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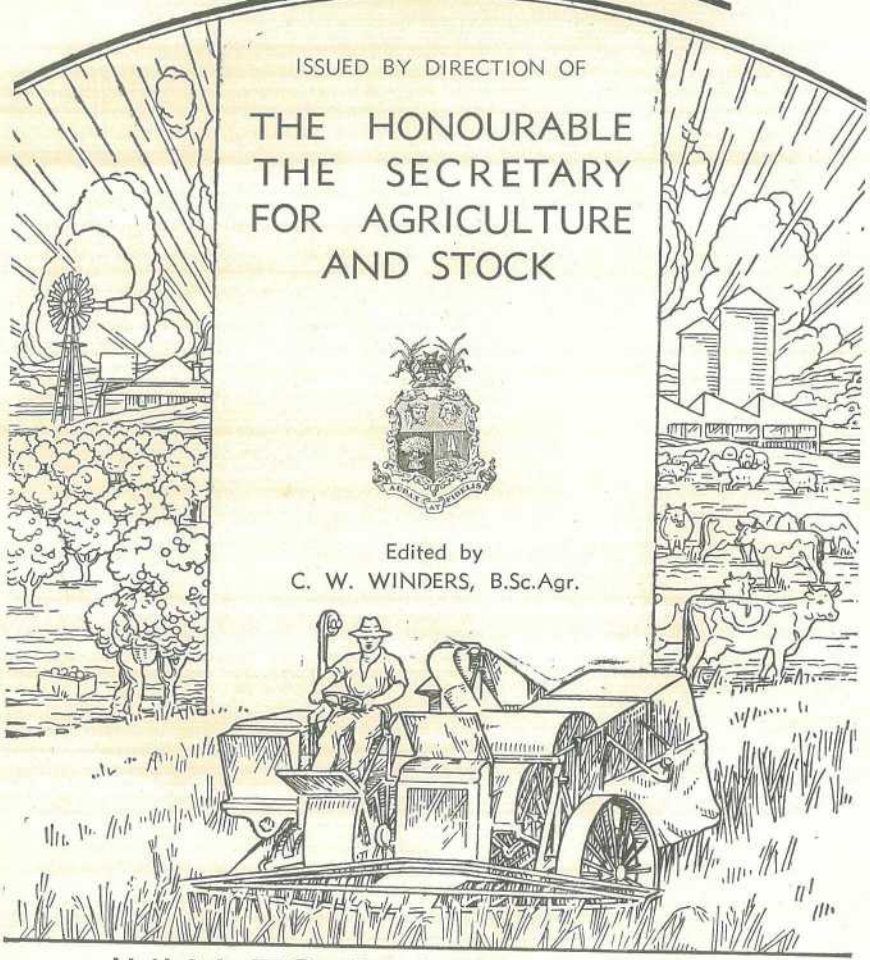

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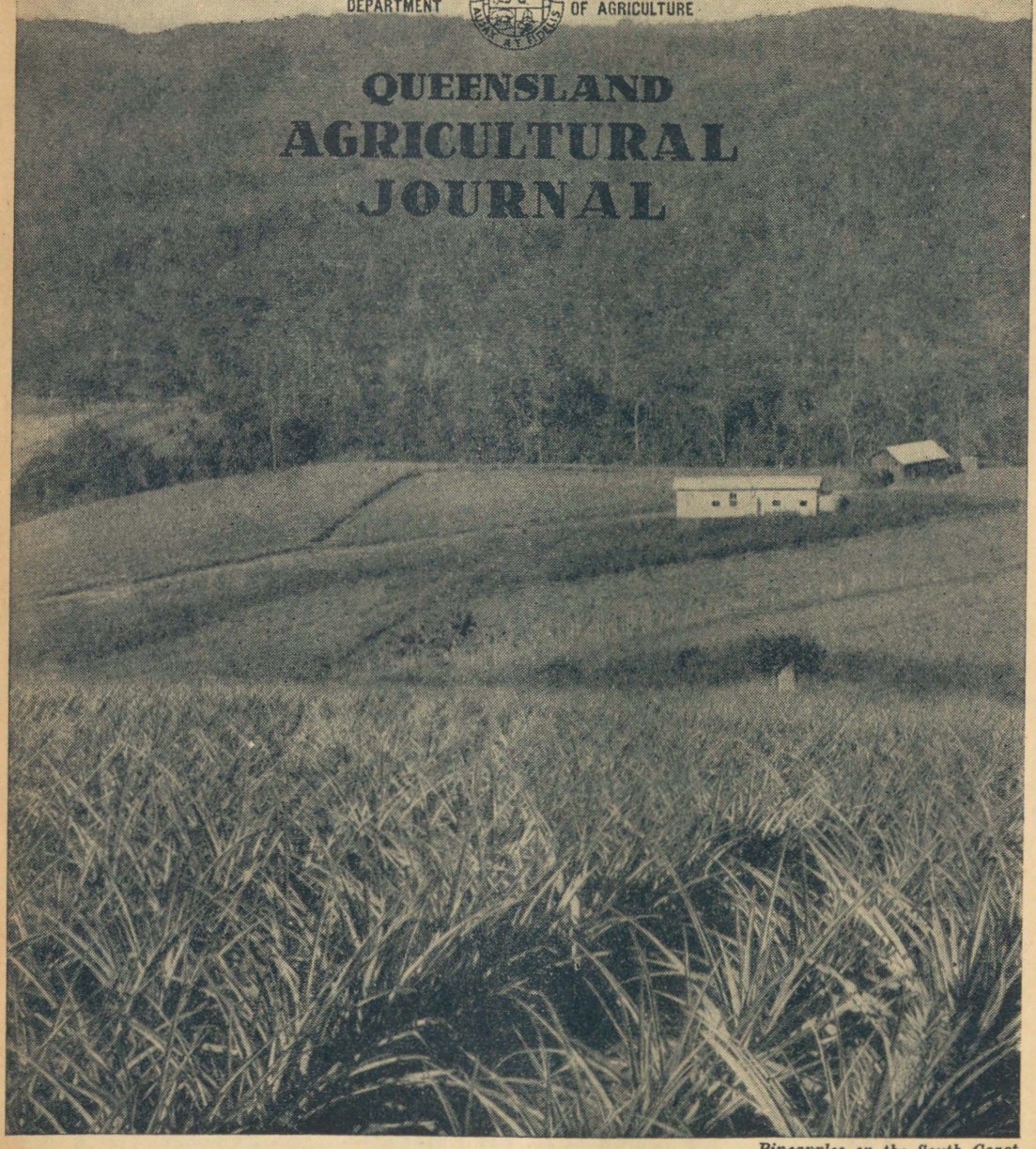

*Pineapples on the South Coast.*

## LEADING FEATURES

Pests of Hives and Bees
Collar Rot of Apples
Trap Gate for Cattle
Lucerne Price Movements
Pig Feeding and Carcase Quality

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# Pests of the Hive and Honeybee.

C. ROFF (Adviser in Apiculture) and A. R. BRIMBLECOMBE (Entomologist), Science Branch.

BEES, like most other living creatures, are subject to attacks by a number of enemies. Some of these take toll of the adult bees; others attack the brood, the comb or the hive. Although depredations on living bees are of casual occurrence, damage to combs and hives can become extensive and seriously affect the beekeeper's returns. This can be largely avoided, however, by the adoption of preventive or control measures.

## WAX MOTHS.

Two closely related moths, the larger wax moth and the lesser wax moth, are by far the most troublesome apiary pests in all parts of Queensland. The former is the more destructive, and although the information given below relates particularly to it, the lesser wax moth has similar habits and may be controlled by the same methods.

### Life History and Habits.

Wax moths (Plate 1, figs. 5 and 6) are fawn coloured and have a wingspread of 1-1¼ in. They are most active after dusk, when the females enter hives by evading the guard bees, especially in the weaker colonies. A female may lay many hundreds of eggs, depositing them in masses in the darker places in the hive, mostly on the combs and between hive parts. The eggs (Plate 1, figs. 1 and 1a) are very small, globular in shape and white in colour. These hatch in about eight days, giving rise to small, pale-coloured larvae or grubs, which immediately tunnel into the comb, mainly to the position of the midrib. The tunnels are evident by broken cells (Plate 2) and are lined with silken webbing which assists the grubs to evade the bees when attacked by them. Larval movements within the tunnels are plainly visible when infested comb is held up to the sunlight.

The grubs are essentially pests of beecombs, but may also damage brood, frames and the hive. By tunnelling in the region of the midrib, they destroy the bases of the cells and ultimately may cause collapse of the comb (Plate 3 b). Sometimes the grubs work along the surface of the cells and expose the brood, or cause honey to leak out.

