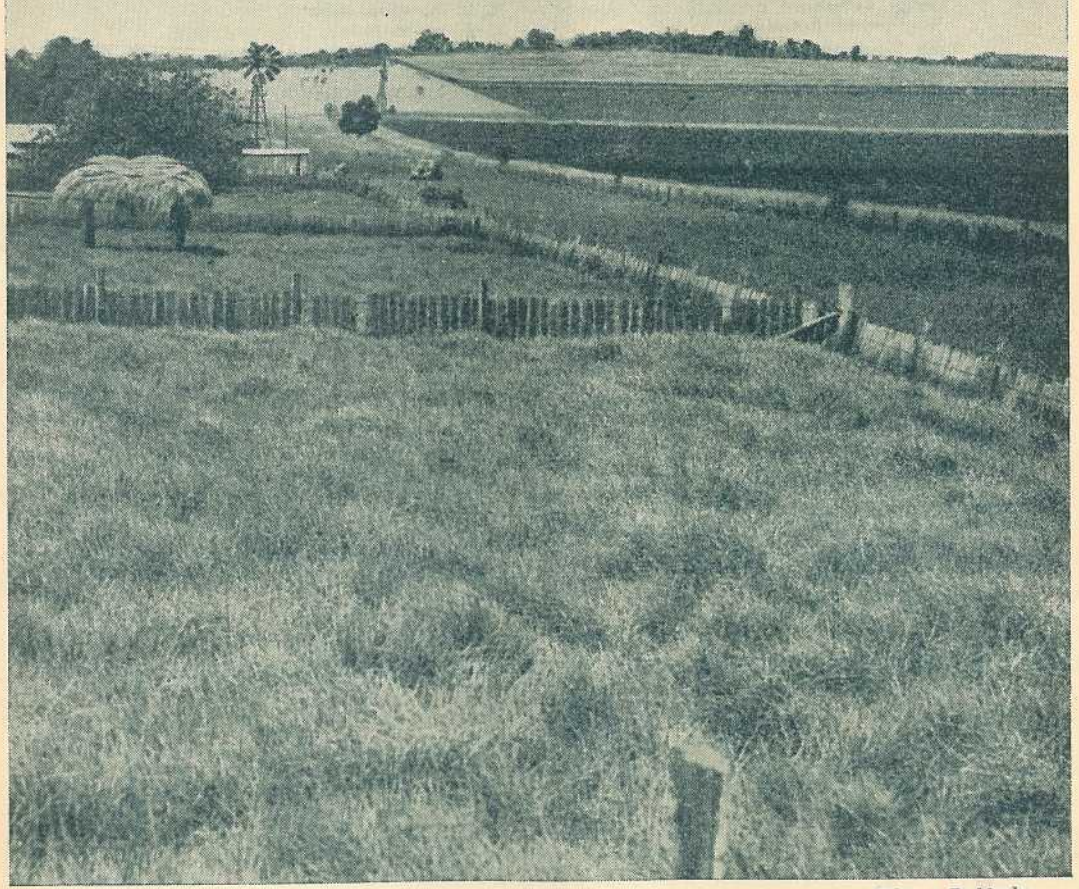
VOL. 70. PART 3 MARCH, 1950

DEPARTMENT OF AGRICULTURE

QUEENSLAND AGRICULTURAL JOURNAL



Kikuyu Paddocks.

LEADING FEATURES

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

Volume 70 Part 3

QUEENSLAND AGRICULTURAL JOURNAL

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

MARCH, 1950

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

GOVERNMENT PRINTER, BRISBANE

5

Contents

Chemical Weed Control in Grain Crops.

C. S. CLYDESDALE, Senior Adviser in Agriculture, and J. HART, Adviser in Agriculture.

THE proved efficiency of some recently discovered selective weed-killers and pest control products has created a demand for equipment suitable for the application of these materials to large areas of crops under widely varying conditions. For example, on the Darling Downs there is a steady enquiry for equipment suitable for the chemical control of weeds, particularly wild turnips in winter cereal crops, and for weed and insect pest control in summer grain crops. As both weedicides and insecticides used for these purposes are normally applied in the form of a spray, a spraying unit which can be adapted as required for the application of either of these materials is desirable. In addition, it must be suitable for the rapid treatment of large areas of crop and must be constructed so as to allow regulation of the application rate and adjustments for crop height.

Spraying plants designed to fulfil the above requirements are available in Queensland. These, together with several aspects of weedicide application, are discussed and illustrated in this article.

Interest in the use of large scale spraying equipment for the control of weeds and crop pests has developed only in recent years in Queensland. Consequently data from local experience on which to base conclusions are limited. However, at this stage it is considered that a summary of useful information on large-scale spraying methods and equipment, particularly in relation to weed control in cereal crops, would be of value to the farming community generally.

For the purposes of this article it has been necessary to draw liberally upon information presented in the following papers:—"Chemical Weed-Control Equipment," by Norman B. Akesson and W. A. Harvey (University of California Agricultural Experiment Station Circular 389), and "Chemical Methods of Weed Control," by P. B. Lynch (New Zealand Journal of Agriculture, November, 1948). Acknowledgement is also made of the courtesy of several firms who have made available information on their respective units, which is presented in the following pages.

WEEDICIDES SUITABLE FOR USE IN GRAIN CROPS.

A satisfactory weedicide for use in grain crops must be selective in action—that is, it must be capable of killing weeds in various crops without destroying or seriously harming the crop itself. Two such types of weedicides are available—synthetic growth-regulating substances (or hormones), and one based on dinitro-ortho-cresylate (D.N.O.C.), a basic dyestuff made from coal tar.

When applied in more than minute amounts to certain plant species, hormones upset the normal rhythm of plant growth and development, causing effects ranging from slight distortion of leaves to death of the entire plant. The fact that members of the grass family possess a high degree of tolerance towards hormone weedkillers enables such weedkillers to be used in pastures, in lawns and in cereal crops for the control of susceptible broad-leaved weeds.

There is a variety of types of hormone weedkillers, most of which have a 2, 4-D (2, 4-dichlorophenoxyacetic acid) base. Many commercial preparations are available in Queensland in liquid and powder form.

The D.N.O.C. preparations, one of which is sold in Queensland as "Dinoc," have a different reaction from the hormones on plant life and are not satisfactory against such a wide range of weeds. Furthermore, D.N.O.C. materials are more expensive than hormone preparations and their suitability for low volume spraying is still open to doubt.

However, mention of D.N.O.C. weedkillers has been made because of the susceptibility of buckwheat (*Polygonum convolvulus*) to D.N.O.C. compounds. This weed pest in wheat crops on the Darling Downs is generally resistant to the hormone weedicides. The economics and field scale practicability of using D.N.O.C. to control buckwheat in winter cereal crops have not yet been investigated in Queensland.

LOW VOLUME SPRAYING.

Large-scale spraying equipment in general use is capable of applying amounts ranging from 5 to 30 gallons per acre. This range appears to be quite satisfactory for the present method of weedicide application. However, recent investigations in other countries have shown that, by increasing the concentration of the weedicide and decreasing the volume of spray application per acre, satisfactory weed control results can be achieved in some instances. This finding has directed particular attention to the construction of units capable of applying low volume quantities of from 1 to 6 gallons per acre at low spray pressures. Nozzles designed for this purpose have been produced in America. These low application rates also come within the scope of some recently designed Australian spraying units.

The advantages of low volume spraying in comparison with high volume spraying may be summarised thus: the method is less expensive; less water is required; there is less weight in the appliance and crop damage is reduced; faster spraying may be achieved, and it is possible to use spraying methods on land where it is difficult to spray ordinarily with a machine or where available water supplies are limited.

Certain disadvantages, however, are associated with low volume spraying, the chief of which is increased spray drift of the fine mist-like spray produced. In units employing fine nozzles the spray materials must be completely dissolved or they will not pass through the nozzles.

This means that certain weedkillers applied as suspensions cannot be applied satisfactorily through low volume nozzles. Moreover, in the case of weed growth in tall crops, or with bushy plants, where spray needs to be applied with considerable force to reach all parts of the plant or to the weeds at ground level, satisfactory penetration is unlikely to be secured with low-pressure spraying.

As yet, insufficient data are available on low volume spraying to recommend its general use, but growers contemplating the purchase or construction of a spraying unit should, perhaps, take into consideration the future practicability of this form of spray application. It is pointed out, however, that many present-day units are capable of applying quantities as low as 10 gallons per acre at reasonable speeds. Therefore, such units should be satisfactory as it is probable that, where low volume spraying is practicable, the spray concentration can be adjusted satisfactorily to the slightly increased rate of application per acre and still give good results.

EFFECT OF HORMONE WEEDKILLERS ON CROPS.

Wheat, Oats and Barley: Hormone weedkillers may be used to control susceptible weeds in these cereal crops at quantities up to 1 lb. per acre acid equivalent. Treatment should not be undertaken during the very early stages of crop growth, preferably not before the six-leaf stage.

Linseed: Varying plant effects have resulted from spraying linseed with hormone weedkillers. To avoid any likelihood of plant damage, it is recommended in the light of insufficient experience at this stage that linseed crops be sprayed *only when between 4 and 7 inches in height.* It appears likely that some ill effects may result if the plants are sprayed before or after this period.

Oil based sprays must not be used for treating this crop.

Maize, Millets and Sorghums: These crops are generally resistant to hormone weedkillers in water solution at concentrations up to ½ lb. per acre acid equivalent. Applications of the latter amount may cause such irregularities as the appearance of adventitious roots on the lower portion of the plant stem, but it is not expected that there will be any adverse effect on crop yields.

Sunflowers, Lucerne and Field Peas: These crops are liable to severe damage and should not be sprayed with hormone weedkillers.

Pasture Plants: Grasses past the seedling stage are generally very resistant to hormone weedkillers in moderate applications.

EFFECTS OF D.N.O.C. WEEDKILLERS ON CROPS.

A moderate application of D.N.O.C. is 1 lb. of the active constituent plus 1 lb. sulphate of ammonia per acre, the latter being of value in its role as an activator.

Wheat, Oats and Barley: Resistant to moderate applications and may be safely sprayed.

Linseed: As with hormone weedkillers and until further investigation are completed, it is recommended that linseed be treated only in the 4-7 inch stage.

Lucerne: When young, lucerne is liable to severe damage, but stands 4 to 6 weeks old are fairly resistant. However, at all times extreme caution must be exercised in the treatment of lucerne stands with D.N.O.C. sprays.

Maize: Maize is resistant to moderate applications.

D.N.O.C. sprays are much more effective on weeds in the seedling stage but are also liable to damage crop plants if these are sprayed before becoming well established.

EFFECT OF HORMONE WEEDKILLERS ON MAJOR WEED PESTS OF WINTER AND SUMMER GRAIN CROPS.

The major weeds of Darling Downs crops are listed in classes according to their susceptibility to hormone weedkillers. It is stressed that these classifications are very broad, because factors such as weather conditions and stage of growth may cause a different reaction from that stated in this list.

(*a*) *Susceptible plants*:

Wild turnips (including *Raphanus raphanistrum* and *Rapistrum rugosum*).

Bathurst burr (*Xanthium spinosum*).

Noogoora burr (*Xanthium pungens*).

Hexham scent (*Melilotus indica*).

Bindweed (*Convolvulus arvensis*).

Dock (*Rumex* sp)*.

Mint weed (*Salvia reflexa*)†.

Khaki weed (*Alternanthera repens*)†.

Chickweed (*Stellaria media*)†.

Stagger weed (*Stachys arvensis*)†.

(*b*) *Resistant plants or those in which percentage kill is variable*:

Fat hen (*Chenopodium album*).

Buckwheat (*Polygonum convolvulus*).

Mexican poppy (*Argemone mexicana*).

Galvanised burr (*Bassia birchii*).

Fumitory or Pinkeye (*Fumaria parviflora*).

Datura (*Datura stramonium* and *Datura ferox*).

Nut grass (*Cyperus rotundus*).

CONTROL OF WILD TURNIPS IN CEREAL CROPS.

Wild turnips belong to a family of plants particularly susceptible to even light applications of hormone weedicides. The selective nature of these agents makes the destruction of the turnip pest in cereal crops a simple matter. Farmers have been quick to recognise this fact and over the past two seasons considerable areas of turnip-infested cereal crops have been successfully treated on the Darling Downs.

Experience has shown that the wild turnip plants can be killed at all stages of growth, but generally the most effective treatment is that given when the plants are young and leafy. A spray mixture of 1 lb. acid equivalent with 100 gallons of water is generally regarded as sufficient to treat approximately 6 acres.

* More than one spraying may be required.

† Preferable to spray in seedling stage.

Material applied at the rate stated will cost about 2s. 6d. per acre at present prices. Other treatment costs, such as labour, petrol and plant depreciation, are relatively light, due to the fact that under normal working conditions it is possible to cover approximately 20 acres per hour with a spraying machine of moderate size.

CLEANING SPRAYING EQUIPMENT.

Where the spraying unit is used for both weed and insect pest control purposes it may happen that the crop to be treated with insecticides is one susceptible to hormone sprays. In this case it is necessary to thoroughly clean the unit prior to use, for even a small residue of hormone weedicide is potent enough to damage sensitive plants.

In California, where very large acreages are sprayed, the following recommendations are made:—

For oil-soluble 2,4-D, rinse the tank first with kerosene. Follow with a rinse of washing soda solution (1-2 lb. to 25 gallons of water). Leave the solution in the tank for about 5 minutes. Rinse several times with water, preferably hot. For water-soluble 2,4-D, first rinse the tank with water, then soak the whole liquid-carrying part of the equipment overnight, or longer, in water. Drain, and run washing soda solution through the machine. Rinse thoroughly, using hot water if possible. Even after the above precautions have been taken it is wise to test the sprayer first on very sensitive plants, such as tomatoes, before embarking on large-scale spraying of susceptible crops. If the tomato plants are unaffected after two days, then the spraying unit can be used with safety.

SPRAYING UNITS.

Each of the spraying units described in the following pages fulfils the requirements of a satisfactory unit for use in large-scale cereal crop operation, though not necessarily for low-volume application.

1. Marino Hormone Spray Plant.
2. P.M.S. Boom Spray.
3. Wilmist Sprayer.
4. Buzacott-Wolseley Spray Plant.

Marino Hormone Spray Plant.

In the main this plant (Plates 63 and 64) consists of a 1 h.p. 4-cycle petrol engine and a rotary pump with inbuilt relief valve which can be set to deliver pressure from 20 to 35 lb. per square inch. A 30-ft. boom fitted with 12 nozzles is the normal equipment, but a boom of any length can be supplied on request. To facilitate non-operational travelling this boom can be speedily removed by loosening three thumb screws.

In addition to the main intake strainer, each nozzle is also fitted with a strainer. Varying size of spray discs provides an output control ranging from 10 to 15 gallons per acre at 4 miles per hour.

The outfit includes a hand spray complete with quick release gun, rod, spray nozzle and required hose. All main connections of the unit are made of rubber so that the machine can be speedily assembled and dismantled.

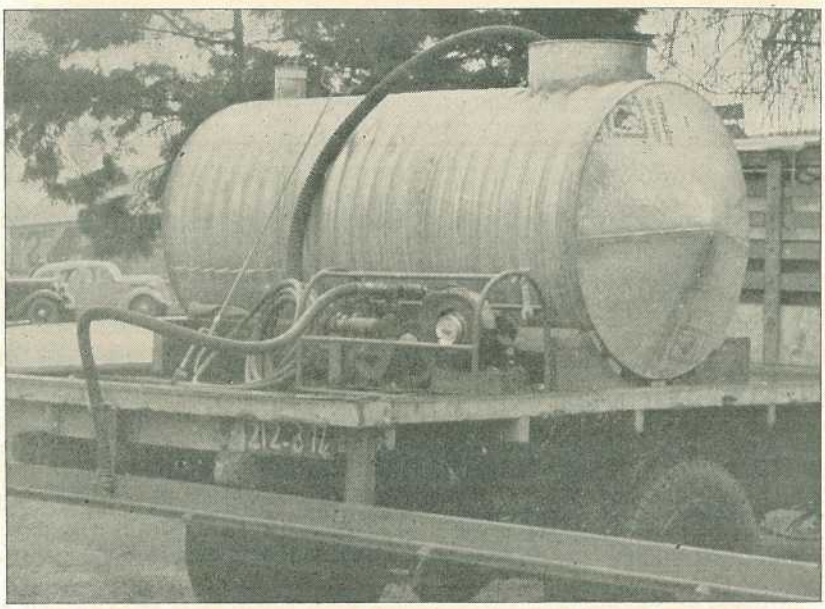


Plate 63.
MARINO HORMONE SPRAY UNIT.

Plate 64.
MARINO HORMONE SPRAY UNIT.

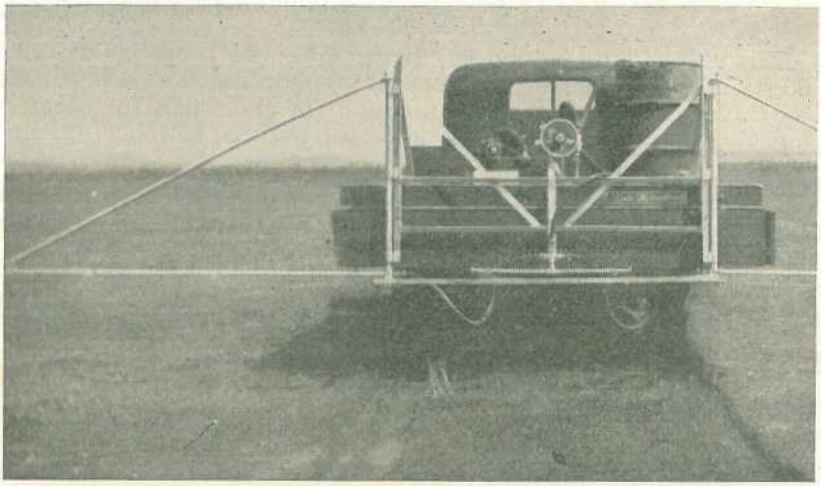


Plate 65.
P.M.S. BOOM SPRAY.

Plate 66.
P.M.S. BOOM SPRAY, SHOWING BOOM FOLDED FOR NON-OPERATIONAL TRAVELLING.

P.M.S. Boom Spray.

This unit (Plates 65 and 66) is supplied with booms 20 ft., 40 ft. or 60 ft. in length, the 60-ft. boom spray being mounted on a pneumatic-tyred trailer carrying a 200-gallon tank. On all models the boom can be quickly raised or lowered for crop height, and can be folded forwards or backwards for transport.

The unit is powered by a 1 h.p. or 2 h.p. 4-cycle petrol engine. The 60 ft. unit operates on its own engine or on the power take-off from the tractor.

Two strainers are fitted into the machine, one between the inlet and the filling tank and the other between the tank and the boom. The nozzles can be readily screwed off should blockages occur.

At 5 m.p.h. with standard type nozzles, 12 to 15 gallons of spray per acre are applied.

Other features of the unit include a brass gear pump and a hand spotting gun.

Plate 67.
WILMIST SPRAYER.

Wilmist Sprayer.

The "Wilmist" (Plate 67) is a compact unit working on an entirely different principle from the common boom sprayers. The spraying solution is forced under low pressure through jets at the mouth of a wind tunnel, where it is spread by a strong blast of air formed by a propellor at the rear of the tunnel. This propellor is enclosed in a bath of oil.

With three varying sized jets, applications ranging from 5 to 15 gallons per acre can be obtained travelling at a rate of 5 miles per hour. This spray has a coverage of about 30 to 40 feet.

The unit is powered by a 3½ h.p. 2-stroke Commando engine which can be disengaged quite simply and used for other farm purposes. Both vertical and horizontal movement of the wind tunnel can be regulated.

Buzacott-Wolseley Spray Plant.

