and boiling for 2½–3 hours before covering with syrup.

Wild Duck Shooting in Queensland.

By C. ROFF, Fauna Officer.

During an open season for wild duck, many protected waterfowl, including black swans, pigmy geese, ibis, herons and grebes, are mistakenly and sometimes wilfully shot as game birds by inexperienced and indiscriminate shooters.

It is essential for the duck shooter to know the conditions under which he may operate legally, and also to be able to identify the various birds he may take.

Legislation.

An open season is declared usually once annually, depending on the numbers and the maturity of the various species. For instance, this year in Queensland an open season permitting the shooting of wild ducks was declared on 26th June and continues until 30th September, a period of slightly more than three months.

The current declaration relates to grey or black duck, maned goose or wood duck, chestnut and grey teal, blue-winged shoveler, hardheads, musk duck, pink-eared duck or widgeon, plumed tree duck and whistling tree duck. These birds may be taken throughout the whole State during the open season, and a permit to take them is not required. In the western districts of Queensland, grey duck and maned goose may be taken throughout the whole year.

It is imperative to observe that an open season is never declared for the green pigmy goose, the white-quilled pigmy goose, the whiteheaded-shelduck or Burdekin duck, the pied goose or the black swan.

For the open season, the bag limit may be varied by proclamation if necessary, and for this season the maximum number of wild ducks which may be killed by one person in 24 hours has been fixed at 15.

Shooting is not permitted on a sanctuary. All islands forming part of the State of Queensland, National Parks and State Forests, and certain other areas and private properties have been declared sanctuaries.

Additionally, the declaration of an open season does not authorise entry, for shooting purposes, into any land the property of another person. To enter property and shoot wild duck during an open season, it is necessary to obtain prior permission from the owner or occupier of the land concerned.

Sportsmanship.

The legislative aspects of wild duck shooting have now been briefly outlined, but of prime consideration also are the aesthetic aspects which come under the heading of sportmanship. The definition of sportmanship changes with the time and place, but all definitions include certain elements, conspicuous among which is giving the game an "even break," a willingness to abide by existing regulations and a consideration for other sportsman and landowners. These are the basic elements that make for sportmanship and good sportsmen.

The numbers of shooters are constantly increasing and the difficulties of participants in securing even a modest bag are becoming more and more evident. This condition often brings a tendency to relax standards of conduct in an "end justifies the means" type of philosophy.

There are many different opinions as to what constitutes good sportsmanship, but there will be general agreement that among them should be included most of the following concepts—

(1.) Observe the regulations governing the taking of game.

(2.) Shoot only when the game is clearly visible. The value of this rule should be obvious. It is certainly poor sportmanship

and poor judgment to shoot at something moving in the brush without knowing definitely what the object is. It might be a horse, a cow, game on which a season is closed, or another shooter.

(3.) Shoot only when game is within range. The waste of wildlife because of crippling by long-range or careless shooting can be considerable. Every man who goes into the field with a gun should know accurately its range and the pattern that it will make.

(4.) Shoot only at individual targets. Do not shoot blindly into a flock of birds, but pick individuals as targets. This prevents scaring birds out of the swamp and it also reduces the number of crippled birds.

(5.) Make every effort to retrieve all cripples. This not only reduces needless suffering by wounded creatures but reduces the total hunting take.

(6.) Take only what can be used, and don't be a "bag limit hound." Too many sportsmen like to play Santa Claus by bringing game home to distribute to their friends, principally to satisfy the ego of the giver by displaying his hunting ability. Persons who do not hunt seldom care enough for game to prepare it properly; it usually finds its way into the rubbish tin. Furthermore, the establishment of limits has developed a class of shooter who feels that he must prove his ability by taking a legal limit each day. This sets a false standard—the genuine sportsman gets the greatest satisfaction out of his days in the field without pressing himself to get the legal limit.

(7.) Give the game more than an even break. It is a truism that most men value that which costs the most effort. The bird that is remembered longest is the one that came as the result of the greatest skill and effort. Those who handicap themselves by self-imposed rules have many thrilling memories denied to those who value their days afield solely by the number of kills.

(8.) Practice courtesy towards landholders and fellow shooters. Observance of this rule would eliminate much antagonism now held by many landholders. More and more land is being posted against shooting by landholders. This is the normal reaction to the ignorance, boorishness and stupidity, not to mention criminality, of those who cut fences, trample crops, shoot livestock, and sprinkle areas near farmhouses with shot in their selfish anxiety to get the last possible individual bird.

Duck Banding.

In conclusion, it is of interest for duck shooters to know that duck-banding is practised in other States and several bands already returned show that grey teal banded in Victoria have been recovered from Ayr and Southport. Should you take a duck this season with a band on its leg, forward the band to the Department of Agriculture and Stock, Brisbane. This banding work is of value in the search for information on the habits of Australian waterfowl.