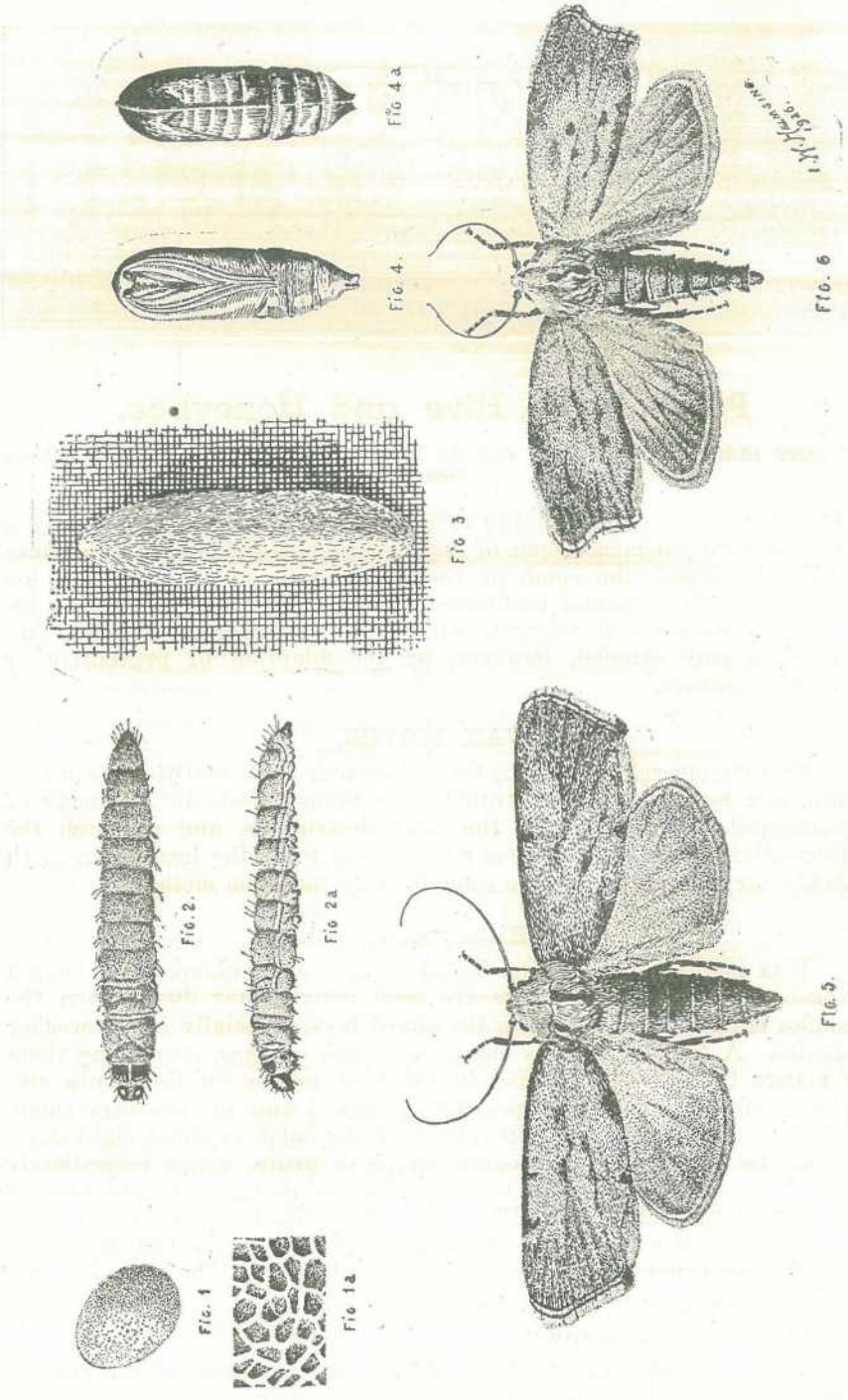


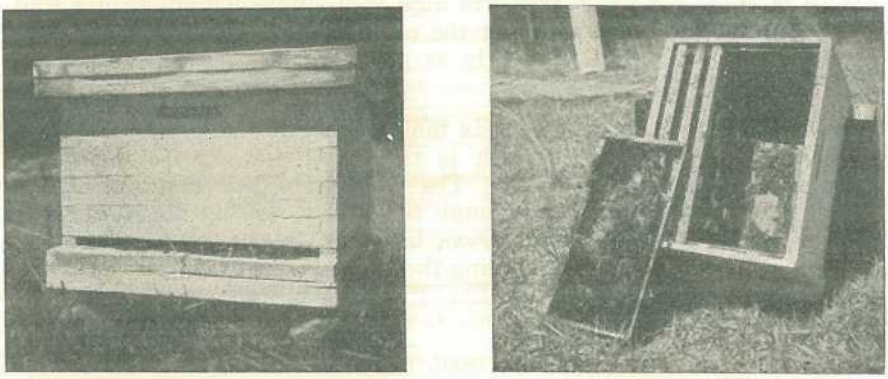

Plate 1.

**Larger Wax Moth.** Fig. 1, Egg x 30. Fig. 1a, Surface of egg x 210. Fig. 2, Larva, top view x 2. Fig. 2a, Larva, side view x 2. Fig. 3, Cocoon x 2. Fig. 4, Pupa, underside x 2. Fig. 4a, Pupa, top side x 2. Fig. 5, Adult female x 2½. Fig. 6, Adult male x 2½.

Plate 2.

**Beecomb Damaged by Wax Moths.** Cocoons are showing on the right side of the frame.

Damage is most severe in stored combs, whether in the apiary or storehouse. Infestations are also possible in active hives, where empty combs may be destroyed, brood killed and honey lost. In this way weak colonies become unproductive and eventually may be lost. In neglected apiaries serious damage soon develops and an early indication is debris blocking the hive entrance (Plate 3 a).



a b

Plate 3.

**Wax Moth Damage.** a, Wax debris blocking hive entrance. b, Damaged beecombs.

Larval development is most rapid in dark comb, particularly that containing brood or brood fragments. Feeding may occur on pollen cells, but more often these are avoided. Normally, the grubs cannot survive on pure wax and therefore white super honeycombs and foundations are seldom attacked.

Full-grown grubs (Plate 1, figs. 2 and 2 a) are grey in colour and almost an inch in length, and in warm weather their growth is completed in six to eight weeks. The change into the pupal stage (Plate 1, figs. 4 and 4 a) may occur in the comb, but usually the grubs crawl away to form the tough silken cocoon (Plate 1, fig. 3) on the top and side bars of frames (Plate 2) or on the hive walls. Prior to forming

cocoons, however, the grubs may make excavations into the wood, sometimes boring holes through the frames. The pupal period lasts about two weeks, then the adult moths emerge, mate and reinfest the combs within the hive or search for other hives.

Wax moths and their grubs are most abundant during the summer months, and it is in this period that damage is greatest. A few grubs may be present during the winter months working beneath odd pieces of burr comb and propolis in the less accessible places within the hive. Almost invariably one or more colonies in an apiary are infested, and if combs from these are directly stored either in supers or in the storehouse, damage will increase and spread quickly.

## Control.

Strong colonies usually resist invasions by wax moths either by preventing the entry of the female moths or by attacking them or their grubs within the hive. Good beekeeping practices therefore are normally sufficient to ensure that beecombs in active colonies do not become infested.

Weak colonies rarely escape attacks and these may be determined by regular inspections. Surplus beecombs should be removed for storage and the hives scraped clean of all burr comb and propolis, which otherwise would provide protection for grubs.

All combs removed for storage should be fumigated with paradichlorobenzene (PDB) or carbon bisulphide. For this purpose they are placed in spare supers stacked five high in a single column with a wad of newspaper as a base to check the escape of the heavy fumes. The supers must be stacked as tightly as possible, the cracks being closed with strips of gummed paper.

When PDB is used, 3 oz. (six tablespoonsful) are spread over the frames of the top super, which is then well sealed with a pad of newspaper under a hive cover. The crystals of this material slowly change to fumes which sink through the supers, killing all larvae and moths present and also any larvae hatching later. Reinfestation is prevented by regularly replenishing the crystals, preferably at intervals of 2-3 weeks during warm weather. PDB is non-inflammable and non-explosive.

When carbon bisulphide is used, a dose of 1 fluid oz. (two tablespoonsful) is poured into a small, shallow container, placed in an empty additional super on the top of the stack; and again the whole is then well sealed with a paper pad and hive cover. This chemical kills larvae and moths as the fumes sink through the supers, but it does not remain effective sufficiently long to kill the later hatching larvae, and there is no residual repellant action against reinfestation. This treatment should be repeated at intervals of three weeks, especially during the summer.

Combs fumigated with either PDB or carbon bisulphide must be thoroughly aired before being replaced in working colonies.

**Carbon bisulphide is highly inflammable and explosive. When this material is being handled, naked lights must be kept away and smoking prohibited.**

## ANTS.

Several species of ants often visit hives in the vicinity of their nests and take honey or pollen and even brood from the weaker colonies. Their persistence seems to cause the development of a tolerance amongst the bees and for this reason control becomes necessary. The more troublesome species are the coastal brown ant, the small black ant, the meat ant (Plate 4), and the sugar ant (Plate 5).