The Buzacott-Wolseley (Plates 68-71) is a highly efficient machine capable of applying amounts varying from 1 to 25 gallons per acre. The spray liquid is fed through a conventional boom to a series of spinning cones which throw the spray out in the form of a mist. Each cone is driven by a small electric motor which draws its power from a heavy duty battery continually charged by a generator. Plate 70 illustrates a single motor and cone.

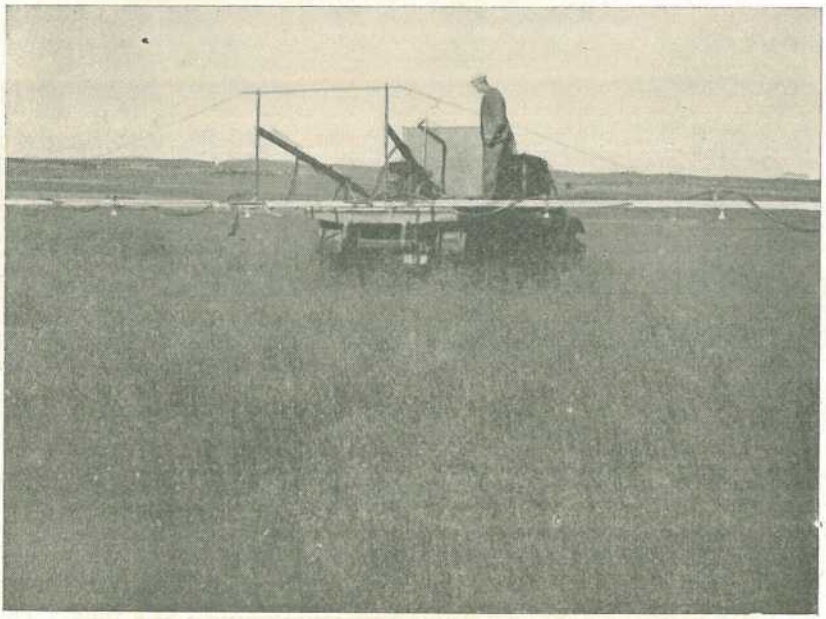


Plate 68.
BUZACOTT-WOLSELEY SPRAYING UNIT.

Cones are spaced at intervals of 6 feet along the boom and therefore the cost of these spraying plants is roughly in proportion to the length of boom.

Although a Buzacott-Wolseley spraying unit with a boom 30 ft. in length would be much more expensive than other types of sprayers giving a similar coverage, the unit has the advantage of giving extremely low volume applications with little likelihood of blockages, as the smallest orifice through which the spray liquid passes is $\frac{3}{8}$ inch.

INFORMATION ON FARM-BUILT SPRAYERS.

For the benefit of farmers contemplating building their own spray outfits, information on various points to be considered is set out hereunder. Acknowledgment is made of papers on chemical weed-control equipment by N. B. Akesson, of the University of California, which have been liberally drawn upon. The discussion refers to conventional weed-killing equipment and not specially to low volume-low pressure spraying or to unusual types such as the "Wilmist" and the "Buzacott-Wolseley."

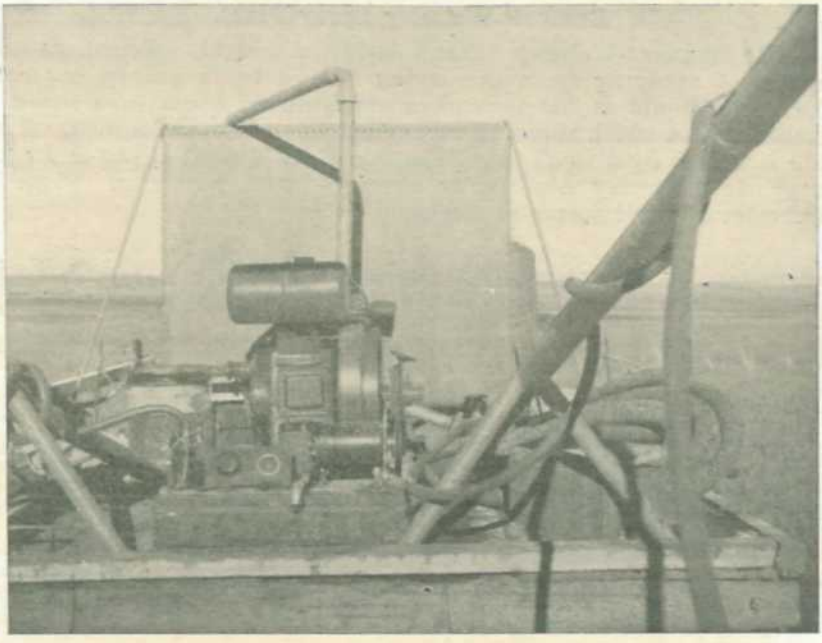


Plate 69.
POWER UNIT OF BUZACOTT-WOLSELEY SPRAYING PLANT.

Pumps.

The most important item to be considered when building a power sprayer is the pump.

It is possible to buy almost every type of pump in combination with an engine, both mounted on a single base and designed as a unit. These are more satisfactory for spray outfits than a pump powered by an auxiliary engine or the power take-off drive from a tractor. For a power take-off driven spraying unit, the pump may be mounted on the tractor, while the tank and boom are on a trailer; or pump, tank and boom may be carried on the tractor and the pump driven either directly from the power take-off or from the belt pulley. A spray unit with an auxiliary engine has an advantage over the power take-off because the auxiliary's speed can remain constant regardless of changes in the tractor's speed. The important point in choosing either the auxiliary or power take-off drive is to select a drive which will maintain the pump at sufficient speed for the necessary pressure.

Where one piece of spraying equipment is to be used for several different jobs, such as orchard and weed spraying, a high-pressure pump is practical. The pressure may be lowered for weed spraying with the by-pass valve or pressure regulator. If the equipment is to be used for weed spraying only, a high pressure pump is not necessary, since a maximum nozzle pressure of 75 to 125 pounds per square inch is adequate.

Centrifugal pumps of single, two-stage or multi-stage design are commonly used for weed sprayers. In order to produce sufficient pressure, centrifugal pumps must operate at relatively high speeds

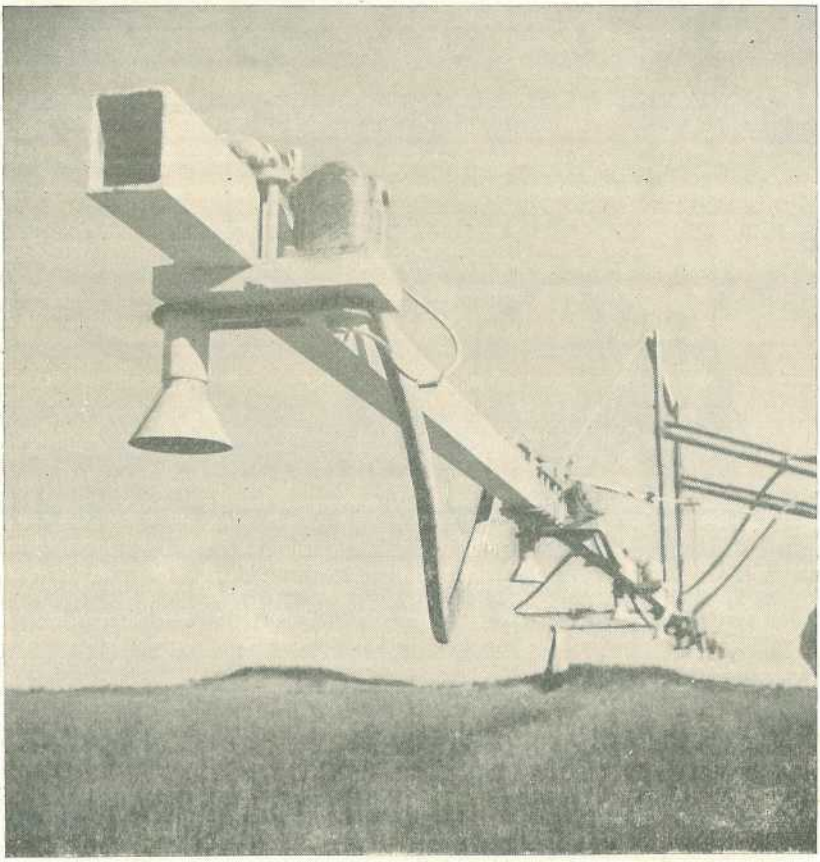


Plate 70.

Buzacott-Wolseley Spraying Unit with Boom Folded to Facilitate Electric Motor.

(3,000 to 3,600 r.p.m.). Power for maintaining these speeds is usually supplied by a petrol engine. A common design is a single-stage centrifugal pump attached directly to a single-cylinder, air-cooled engine. Higher pressure can be obtained at the same pump speed or the same pressure at lower speed by using a two-stage or multi-stage type, consisting of two or more centrifugal pumps mounted on a single shaft in the same housing. With this type pump, speed may be regulated for high or low pressures.

The power requirement for many centrifugal pumps is greatest at zero pressure and maximum discharge. The engine should be large enough to supply the necessary power without being overloaded. A commercially built pump and engine unit will either be designed to prevent overloading, or it will have instructions showing maximum operating time at full discharge.

Centrifugal pumps are not positive displacement types and no harm is done by closing the discharge while the pump is in operation.

Centrifugal pumps do not require by-pass pressure regulators or relief valves. Pressure may be controlled by a diaphragm type pressure reducing valve or by opening the control valve.

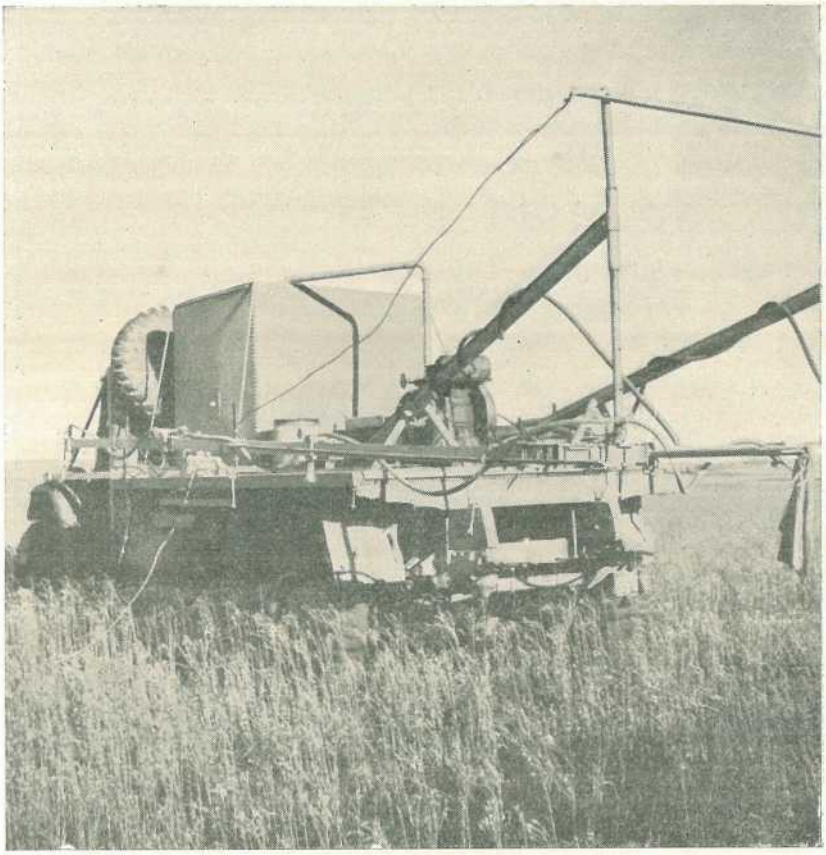


Plate 71.

BUZACOTT-WOLSELEY SPRAYING UNIT WITH BOOM FOLDED TO FACILITATE NON-OPERATIONAL TRAVELLING.

Rotary gear pumps with either external or internal flow are also used for weed spraying. They are a positive displacement type and do not need priming but do need a by-pass valve or pressure regulator to relieve the pump when the spray nozzles are shut off.

Information on pumps suitable for spraying purposes may be obtained from the manufacturers.

Tanks.

Metal tanks are preferable to wooden ones because they are easier to clean and less likely to leak. The tank should have a large opening at the top for easy cleaning and care of the agitator.

The size of the tank depends somewhat on the capacity of the pump, on whether concentrated or diluted sprays are to be used, and on nearness to water supply. In general, if water is readily available a 300-500 gallon tank is large enough.

Some tanks are galvanised, some are enamelled and others are left bare. Bare tanks have a tendency to rust, but this may be reduced by carefully draining the tank after each use and flushing it with rust-preventive oil or cylinder oil.

Agitators.

A tank to be used for straight oil sprays alone does not require an agitator, but for all mixed sprays agitation is necessary. With oil emulsions and heavy suspensions, the agitator must be kept running constantly. With hormone sprays, only light agitation is needed.

Mechanical agitation is generally more efficient than hydraulic agitation. It is achieved by a series of paddles mounted on a shaft which runs through the spray tank and is driven by a reduction drive from the pump engine. The ends of the paddle blades should have a total width about equal to one-half the length of the tank (that is, 4 blades each 8 in. wide in a 60-inch tank). The blades should sweep within ½ inch of the tank bottom.

Hydraulic agitation requires no moving parts in the spray tank. The excess flow at boom pressure is re-circulated to the spray tank and forced out through many small openings in a 1- or 2-inch pipe laid in the tank bottom and sometimes fitted with nozzles. About 25 gallons of agitation flow at 100 lb. per sq. in. is recommended for a 3-foot diameter, round bottom 200-gallon tank and about 33 gallons for a flat bottom tank. This extra flow must be added to the boom requirement when the pump is bought.

Refilling.

The pump and motor may be used to refill the tank with suitable backfill equipment. Care should be taken to reduce picking up dirt or gritty water from irrigation ditches or wells by providing a large strainer on the suction line.

Booms.

Spray booms are generally made of 1-in. to 2-in. pipe. Galvanised or black iron, aluminium and other light metal pipes have been used. The 1-in. size is sufficient for a 15 ft. boom; 1¼ in. or larger is recommended for larger booms. Smaller pipe is not practicable because of both the resistance to liquid flow which the small pipe presents and the greater tendency to whip and buckle, particularly in the long boom. Also, it is easier to cut holes in the larger diameter boom and mount the nozzles. Supports must be provided for the boom, generally in the form of chain or cable for vertical support and rods to maintain lateral strength. The boom must be mounted to allow variable height adjustment, and supports must be easily changed to co-ordinate with these adjustments. For ditch bank or roadside work, the boom may be mounted entirely on one side of the rig. Boom tips or the entire boom on one side of the rig may be hinged and provided with a spring return to reduce breakage caused by catching the boom on gates, posts and other obstructions. The boom is generally in two or three sections which may be folded up or back for convenience in moving on roads and through gates.

Nozzles are brought into the boom from the top or side by means of welded nipples or couplings. This leaves a settling space in the boom for dirt particles and also keeps the boom from draining when the main control valve is shut off. Some operators are using small spring loaded ball valves on each nozzle which open when the pressure exceeds 5 lb. per sq. in. and close when the boom valve is closed and the pressure drops below. Another recent development is the reversing valve which places a suction on the main boom line when the main valve is shut off and draws liquid back from the nozzles into the boom. The suction is provided by discharging the flow from the pump through a venturi or

jet when the boom is shut off. A four-way valve makes it possible to combine the main boom valve and the suction valve in one, and the two operations may thus be taken care of by this one valve.

A good quick shut-off valve should be provided in the main boom line. Several manufacturers are using a spring loaded poppet type valve with eccentric and lever. This type may be opened or closed merely by pulling a jerk line from the tractor operator's seat. A screen should be placed in the boom line to reduce nozzle clogging; and when using small nozzles, an additional set of screens is most convenient for the boom line, eliminating the necessity of pulling the screen apart for cleaning.

Hand booms are best made of light metal alloys instead of the usual $\frac{1}{4}$ in. or $\frac{1}{8}$ in. iron pipe. The most convenient valves are those which can be operated by squeezing the valve lever against the boom with one hand. When the lever is released, a spring closes the valve. The usual provision is for 25 to 50 feet of oil resistant hose to supply one or two nozzles on the hand boom.

Nozzles.

Nozzles producing a flat fan discharge are generally considered to give most uniform coverage and strongest drive. Cone discharge nozzles are used by some manufacturers for the very fine nozzles, greater uniformity of discharge being the reason for this practice. Nozzles are made either with a removable tip and strainer, or the tip and body may be formed as a unit. Approximately 10 to 20 lb. per sq. in. are required to make the flat fan nozzle "fan out" or disperse properly. Greater pressure increases the discharge and decreases the droplet size. For this reason, a low pressure of only 15 to 30 lb. per sq. in. is recommended on the fine nozzle to prevent fuming and drift due to the small droplets. Higher pressure also increases the drive or penetrating quality of the nozzle discharge to a certain point, after

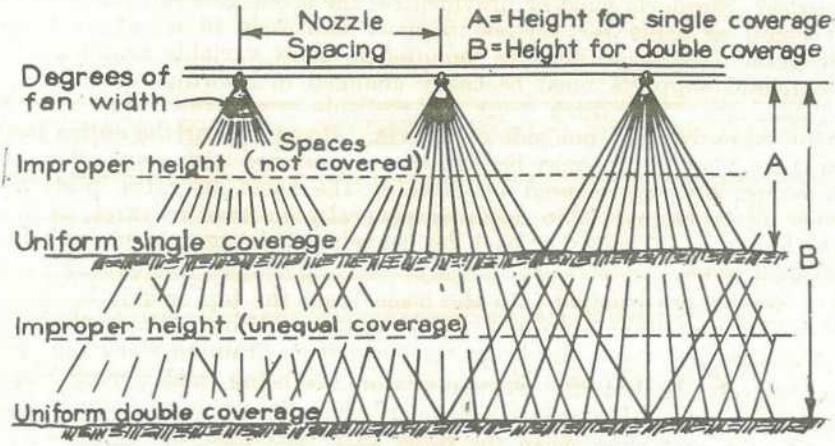


Plate 72.

SHOWING CORRECT HEIGHT OF BOOM FOR PROPER SINGLE AND DOUBLE COVER AND RESULTS OF IMPROPER BOOM HEIGHT.—Note that double coverage does not increase the amount of spray applied per acre.

which the resulting smaller droplets reduce the drive. This is an important feature when general contact work is being done in rank weed growth.

Nozzles may be arranged all on one side of the boom; or as is frequently done, alternate nozzles are placed on opposite sides of the boom and slanted toward one another; and double coverage as shown in Plate 72 is used. Double coverage does not increase the gallons per acre used but causes each swath to be hit by two nozzles in place of one and thus reduces the chance of skipping or leaving a portion of a swath uncovered when operating on rough ground and over irrigation checks.

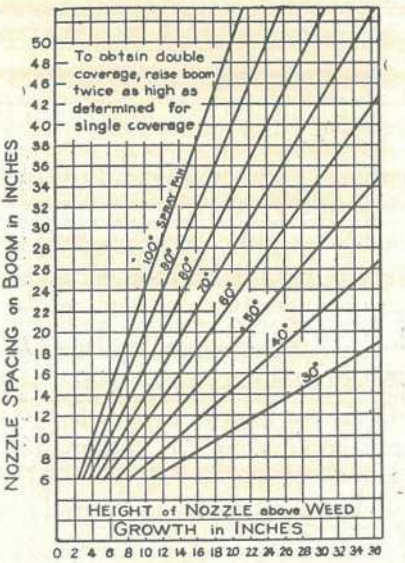


Plate 73.

CHART SHOWING HEIGHT OF NOZZLES ABOVE WEEDS REQUIRED TO GIVE SINGLE COMPLETE COVERAGE FOR 6 TO 48 INCH NOZZLE SPACING ON BOOM, AND VARIOUS NOZZLE SPRAY FAN WIDTHS.