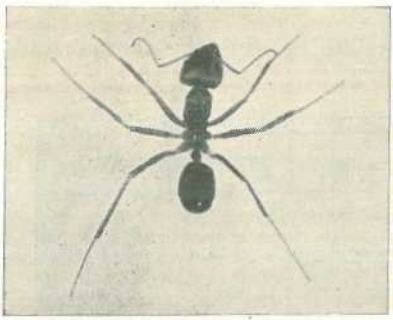


Plate 4.
**Meat Ant.**

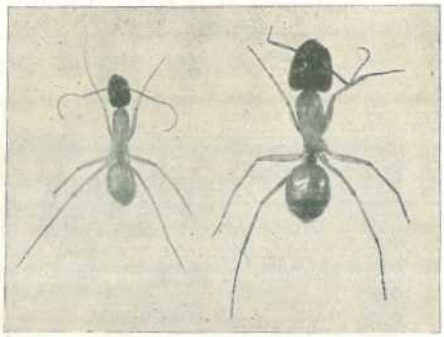


Plate 5.
**Sugar Ants.**

The first two species are about an eighth of an inch in length and brown to black in colour. Their nests may be located almost anywhere on the ground, in the grass, or under stones, pieces of wood and other objects. The other two species are each almost half an inch in length. The meat ant has a metallic reddish-black colour. Its nests are usually conspicuous, gravel-capped mounds. The sugar ant is yellowish-black in colour and the nests occur under stones or logs.

The smaller species of ants breed quickly and may invade an apiary site. Their nests therefore are usually located under or near the infested hive. The larger species are more fixed in their nesting sites, and invade only for food.

### Control.

Control of each species of ant is the same. The nests or mounds should be located and liberally watered with a 2·0% solution of chlordane. With the smaller species the treatment should include margins of several feet around the located nests, while with the larger species the solution should also be run down many of the nest openings. Periodical inspections should be made and further treatments applied when necessary. Exposed nests or mounds should be covered with old hessian sacks or grass so that the chlordane will not be a danger to the bees themselves.

## MICE.

During winter, mice enter storage supers or weak colonies mainly for protection. In active hives their presence disturbs the colony during the inactive winter period and they mutilate combs by feeding and nesting (Plate 6). If they occupy an upper super the lower ones are fouled and are unacceptable to the bees.

## Control.

Strong colonies resist mice when these pests attempt to enter the hives. Other colonies can be protected by any one of the following methods:—

(1) Place a queen excluder between the brood chamber and the bottom board.

(2) Reduce the width of the entrance to three-eighths of an inch.

(3) Fasten a strip of queen-excluding zinc or wire over the hive entrance.

Supers containing stored combs should be tightly stacked and all openings blocked against entry by mice.

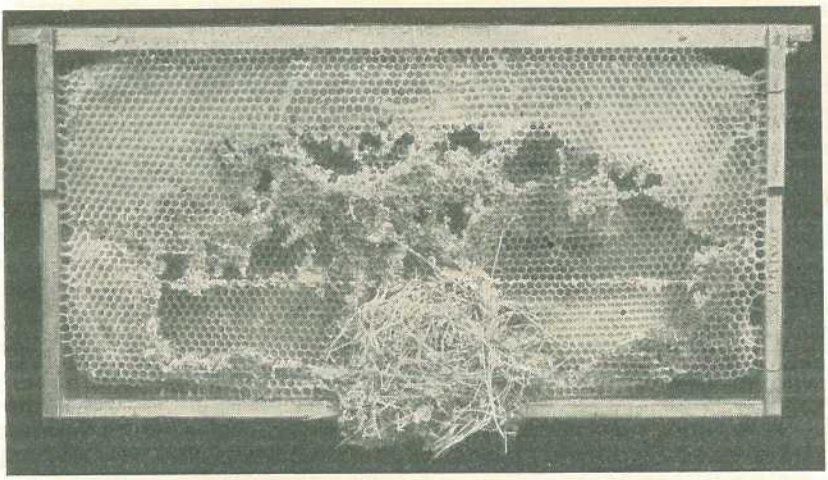


Plate 6.

**Mouse Nest Built in a Beecomb.** Wax moth damage is also evident.

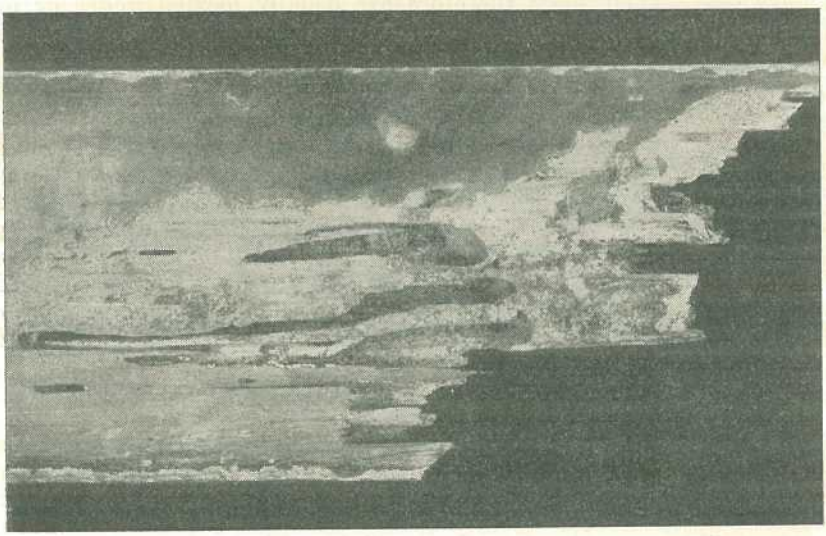


Plate 7.

**White Ant Damage to Hive.**

## WHITE ANTS.

In some parts of the State, especially in the south-eastern districts, white ants attack the hives and cause considerable damage by eating away the wood (Plate 7), particularly the bottom board, which in many instances may be resting directly on the ground. The troublesome species inhabit the soil and are not always evident by mounds.

### Control.

White-ant damage can be prevented by coating the underside of the bottom boards with a pentachlorophenol solution prior to painting or alternatively by painting this surface annually with creosote.

## OTHER ENEMIES.

Bees are attacked by a number of predators. Although these pests merely capture individual bees they are often persistent and are voracious feeders.

Giant toads may congregate near apiaries and snap up bees entering or leaving the hives and in this way weaken colonies. These pests can be checked by placing the hives on stands at least two feet high or by fencing the apiary with ½ in. mesh wire netting.

The rainbow bird and wood swallows at certain times of the year flock around apiaries and feed upon field bees. This can affect the working strength of an apiary if forage conditions are poor and brood-rearing is slow. When these birds are troublesome it is better to move the apiary to a more favourable location.

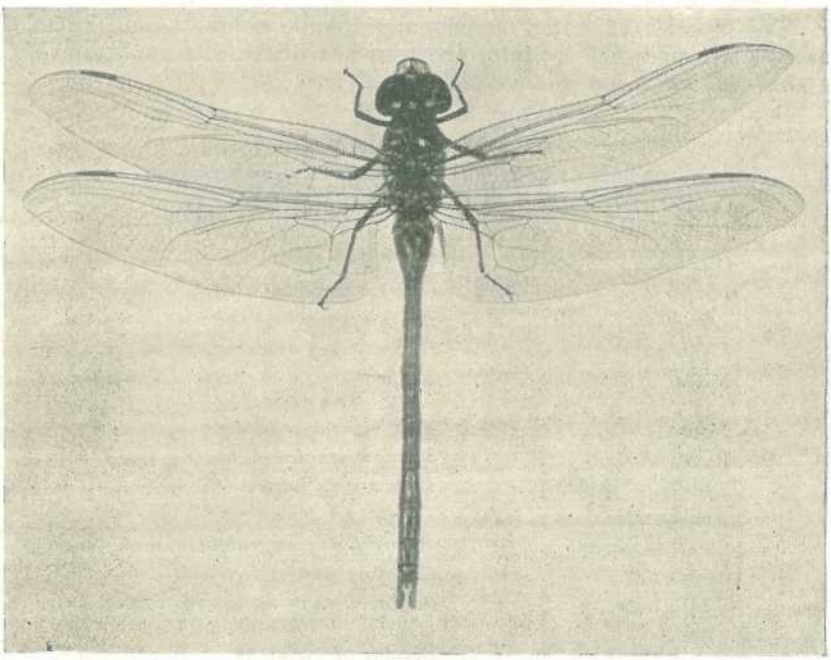


Plate 8.
**Dragon Fly.**

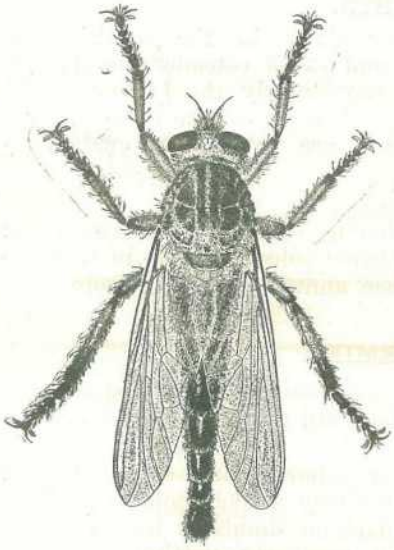


Plate 9.
**Robber Fly.**

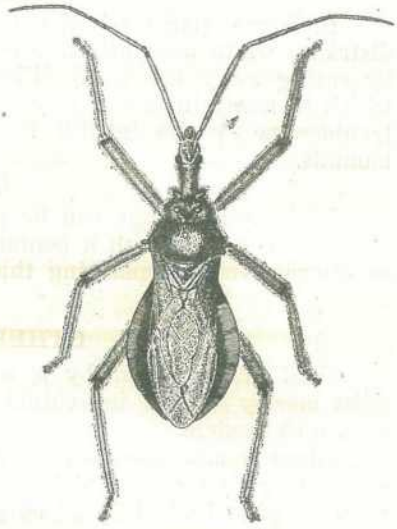


Plate 10.
**Assassin Bug.**

Dragon flies (Plate 8) and robber flies (Plate 9) take toll of field bees on the wing and the assassin bug (Plate 10) may seize some of those visiting flowers. The well known and venomous red back spider also captures an occasional bee.

Two species of mites occasionally invade colonies and infest the bees. Their presence irritates the bees but does not seem to have any detrimental effect on colony strengths.

| | Scientific Names of Pests. |
|---|---|
| Assassin bug .. .. | *Pristhesancus papuensis* Stal. |
| Coastal brown ant .. | *Pheidole megacephala* (F.) |
| Dragon flies .. .. | Species of *Hemianax* |
| Giant toad .. .. | *Bufo marinus* L. |
| Larger wax moth .. | *Galleria mellonella* L. |
| Lesser wax moth .. | *Achroia grisella* Fab. |
| Meat ant .. .. | *Iridomyrmex detectus* (F.Sm.) |
| Mites .. .. .. | *Pediculoides ventricosis* (Newp.) and *Hypoaspis* sp. |
| Mouse .. .. .. | *Mus musculus* Linne |
| Rainbow bird .. .. | *Merops ornatus* Latham |
| Red back spider .. | *Latrodectus hasseltii* Thorell |
| Robber flies .. .. | Species of *Promachus* |
| Small black ant .. .. | *Iridomyrmex rufoniger* Lowne |
| Sugar ant .. .. | *Camponotus nigriceps* Sm. |
| White ants .. .. | *Coptotermes acinaciformis* Frogg. and *C. lacteus* Frogg. |
| Wood swallows .. .. | Species of *Artamus* |

# PLANT PROTECTION

## Collar Rot Disease of Apples.

T. McKNIGHT, Pathologist, Science Branch.

OVER the last five years a collar rot disease caused by the fungus *Sclerotium rolfsii* Sacc. has been responsible for numerous losses in apple orchards on granitic sands and sandy loams in the Stanthorpe district. Losses as high as 60 per cent. have occurred in young orchards.

Collar rot is regarded as a major cause of the death of young trees in orchards. The fungal nature of the disease is commonly overlooked, and too shallow or too deep planting, either heat girdling or frosting, or either too early or too late planting, is held responsible for the death of the trees.

The disease is particularly severe on old land that has been repeatedly cropped to vegetables. It appears most frequently in trees two to three years old but it has also been recorded attacking trees up to 14 years of age. Varieties of apples found infected in the field up to the present are Granny Smith, Delicious, Lord Nelson and Gravenstein.

### Symptoms.

The fungus attacks the trunk at, or just below, ground level, where it produces a rot. A prominent white weft of fungal strands may be present over the diseased area when the soil is moist, but a definite diagnosis of the disease is made by the presence on the crown area, in the soil nearby, or on the roots down to five or six inches, of the brown, round or slightly irregularly shaped sclerotia or resting bodies of the fungus. These resting bodies resemble radish seed (Plate 1).

One side of the trunk is attacked first, and the leaves on limbs on this side quickly show the presence of the disease by turning a characteristic reddish or greyish-purple colour and wilting. The leaves then become dry, papery and brown in colour. The fungus produces a rot of the bark and woody tissues which gradually encircles the stem, cutting off the flow of water and nutrients, and the tree dies (Plate 2). Rarely, a tree may show a sudden collapse involving the whole tree.

### Cause.

Isolations from the rotted areas on apples have given cultures of the fungus which reproduced the disease on inoculation. The fungus from the apple produced larger sclerotia than those usually produced on vegetable crops affected with the same disease. However, inoculation tests have shown that fungous cultures obtained both from apples and from vegetables (carrots) are able to produce a collar rot of apples. It has been demonstrated that uninjured apple seedlings, of Merton and of seedling stock, inoculated in June, will die within six months if the sclerotia of the fungus are placed in soil 1-1½ inches from the crown.

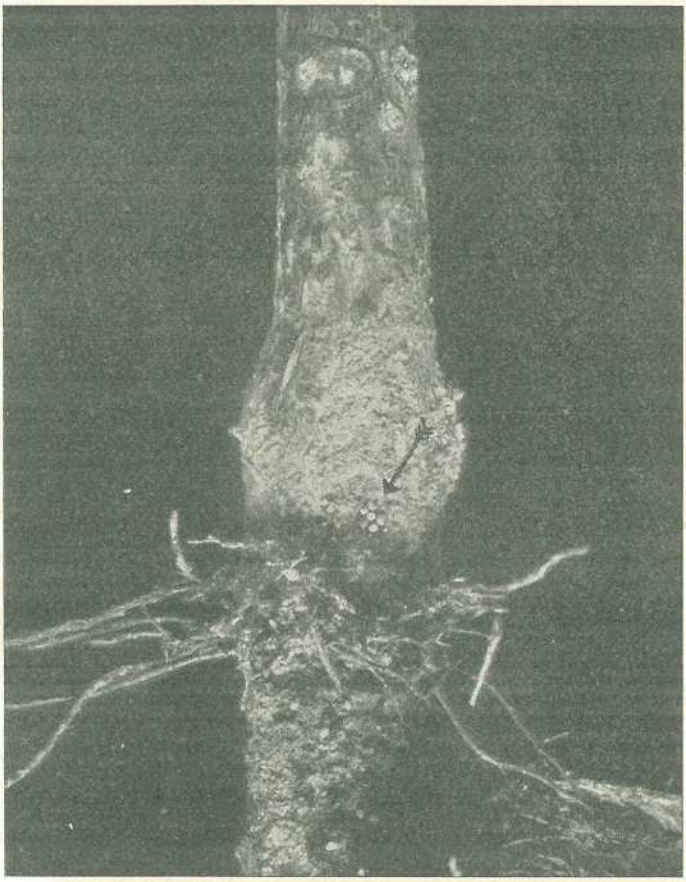


Plate 1.

**An Infected Apple Crown, Showing the Sclerotia of the Fungus Occurring on the Surface at the Point Marked by the Arrow.**

## Control.

Badly drained areas of the orchard should be avoided when planting apples, as such areas are conducive to the development of this fungus.

The sclerotia of the fungus are distributed through the soil during cultivation. The same fungus causes crown rots in vegetable crops and New Zealand blue lupin and is commonly observed attacking such crops interplanted in infected orchards.

The history of old vegetable land with respect to crown rots should be carefully considered before such land is converted to an apple orchard. In this respect, Stanthorpe officers of the Department of Agriculture and Stock should be consulted at least one season before planting is considered.

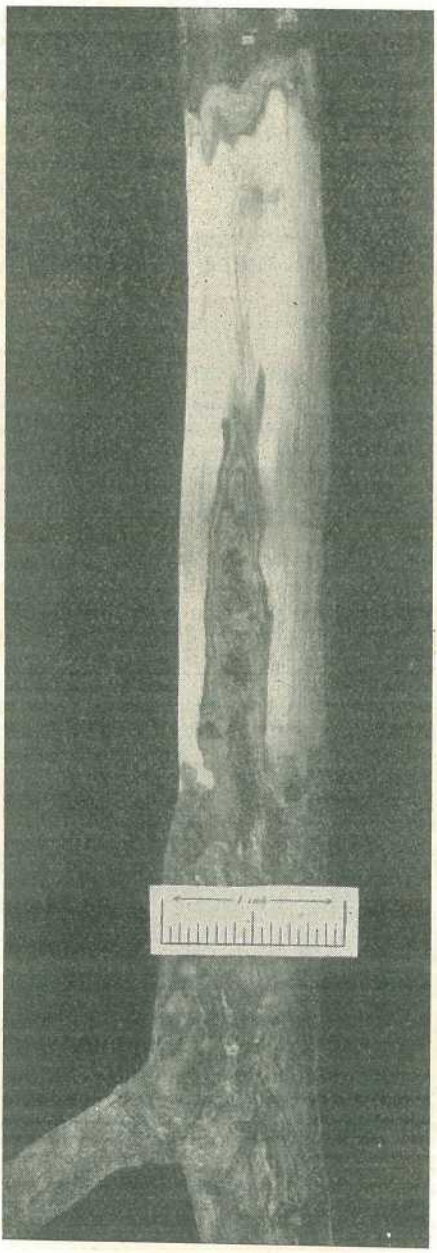


Plate 2.

**An Infected Apple Tree with the Bark Cut Away from the Base to Show the Rot Penetrating the Wood.** This should be removed in the surgical treatment described in the article.

It is thought possible that infection may sometimes be present on the planting material. Accordingly, a very careful examination should be made for the white fungus and the brown sclerotia on the roots of the young trees before they are planted out. Any infected trees should be carefully removed and burnt and the remainder dipped in Bordeaux mixture, Cheshunt mixture, or a suspension of one of the proprietary copper sprays before planting out.

Careful and regular examinations should be made after the trees are set out. On the appearance of the first symptoms of the disease in the leaves, the soil should be removed from the crown to expose the infected area. This area should then be cut away with a sharp knife until clean, healthy tissue is revealed, when the area should be covered with a thick paste of either Bordeaux mixture or one of the proprietary copper sprays. Cheshunt mixture may also be used to treat exposed tissues and the surrounding soil. The soil should be kept removed from the crown for several weeks, or up to 10 weeks, by which time the area will be effectively covered with callus tissue. During this period, depending on weather conditions, it may be found necessary to renew the application of copper paste over the cut area.