The nozzle height to obtain single or double coverage with different nozzle spacing on the boom is shown in Plates 72 and 73. The proper boom height is always as low as can be used with the nozzles available so as to reduce possibilities of drift and skipping. Increased pressure widens the fan angle. Thus, the boom height may have to be changed when pressure is altered.

Calibrating the Sprayer.

One of the most important considerations in the design of a spray rig is the requirement of the spray job to be done. Suggested volumes and pressures for various spray applications may be summarised roughly as follows:—

(1) Selective oil sprays in carrots: 35-70 gallons per acre at 40-80 lb. per sq. in.

(2) Selective sprays in cereals, onions and linseed: 2 to 100 gallons per acre at 20-100 lb. per sq. in., including low-volume application of hormone weedkillers.

(3) General contact spraying (as for Johnson grass): 80-350 gallons per acre at 75-150 lb. per sq. in.

These recommendations show the wide range of pressure and volume to be expected in normal weed spraying.

The number of gallons per acre a sprayer will discharge depends on:—

(1) Ground speed. An accurate check on tractor speed can be made by timing tractor and rig over a measured length of the field.

$$\text{m.p.h.} = \frac{\text{No. of feet travelled}}{\text{No. of seconds}} \times \frac{682}{1{,}000}$$

With most tractors, 4 m.p.h. is a convenient speed.

(2) Nozzle pressure. This should be kept within the recommended range for various types of spraying as mentioned above.

(3) Nozzle spacing. This is chosen to fit in best with the spray jobs to be done.

(4) Size of nozzle opening. It is possible, with a set of different nozzle sizes, to vary the gallons per acre over wide limits with only minor changes in speed and pressure.

(5) Amount of active ingredient in the spray mixture. This can be changed by adding water or oil.

Plates 74 and 75 can be used to determine (*a*) the right size nozzle for a particular spray application, (*b*) the number of gallons per acre which a nozzle of known discharge rate will apply at various speeds; and (*c*) the speed of travel to apply a required gallonage with nozzles of known capacity.

For example, if it is desired to obtain the nozzle discharge required to have a 80 gallon per acre application made at 5 m.p.h. and nozzle spacing of 18 inches, refer to Plate 75, which gives a reading of 73 gallons per hour or about 1.25 gallons per minute per nozzle. For 12-inch spacing, multiply the figure by 0.66, and so on.

Spray fan widths are also given in the manufacturers' catalogues in degrees at stated pressure for each nozzle. By consulting Plate 73 the correct boom height can be found with a given nozzle spacing and for the fan width produced by the nozzle at the pressure used.

It may be useful to determine the exact output of the sprayer after the nozzles have been installed, and the rig is ready for operation. The nozzle discharge data are based on water and will increase as oil is added to a maximum of 20 to 30 per cent. increase on straight oil. A check can be run on the sprayer, to see if the calculation made and the nozzles chosen are correct, by operating the machine standing still and measuring the actual discharge in a pint container for a given time. A rough check in the field can be made by the use of a calibrated tank or by carefully measuring the amount required to refill the tank at the end of two or three rounds when a known acreage has been covered.

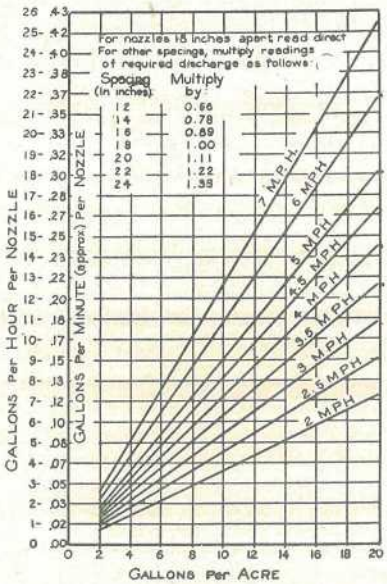


Plate 74.

Chart Showing Discharge per Nozzle to Give 2 to 20 Gallons per Acre at Various Field Speeds.—Note that when using this chart with nozzle spacings other than 18 inches, the gallons per minute or hour found must be multiplied by the proper factor as shown, and when the chart is used to find gallons per acre and m.p.h. the answers must be divided by the correction factor.

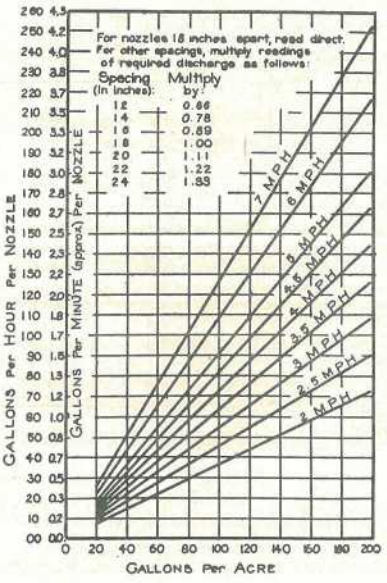


Plate 75.

Chart Showing Discharge per Nozzle to give 20 to 200 Gallons per Acre at Various Field Speeds. (See noting to Plate 74.)

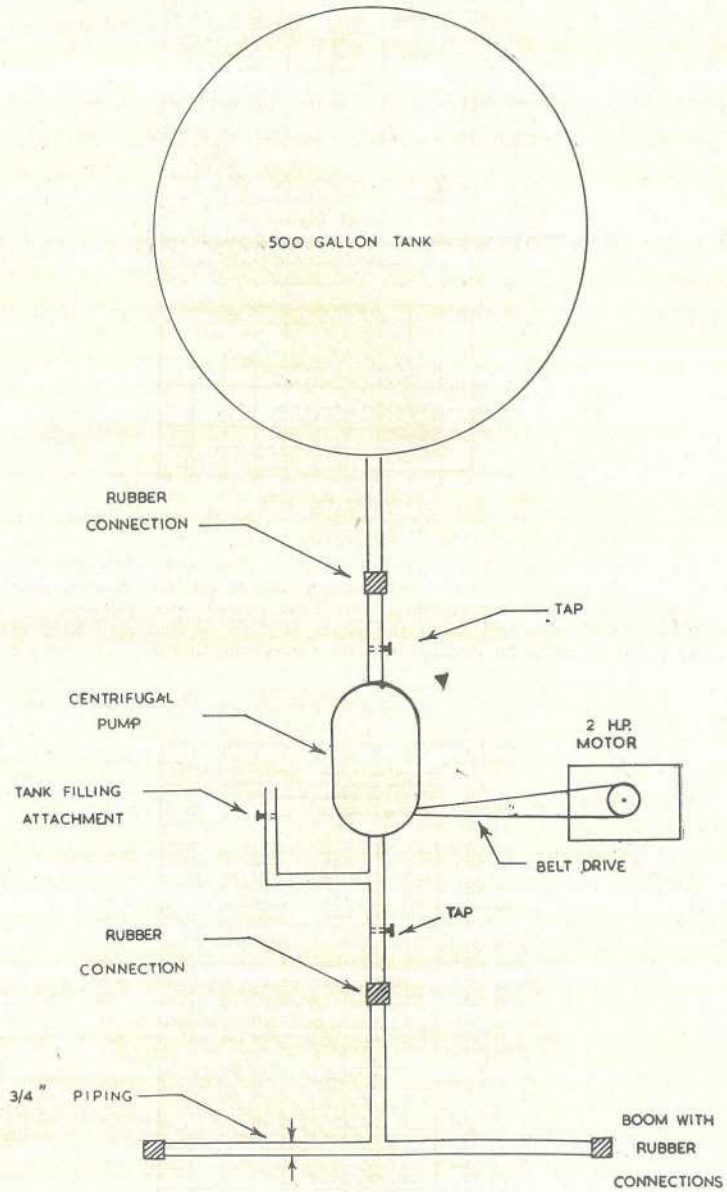


Plate 76.

DIAGRAM SHOWING GENERAL ARRANGEMENT OF MR. E. APELT'S SPRAYING MACHINE.

HOME MADE SPRAYING UNIT CONSTRUCTED BY Mr. E. APELT, YARGULLEN.

This unit is simple in construction and has proved effective for wild turnip weed control. The diagram shown in Plate 76 together with the photographs (Plates 77-79) will be of assistance to any grower desirous of building his own spray outfit.

Plate 79 shows the unit with boom folded to facilitate travelling when the machine is not in operation. This is made possible by breaking the rubber connections at the centre of the boom and allowing each half of the boom and boom support to swing forward.

Materials and Cost.

These figures were kindly made available by Mr. Apelt. Costs shown were ruling prices at time of construction (1949).

	£	s.	d.
(1) Galvanised iron tank—500 gallons	8	0	0
(2) Centrifugal pump (1-inch intake, ¾-inch outlet) ..	5	0	0
(3) 3 only ¾-inch water taps		14	0
(4) 52 feet of ¾-inch galvanised iron piping		16	2
(5) No. 9 nipples (Bordeaux spray jets No. 11-01) ..		17	3
(6) Short lengths 1-inch hose		4	0
(7) 8 hose clasps		2	4
(8) Angle iron for main support and boom (including welding costs). Main support 3 inches; side braces 1 inch	9	0	0
	£24	13	9

In addition a power unit of at least 2 h.p. is required. Such engines are often a part of normal farm equipment and could be readily converted for use during periods when the spraying unit was needed.

Plate 77.
SHOWING MR. APELT'S HOME-MADE UNIT IN ACTION.

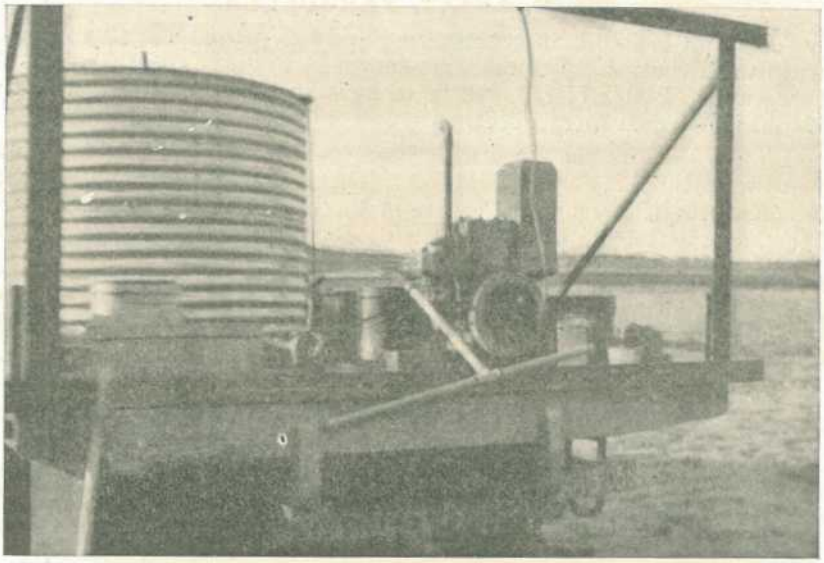


Plate 78.
SHOWING PUMPING UNIT OF MR. E. APELT'S SPRAY RIG WITH BOOM DISCONNECTED.

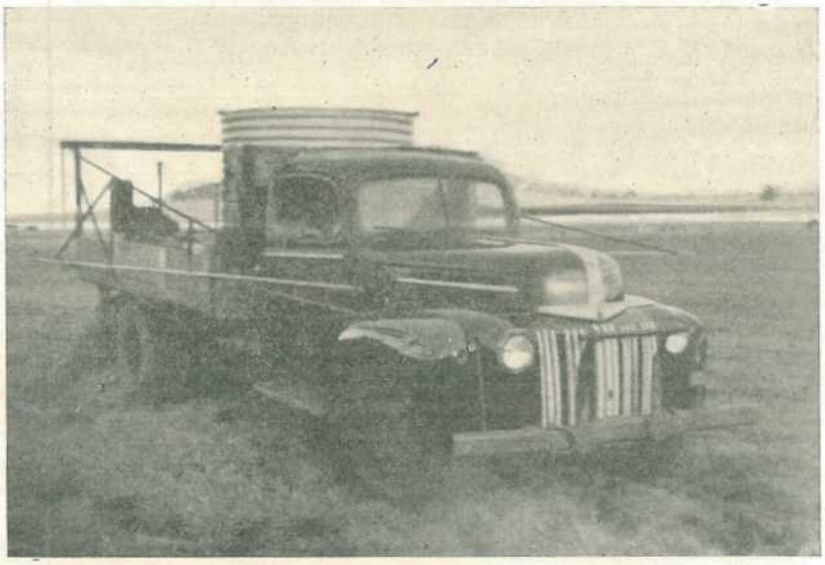


Plate 79.
SHOWING MR. APELT'S UNIT WITH BOOM FOLDED FOR NON-OPERATIONAL TRAVELLING.

Winter Injury to French Beans.

H. M. GROSZMANN, Horticulturist.

FRENCH beans are naturally adapted to summer growing conditions, and in winter will thrive only in the most favoured, frost-free localities. Even where no frost is experienced, prolonged low temperatures or cold, drying winds may adversely affect the plant. This was very evident during July and August of 1949, when two distinct types of winter injury were prevalent throughout the main bean growing areas of southern Queensland.

The first (Plate 80) is distinguished by numerous curved and stunted pods on apparently vigorous plants. On examining the beans, it is found that the seed has failed to develop, with consequent dwarfing of the pods. These rarely exceed four inches in length, and as they mature they become hollow and useless. This abnormal condition is caused by temperatures which are not sufficiently low to injure the plant but low enough to prevent normal seed formation. It is most likely to occur on land which is just above normal frost level, and if such land is to grow beans the crop should be planted at such a time that it will not be flowering during July and August. This means avoiding planting in April and May.

The other abnormal condition is marked by the appearance of dead, scorched areas on the leaves. The first symptom is a slight browning of the most exposed leaves and this is followed over a period of several days by death of the area between the main veins, and sometimes of the leaf margin. The veins may remain green for some days. The degree of injury differs greatly from place to place. Often an affected plant will continue to grow and appear little the worse for the damage to a few leaves. In some localities, however, young plantings have died out completely.

While the exact explanation of this scorching is uncertain, the most likely cause is prolonged exposure to very cold winds. Some have suggested actual frosting, but the topographical distribution of the trouble, together with its appearance over a period of several days, scarcely fit in with this explanation. Moreover, in past years, even

when much heavier frosts were experienced, it was not nearly so prevalent as during last July and August, which was a period of prolonged, cold, drying winds.

Where this injury rarely occurs, it scarcely seems necessary to take any precautions against it. Where it occurs frequently, the locality

Plate 80.

WINTER INJURY TO FRENCH BEAN PLANT SHOWING CURVED AND STUNTED PODS.

is not really suitable for winter beans, though in some cases the provision of windbreaks may reduce the damage. Even where scorching does not occur, strong winds often do much damage by breaking the plants and drying out the land, and these adverse effects are generally sufficient to warrant the planting of windbreaks.

Approved Strawberry Planting Material, 1950 Season.

THE Department of Agriculture and Stock proposes to extend its scheme for providing approved strawberry planting material to the 1950 growing season. Nominated crops will be inspected by Departmental officers and at the end of the season the names of growers having an approved source of runners will be published in *The Queensland Agricultural Journal* and *The Fruitgrowers' Gazette.*

Any grower desirous of having his strawberry runner bed approved by the Department of Agriculture and Stock should prepare the information required under the following headings and forward this to the Department not later than 1st May, 1950.

Particulars required:—

(1) Name in full. (2) Address (details). (3) The area of the plot from which it is intended to sell runners. (4) Source of the runners used to plant the crop under consideration. (5) Variety to be planted. (Only the varieties Phenomenal and Aurie may be nominated.)

The strawberry grower will have to be prepared to undertake the following matters relating to his side of the work:—

(1) Plant the area with runners from a source approved by the Department in the previous year.

(2) Keep the plants well cultivated and reasonably clean at all times, including the period from the time the crop finishes to the digging of runners.

(3) Apply such fertilizers, insecticides, and fungicides as may be necessary to maintain the crop in good condition or as the inspecting officers may require.

(4) Rogue out all virus infected and off type plants at not greater than fortnightly intervals or as directed.

(5) Permit the roguing of virus infected or off type plants by the inspecting officer.

(6) Destroy not later than November any strawberry plants on his property other than those subject to inspection for approval.

(7) Supply any information which may be required by an inspecting officer in connection with the approval scheme.

(8) If listed as an approved grower to sell only such runners as are approved.

(9) Make his own arrangements for the sale of his runners.

(10) Furnish a list of all sales in excess of 500 runners not later than 30th April, 1951, to the Department of Agriculture and Stock.

(11) Accept the standards set out below:—

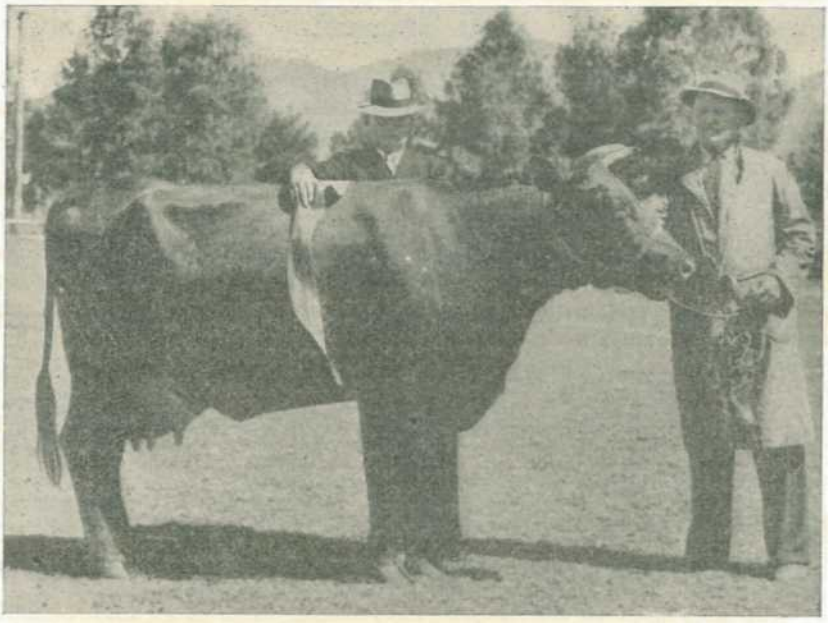
(*a*) At the first inspection (winter) the crop must contain not more than 2 per cent. plants affected with virus diseases.

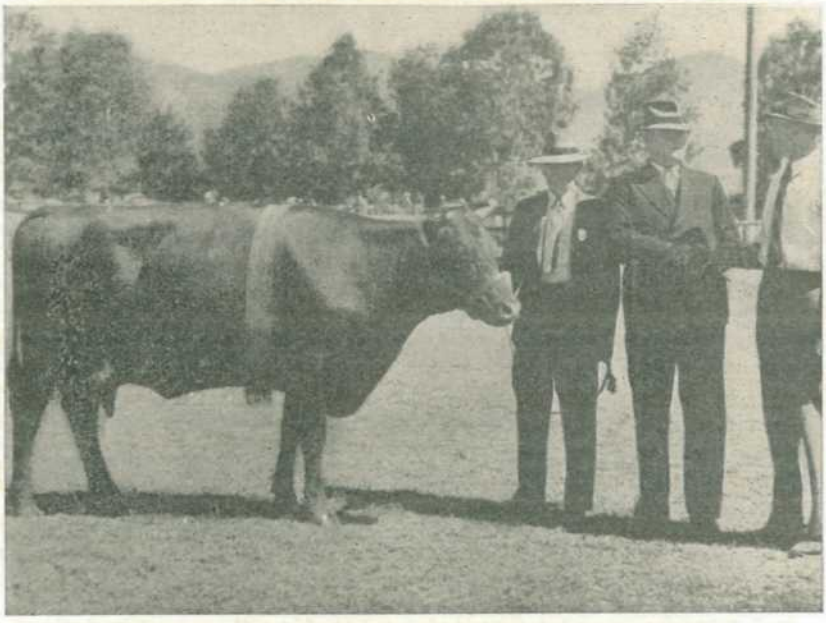
(*b*) At the time of subsequent inspections the crop must contain not more than 0.5 per cent. plants affected with virus diseases or 5 per cent. plants affected with off-type characters.