This method appears to be effective if the disease is detected early enough—that is, before the infection has involved a considerable area of the trunk.

New Zealand blue lupins should not be used as a cover crop in an infected orchard as they may assist in the multiplication of the fungus in the soil and also in its distribution. As an alternative, rye or wheat should be sown.

Growers who require further advice on this disease should contact the Department of Agriculture and Stock in Stanthorpe.

*Formula for Cheshunt Mixture.*

Powdered bluestone (copper sulphate) .. .. .. 2 parts.

Fresh powdered rock ammonia (ammonium carbonate) 11 parts.

If necessary, crush the bluestone and rock ammonia to a fine powder. Thoroughly mix the two together in the correct proportions and keep in a tightly stoppered glass or earthenware vessel for at least 24 hours before using.

For use, dissolve the dry mixture in water at the rate of 1 oz. to 2 gallons. Water this solution on the soil so as to wet it thoroughly.

Wash out the can after use, since the solution will corrode metals.


# The Selection and Breeding of Dairy Cattle.

R. D. CHESTER, Officer in Charge, Cattle Husbandry Branch.

THE key to successful dairy farming is the individual cow. The healthy, long lived, fertile, high producing cow is the foundation on which a prosperous dairy industry must be built and it should be the aim of every good farmer to maintain a herd of such animals. This is not easy to do, and when by careful breeding a farmer succeeds in getting together a good herd, it becomes a matter of vital importance that he be able to maintain the herd at the high standard achieved. It is, therefore, very necessary that the best cows in the herd should have the capacity to pass on to their daughters these qualities of health, longevity, fertility, and high production.

In order to maintain an efficient high producing herd, the farmer must give close attention to the theory of breeding and the practical application of herd recording and breeding techniques to the management of his herd. A farmer's ultimate success as a breeder depends upon his skill in the selection and mating of animals. The term selection as applied to dairy cattle breeding means the choosing of males and females in one generation of cattle as parents for the next generation. Only the best material should be used if worthwhile progress is to be expected. Mistakes in selection, if not detected early, may easily ruin a good herd.

In selecting dairy animals for breeding purposes, milk and butterfat records must be taken into consideration along with type and conformation. Some dairymen consider production records to be all-important; others make selections entirely on type. The wise man places the greater emphasis on production records but at the same time does not lose sight of the importance of conformation.

Shows have been strongly condemned by many leading animal breeding authorities and the opinions of these authorities have been severely criticised by stud breeders. There is nothing fundamentally wrong with such a state of affairs. Out of controversy comes closer examination of the subject and progress is made towards better methods of measuring worth in dairy cattle.

Cattle shows play an important part in the life of those engaged in the industry and in the progress of that industry. The competition inseparable from shows can inspire stud breeders as well as commercial

dairymen to improve their stock by providing an ideal towards which to work. The agricultural show can be a most important field of education, particularly for young farmers. Nevertheless, since profitable production is the goal of all work with dairy cattle, it is important that judges and show societies should place emphasis on production performances.

Emphasis on fancy points which bear no relation to production does much to destroy the usefulness of shows. It is apparent that in Queensland show-rings far too much attention is still given to unimportant features and far too little consideration to lifetime production performances. Wise breeders will avoid selecting animals according to present show standards alone. Breed societies should strive to modify judging methods in order to stress the economically important features of show-ring contenders.

Under present judging systems, a cow has no chance of winning a prize if she has a serious defect in body conformation no matter how good her production record may be. Cows are judged on their physical appearance and bodily condition at the time of judging. Moreover, show judges do vary in the relative values they place on particular points of conformation and so the personal element is bound to intrude to some extent.

Undue emphasis on type, particularly in the case of bulls, greatly reduces the educational value of shows, and indeed may be the means of fixing fallacious ideas in the minds of young farmers. The judging of dairy bulls is the least satisfactory feature of shows. Judging them on conformation and masculinity may be quite misleading where breeding worth is concerned. One of the greatest evils associated with shows is that top show winners are frequently sold as sires regardless of their actual merit for breeding.

It is the opinion of some dairy farmers that successful studmasters have a sort of sixth sense which enables them to plan bull-cow matings more efficiently than ordinary people. Be that as it may, some breeders have outstanding success. On the other hand, any breeder can be assured of improved results by working to a plan. In the case of dairy cattle, there is sufficient scientific knowledge on which to work to enable any man with a good practical knowledge of stock to make a success of breeding.

The breeding methods adopted will vary according to the requirements of the individual breeder. The stud breeder will often adopt methods quite different from those of the commercial dairyman, and there are very good reasons why he should do so.

If the stud breeder is a show exhibitor, intent on winning as many prizes as possible, he may adopt a policy of making frequent purchases outside his herd in an effort to obtain cattle with outstanding show type. Provided he is a good judge, he can buy cattle out of condition relatively cheaply, take them home, feed and groom them and turn them out as show champions. Exhibitors tend to use wide outcrosses in breeding for show animals in the hope of getting an occasional outstanding animal. This type of selection does not lead to uniformity of type within the herd, and the progeny of show champions produced in this way will frequently be greatly inferior to their ancestors and therefore disappointing to the purchaser.

The second class of stud breeder is concerned less with shows than with the development of a uniform type and uniformly high production within his herd. He will purchase very few animals from outside, and then only animals which bear some relationship to his own cattle. He will breed within family groups in his own stud, with the object of purifying the strain of his cattle so that they will breed more truly for type and production; he will practise line breeding at all times and inbreeding quite frequently. His aim is to breed high producing families of cows and to sell bulls which will sire daughters of above average production capacity.

The commercial dairyman aims at maintaining a good herd of high producing cows. His aim always is to get the production of the worst 25 per cent. of his cows up to the herd average. He cannot afford the risk of inbreeding to maintain uniformity and so must depend on the purchase of proven bulls or sons of proven bulls from studs of known breeding worth. As far as possible, he will save all his female replacements from cows with production above the herd average. The importance of a good bull in the herd of a commercial dairyman cannot be over-stressed.

## THE MECHANISM OF INHERITANCE.

The animal body is made up of minute cells and these cells are divided into two classes—(1) the body cells, which are concerned with the structure and composition of bone, muscle and other body tissues; and (2) the germ cells, which are concerned with reproduction.

All cells irrespective of their class contain the substance chromatin, in which the factors responsible for inheritance of body characters are located. These factors are known as genes. The genes are grouped together in a number of rod-like bodies called chromosomes.

Genes are responsible for each character of the animal. A character such as horns may be controlled by a single pair of genes in the chromosome, but most characters, including important economic ones, are controlled by a combination of a number of pairs of genes. Milk production in dairy cows is such a character. Characters depending on a single pair of genes are much more easily controlled by the breeder than are those depending on gene combinations.

All body cells, as distinct from reproductive cells, contain chromosomes arranged in pairs and the genes in each member of a pair correspond. These paired genes act together to modify body character. One gene of each pair comes from the sire and the other from the dam, as will be clear from what follows.

Growth of the animal body is brought about by repeated division of body cells. In the process of growth, body cells divide in such a way that the chromosome content (and hence gene content also) of each new cell is the same as that from which it was derived. This is because each chromosome divides along its length, thus making the original number of chromosomes available for each daughter cell.

In the process of reproduction, on the other hand, the male (or, as the case may be, female) germ cells (called spermatoza and ova respectively) contain only half the number of chromosomes of ordinary body cells. This is because in dividing to form germ cells the body cells do so in such a way that the chromosome pairs simply separate into two equal groups each containing half the original number. There is no division along the length of the chromosomes.

When union of spermatozoa and ova takes place, in the act of fertilization, the original number of chromosomes is restored, half being derived from the male parent and half from the female parent. Thus the new individual has the same number of chromosomes as its parents.

One particular member in a pair of genes may be dominant to the other member, and in this case the one gene is called a dominant and the other a recessive. In other cases each gene may have a modifying effect on the other, and they are said to blend. In some cases both genes of the pair may be exactly similar.

Animals in which a particular pair of genes is made up of two identical genes are said to be *homozygous*, or pure, for the particular character controlled by this gene pair. In such cases all the animal's reproductive cells will contain the same type of gene for the particular character concerned; but where the gene pair is made up of two dissimilar genes, one half of the reproductive cells will contain one type of gene and the other half a second type. Just which type is passed on to the new individual is purely a matter of chance. The animal in this case is said to be *heterozygous*, or impure, for this particular character.

The term "purebred" as applied to cattle is therefore a relative one, indicating that animals so labelled are homozygous or pure for certain genes and gene combinations. They are, in fact, usually pure for factors controlled by single genes as opposed to factors controlled by groups of genes. These single gene characters are unfortunately usually factors of little economic importance. Purebred cattle are also relatively pure for many characters controlled by groups of genes, and although there may be variation within breeds for these characters, the variation is much less than for cattle that are not purebred. Such factors as body size and shape, udder conformation and milk production may be considered as examples of these factors. The Ayrshire breed, for instance, has a gene pair which is homozygous for horns. It also has groups of gene pairs which show only slight variation and which influence udder shape and milk production.

## TYPE AS AN INDICATION OF LIFETIME PRODUCTION.

Farmers generally and stud breeders in particular are of the opinion that a cow's ability to produce milk can, at least to some extent, be related to what is called dairy type. By dairy type is meant certain anatomical features which have been selected by breed societies as typical of the good dairy cow.

Scientific workers in animal husbandry have given a great deal of time and research to efforts to correlate specific features of conformation with milk production. Most of these investigations have failed to show any convincing relationship between specific points of type and the cow's production ability, yet many people with a reasonably good knowledge of dairy cattle can select a cow capable of high production from one capable of producing only poorly or moderately. At least this selection can be made with reasonable accuracy after the cow "springs," though it is very doubtful if such would be the case if the animals being selected were heifers only 12 or even 18 months of age.

Research in America on this problem has clearly shown that some show judges are reasonably good judges of production in mature cows on a type basis, while others often fail in their efforts to judge for production on that basis. In view of the fact that in many cases these recognised competent show judges fail to select high producers on type alone, it is obvious that careful consideration should be given to production figures before purchasing dairy cattle if it is desired to acquire females capable of producing above average for the breed.

Some breed societies have classification systems in which registered animals within the breed are classified into a number of groups according to type. A comparison of type classification and production records available for classified animals indicates that, on the average, cows with the highest type classification are also the highest producers. This would appear to be an argument in favour of selection according to type. Undue weight should not be given to this finding, however, as cattle are classified when mature and in some cases the classification judges have prior knowledge of the cow's production. Because of this knowledge their judgment may be influenced when a decision is to be made.

Some breed societies provide for a cow to be resubmitted for classification after production records are known. A higher classification may then be given, thus demonstrating that the earlier classification based on type and conformation failed to assess the animal at its true worth.

On the basis of all the evidence available, it can be stated that there is some positive correlation between type in mature cows and production, but the correlation appears to be small. This means that by selection on type one would have a slightly better chance of getting above average producers than if one merely took a run of the cattle in a herd. On the other hand, it has to be recognised that some cows of excellent type might be poor producers and some excellent producers might be inferior in type.

Because herd recording and advanced register testing have had such limited application in Queensland, the farmer is forced to rely on every means that can afford some assistance in making his selection. As type is associated with production, even if only to a small extent, due recognition should be given to selection by this method.

A major error which can be made when selecting according to type is to rely on outdated ideas or fancy points which have been shown to have no bearing on production.

Undue emphasis is often given to milk veins because certain writers have considered that the size of these veins is an external indication of the amount of blood that passes through the udder, but the external milk vein is only one of the paths by which blood drains from the udder. Blood also passes by internal veins not visible to the judge. The size of the milk vein is therefore not a reliable guide as far as blood flow is concerned, and this being so, the foundation for judging cows on milk vein development is unsound. It is incidentally not entirely clear why breed societies insist on the milk vein being tortuous. There was once a theory—now largely discarded even by the most biased exponent of type selection—that the width of the escutcheon was an indication of production ability. The dairyman must avoid selection on the basis of these fallacious ideas.

Horn growth and development is just one fancy point which is worthy of mention. Distinctive horn development can give an added appearance of uniformity to a dairy herd and as a point of beauty is to be commended, but if good producers are culled because of cocked horns, great harm can be done to breeding programmes and to the dairying industry as a whole. It is necessary to remember in this connection that some breeders train the horns of their animals with mechanical devices of one sort or another to ensure that they conform to approved standards. The folly of such practice from the production standpoint is obvious.

All dairy cattle are better producers when they have no horns and it should be the aim of every true dairyman to dehorn both males and females during the first two weeks of life. The adoption of dehorning as a general practice rests largely with breed societies.

In selecting stock on type and conformation, chief consideration should be given to body characters which can be associated with health and general well being. Good dairy cattle must be able to move freely (walk well), have large internal capacity for the vital organs, have the ability to thrive under reasonably good conditions, and have a hair covering suited to the environment. They should have room for extensive attachment of udder to the body. The udder itself should be long, wide and deep, with attachments extending well up behind and far forward; the quarters even and with no marked indentations between the teats. The latter should be of such size and shape as to enable easy but firm attachment of milking machine cups. It is of great importance that a cow milks freely and completely by machine without the necessity for hand stripping.

Since the dairy bull is responsible for just half the hereditary composition of all his daughters, his selection is of paramount importance. Even when full records of past and present generations are available, the farmer must still exercise considerable judgment in selecting his herd sire. Generally speaking, animals which are well balanced in all respects should be selected. Concentration on one particularly good characteristic at the expense of other features is likely to have poor results. On the other hand, each additional character for which selection is made reduces the intensity of selection. Thus only economically important features should be considered.

## THE EFFECT OF ENVIRONMENT.

It is not possible just by looking at an animal or studying its production record to know to what extent type or production has been affected by heredity and environment.

Environment, including climate, management, feeding and disease, plays a tremendous part in determining the differences between dairy cows in Queensland. For instance, the average production per cow in Queensland is less than 120 lb. of butterfat per year, but it is quite certain that the inherited potential of Queensland cows to produce butterfat in a more favourable environment is much higher.

It is important to keep in mind the fact that strains of cattle can be bred which are more suited to the environment than are other strains. As far as possible, dairy sires should be selected from studs in the district in which they are to be used.

Because of the importance of environment in animal breeding, the farmer must always be on the alert to detect environmental influences which may be lowering the potential production of his herd. Cattle bred for high production may be no more profitable than "scrubbers" if they are not given favourable conditions in which to produce.

American workers claim that, in pure breeds of dairy cattle kept under average to good conditions, only 20 to 30 per cent. of the variation in production is due to heredity, the remaining 70 to 80 per cent. variation being due to environment.

## THE IMPORTANCE OF HEALTH AND FERTILITY.

The first consideration in establishing and maintaining a high producing dairy herd must at all times be the health and fertility of the herd. A high producing cow or a progeny tested bull is a liability rather than an asset in a herd if it is infected with disease or if it fails to breed regularly. Sterility is one of the major sources of economic loss to the dairying industry in Queensland, and the progressive dairyman must at all times be prepared to cull cows which prove troublesome to settle, or bulls which on the average fail to get at least one calf per two healthy cows served. *Should a cow fail to conceive after three services by a fertile bull, veterinary assistance should be sought by the farmer in order to diagnose the source of trouble.*

The purchase of aged proven bulls is a highly valuable means of herd improvement, though there is a risk of such bulls introducing disease into the herd or proving poor calf getters. The risk can be minimized if, before making such purchases, full enquiries are made concerning the health history of the herd from which the bull is to be purchased. At the same time, the buyer should be fully persuaded

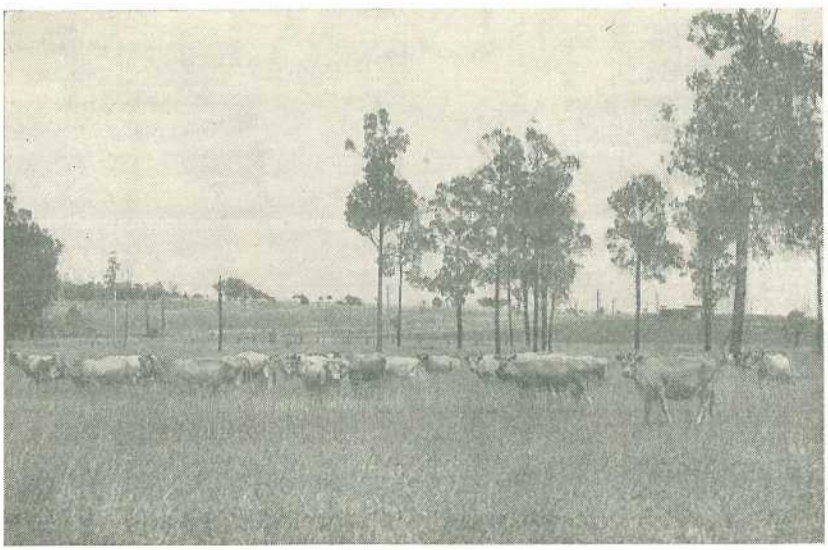


Plate 1.

**The Production of the Individual Cows in the Herd Can Only be Assessed by a Programme of Herd Recording and the Keeping of Accurate Records over a Period of Years.**

that the bull is, in fact, getting a reasonable percentage of cows served in calf. It is, of course, very desirable that such bulls be tested for tuberculosis and brucellosis before introduction.

Despite the fact that progress in veterinary medicine in recent years has been so rapid that many serious diseases can now be controlled effectively by means of vaccines and drugs, the progressive dairyman should endeavour to secure naturally fertile, healthy animals and avoid at all costs introducing disease.

## METHODS OF SELECTION.

When selecting animals from which future generations are to be bred, there are broadly three different approaches which can be made.

Animals may be selected according to:—

(1) Individual merit, the worth of the animal being based on its appearance (type and conformation) and, in the case of a cow, its production record.

(2) Pedigree.

(3) Performance and/or appearance of progeny.

Dairymen may from time to time use each method of selection or any combination of these methods, depending on circumstances and on the information available.

### Selection According to Individual Merit.

Selection according to individual appearance and production performance is known as *phenotypic* selection. It is selection on the face value of an animal and does not give any consideration to ability to consistently transmit desirable characters to the progeny, this being left to chance.