(*c*) The crop must, in the opinion of the inspecting officer, be sufficiently well cultivated and free from weeds and pests and diseases in addition to those already mentioned to ensure that the planting material will be of good quality.

The Department of Agriculture and Stock will undertake to inspect strawberry crops for the purpose of determining whether they conform to the standards required for approval. The Department reserves the right to restrict those inspections to the number of crops which can be efficiently handled and to those with a reasonable chance of being successful.

Tableland Milking Achievement.





"Learmont May 3rd" (top) at the Atherton Show last May broke the Ground Milking Competition record for Australia with 85.9 lb. of milk and 3.3928 lb. of butterfat. She bettered these figures at Malanda Show in September, producing 96 lb. of milk and 3.926 lb. of butterfat. "Learmont Jewel" (bottom) won the Junior class at Atherton with 54.8 lb. of milk and 1.8845 lb of butterfat. Both animals are owned by Messrs. P. J. Donaghy and Sons.

The Minister for Agriculture and Stock (Hon H. H. Collins) is shown decorating "Learmont May 3rd" and also congratulating Mr. G. Donaghy on the junior's performance.

The Butter Improvement Service.

L. L. MULLER and L. E. NICHOLS, Dairy Research Laboratory,
Division of Dairying.

IT has long been appreciated that to attain and maintain the highest standard of efficiency in the butter industry, a technical control service in the chemical composition and bacteriological quality of the product is essential.

GENESIS OF THE SERVICE.

The realisation of the necessity for such a service led to the introduction of the Butter Standardisation Service in 1937. Under this scheme a limited number of factories were given detailed chemical and bacteriological information on a fixed number of butter samples each month. During its operation, this scheme emphasised the economic advantages to be gained and paved the way for its application to all factories.

In 1940 the present Butter Improvement Service was instituted.

OBJECTIVES.

The objectives of the Service can be briefly stated as:—

(*a*) To obtain the practical maximum of butter output from a given quantity of butterfat consistent with legal standards.

(*b*) To maintain a uniform level of salting to satisfy consumer demands for an even flavour, and to ensure that the serum brine concentration is sufficiently high to retard bacterial development.

(*c*) To obtain information on the standard of factory hygiene and the principal sources of contamination so that any damaging effect on quality can be diagnosed.

(*d*) To help obtain the best keeping quality.

PROCEDURE.

General.

Of the 53 butter factories at present operating in Queensland, all but seven are covered by the Butter Improvement Service. These seven comprise a group with high production, exporting from Gladstone, which

employ their own technologist and so provide themselves with a similar service using similar media, methods and standards to those used in Brisbane. The other 46 factories, with the exception of four on the Atherton Tableland, send butter for export through Brisbane or supply the Queensland Butter Marketing Board for Brisbane's requirements, so that the butter is available for sampling at the time of grading.

Sampling.

Choice or, if necessary, first grade butter samples from the five most recent churnings of each factory are taken at intervals of about three weeks. These samples are subjected to bacteriological and chemical tests.

Bacteriological Tests.

Plate Count and Casein Digester Count.—This is a method of estimating the number of bacteria present in each gram of the butter and the number capable of digesting milk proteins.

The Presumptive Coliform Test, which indicates the extent of post-pasteurisation contamination.

Yeast and Mould Count.—This is determined by the plate method, using a differential medium which prevents the growth of bacteria but encourages the growth of yeasts and moulds.

A *"Bottle" Test* was formerly included to gain some information on keeping quality, but the method used was found to have some disadvantages and the test was discontinued.

Chemical Tests.

The Moisture and Salt Content of each sample is determined.

pH.—The pH of the butter serum is determined on each churning made from a separate vat of cream. The pH is a measure of the intensity of acidity or alkalinity in the butter and can be related to cream neutralisation in the butter factory.

DESIRED STANDARDS.

Bacteriological.

Standards have been set for the four results obtained, namely:—

(*a*) Plate count per gram .. .. Less than 100,000

(*b*) Casein digester count per gram.. 5,000 or less

(*c*) Yeast plus mould count per gram 100 or less

(*d*) Presumptive Coliform test .. Negative in 1/10 gram

To stimulate a competitive interest in the results and to give a simple figure that can be used to illustrate how closely a factory's results approach the standard, a *Bacteriological Quality Index* (*B.Q.I.*) is used. Based on the above tests, if the results fall within the standards mentioned 20 points are allotted, thus giving a possible total of 400 points. If the number of samples differs from five the allocation of points to each result is varied accordingly so as to give the same total of 400.

Chemical.

Moisture.—The legal maximum moisture content of butter is 16.0 per cent. and economy demands the closest approach to this figure. However, as penalties exist for butter containing excess moisture, an average better than 15.8 per cent. is difficult to achieve with safety. The results obtained by many factories show that this figure can be achieved in practice without difficulty.

Salt.—The maximum salt content of butter permissible for local requirements is 2.5 per cent. and for export 2.0 per cent. However, 1.5 per cent. appears to satisfy most local demands, while 1.2 to 1.3 per cent. is often asked for in export butter. For these reasons it is difficult to set a definite standard for salt, but 1.2 to 1.5 per cent. is considered a desirable figure.

Points Score.—Again in moisture and salt control the competitive aspect has been recently intensified by the introduction of a points scoring system which is used in quarterly and annual reports for placing the factories in order of merit. Most stress has been placed on the moisture control aspect by allowing 85 per cent. of the points for moisture and 15 per cent. for salt. Because of the varying standards 1.2 per cent. or more of salt is given full points. Full points are given for 16 per cent. moisture, with only slight progressive reductions down to 15.7 per cent. Below this the points fall off more rapidly. The total score possible is 100.

pH.—In accordance with the recommendations of most investigators a provisional range of 6.8 to 7.2 was set for pH to ensure optimum keeping quality.

Since their inception in 1948 the pH results have been providing useful information on neutralisation procedures and accuracy in Queensland factories and have enabled guidance to be given to factories where necessary.

INTERPRETATION OF BACTERIOLOGICAL RESULTS.

From the results of tests on each batch of samples a fairly reliable indication of the principal sources of contamination in the factory can be obtained. High total counts in the absence of casein digesters or coliforms are often due to inefficient pasteurisation, with the resulting survival of large numbers of heat-resistant bacteria.

When casein digesters and coliforms are also numerous, contamination is suspected from such sources as pumps, pipelines, coolers, vats and glands. In some cases coliforms have been found to originate in the factory water supply. The yeast and mould count is practically a direct indication of the sanitary condition of the wooden churns used exclusively in Queensland.

The question of butter texture bears strongly on the interpretation of bacteriological results. Where the butter is underworked, the moisture is distributed rather unevenly, many of the droplets being large enough to support bacterial growth between the time of manufacture and grading. Grading comments are some guide here, as the butter may be underworked when the texture is open or mottle is present, thereby encouraging bacterial growth. However, it is probable that finer distinction is necessary in some cases and it is hoped to include a microscopic examination for the efficiency of working in B.I.S. reports at a later date.

USE OF RESULTS.

When completed, results are forwarded to the factory with appropriate comments and suggestions. A copy is also forwarded to the local field officer, who is directed to check on the reasons for any departure from normal. Quarterly and yearly results are also compiled and circularised to show the seasonal and yearly trends. The recording of results in the laboratory enables a picture of the factory hygiene and chemical control standards to be built up. When results indicate the need, or if a request is received for assistance, the services of a laboratory officer are made available for a survey of the factory. A bacteriological survey performed by examining a series of samples at the factory will usually show the way to remove sources of contamination. Problems of texture or chemical control are also examined in an endeavour to find a solution.

The results of bacteriological surveys of factories in the past have usually shown that attention to the following main points will give an improved B.Q.I.:—

(1) Daily dismantling, thorough cleaning and sterilizing of pipe lines and pumps.

(2) The elimination of dead ends and undue length of piping.

(3) The observance of a strict and intensive churn cleaning and sterilizing routine.

(4) The prompt replacement of worn or pitted equipment.

(5) Chlorination of the factory water supply, particularly the butter wash water. A concentration of 0.5 p.p.m. of chlorine in the water entering the churn has been found effective. Colour standards for the orthotoldine test to check this concentration are supplied to factories.

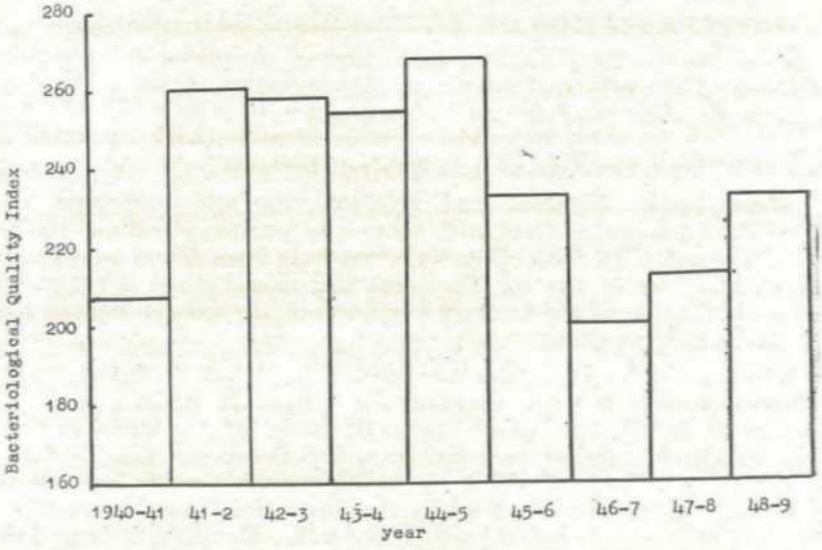


Plate 81.

AVERAGE BACTERIOLOGICAL QUALITY INDEX.

RESULTS.

Bacteriological.

The average Bacteriological Quality Index from 1940-41 to 1948-49 is shown graphically (Plate 81). It will be seen that satisfactory results were obtained early in the history of the Service and maintained until the year 1944-45. For the next two years a marked drop was evident, coinciding with the deterioration of factory equipment which had been practically unobtainable during the war years, the acute shortage of suitable detergents and chemical sterilizers, and, in many cases, the labour shortages. The gradual improvement from 1946-47 onwards has probably been partly the result of an improved supply of necessary equipment, detergents, and chemical sterilizers. However, the intensification of efforts by field and laboratory staffs made possible by the availability of more officers, combined with the efforts of factory managers, has undoubtedly resulted in part of the improvement.

Quarterly averages are probably more indicative of the true standard of factory hygiene, as the results show a strong seasonal trend. Table 1 shows the quarterly averages for the last two years. It will be seen that lower averages coincide with the summer months, and, of course, the flush period for butter production, which is the critical testing time. The need for special care in the treatment of cream and butter manufacture in the warmer months is shown by this trend.

TABLE 1.

Quarter.	1947-48.	1948-49.
July-September	247	279
October-December	209	200
January-March	163	187
April-June	227	263
Yearly average	210	229

Chemical.

Moisture and salt.—The improvement in the average moisture content has been steady since the inception of the Service (Plate 82). The salt percentage, however, has varied to some extent (Plate 83) but extreme variation in the salt percentage which was common originally is now infrequent.

Table 2 compares an estimate of the average composition of Queensland butter prior to the introduction of the Service with an estimate for 1948-49 (which includes an allowance for the group of seven factories with their own service).

It will be seen that about 1 per cent. more butter is being obtained from the same quantity of butterfat, representing about 1,000,000 lb. on Queensland's annual output. The improvement in moisture and salt figures between 1947-48 and 1948-49 corresponds with a gain of about 100,000 pounds of butter.

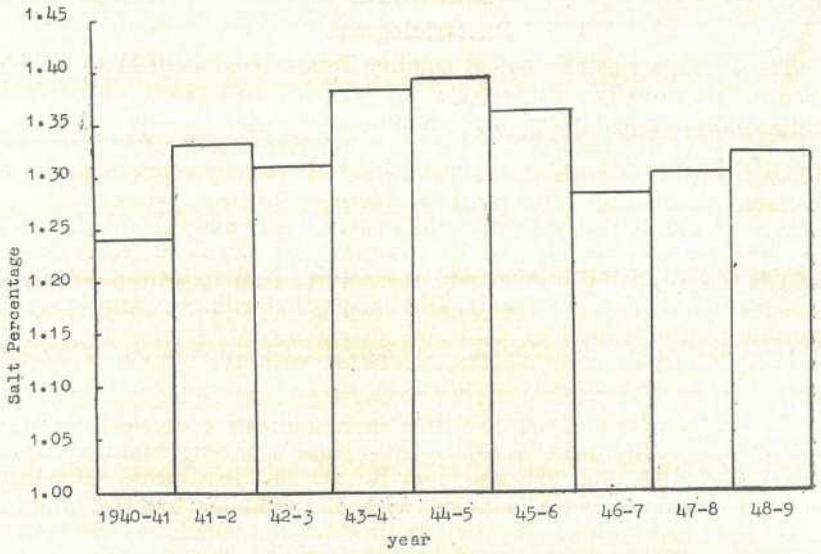


Plate 82.
AVERAGE SALT RESULTS.

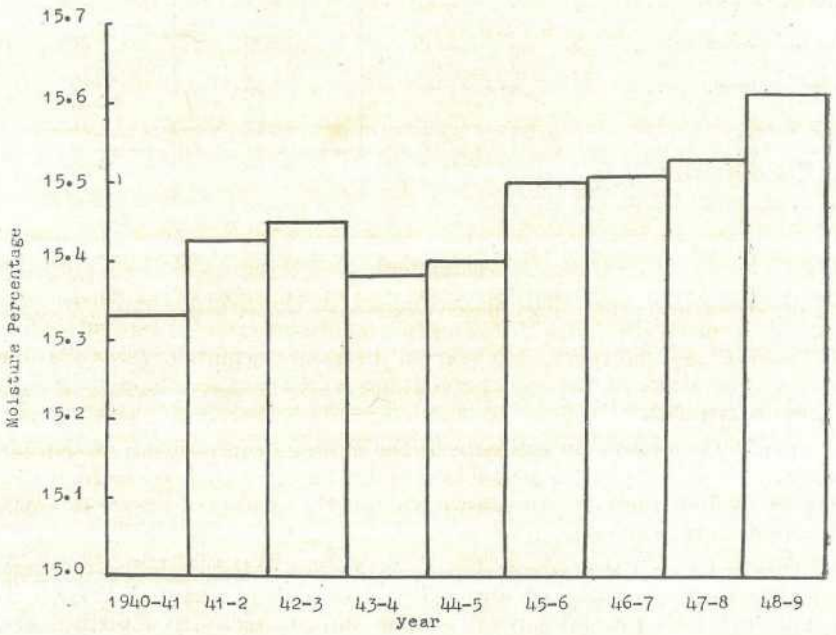


Plate 83.
AVERAGE MOISTURE RESULTS.

TABLE 2.

—	Prior to Service.	1948-49.
	Per cent.	Per cent.
Water	14.9	15.62
Salt	1·0	1·33
Curd	0·8	0·83
Fat	83·3	82·22

Intensification of the competitive aspect in moisture and salt control by the introduction of a points score appears to have had a good effect, particularly in relation to the moisture percentages. Table 3, showing the quarterly average moisture and salt percentages and average point score, illustrates this improvement.

TABLE 3.

Quarter.	No. of Samples.	Average per cent. Moisture.	Average per cent. Salt.	Average Points Score.
January-March, 1948	471	15·47	1·21	70·0
April-June, 1948	391	15·53	1·19	76·5
July-September, 1948	484	15·51	1·29	77·4
October-December, 1948	456	15·56	1·32	79·5
January-March, 1949	741	15·62	1·29	83·0
April-June, 1949	620	15·66	1·27	84·6

The good position in butter composition is well illustrated by the fact that in 1948-49, 26 of the 53 butter factories averaged 15.7 per cent. or more for moisture and 35 averaged 1.3 per cent. or more for salt. It only requires a little better effort by a few factories low on the list to ensure the highest possible efficiency in this aspect of butter manufacture.

pH.—The results since the introduction of pH determinations to the Service are summarised in Table 4.

TABLE 4.

Quarter.	No. of Samples.	Per cent. Distribution of Samples.			Average pH.
		5·6–6·7 pH Range.	6·8-7·2 pH Range.	7·3-8·2 pH Range.	
July-September, 1948 ..	143	7	32	61	7·46
October-December, 1948 ..	229	12	31	57	7·32
January-March, 1949 ..	404	9	42	49	7·26
April-June, 1949 ..	341	5	24	71	7·42

The small percentage of acid butters shown above (range 5.6-6.7) is desirable for the best keeping quality and it is hoped that further efforts will result in lowering the percentage of highly alkaline butters. If a residual cream acidity of 0.08 per cent. is aimed for by the factory operative, this objective should soon be achieved.

CONCLUSIONS AND RECOMMENDATIONS.

The results obtained and the methods used under the Butter Improvement Service for the past nine years are presented and discussed. It is shown, that, with the exception of a decline in bacteriological quality at the end of the war period, there has been a fairly steady improvement in bacteriological and chemical quality of butter.

The operation of the Service throughout the years has been made easier by the increasing co-operation and interest of many factory managers. To further increase this interest, competitions using Butter Improvement Service standards as a basis for judging have been a feature of the Factory Managers' Conferences. This co-operation has also been appreciated because of the opportunity it has afforded the Laboratory to commence a study of some factors affecting the keeping quality of butter.

The bacteriological results of many factories illustrate clearly that an excellent standard of hygiene can be maintained in practice by the use of adequate cleaning and sterilizing methods. Criticism is often levelled at the bacteriological results on the grounds that some factories with rather poor results still produce butter of good grading quality. It must be stressed that the grading quality of butter is seldom directly related to the bacteria counts. A factory with rather high counts can grade consistently well if the types of bacteria are relatively harmless and if the butter is thoroughly worked. However, where poor hygiene exists, bacteriological defects such as "rabbito" can and do occur, often resulting in extensive losses. Prevention of such losses, and more particularly maintenance of that high standard of hygiene very necessary in handling any food material, are the reasons for a bacteriological control system.

The chemical control in butter manufacture has reached a stage where only a little more care and attention to detail is necessary to achieve a high overall standard of efficiency. In moisture control, further attention by some buttermakers to the estimation of churn loads seems to be needed, while regular salt testing at the factory should lead to more evenly salted butter. With neutralisation, frequent checking of the residual cream acidity and comparison with the pH results supplied should facilitate adjustment of the pH to the range recommended. It is worth remembering that, within limits, the percentage of salt in the butter bears little relation to the occurrence of grading comments about harsh salting. A butter of low salt content may well be penalised by a butter grader if the salt is poorly distributed and only partially dissolved through underworking, while a thoroughly worked butter of relatively high salt content will probably be free from any harshness.

The uplift of butter quality is an urgent problem confronting the industry. Compliance with the standards set by the Butter Improvement Service, and careful cream grading, should ensure that any loss of quality from controllable causes in the factory is minimised. The major part of any further uplift in butter quality must, however, come from improvement of cream quality.

Wool and its Physical Properties.

G. R. MOULE, Director of Sheep Husbandry.

THROUGHOUT the history of our civilisation wool has been well known for the part it has played in clothing the people of the world. According to modern concepts, clothing should keep the body at its normal temperature and should protect it from sudden changes in the temperature of the atmosphere. It should not cling to the body or feel wet, nor should it irritate the skin. It should be light and comfortable, and protect the body from the sun's radiation. It should also be satisfying in appearance and should be easily laundered.