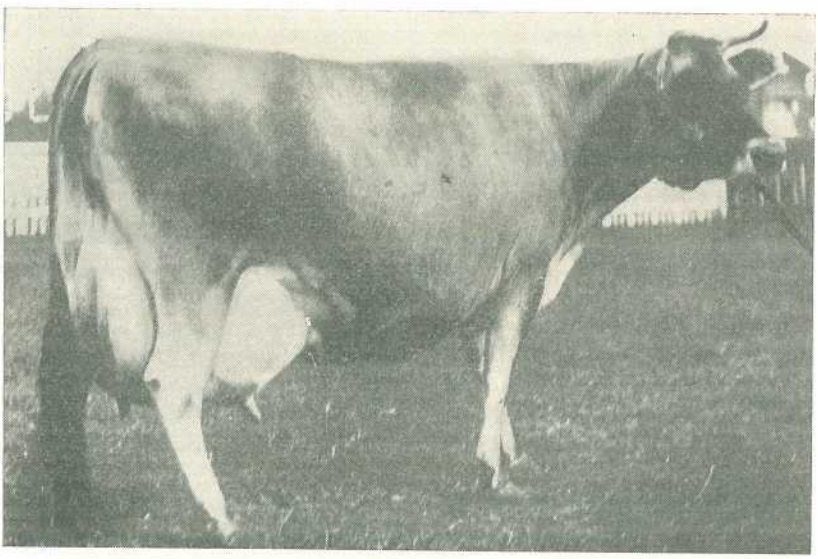


Plate 2.

**A Cow with Good Type and Production.** The possible merit of her offspring can only be assessed by considering her pedigree and production of her half sisters. The appearance and performance of the cow is not in itself sufficient evidence on which to make selection of her son as a potential herd sire.

It is the simplest of all methods of selection, requiring no elaborate system of recording. Single measurements of production may, however, be very misleading. Thus 24-hour or 48-hour milking records are unreliable as a measurement of the milking capacity of an individual cow. Regular tests over a 273-day period give a more accurate idea of a cow's capacity to produce, though 305-day tests are preferred because a cow may normally be expected to produce for 10 months and remain dry for two months each year. Records of several lactations or lifetime production records give more accurate information about a cow's ability than single lactation tests. Information of this sort is now being made available in the Register of Merit published by the Department.

Single lactation records may be greatly affected by factors such as sickness and drought or the plane of nutrition (quality and quantity of feed) generally. It will be readily appreciated that in such cases a single lactation may give a quite erroneous impression of a cow's worth.

The practice of saving heifers for herd replacement only from the high producing cows in a herd is an example of phenotypic selection. It is a practice on which a considerable amount of research has been undertaken to determine its value. Production improvement by this method of selection is disappointingly slow. It has been shown both in America and in New Zealand that daughters of cows with production above herd average are likely to inherit only 15 per cent. of their dam's ability to produce above herd average, and that daughters of low producing cows will inherit only 15 per cent. of their dam's capacity for lower production. Thus in a herd with average production of 300 lb.

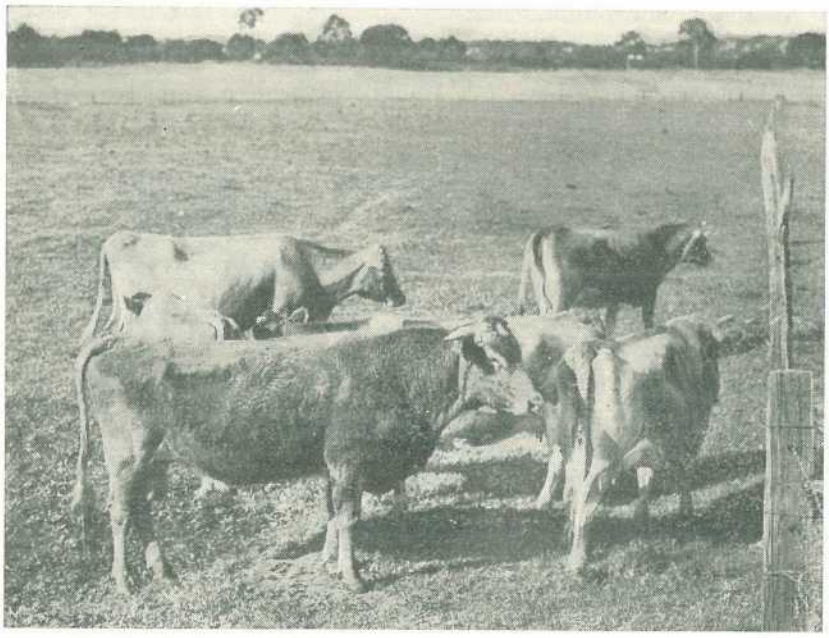


Plate 3.

**The Production Potential of a Bull is Best Measured by Reference to His Daughters.** Bulls should never be selected on type alone.

butterfat, cow A may produce only 200 lb. and cow B as much as 400 lb. On the average, the daughter of cow A would produce 285 lb. of milk and the daughter of cow B only 315 lb. of butterfat. In other words, there is in both cases a pronounced tendency for the offspring to revert to the herd average.

### Selection of Bulls According to Type.

Where bulls are concerned, phenotypic selection has little application and wherever practicable one of the other two methods of selection referred to should be used in conjunction. Provided bulls do not show symptoms of disease or evidence of anatomical malformation or lack of development, little consideration should be given to type in making selections and the farmer should concentrate on pedigree and progeny tests. The production potential of a bull is best measured by reference to his daughters.

### Selection According to Pedigree.

In Queensland, dairy animals are still selected in the first place on their individual merit, but when the progressive dairyman has made his preliminary selection on this basis, he then turns to the animal's pedigree in order to find what backing both in type and production the individual may have. A pedigree should reveal the show-ring and production records of an animal's ancestors.

There is a tendency for dairymen to purchase young bulls on pedigree alone without inspecting the production record of the herds from which they come. This method of selection may be sound enough when records of all animals in the pedigree are reasonably complete, but unfortunately this is not often the case with dairy cattle pedigrees in Queensland. Most often, pedigrees contain only the favourable records of some individual animals in the pedigree while most animals have no record. Purchase of this type of pedigree is bound to lead to disappointment and farmers are strongly advised to avoid selection by this method alone.

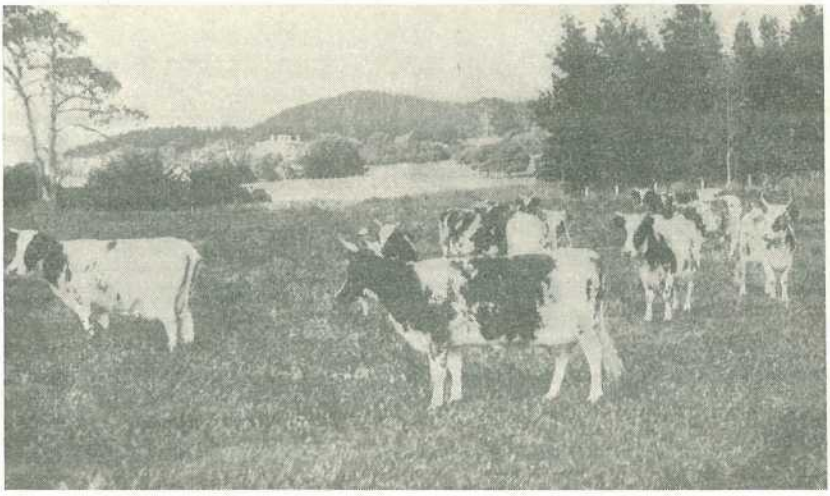


Plate 4.

**The Average Production of a Line Bred Herd is a Better Guide to the Possible Value of Bulls and Heifers Purchased from that Herd than is the Individual Performance of One or Two Selected Cows in the Herd.**

Animals with good type or production but with mediocre pedigrees will probably prove unsatisfactory as breeders. Such animals should certainly be at least partially progeny tested before being used extensively as breeders in the herd.

In the case where the animal has produced no offspring which can be inspected, the best indication of the type of animal it is likely to produce may be had by examining its ancestors for two, or perhaps at most three, generations back. If these ancestors are of uniformly high standard, it may be assumed that the beast's descendants will tend to be of a similar standard. If there is lack of uniformity in the quality of the near ancestors, the beast may give offspring of higher or lower quality than its own appearance would suggest. In considering the merit of near ancestors, it is wise to bear in mind the fact that these animals are selected individuals, and that frequently the information available concerning them is also selected in order to make them appear in as favourable a light as possible. It is, therefore, advisable to discount these records a little in estimating the breeding worth of the offspring.

The evaluation of pedigrees is at times exceedingly difficult. Most pedigrees as presented by breeders and breed societies in Queensland give no information concerning the breeding value of the animal from the production side. This failing is probably the fault of neither the breed society nor the breeder, but is due largely to the inadequate system of advanced register testing which was practised in Queensland until recently. With the introduction of an improved testing scheme for the advanced register, coupled with a big development in group herd recording, pedigrees will in future come to mean a great deal more to dairymen in this State than has been the case previously.