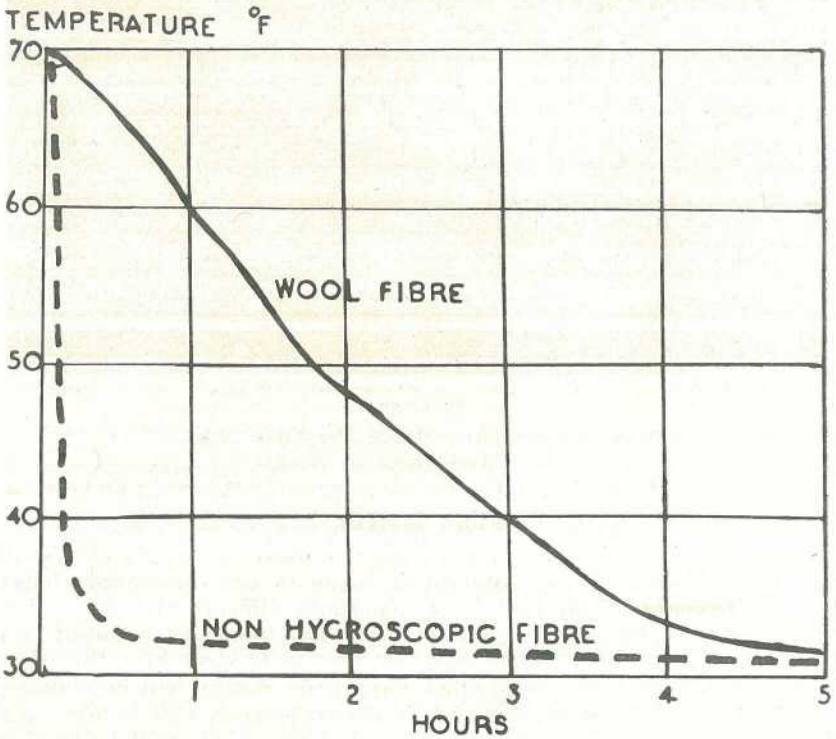


Plate 84.

SHOWING HOW WOOL, AS COMPARED WITH FIBRES OF OTHER FABRICS, ALLOWS TEMPERATURES TO FALL SLOWLY.

Wool satisfies many of these criteria because of its physical properties. Woollen fabrics are particularly thermostatic—that is, they protect against sudden changes in temperature. Plate 84 shows how wool acts as a buffer and allows the temperature to fall slowly, whereas the non-hygroscopic fibre allows it to fall very suddenly. Woollen fabrics are absorbent and porous, elastic and resilient, and in addition are strong and durable but light and soft. It is well known that wool has an exceptionally high capacity for taking up dye, and accordingly woollen fabrics are satisfying in appearance. Because of their softness they do not crease. In addition, wool has the distinct advantage of being non-inflammable.

All of these qualities can be linked closely with the physical properties of wool and accordingly an appreciation of these is essential to an understanding of wool utilisation.

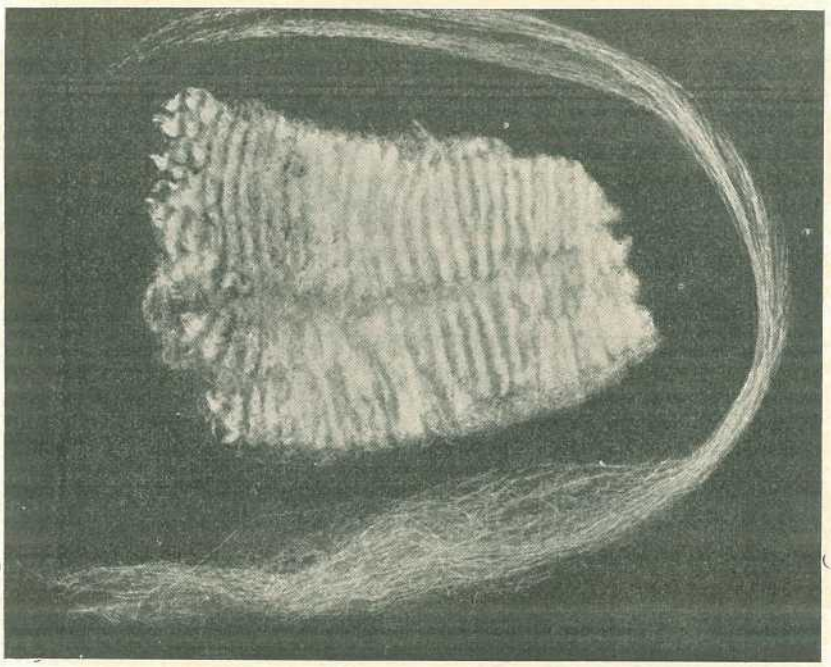


Plate 85.
MICROPHOTOGRAPH OF SHORT AND LONG WOOL.
(From "World Book of Wool.")

Fibre Length.

On first glance it appears to be easy to assess the length of a staple of wool. However, if an attempt is made to measure staple length it soon becomes evident that it is sometimes difficult to decide where the majority of fibres end. Should individual fibres be removed from the staple and measured while sufficient tension to straighten the crimp, but not stretch the fibre, is applied, surprising results will be obtained. In a staple of Merino wool which is about $3\frac{1}{2}$ inches in length, some fibres as long as six inches will be found, while others will be as short as three inches.

The manufacturer is well aware of this variation in the length of the individual fibres in a staple and he also knows that long fibres spin strong yarn. For this reason the wool classer always differentiates the short from the long stapled wools and the buyer looks for the longer wools when seeking lines which can be made into worsted material. A worsted yarn is spun rather tightly so that long threads are closely wound about one another, and as the yarn has a great number of twists per inch the long fibres grip firmly, giving the thread great strength and the fabric a smooth finish.

The shorter wools are used for the manufacture of materials known as woollens, in which the longer fibres lie parallel to one another and the shorter fibres are allowed to criss-cross them. Woollen yarns are not spun as tightly as worsted yarns (Plate 86) and woollen fabrics have a soft fluffy finish. Blankets are a good example.

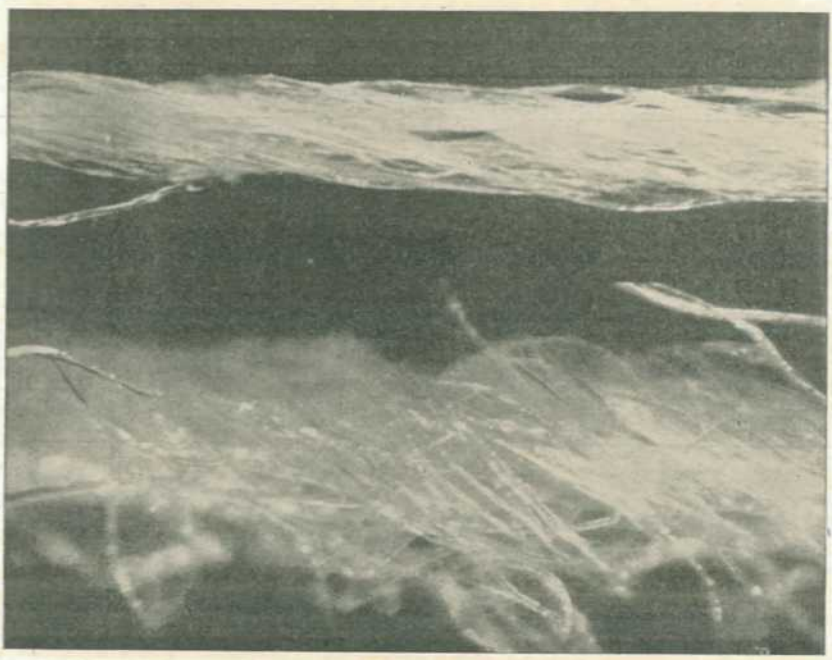


Plate 86.
MICROPHOTOGRAPH OF WORSTED AND WOOLLEN YARN.
(From "World Book of Wool.")

Fibre length has two important influences on wool production. A fleece consists essentially of a large number of minute cylinders of wool keratin, each possessing a certain length and a certain diameter. The longer the fibres the greater the volume of wool keratin in each cylinder and consequently the greater the weight of the fleece. On the other hand, the longer the fibres the more the fleece is likely to open, exposing the tips of the staples to damage by the radiant energy of the sun. Damaged tips break in the manufacturing process, forming short fibres called "noil." While the noil can be worked in with the carded wools, it represents waste to the manufacturer who has bought the long wool for spinning into worsted yarn.

Fibre Diameter.

Merino wool is renowned for fineness of fibre diameter, while it is well known that the wool from the sheep of the British breeds is somewhat coarser. Despite their fineness, wool fibres have great tensile strength and it is possible to spin them into fine yarns which are very strong. A surprising length of yarn can be spun from a pound of combed tops, as the wool is called after the fibres have been laid parallel. When the yarn is spun it is wound into hanks, each being 560 yards long, and a system of counting the number of hanks of wool which can be spun from a pound of combed tops, made from any line of wool, has been adopted by the trade.

Working with Merino wool produced in South Africa, Duerden established a relationship between the number of crimps per inch, the average diameter of fibres in a staple of wool, and its spinning capacity. The scale he developed is known as the Duerden Scale and it is set out as Table 1.

TABLE 1.

THE DUERDEN SCALE.

Count.	Crimps per Inch.	Average Fibre Diameter in Microns*.
100's	22–24	15·4–16·2
90's	20–21	16·2–17
80's	18–19	17·0–17·9
70's	16–17	17·9–18·9
66's	14–15	18·9–20·0
64's	12–13	20·0–21·3
60's	10–11	21·3–23
58's	8–9	23·0–25·5
56's	6–7	25·5–29

*1 micron = 1/25,400 of an inch.

Duerden worked mainly with wools grown by stud sheep which had fairly uniform conditions and were adequately fed. The relationship between crimp and fineness of Australian wools has been investigated by Lang, who has shown that the Duerden scale is too narrow to fit Australian conditions. The relationship between crimp and fibre diameter of wools grown by flock sheep in Australia is not as close as that suggested by Duerden. However, because of compensating errors a large line of wool usually spins close to the expected count.

In a recent survey some groups of wool fibres whose diameters had been measured were submitted to a number of people who were asked to arrange them in order according to fineness. The results revealed that skilled wool classers were capable of recognising differences in the diameter of groups of fibres as small as 2.5 microns. Reference to the Duerden scale indicates that even skilled classers may find it difficult to differentiate between wools of consecutive counts by the visual examination of fibre diameter alone.

It should not be imagined that all the fibres in a staple of wool are of the same diameter. There is some variation even in the best wools, while some of the "rougher" types may have wool which has a very wide variation in fibre diameter.

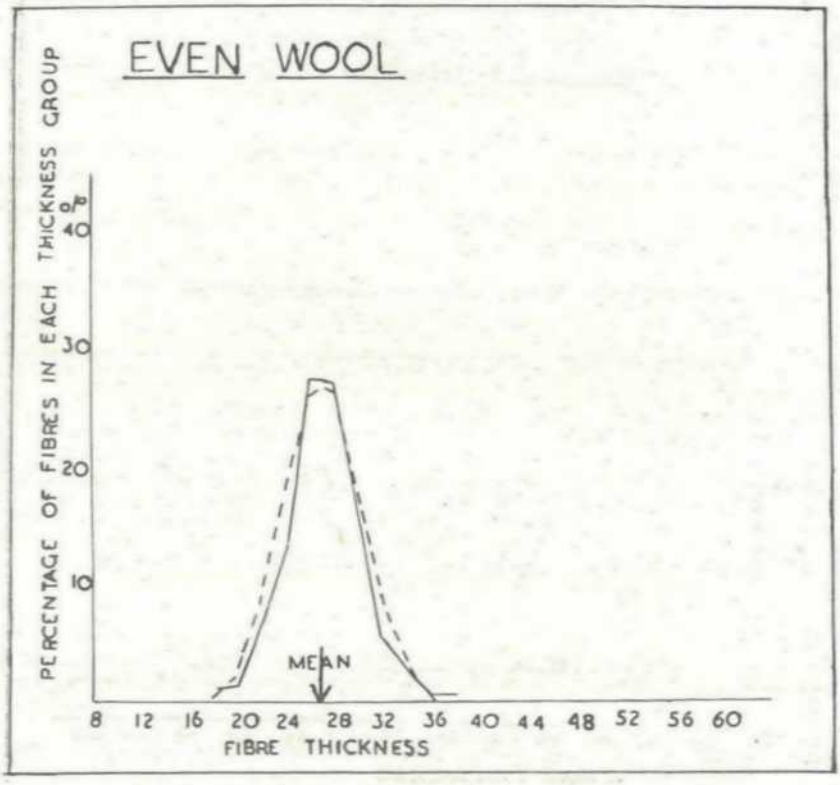


Plate 87.

Showing the Results of Measuring the Diameters of the Fibres in an Even Staple of Wool.—The number of fibres in each thickness group is indicated by the continuous black line. The dotted line shows the results which would be obtained from measuring the "theoretically perfect" sample.

By measuring the diameter of a large number of fibres in a staple and counting the number of fibres of each thickness, it is possible to express the variation in fibre diameter by means of the graphs in Plates 87 and 88. These show an extremely even wool (Plate 87) and a very uneven wool (Plate 88). In this latter there is a group of coarse fibres which may mask the appearance of the whole fleece. Variations also occur in the shape of fibres, some being quite oval. This is of particular importance in manufacture, because a few oval fibres amongst normally round ones may cause considerable distortion in the yarn.

Variations in diameter of the fibres in a staple can be of paramount importance to the producer. Remembering that the weight of the fleece is dependent upon the volume of keratin in each cylinder of wool, it will be realised that the greater the fibre diameter the greater the volume of each cylinder. If, however, a group of coarser fibres masks the picture so that a sheep whose wool is predominantly fine appears to be a "strong" wool, its fleece may be considerably lighter than is anticipated. The importance of this to the man who is selecting a top ram for stud use cannot be stressed too strongly.

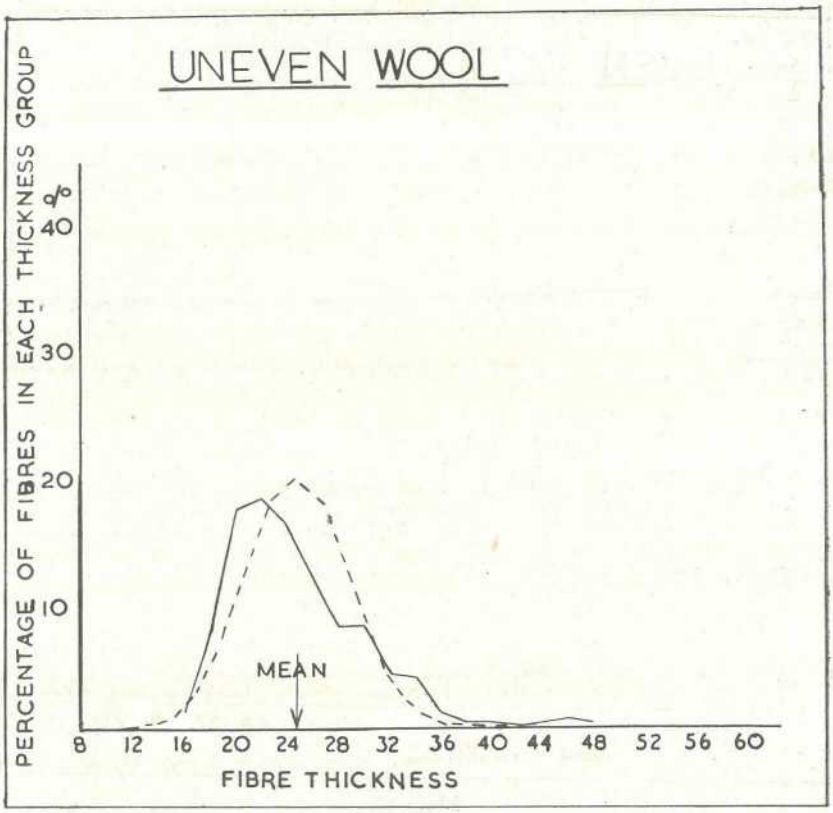


Plate 88.

SHOWING THE VARIATION IN FIBRES IN AN UNEVEN STAPLE OF WOOL AND THE DIFFERENCE IN THE NUMBER OF FIBRES IN EACH THICKNESS GROUP.—The distribution is indicated by the continuous black line, while the dotted line shows the theoretical distribution of the fibres in each thickness group for a staple which has a wide range between its finest and coarsest fibre.

The capacity of woollen clothes to protect the body from sudden changes in atmospheric temperatures and to absorb moisture is largely dependent upon the diameter of the fibres. A large amount of air is entrapped between the fibres, and this insulates the body from sudden changes in atmospheric temperature. The nap on blankets or on Harris tweeds increases the amount of air held between the fibres and this accounts for their warmth. In addition, wool itself is a poor conductor of heat and this gives protection against radiant energy as well as against sudden changes in temperature.

It may come as a surprise to some people to know that the clothes worn by the average city man, and weighing about 8 lb., contain about 1 lb. of water. When there is a dry wind blowing the amount of water is reduced to about ½ lb., while on a hot moist day it increases to over 1½ lb. The question immediately arises as to where this water is secreted. Each fibre in a woollen fabric becomes ensheathed by a thin film of water. It is interesting that the total surface area of the fibres in 1 lb. of 64's Merino wool is about 800 square feet. As there are about 3½ lb. of wool

in the clothes worn by the average city man, the total surface area of the fibres is very high and this is responsible for the absorptive capacity of woollen fabrics.

Tensile Strength and Elasticity.

The experienced wool classer always selects a staple from a fleece and tests it for soundness before he decides the line. He does this because the uses to which the wool can be put are partly dependent upon its tensile strength and elasticity. Wools lacking tensile strength break easily during manufacture and form a large amount of noil. In addition, wools lacking tensile strength have to be blended with sound fibres to ensure a fabric which has normal strength.

If an independent wool fibre is stretched it will expand a certain amount and then break. It is interesting to know that the same force would be required to break a thread of steel of the same diameter. However, the other fibres used for clothing are stronger than wool—silk for instance has 2½-3 times the strength of wool, and nylon is still stronger. Cotton is twice as strong as wool.

These fibres are not as elastic as wool—that is, the wool fibre will stretch to a greater length without breaking. Besides giving the extra length obtained by extending the crimp, the protein molecules in the wool fibre are arranged so as to permit extreme extension. It is known that the spindle cells can stretch up to three times their normal length. Some wools lack elasticity and tensile strength. This is particularly noticeable in the case of fleeces grown by animals which have suffered from nutritional deficiencies or ill health. Lack of tensile strength can be brought about by a decrease in the volume rate of production of wool keratin, leading to a general reduction in the diameters of wool fibres. An example of this is seen in sheep which have suffered bad fly strike.

New Zealand investigators found that there was a fairly definite ratio between the tensile strength of the fibres in the sound and tender parts of the staple. Generally speaking, when there was slight break the sound regions of the staple could stand about three times the load of the tender parts. When the break was bad, the sound parts could stand about eight times the load of the tender parts.

It is well known that sheep suffering from copper deficiency grow wool which is "rotten," as it can be broken at any point along the staple despite the lack of any indication of a decrease in fibre diameter due to a diminution in the volume rate of production of wool keratin. It has been suggested that when sheep are subjected to copper deficiency there is an interference with the arrangement of the protein molecules in the wool fibres.

Handle.

Handle is important to the manufacturer because it connotes whether the wool has "body"—that is, it indicates the fullness as well as the softness of the final product.

It is a composite character which is not easy to describe. It refers to the ability of a line of wool "to fill the hand" and at the same time retain its traditional softness.

The ability of any line of wool to fill the hand will be dependent upon the respective lengths of the individual fibres, the average diameter

of the fibres, and the variation in fibre diameter and the resilience of the fibres, which may be influenced by the arrangement of the protein chains. In addition, the amount of yolk and foreign matter may have an influence.

The softness of a staple of wool is partly dependent upon the diameter of the fibres, on the pliability of the fibres and the presence of hairs of kemps in the staple, and on the number of folds in the outer cortical sheath of the fibres themselves.

Wools grown by sheep depastured on copper deficient areas are notorious for their slippery handle and for their lack of body. The trade often describes wools of this type as "gutless."

When compared with wools of similar fibre diameter and staple length, copper deficient wools are somewhat like silk. They lack substance and can be compressed into a small space. This is probably due to lack of elasticity and resilience, which may result from a retardation of the rate at which keratinisation is completed in the wool follicle.

Colour.

There is considerable variation in the colour of greasy wool, depending upon the type of country in which the sheep are running. A good deal of this is due to dust and vegetable matter, which will come out during scouring, but there is some variation in the colour of the scoured wool and this is important to the manufacturer and hence to the buyer.

Several factors influence the colour of scoured wools. Long-woolled sheep of the British breeds have a lustre about their wool, while that of the Downs breeds tends to be duller. It is usually considered that the so-called scales formed by the folded outer cortical sheath reflect a good deal of light. This helps to give wool its well known brightness, as distinct from the lifeless flat chalky white of fibres without surface scales.

Environmental influences have an important bearing on colour. Wools which have been damaged by the sun's radiant energy lack brightness, and canary stain, resulting from sudden changes in feed accompanied by hot humid weather, is well known in the trade. Because it cannot be removed by scouring it depreciates the values of clips very considerably.

The colour of wool, including its brightness, has an important influence on its reaction in the dying vats. The dye gets in through the minute pores between the folds of the cuticle sheath. Thus the size and arrangement of the folds in the cuticle sheath influence the appearance of the dyed fabric.

TUBERCULOSIS-FREE CATTLE HERDS (AS AT 1st FEBRUARY, 1950).

Breed.	Owner's Name and Address of Stud.
Aberdeen Angus	The Scottish Australian Company Ltd., Texas Station, Texas
Jersey	W. E. O. Meier. "Kingsford" Stud, Rosevale, via Rosewood.

ANIMAL HEALTH

Tick Fevers of Cattle in Queensland.

C. R. MULHEARN, Divisional Veterinary Officer.

TICK fever and redwater, the popular names applied to a disease of cattle caused by extremely small blood parasites transmitted under natural conditions by the cattle tick (*Boophilus microplus*), only occur within the tick-infested zones.

Introduced into northern Australia with the tick towards the end of the last century, it accompanied that pest in its spread southwards through Queensland.

The initial outbreaks of the disease caused heavy mortality, often exceeding 50 per cent. of the local cattle population. As the tick became established, however, the remaining cattle acquired resistance, and as most young cattle bred in tick-infested country develop a natural resistance, the disease is usually now only responsible for comparatively small losses within the tick-infested area.

Cattle continually exposed to tick infestation carry these small blood parasites in their systems and are resistant or immune, whereas most cattle over one year old, which have been bred in tick free country, will readily contract the disease if exposed to tick infestation. Such animals are referred to as being susceptible.

Economic Importance.

The disease is of serious economic importance to the Queensland cattle industry. As the tick is mainly confined to the coastal watershed, cattle bred in tick-free country cannot be moved to and maintained in tick-infested country without the risk of serious loss. This interferes with the free movement, fattening and marketing of cattle from inland to coastal Queensland and vice versa.

Another form of loss and inconvenience is incurred when stud cattle are introduced from clean districts into the tick area. If these cattle are forwarded direct to the holdings, it is certain that they will suffer an attack of tick fever, often with fatal results, and consequently it becomes necessary to inoculate them prior to introduction to the tick-infested country. After inoculation, such animals are highly resistant to infection.

Frequently, losses occur in cattle in marginal country—that is, country situated between the definitely tick-infested and the definitely tick-free country. Owing to seasonal and other conditions, the animals in these marginal areas may not be exposed to ticks for several months or even years, and consequently become susceptible to tick fever. When they are again exposed to ticks, as they may be in a favourable season, severe loss is likely to occur.

Losses are also continually occurring in cattle within the tick zone. This occurs particularly in areas where dry seasons cause a diminution in the number of ticks or where these parasites have been killed out by too frequent dippings.

Method of Transmission.

As already stated, tick fever is an infectious disease caused by small blood parasites spread by means of the cattle tick, and does not occur where the tick is non-existent.

The tick spends the whole of its parasitic life on the same animal, and if this animal is a "carrier" these blood parasites are taken up by the tick, which transmits through its eggs these same parasites to its progeny, the larval ticks, which pass them into a second animal to which the progeny, in their turn, attach. In this manner, most cattle in tick-infested country are being constantly reinfected, and this keeps them immune or resistant to the disease.

Ticks, as such, are therefore not responsible for outbreaks of tick fever, but the disease results from the blood parasite passing from one generation of ticks to the next. All ticks do not carry these organisms; for example, if a tick developed on a "non-carrier" animal, the next generation of ticks would not carry them. Ticks which carry the organism are often referred to as infective or "pathogenic" ticks, but to outward appearances they are no different from non-infective ticks. It has been stated that different types of ticks transmit different forms of tick fever, but this is a fallacy, as there is only one common cattle tick in Queensland and this one transmits all forms of tick fever.

Outbreaks of tick fever develop only when infective ticks become attached to susceptible cattle.

There is quite a pronounced variation in susceptibility in different ages and types of cattle. Young animals have a strong natural resistance; hence they usually contract the disease in a mild form but develop a strong resistance, which is maintained provided they are exposed to a certain degree of tick infestation. This age resistance gradually decreases, and is largely lost when the animal is 9-12 months old.

As a general rule, old animals in fat condition are more susceptible and contract the disease in a more severe form than young light-conditioned animals.

The incidence of the disease varies from year to year. It is usually most prevalent in a good season, when conditions are suitable for tick propagation, following a series of dry seasons.

Symptoms.

For many years, it was considered that tick fever in Australia was caused by a single blood parasite, but it is now known that several organisms may be responsible for different forms of the disease. The most important of these are the piroplasm and babesiella, both of which produce symptoms of redwater, and the anaplasm, which produces a more chronic type of disease.

The first sympton in the redwater form of the disease is fever, and this may be noted even while the animal is apparently normal in other respects. The temperature gradually rises over a period of days, and it may reach a maximum of 106-108 degrees at the height of the

fever. In milking cows, there is usually a marked reduction in milk yield shortly after the onset of the fever. Scours may be evident in the early stages, though constipation usually follows.

A few days after the onset of fever the appetite is depressed and the animal will isolate itself and stand in the shade. At this stage, the ears droop and the coat is roughened. Jaundice then becomes evident, and may be noted from an examination of the eyes or mouth. It may be difficult to detect in Jersey cattle. Red urine may also be passed, and this must be looked upon as a very serious symptom, for the animal is then in an advanced stage of the disease. In this advanced stage, the eyes are staring, the muscles quiver, and the animal is unsteady on its feet; it finally collapses, becomes unconscious and dies.

In the less severe cases, in which the animal recovers, it may or may not reach the stage of redwater and then gradually improves, finally coming back on to its feed after a period of several days. In such cases, the animal loses condition, the blood becomes weak and there is a definite pallor about the mouth and eyes. The crisis is usually passed in less than a week.

In the anaplasmosis form, the course is less severe but more prolonged, and the animal loses much condition and becomes weak. It may take months to completely recover.

Post-mortem Changes.

The carcase may show small bleedings throughout the tissues, which are often stained a definite yellow colour, particularly noticeable in the fat, due to generalised jaundice.

The body cavity may contain a quantity of blood-stained fluid, whilst the liver is usually enlarged and bronze coloured. The gall bladder may be full of thick bile. The spleen is very enlarged, sometimes up to twice its normal size, and instead of being firm it feels soft and doughy and the interior is of a semi-fluid consistency.

The kidneys are darker in colour than normal and enlarged. The bladder usually contains a quantity of urine, which may vary from a dirty red to a port wine colour. This, however, is not a constant feature, for on rare occasions an animal may die of tick fever and the urine remain a dark amber colour.

Animals which die of the anaplasmosis form of tick fever show evidence of loss of condition, generalised jaundice and extreme pallor due to poverty of the blood, but the urine remains normal in colour or is a dark amber.

Deaths due to anaplasmosis are seldom encountered, and the majority of tick fever deaths are due to the redwater forms, and particularly the form known as babesiellosis.

Difficult Diagnosis.

The foregoing symptoms and post-mortem findings are those encountered in typical cases, which should be diagnosed without much difficulty. However, typical cases are sometimes encountered, and some difficulty may be experienced in making a field diagnosis. Again, there are other diseases which present both ante- and post-mortem findings very similar to those of tick fever, and in such cases it becomes necessary to enlist the aid of the laboratory to assist in correct diagnosis.

Specimens to be submitted for this purpose are blood smears from the live animal (Plate 89), and, from the dead animal, liver, spleen and particularly kidney smears.

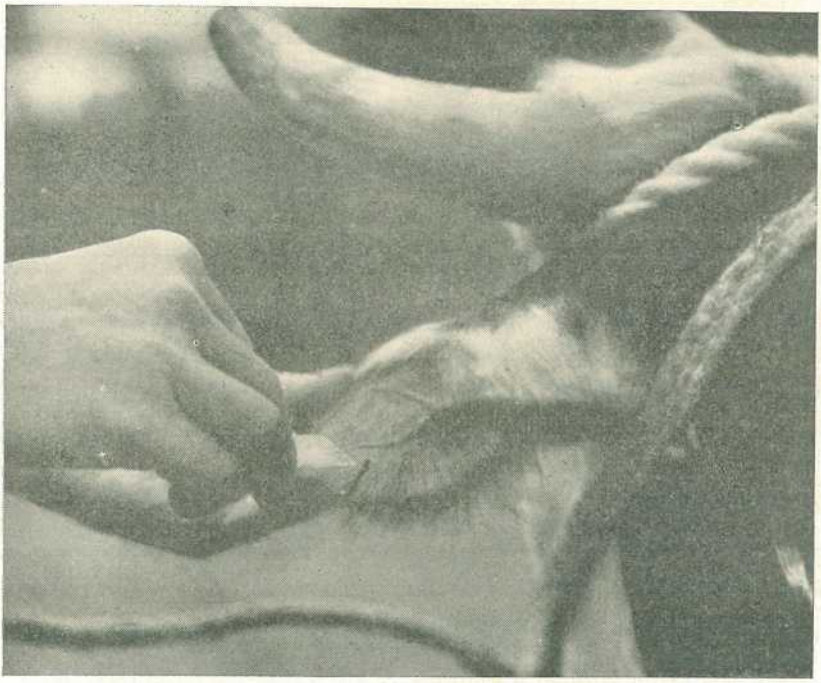


Plate 89.

TAKING A BLOOD SMEAR FOR DIAGNOSIS OF TICK FEVER.—A vein in the ear is pricked, a drop of blood is spread thinly on a glass slide, and the smear dried rapidly.

A smear is made by spreading a small drop of blood very thinly over the glass slide and drying it rapidly.

Specimens such as portions of the liver, spleen and kidney and a small quantity of urine may also assist in arriving at a diagnosis.

Diseases which may be confused with tick fever are lantana poisoning, leptospirosis and enzootic haematuria.

In lantana poisoning, there is generalised jaundice, but no red urine. Other typical features of this condition are peeling of the nose and black scours.

Leptospirosis is very similar in many respects to tick fever and is frequently seen in its worst form in young calves, up to six months old, but also affects aged cattle. Red urine is a prominent symptom of this disease.

Enzootic haematuria chiefly affects aged cows, which pass blood and blood clots in the urine. It is a more chronic disease than tick fever.

Treatment.

Fortunately, the redwater forms of tick fever may be treated successfully with certain specially prepared specifics, such as Acaprin, Pirevan, Piroparv, Babeson, etc., which can be obtained from most chemists. These specifics are usually in the forms of a solution put up

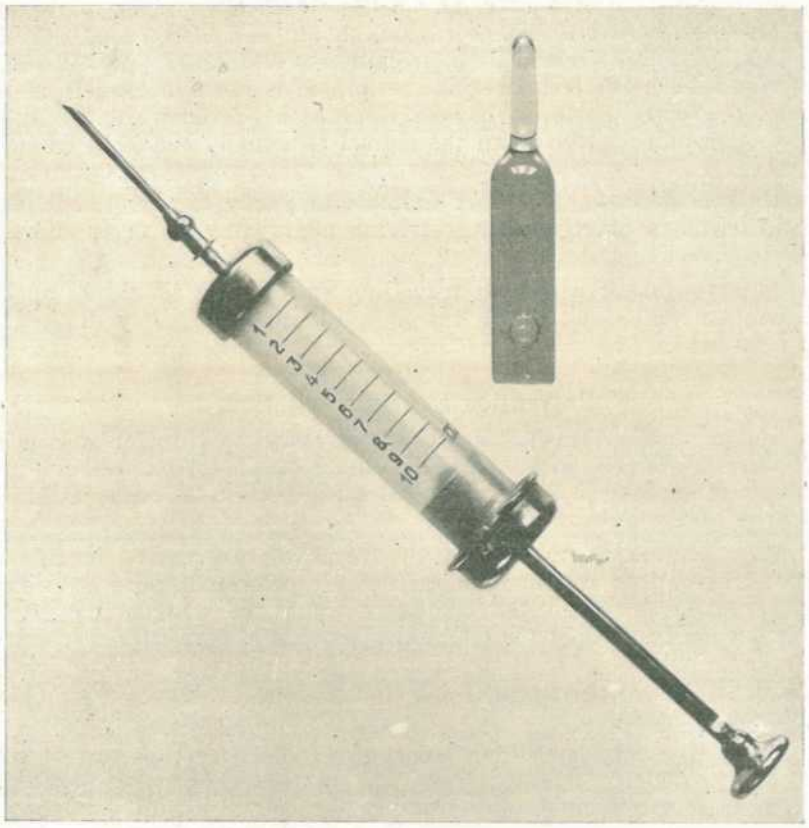


Plate 90.
HYPODERMIC SYRINGE AND AMPOULE OF SPECIFIC FOR TREATMENT OF TICK FEVER.

either in ampoules of 6-10 c.c. (Plate 90) or in 50 c.c. rubber-stoppered bottles. The preparation must be injected under the skin by means of a hypodermic syringe, and the dose rate is from 6-10 c.c. If the animal does not recover within 24 hours after the injection of a single dose, treatment should be repeated.

These drugs are very effective, particularly if given during the early stages, and evidence of recovery will usually be noted in less than 24 hours, with complete recovery in a few days.

In advanced cases, more difficulty may be experienced in effecting a recovery, and it may be necessary to give two or even three doses at 12-hourly intervals.

In some instances, owners should be able to anticipate outbreaks of tick fever—for example, when susceptible cattle are inoculated or moved onto tick-infested country—and they should be prepared to treat these cases before they become too advanced. A temperature of 105-106 deg. should be looked upon seriously, and the animal treated, particularly if it is showing any other signs of illness.

In the tick-infested area, any cattle which show signs of sickness and fever, without an obvious reason, should be suspected of developing tick fever and treated as a precautionary measure. No ill effect will result from the treatment if the animal is not suffering from tick fever. The drug, however, has no value as a preventive and will not be effective unless given when the animal is actually suffering from the disease.

If it is necessary to move animals to yards for treatment, they should be taken quietly, as over-driving aggravates the fever and may cause collapse and death.

If an outbreak occurs in travelling cattle, they should be spelled at some convenient place and the affected animals quietly drafted off for treatment.

Prevention and Immunisation.

It frequently happens that it is necessary to transfer susceptible cattle from tick-free to tick-infested areas, and unless certain precautions are taken in such cases losses are certain to occur following exposure of the animals to ticks.

This precaution may take the form of preventive inoculation (Plate 91) and/or treatment with a tick repellant dipping fluid, such as DDT solution. The DDT treatment would be satisfactory if the animals were being held for temporary periods in tick-infested country, and they would have to be treated at 7-day intervals. If the animals were to be held permanently on tick-infested pastures, inoculation would be necessary.

Inoculation consists of an injection of blood freshly drawn from a specially prepared animal (Plate 92.) Several systems of inoculation may be used according to circumstances.

The most satisfactory system consists of a double inoculation, using firstly piroplasm blood, which gives a relatively mild reaction, and about a month later babesiella blood, which fortifies the resistance produced from the first inoculation.

These inoculations are best carried out prior to exposure to tick infestation, so that the animals will have a strong resistance to tick-borne redwaters when subsequently exposed to ticks. If these inoculations are carried out in tick-infested country, it would be desirable to regularly dip the animals in DDT or similar preparations to minimise the risk of tick infestation until the reaction has passed.

It is not always practicable to undertake this double inoculation, so in many cases blood containing both these organisms is used. The risk of severe reactions is greater with this method, and unless precautionary measures are taken and the cattle are kept under close observation losses may occur.

Inoculation with a mild form of anaplasm may be combined with either of the above methods.

After inoculated cattle are exposed to ticks, they should be carefully watched for about one month. If no outbreak occurs within this time, it can be assumed that the inoculation has been successful and the animals will remain resistant.

Cows which are heavy in calf should not be inoculated, for a severe reaction may bring on abortion.

Plate 91.

Inoculating a Beast.—The method of inoculation is identical for both the preventive and the curative treatments.

Cattle Which Should be Inoculated.

Stud cattle which have been bred and maintained in tick free country until they are 12 months old or older should be inoculated prior to being transferred to tick-infested country. These inoculations are usually undertaken at the Animal Health Stations, under the supervision of Departmental officers.

Any cattle which have been bred or maintained in a tick-free area for more than 12 months should be inoculated before being transferred to tick-infested country. Blood for this purpose may be obtained from the Animal Health Stations, but it should be used within 24 hours of despatch from the laboratory.

If a large number of animals are to be inoculated, it may be more convenient to take a specially prepared bleeder to the place where the inoculation is to be done, and bleed it immediately before the inoculation.

Inoculations are also regularly carried out in the "marginal" country, and in any other area where the degree of tick infestation is light and subject to fluctuation.

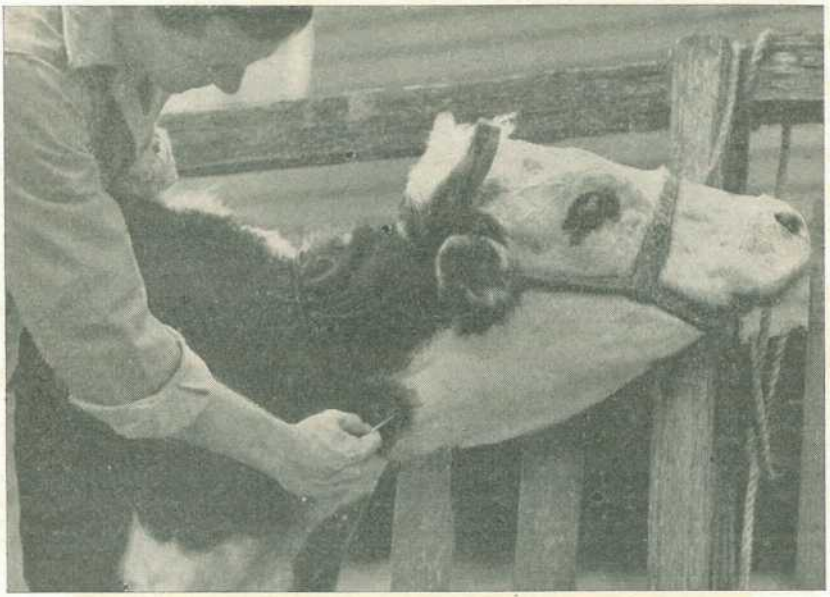


Plate 92.

DRAWING BLOOD FOR INOCULATION FROM A "BLEEDER."—The blood is taken from the jugular vein into a sterilized bottle.

Owners can frequently anticipate any marked increase in the degree of tick infestation and inoculate as a precautionary measure; in other cases, inoculations must be regularly practised each year to avoid losses.

Both blood and bleeders for this work can be obtained from the Animal Health Stations at Yeerongpilly (near Brisbane) and Oonoonba (near Townsville).

Noogoora Burr Poisoning of Cattle.

G. C. KENNY (Inspector of Stock, Gympie), S. L. EVERIST (Botanist), and A. K. SUTHERLAND (Senior Veterinary Pathologist).

NOOGOORA burr (*Xanthium pungens*) is one of the worst weed pests in Queensland. The Department's records show that Noogoora burr seedlings have frequently caused very heavy losses among cattle. In October, 1929, 11 of a herd of 55 dairy cattle died within a few days at Bundaberg and 42 head were lost on a farm at Goomeri. Deaths from Noogoora burr poisoning are recorded also as occurring at Proserpine in 1936, Mundubbera and Gympie in 1941, and Maleny in 1946. In September, 1949, 112 cattle (valued at £1,300) were lost in two days in the Gympie district from Noogoora burr poisoning. In the same month, 10 cows in two herds at Eumundi died from the same cause.

The purpose of this article is to record observations made on the recent outbreaks, to describe means of recognising the condition, and to suggest steps which should be taken to prevent loss from it.

Noogoora burr poisoning was studied experimentally at the Veterinary Research Station, Glenfield, N.S.W., in 1930.* These experiments showed that:

(1) Noogoora burr is poisonous to pigs, sheep and cattle, but only when in the very early stages of its growth, i.e. when the seed-leaves or cotyledons are still present on the plant.

(2) The lethal doses of the plant appear to be:

Pigs—2% of the body weight, or about 2 lb. for a 100 lb. pig.

Calves—1.8% of the body weight, or about 4 lb. for a 224 lb. calf.

Sheep—A considerably higher percentage of body weight.

(3) A lethal dose of the plant usually causes death in from 20-48 hours.

(4) Haemorrhagic inflammation is produced in the stomach and intestines.

(5) The poisonous principle appears to be confined to the cotyledons (seed-leaves).

DESCRIPTION OF PLANT.

Noogoora burr is an annual with coarse upright stems and spreading, broad, toothed alternate leaves on long stalks. The stems and leaves are rough to the touch. Although the plant often grows six feet high, it frequently produces large numbers of seeds when very much smaller.

Plate 93.

NOOGOORA BURR SEEDLING 24 HOURS AFTER EMERGENCE.—Note leaf bud between the spreading cotyledons.

* H. R. Seddon and R. O. C. King (1937)—N.S.W. Dept. of Agriculture Veterinary Research Report No. 7, pages 101-108.

The burrs are numerous, oval in shape, about one inch long, brown when ripe and covered with hooked spines. There are also two straight spines, like horns, at one end. The ripe burrs stick tightly to wool, hair and clothing and they float on water and so are distributed over a wide area. The plant grows most abundantly on river and creek flats which are subject to flooding.

Each burr contains two seeds. One of these usually germinates in the first favourable season after it is shed, the other in a subsequent season. Rarely do both seeds germinate at the same time.

Germination takes place in warm weather following soaking rain, usually between the beginning of September and the end of March. Seedlings appear in from 4 to 9 days after suitable rain. At first they consist of two narrow, thick, smooth, tender, dull-green seed-leaves (called cotyledons) spreading out from the top of a soft sappy stalk (Plate 93). The cotyledons are about one inch long, but grow rapidly to about two inches. They are $\frac{1}{4}$-$\frac{1}{2}$ inch wide, blunt at the end, broadest below the middle and taper to a thick, flattened stalk at the base.

Plate 94.

NOOGOORA BURR SEEDLING THREE DAYS AFTER EMERGENCE.—Note the two true leaves with toothed margins.

Shortly after the cotyledons appear, the first true leaves emerge from between them. The true leaves are thinner in texture and somewhat rough because they are covered with short, bristly hairs. They are broader than the cotyledons and their edges are toothed (Plate 94). As the plant grows the leaves become larger and more of them are produced. The cotyledons, too, increase in size for a few days, then turn yellow and wither, usually when the plant is about two weeks old and carrying four to six expanded true leaves.

OBSERVATIONS ON RECENT OUTBREAKS.

Outbreaks of Noogoora burr poisoning occurred, as has been stated, in the Eumundi and Gympie districts during 1949. At Gympie, where 112 cattle died, 19 herds were affected. Deaths were first recorded on 15th September, and the following morning a warning to all farmers was issued from the local radio station. Most farmers quickly moved their herds from burr-infested areas, so that losses occurred on 15th and 16th September only. The few herds that were not quickly shifted sustained losses up to a week later.

One farmer, after losing four cows on 15th September, removed his herd from the dangerous paddocks. He had no further losses for two days. Then the herd again gained access to burr seedlings and three more cows died in the next 24 hours. The cattle were again removed from the infested paddocks and there were no more deaths.

The outbreak of Eumundi caused the death of 10 cows in two herds, the deaths occurring on 12th, 13th and 14th September. In the following month cases were reported in a herd at Wandoan and in one near Brisbane.

Symptoms.

In some herds which appeared healthy at milking time, cattle were found dead when mustering for the next milking. In others, cows which appeared healthy when milked developed symptoms within a couple of hours, then collapsed and soon died.

In the early stages there were signs of excitement, nervousness and trembling, which rapidly developed into a nervous twitching or tetany. Some affected animals would charge when approached. They were very restless and the movements were jerky and the gait stilted. Abdominal pain was shown by occasional kicking at the abdomen. Some animals salivated freely.

Animals soon went down, apparently in great pain, and usually lay flat on their sides. There were muscular spasms involving the whole of the body and limbs. The skin was extremely sensitive and if touched on any part the animal would flinch violently. There was a good deal of groaning and repeated kicking. At times the beast half rolled on its back as it kicked. This rolling may account for the lack of signs of struggling around some of the carcases. In these cases the beast probably kicked at the air instead of the earth so that the undisturbed state of the ground was not necessarily indicative of a painless death. Again, even in instances where the ground had not been torn by the hoofs, marks had usually been made by the movements of the head. In other cases there was evidence that the ground had been kicked a good deal during struggling before death.

Death usually occurred about two hours after going down. There was no scouring, although post-mortem examinations revealed severe inflammation of the intestine.

Course of the Disease.

Cattle poisoned by Noogoora burr usually die within 12 hours. In one herd, however, deaths continued to occur 48 hours after the cattle had been removed from the burr. Four cows had died in this herd before they were shifted, but no animal was noticeably sick when they were taken from the infested pasture. In another herd a few cows recovered without treatment, although they were sick when the herd was removed from the burr-infested pasture.

Post-mortem Findings.

The carcases bloated rapidly after death and rigor mortis occurred quickly. At times carcases bloated to such an extent that the skin burst and the eyes were forced from their sockets.

In the abdominal cavity there were often many small and large haemorrhages on the outer surfaces of the stomach and intestines. The lining of the abomasum showed in some cases intense inflammation, in others moderate diffuse discolouration (congestion) with a few haemorrhages, and in others no departure from normal.

In almost all cases the small and large intestines were acutely inflamed, showing intense reddening and many haemorrhages of the mucous lining.

Lesions noted in the liver in certain cases were swelling of the whole organ, small scattered haemorrhages or brown (necrotic) spots. Haemorrhages were often present on the lining of the gall bladder and sometimes this organ was surrounded by a gelatinous exudate.

In most affected animals the heart had many small and large haemorrhages on both the internal and external surfaces.

In all cases examined, the bladder was distended with urine, suggesting that burr poisoning may interfere with ability to urinate.

Diagnosis.

Although there are certain rather striking features about the symptoms and post-mortem findings in Noogoora burr poisoning of cattle, it might be confused with poisoning caused by other plants or by arsenic. When cases of acute abdominal pain and death after a short illness occur a few days after rain in the warm months of the year, Noogoora burr poisoning should be suspected.

The important point in diagnosis is, of course, evidence that cattle have grazed on Noogoora burr seedlings. Although it is sometimes possible for a botanist to identify the seedlings in the paunch contents, the plants are soft and are therefore easily disintegrated by chewing and digestion.

Nature of the Toxin.

The toxin (poison) present in the cotyledons of Noogoora burr seedlings has not been definitely identified but it is evidently a substance (possibly a glycoside) having a rapid and intensely destructive action on the intestines, liver and heart. Although some samples of

seedlings contain prussic acid, this is not always so, and in any case the symptoms and post-mortem findings are *not* those of prussic acid poisoning.

TREATMENT AND PREVENTION.

The first and most important step in treating sick animals and in preventing further cases is to remove the herd from paddocks containing burr seedlings. After two to three weeks cattle can be returned to such paddocks if the seedlings have grown to the stage where the cotyledons have withered and dropped off the plants. It should be noted, however, that repeated storms in warm weather may bring up fresh crops of young seedlings.

As the poisonous principle in the cotyledons is not known, no specific antidote can be recommended. In fact, the rapid course of the disease would seriously limit the possibility of successful treatment.

NOOGOORA BURR POISONING OF PIGS.

Although the experiments done at the Veterinary Research Station at Glenfield showed that pigs are even more susceptible to Noogoora burr poisoning than cattle, natural cases have been rare among pigs in Queensland. The death of 15 pigs aged 4 to 12 weeks on a farm in the Biloela district is therefore worthy of record. The outbreak was described by Mr. C. V. Lilley, Inspector of Stock, on 17th September, 1949, as follows:—

"The pigs grazed on a cultivated field completely covered with a mat of Noogoora burr up to three inches high and were seen eating the burr seedlings. Pigs first developed a stagger and eventually lapsed into a coma in which they were partly conscious. Death occurred within 12 hours after the first symptoms were noticed. Some animals vomited and others had severe diarrhoea. Post-mortem findings were generalised jaundice, swollen liver, pale soft kidneys and thick dark urine. Deaths occurred up to 15 hours after the pigs were denied access to the burr seedlings."

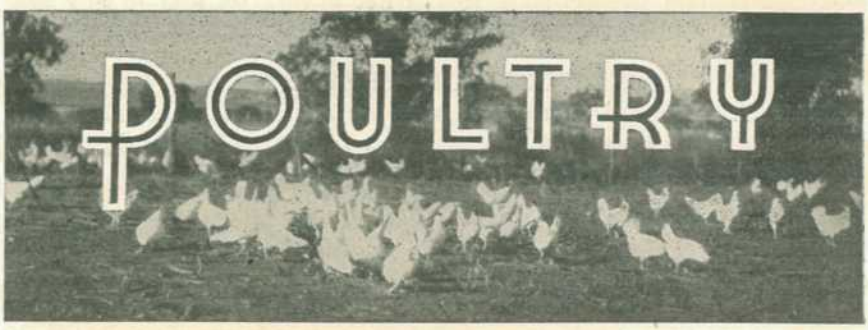
ERADICATION OF NOOGOORA BURR.

The plants can be destroyed by spraying with hormone weedkillers. One crop of burrs can produce at least two crops of seedlings, so it is necessary to spray each crop as it appears. If this is done, the weed can be brought under control quickly. Noogoora burr is susceptible to hormones at all stages of its growth but treatment is cheaper and more effective if it is done when the plants are young. Hormone weedkillers are not poisonous to animals but precautions should be taken to avoid damage to crop plants such as lucerne. Grasses are not killed by the spray.

For killing Noogoora burr the Department of Public Lands offers hormone weedkillers at cost price, freight free to the nearest railway station. Applications should be sent to the Secretary, Land Administration Board, Brisbane, with the following particulars:—

(*a*) Name of property.
(*b*) Rail centre for despatch of supplies.
(*c*) Quantity required.
(*d*) Area and density of Noogoora burr and/or Bathurst burr to be treated.

A free pamphlet giving full information on the eradication of Noogoora burr is available also by request to the Department of Public Lands.



Breeds of Fowls.

P. RUMBALL, Officer in Charge, Poultry Branch.

(*Continued from page 367 of December issue.*)

THE AUSTRALORP (Plate 95).

Queensland Standard as adopted by the Australorp Society, the National Utility Poultry Breeders' Association (Queensland Branch), and the United Poultry Club of Queensland.

Head.—Medium in size; skull fine with no fullness over the eyes; beak of medium length, strong and slightly curved; colour black; 5 points.

Eyes.—Full, prominent and expressive, dark-brown iris, the darker the better: 5 points.

Comb, Wattles, and Lobes.—Medium size, smooth and fine in texture; bright red in colour: comb erect, evenly serrated, and following the curve of the head; wattles neatly rounded; lobes well developed: 5 points.

Face.—Bright red, fine, not sunken, and as free from feathering and wrinkles as possible: 5 points.

Neck.—Medium length; slightly curved, and profusely feathered.

Body, Skin, and Abdomen.—Body deep, broad-backed, and of good length, breast of medium depth, broad and nicely rounded, keel straight, and of moderate length, the whole giving a well-balanced appearance; wings well formed and carried close to body; skin, white texture of finest quality; the abdomen to be elastic and full, but avoiding indications of excessive fat or abdominal weakness: 35 points.

Tail.—Medium length, angle about 35 degrees in the male and 20 degrees in the female: 5 points.

Legs.—Medium length, strong, and wide apart; shanks fine in bone and scale, free from feather or fluff; toes straight and well spread; legs and upper portion of feet slate to black; sole of feet white: 5 points.

Plumage.—Soft, close, avoiding fluff and looseness; colour black, with green sheen: 7 points.

Condition.—As indicated by general health, cleanliness of feathers and legs: 10 points.

Carriage.—Erect and graceful—that of an active bird: 10 points.

Weight.—Cockerel, 7 lb. to 8 lb.; cock, 8 lb. to 9 lb.; pullet, 5 lb. to 6 lb.; hen, 6 lb. to 7 lb.: 5 points.

Total: 100 points.

Disqualifications.—Side sprigs, any deformity.

Serious Defects.—White in lobes.

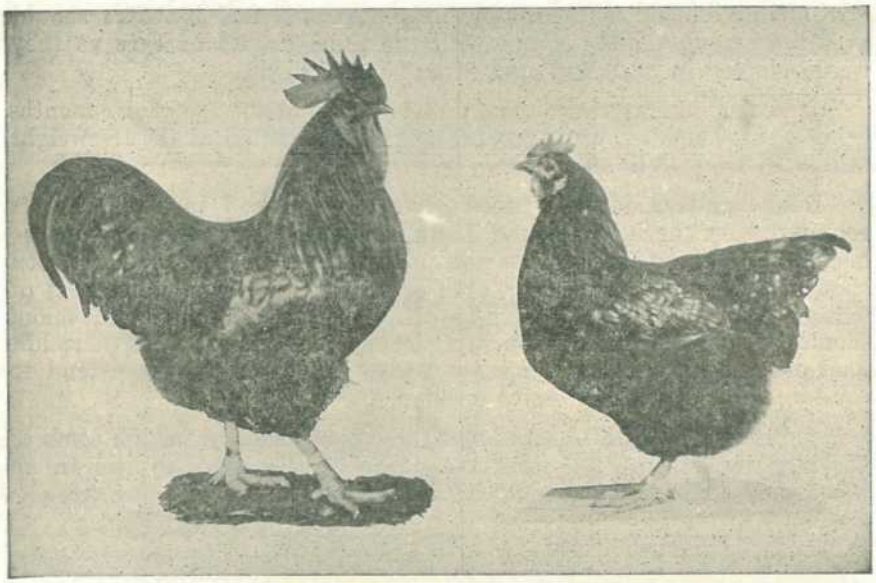


Plate 95.
AUSTRALORPS.

The Australorp has been evolved by a process of selection by Australian breeders from the breed originally known as the Orpington. The Orpington was evolved by Cook, of Kent, in England. Cook states that this breed was made up as follows:—Minorca male mated to a Black Rock female. The female from that mating was mated with Langshan males. The Minorcas used were birds carrying red lobes, and the Langshans were clean-legged.

The Orpington as made by Cook was very little different from the Australorp of to-day. It was a breed made for its dual-purpose qualities. Unfortunately, the original Orpington was developed along certain lines by the fancier until it reached a stage when it was of little or no commercial value to the poultry raiser. Those who were interested in the breed from a commercial point of view, however, did not follow the popular trend and, in order to have something distinct from the show-breed, termed their stock "Utility Orpingtons." From observations it was found that the longer-bodied, closer feathered birds were more productive than other types and breeders therefore selected for these characteristics. It is considered that it is only in these two features that there is any outstanding difference between the Australorp and the Orpington as originally made by Cook.

The Australorp is the most popular dual-purpose fowl in Australia, being a particularly good egg-producer, especially during the first year's production, and at the same time carrying table qualities that are appreciated.

Constant selection has given the industry strains of Australorps in which broodiness is most rare, although the breed is classed as a sitting breed. As no standard existed until 1930, there is considerable variation in types as well as in weight. The weights as laid down by the standard

give a bird of sufficient size for table purposes, and breeders should avoid exceeding these weights with the same degree of care as they would employ in guarding against undersized birds.

It is a rapid-maturing breed, pullets laying at the age of five months being not uncommon, while cockerels can be marketed at the liveweight of 6 lb. at from 18 to 20 weeks.

The standard for the breed gives a very good idea of what is required. As the Minorca and Langshan were used originally in the make-up of the Orpington, avoid using birds in the breeding pen showing any whiteness in ear-lobes or feathers on legs. Closeness of feather is desired. Therefore, in breeding, females with obvious cushions should be avoided. A common fault among males is the profuse saddle hackle standing out well from the body. Males of this type tend to produce females with excessive cushion.

In many strains of Australorps there is a tendency for the comb of the bird, instead of following the curve of the head, to run in an upward direction. This should be selected against in breeding stock.

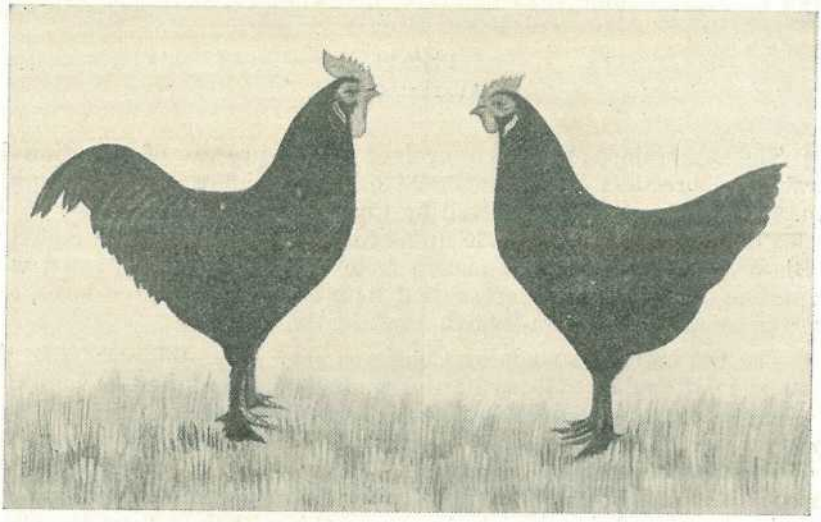


Plate 96.
CHINESE LANGSHANS.

CHINESE LANGSHANS (Plate 96).

General Characteristics.

THE COCK.

Head.—Skull small and full over the eyes. Beak fairly long and slightly curved. Eyes large. Comb single, medium size, straight and upright, showing good clearance back of head, free from side sprigs, evenly serrated with five or six spikes of fine texture. Ear-lobes and wattles medium size. Face to be clean.

Neck.—Of medium length, with a full flowing hackle.

Body.—The back fairly broad, flat, of medium length, saddle abundantly furnished with hackles; breast fairly deep and well-rounded from shoulder to shoulder, not flat; breast-bone straight, with keel level. Wings of medium length, closely carried.

Tail.—Of medium size, carried gradually up and outwards to an angle of about 35 degrees, and medium width, fairly close, furnished with plenty of tail coverts and two secondaries and two sickle feathers slightly longer.

Legs.—Thighs medium length covered with short soft feathers. Shanks of medium length, small-boned, standing well apart and feathered down the outer sides (not too heavily or too scantily).

Feet.—Toes (four) straight, slender, and well-spread, the outer toe being feathered.

Carriage.—Graceful, neat, and extremely active.

THE HEN.

The general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Colour.—Beak light to dark-horn, not white. Eyes dark-brown. Face free from feathers. Wattles and ear-lobes to be brilliant red. Legs and feet blue-black, showing pink between the scales; the web and bottom of feet pink-white (the deeper the pink the better); toe-nails white.

Plumage.—Dense black with a brilliant beetle-green gloss free from purple or blue tinge, medium texture, not too tight like the Game, not so loose as the Cochin.

Weight.—Cock, 6½ lb.; cockerel, 5½ lb.; hen, 5½ lb.; pullet, 4½ lb. minimum.

Eyes.—Dark-brown or black.

Serious Defects.—Yellow legs; white beak or yellow eyes; five toes; permanent white in the ear-lobes; slate or blue legs in young birds; white feathers; vulture hocks; wry tail; squirrel tail; lop combs; side sprigs; crooked breast-bone amounting to deformity. Deduct up to 5 points for feathers on middle toes. It might be added that the female shape should be free from lumpy or squat appearance, and that the back should be devoid of cushion or fullness at saddle.

The Langshan undoubtedly originated in China, where it has been bred for centuries. The name is derived from the district of Langshan, in China. Major Croad, after whom a variety is named, first introduced this breed into England in 1872. The first introduction of Langshans into Australia is unknown.

Langshans are good table fowls, and the variety known as Chinese or Australian is noted for its egg-laying qualities. This variety has proved itself by repeatedly laying the highest number of eggs in the heavy breed sections of egg-laying competitions. In this regard it is quite comparable with the Australorp. The breed is not so popular as the Australorp, possibly because of the fact that the birds are smaller.

The Chinese Langshan is a very compact bird, exceptionally alert and active, whilst the feathering is fairly close or tight. The face is usually exceptionally free from feathering and bright red—a good feature that should not be overlooked when selecting breeding birds.

The standard calls for black plumage with beetle-green sheen. As this is not difficult to obtain, birds with purple or bluish sheen should not be used.

Common faults that may be found are light-coloured eyes, feathers on the middle toe, and white feathers. These are features which should be guarded against in the selection of breeding birds.

RHODE ISLAND REDS (Plate 97).

General Characteristics.

THE COCK.

Head.—Skull strong but not thick. Beak curved, moderately long. Eyes large and bright. Comb (*a*) single or (*b*) rose; (*a*) medium size, upright, straight and firmly set, with five even serrations; (*b*) low and firm, oval top covered with small points and terminating in a small spike, following the curve of the head. Face smooth. Ear-lobes fine texture, well developed and pendant. Wattles of medium size and moderately rounded.

Neck.—Of medium length and profusely covered with hackle flowing over the shoulders, but not too loosely feathered.

Body.—Fairly deep, broad and long, but a distinct oblong rather than square; broad and full breast; long back, horizontal except where the neck hackle flows over the shoulders and the saddle gently rises; large wings well folded and the flights horizontal; fairly small tail, sickles passing a little beyond the main feathers, well spread, and carried somewhat low (but by no means drooping) to increase the apparent length of the bird.

Legs.—Of medium length; large thighs; well-rounded shanks free from feathers. Toes (four) straight, strong, and well spread.

Carriage.—Alert, active, and well balanced.

Weight.—8½ lb., cockerel, 7½ lb.

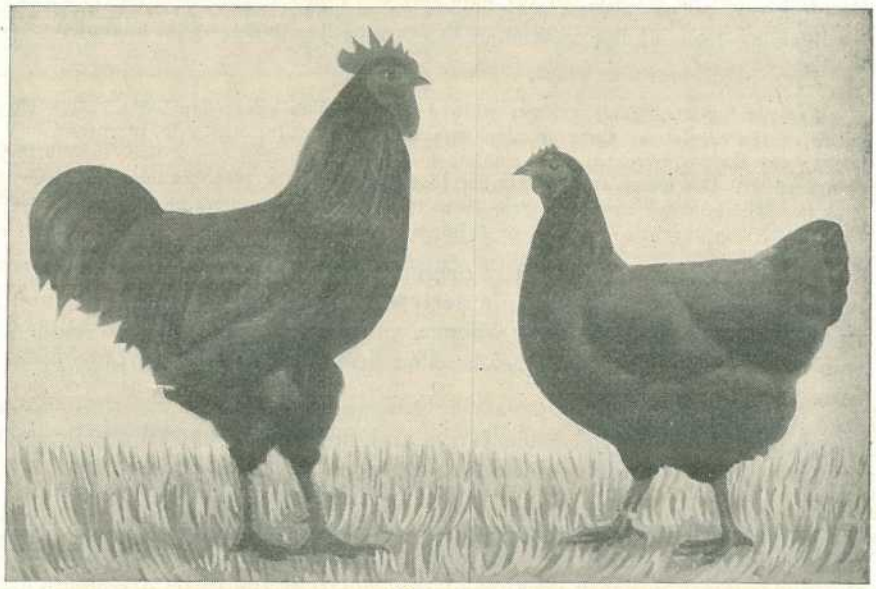


Plate 97.
RHODE ISLAND REDS.

THE HEN.

The general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Weight.—6½ lb.; pullet, 5 lb.

Colour.

Beak red-horn or yellow. Eyes red. Comb, face, ear-lobes, and wattles brilliant red. Legs and feet yellow or red-horn.

Plumage of Cock.—Hackle red, harmonising with the back and breast. Wing primaries, lower web black, upper red; secondaries, lower web red, upper black; flight coverts black; bows and coverts red. Tail (including sickles) black or green-black; coverts mainly black, but may be russet or red as they approach the saddle

Remainder, general surface rich brilliant red, except where black is specified, free from shafting, mealy appearance, or brassy effect; depth of colour (red) is slightly accentuated on wing bows and back, but the least contrast between these parts and the hackle or breast the better, a harmonious blending desirable. The bird should be of so brilliant a lustre as to have a glossed appearance. The under-colour and quills of the feathers should be red or salmon. With the saddle parted showing the under-colour at the base of the tail, the appearance should be red or salmon, not white or smoke. Black or white in the under-colour of any section is undesirable. Other things being equal, the specimen having the richest under-colour shall receive the award.

Plumage of the Hen.—Hackle red, the tips of the lower feathers having a black ticking but not a heavy lacing. Tail black or green-black. Wings as in the cock. Remainder, general surface lighter and more even than in the male, free from shafting or mealy appearance, and except where black is specified a rich even shade of bright red, not as brilliant a lustre as the male. The under-colour and quills of the feathers should be red or salmon. Black or white in the under-colour of any section is undesirable. Other things being equal, the specimen having the richest under-colour shall receive the award.

Scale of Points.

Colour (plumage, &c., 25, eyes 5)	30
Type, including size	30
Quality and texture	15
Head	10
Condition	10
Legs	5
	100

Serious Defects.—Feather or down on shanks or feet, or unmistakable indications of a feather having been plucked from the same; badly lopped combs, side sprig or sprigs on the single comb; entire absence of main tail feathers; two absolutely white (so-called wall or fish) eyes; a feather entirely white that shows in the outer plumage; an ear-lobe showing more than one-half the surface permanently white (this does not mean the pale ear-lobe, but the enamelled white); shanks and feet other than yellow or red-horn; any deformity.

The Rhode Island Red is an American breed which originated on the shores of Narragansett Bay, in the State of Rhode Island. The farmers in that district, with the object of improving the vigour and table qualities of common farm flocks, engaged in crossing. The birds introduced for this purpose were Cochin, Brown Leghorn, Malay, and Wyandotte. The result of crossing and selection evidently interested serious-minded breeders in the bird, with the result that in 1901 a standard was drawn up and in 1904 the breed was admitted to the American standard of perfection.

An outstanding character of the Rhode Island Red is its constitution, the bird being of a very hardy nature. It possesses excellent table qualities and matures fairly rapidly, although chickens hatched later than August appear to lag. This may be a matter of individual strain. Although the breed is used extensively in some parts of the world for commercial purposes, such is not the case in Queensland. It has been, in the main, a fancier's bird. Colour and size as aimed for on the show bench are probably responsible for the fact that less effort has been made to improve its prolificacy. It is a breed well worth greater attention being given to its production ability by commercial breeders.

In breeding, select standard weight birds. Oversized birds are invariably poor producers, and as there appears a tendency for the breed to revert to the smaller-sized birds of its ancestry, under-sized birds should not be used.

The body of the Rhode Island should approach in shape a rectangle. It should be carried level and the line of the back kept horizontal. The wings should have no tendency to drop but should be carried on a level with the back. The back should be flat from front to rear and

also from side to side. It needs to be wide, and the width carried the full length of the body. The breast should be full and prominent to fill in the rectangular shape. A perpendicular line from the breast should meet the base of the beak. The bird should be well balanced, with legs under the centre; shanks fairly stout and of medium length, stiltiness to be avoided.

Colour of eye in females tends to fade with production, and some good-eyed birds as pullets will have pale or greenish eyes as hens. Old birds with good eye colour are most valuable breeders. Select against dark or blackish streaks in beaks, as this fault is troublesome. Do not breed from extremely dark males, as females from this mating will invariably be mottled. Matings should consist of rich snappy coloured males of even shade in hackle, wing-bows, and saddle, and females which are dark rich and even in colour. In addition to depth of colour the plumage should be lustrous bright and alive and not a dead brown or chocolate.

With age white may appear in the back and saddles of males, but if the bird was sound as a cockerel it is not a very serious defect. Very few hens approach closely their pullet colour. Those that do are most desirable breeders.

[TO BE CONTINUED.]

Protecting Infants From Disease.

Danger From Flies.

THE dangers arising from the housefly are due to its promiscuous feeding habits and its intimate association with man. It will walk over and feed upon the faecal desposits in a privy, the refuse in a garbage can, the pastries in a cake shop and the food in the kitchen and pantry with equal impartiality and in turn will convey infective agents secured from the excreta to food during its journey. Hence it is often responsible for the spread of such intestinal infections as typhoid, dysentery and gastro-enteritis. Therefore it is imperative that you do all that is humanly possible to keep the fly menace at bay and there are several weapons at your disposal.

The fly breeds mainly in manure piles, including human faeces, and in decaying vegetable matter. Its entire life cycle is usually completed in from ten to fourteen days and therefore open and exposed manure heaps should not be permitted to represent over a week's accumulation, and the same applies to garbage. Another solution to this problem is afforded by the treatment of manure piles with substances which destroy the larvae. Stables and cow sheds should have tight floors and be well cleaned.

Trapping and otherwise catching the adult flies, particularly if practised at the beginning of the breeding season, if of distinct merit. Sticky fly paper and the swatter should be used in every home and eating house, and the screening of all doors and windows is another useful method of keeping flies at bay. There are also various lethal sprays containing DDT and other substances, and these provide another effective method of attack.

The activity of flies as conveyors of disease organisms from excreta gives opportunity to reiterate the importance of collecting human excreta in privies that are of *fly-tight* construction. It is essential to keep baby well protected from flies and other insects, so don't forget to cover his cot, basinette or pram with a net at all times. Anything that goes in baby's mouth should also be kept scrupulously clean and protected from contamination.

All foodstuffs and baby's milk imperatively must be kept covered with some dustproof material and stored in a cool, airy place. All milk and water intended for baby's use should be boiled and all receptacles scalded before use.

—Maternal and Child Welfare Service.

ASTRONOMICAL DATA FOR QUEENSLAND.

APRIL, 1950.

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

TIMES OF SUNRISE AND SUNSET.

At Brisbane.		
Date.	Rise.	Set.
	a.m.	p.m.
1	5.57	5.47
6	6.00	5.41
11	6.03	5.35
16	6.05	5.31
21	6.08	5.26
26	6.10	5.21
30	6.12	5.18

MINUTES LATER THAN BRISBANE AT OTHER PLACES.

Place.	Rise.	Set.	Place.	Rise.	Set.
Cairns	21	37	Longreach ..	31	39
Charleville	26	28	Quilpie	36	34
Cloncurry	44	56	Rockhampton ..	7	14
Cunnamulla ..	30	28	Roma	16	18
Dirranbandi ..	20	18	Townsville ..	18	32
Emerald	15	23	Winton	35	44
Hughenden ..	29	41	Warwick	5	3

TIMES OF MOONRISE AND MOONSET.

At Brisbane.		
Date.	Rise.	Set.
	p.m.	a.m.
1	4.47	3.47
2	5.21	4.52
3	5.57	5.59
4	6.35	7.08
5	7.18	8.19
6	8.07	9.31
7	9.02	10.42
8	10.03	11.48
		p.m.
9	11.07	12.47
10	..	1.37
	a.m.	
11	12.10	2.20
12	1.12	2.56
13	2.10	3.27
14	3.06	3.56
15	3.59	4.23
16	4.52	4.50
17	5.44	5.18
18	6.37	5.48
19	7.32	6.21
20	8.28	6.58
21	9.24	7.41
22	10.20	8.29
23	11.14	9.23
	p.m.	
24	12.04	10.21
25	12.49	11.23
26	1.30	..
		a.m.
27	2.07	12.45
28	2.42	1.27
29	3.15	2.31
30	3.49	3.26

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

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

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

Date.	Emerald.		Longreach.		Rockhampton.		Winton.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	17	23	32	39	8	14	37	44
6	30	11	45	25	20	0	53	28
11	29	12	44	26	19	1	52	29
16	18	21	34	38	9	12	38	43
21	10	30	25	45	0	21	27	53
26	12	26	27	42	2	17	30	49
30	21	19	37	35	12	10	43	39

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

Date.	Cairns.		Cloncurry.		Hughenden.		Townsville.	
	Rise.	Set.	Rise.	Set.	Rise.	Set.	Rise.	Set.
1	24	37	46	56	31	41	21	32
3	37	24	55	46	40	32	31	21
5	48	11	63	38	48	23	40	11
7	56	3	68	32	52	18	46	4
9	55	2	68	32	51	17	45	3
11	52	8	66	36	50	21	43	8
13	42	19	58	43	43	28	35	17
15	32	29	52	50	36	35	26	25
17	21	39	46	57	29	42	18	34
19	12	48	38	62	23	48	11	40
21	5	55	35	67	19	52	5	45
23	1	56	32	67	16	53	2	46
25	6	50	35	63	20	49	6	42
27	16	45	41	60	26	46	14	37
29	27	34	49	54	33	39	23	29
30	34	28	53	49	38	34	28	24

Phases of the Moon.—Full Moon, 3rd April, 6.49 a.m.; Last Quarter, 9th April, 9.42 p.m.; New Moon, 17th April, 6.25 p.m.; First Quarter, 25th April, 8.40 p.m.

On 15th April the Sun will rise and set 10 degrees north of true east and true west respectively and on the 2nd and 15th the Moon will rise and set respectively at approximate true east and true west.

On the morning of 3rd April there will be a total eclipse of the Moon but from Queensland the beginning will be seen only an hour or so before the Moon will set and only a partial eclipse will be seen from this State.

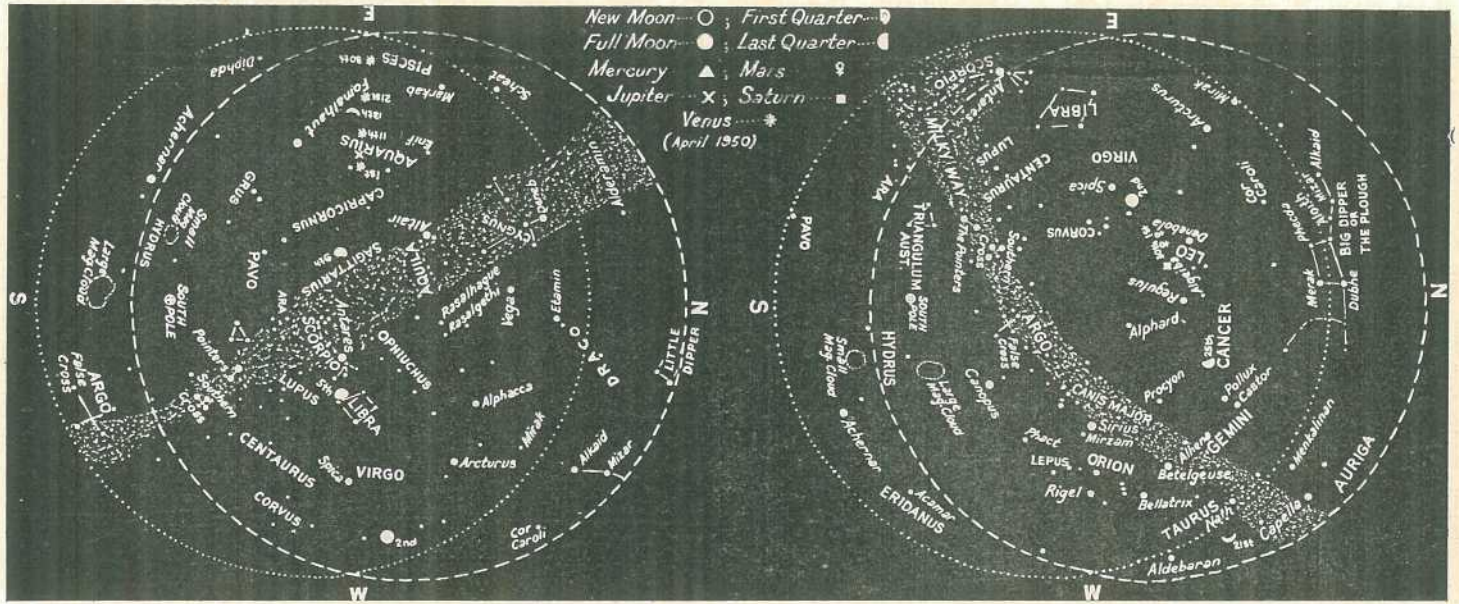
Mercury.—It will remain an evening object all this month. At the beginning, in the constellation of Pisces will set 13 minutes after the Sun and on the 23rd, in the constellation of Aries will reach its greatest angle east of the Sun when it will set nearly an hour after sunset. At the end of the month, in the constellation of Taurus will set 50 minutes after the Sun.

Venus.—On the 11th of this month will reach its greatest angle west of the Sun when it will rise 3½ hours before sunrise. At the beginning and end of the month it will rise 3 hours 25 minutes before the Sun. Before they rise on the 6th, Venus will pass 2 degrees to the north of Jupiter.

Mars.—Which will remain in Virgo during the month, on the 1st will rise half an hour before sunset and at the end of the month will rise during mid-afternoon and set during the early morning hours.

Jupiter.—At the beginning of April, in the constellation of Capricornus, will rise between 2.45 a.m. and 4 a.m. while at the end of the month, in the constellation of Aquarius, will rise an hour or so after midnight.

Saturn.—Now well up in the eastern sky at nightfall. On the first setting 1¾ hours before sunrise and on the 30th setting 2 or 3 hours after midnight.



Star Charts.—The chart on the right is for 8.15 p.m. in the south-east corner of Queensland to 9.15 along the Northern Territory Border on the 15th April. (For every degree of Longitude we go west, the time increases by 4 minutes.) The chart on the left is for 8 hours later. On each chart the dashed circle represents the horizon as viewed from Cape York and the dotted circle is the horizon for places along the New South Wales Border. When facing North hold "N" at the bottom, when facing South hold "S" at the bottom and similarly for the other directions. Only the brightest stars are included and the more conspicuous constellations named. The stars which do not change their relation to one another, moving east to west, arrive at any selected position about 4 minutes earlier each night. Thus, at the beginning of the month, the stars will be in the positions shown about 1 hour later than the time stated for the 15th and at the end of the month about 1 hour earlier than that time. The positions of the Moon and planets which are continually changing in relation to the stars are shown for certain marked days. When no date is marked the position is for the middle of the month.