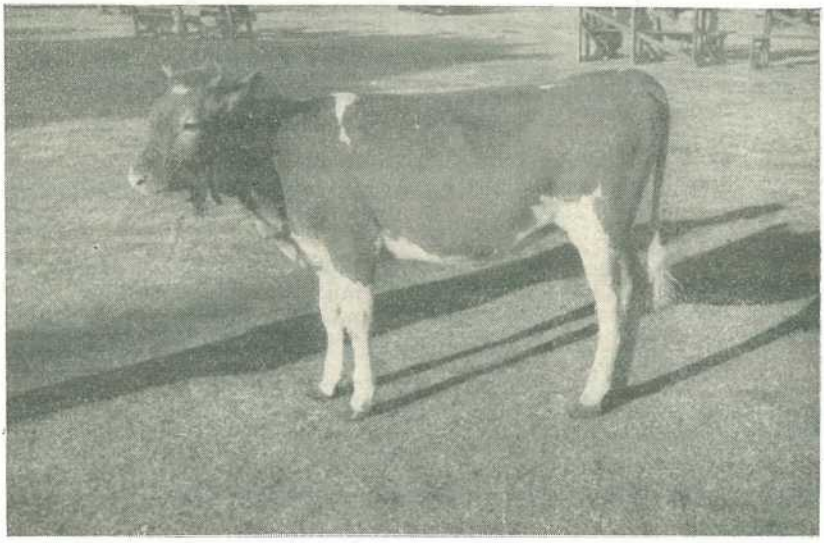


Plate 5.

**A Heifer by a Proven Sire from a Herd of High Producing Cows is a Better Buy than a Heifer by an Unproven Sire from a Cow with an Individually High Production Record in an Unrecorded Herd.**

To be useful a pedigree must be complete. A mere list of names with records of occasional high producers is unsatisfactory. All ancestors should have their records, high or low, appended to the pedigree, and all available information concerning the performance of collateral relatives should likewise be appended. Unless care is exercised it is easy to be misled by information on the good producers and lack of information concerning the poor producers.

The prospective purchaser should at all times ascertain the exact conditions under which production records appearing in the pedigree were made. The purchaser should find out whether the records were made off grass or as the result of heavy feeding with high quality feed. The number of times the cow has been milked each 24 hours also affects the records, as there is an appreciable lift in production when thrice-daily milking is practised. The effect of environment is of the utmost importance in assessing the possible breeding worth of an animal.

One of the common fallacies associated with writing and interpreting pedigrees is the undue stress often laid on some particular ancestor far back in the pedigree. Thus a cow "Rose" seven generations back may have been an outstanding animal, but "Rose 7th" will be little influenced by the gene composition of the original Rose, unless there has been considerable inbreeding.

For fuller utilisation of pedigree in dairy sire selection, the need is for more complete records of registered stock, and in this respect the breed societies have a responsibility to the industry. Commercial dairymen are entitled to records of production in respect of purebred cattle that they purchase. The stud breeder for his part should see to it that the breed society to which he belongs takes an active interest in ways and means of improving methods of recording performances of all purebred animals within the breed. It is an anomaly that animals supposedly bred only for the purpose of milk production should continue to be bred and registered by breed societies without an effort being made to check their individual ability as producers.

Selection of animals according to pedigree has advantages for certain characters and types of animals. As previously pointed out, when selection is made according to individual performance there is a tendency for the offspring to revert to herd average. When selection is made on pedigree this reversion effect will still be noticed, but provided the selected animal comes from a family which shows consistently high production, reversion towards the breed average is likely to be very much less than when selection is made purely on the basis of the dam's record. Thus in characters such as milk production which are not strongly inherited, pedigree can be an important aid to selection.

It is frequently necessary to select both heifers and bulls at an early age, before the heifer has had a chance to produce, or before the bull can be proven. The safest way to select such stock for production is on their pedigree, the selection being based on the assumption that the merit of the animal under consideration will be close to the average of the animals in the pedigree for two or three generations back.

It must at all times be kept in mind that the accuracy of pedigree selection is modified by the "sampling" nature of inheritance. The chances are that, on the average, the selected animal will produce as expected, but the gene composition may be more or less favourable than the average, in which case the beast will turn out to be better or worse

as the case may be than was anticipated from an examination of the pedigree. Using pedigree selection it is not possible to anticipate the production of the individual, but it is possible to predict the average production of a group of animals deriving from the same parents or families.

**Selection by Progeny Test.**

The use of progeny testing in order to find the most desirable breeding animals is not new. It has probably been used by progressive breeders, even if sometimes unconsciously, as long as animals have been domesticated, and it was employed extensively in its modern sense in England, particularly by Bakewell, when the modern British breeds of livestock were being standardised. This application of the progeny test, together with inbreeding, probably did more than anything else to place British breeds of livestock in the pre-eminent position which they have held for so long. It is only in comparatively recent times that animal breeders in other countries have equalled, and in some cases excelled British breeders. The success of the Western European breeders in this connection is founded on progeny testing even more firmly than were the earlier successes of the British breeders.

Progeny testing has been refined and extended considerably since the days of Bakewell, and is now a precision tool with which animal improvement can be affected. It is particularly important in herds of already high standing, where further progress is a matter of considerable difficulty.

Like phenotypic selection and pedigree selection, progeny testing has both advantages and disadvantages.

In such animals as dairy cattle a bull may be at least five years of age before a reasonable number of his daughters are available to give an indication of his ability as a sire. In many cases, therefore, the bull will be dead or gone elsewhere long before he is proven. The dairyman setting out to find a proven bull will need to keep many bulls on his property or to sell with the option of repurchase in three or four years' time. Few farmers can afford to keep half a dozen bulls. A bull sold to another herd is always in danger of contracting disease or becoming infertile. Bull proving, therefore, is not as simple as it may appear at first sight.

It is necessary to have enough *unselected* offspring from the bull to be reasonably certain that judgment is being made on a true cross section of the offspring as a whole. If daughters to be tested are specially selected, the value of progeny testing is greatly reduced. Even a mediocre bull will often sire some good daughters. The dams to which the bull is mated should for preference also be an average sample of the herd. The commercial dairyman is not looking for a few high producers, but rather for a high average herd production. Selection by progeny test is an example of *genotypic* selection, in which the breeder selects on the basis of the inherent ability of an animal to transmit desirable characters to the offspring quite apart from the animal's own merit as an individual.

Despite very real practical limitations, progeny testing is a most valuable aid to selection. It should, however, be used as an aid and not, as is sometimes suggested, as the sole means of selection.

Full use may be made of the progeny test by any dairyman who regularly records his herd, even if only as a check on his selection of a sire by phenotype and pedigree means. The production records of the first five or six daughters sired by the bull will give some indication of his value as a sire, and on the records of these daughters he may be classed as a very good bull, a very bad bull or a bull possibly deserving of further trial. When 10 daughters have been tested, a final decision can be made about a bull classified as worthy of further trial. If dairymen generally were to use the progeny test only to this extent, many average herds would have their production improved, and fewer good herds would be ruined by using a poor bull for a long period without becoming aware of his deficiencies as a sire.

One of the most difficult aspects of dairy herd management is to maintain high production in a herd. It is in high producing herds that the use of progeny testing can be of most value. In such herds reliance on phenotype and pedigree selection is likely to be disappointing because the herd is very much above breed average in production, and there is a constant tendency for all cattle to return to breed average. Only by the use of bulls proven as sires of high producing daughters, or sons of such bulls, can the farmer maintain his herd at the peak of production.

Plate 6.

**If a Proven Bull is not Available then the Son of a Proven Bull may be the Wisest Selection for a Herd Sire.**

There is a considerable amount of evidence to show that sons of bulls proven for production are themselves herd improvers, and for the average commercial dairyman, who is not in a position to pay the high price likely to be asked for the odd proven bull available, the son of a proven bull is a wise choice.

## PUREBRED SIRES AND INCREASED PRODUCTION.

That part of production improvement which can be accomplished by selection and breeding in commercial herds is founded on the stud or pure-breeding industry. Progress can rarely be made towards the selection of higher producers in grade herds unless bulls of high production potential are available from the purebred herds.

Considerable stress has always been placed on the importance of the purebred bull in bringing about an overall improvement in the production of commercial dairy herds. Because of the flow of propaganda from Departmental extension workers and breed societies, the purebred bull is much sought after. This propaganda programme has proved so effective that there may be occasions when commercial breeders buy a bull simply because he is a purebred bull, and not because there is anything about him which would suggest that he is capable of siring above average quality daughters.

Breeders of purebred dairy stock have a responsibility to the industry in this respect. It has often happened that young breeders have met with a considerable setback when the purebred bull which they bought in the hope of improving their herd has proved incapable of doing the job for which he was purchased. Even when all possible care is taken, a percentage of purebred bulls will prove failures, and the expenditure of much effort in selection for qualities which have only questionable relationship to production and little or no effort in selection for production itself can only increase the percentage of these failures to the detriment of the breed and the industry.

The development of a good stud herd is often a lifetime's work. A constructive breeding programme cannot be developed in the short period of two or three cow generations.

The stud breeder must direct his efforts towards demonstrating the practical worth of his animals. Stress should be placed on records of performance for all registered stock. This is the only sound basis for the evaluation of animals, and insistence on this point can eliminate much of the guesswork from selection.

It is essential that studmasters develop a policy in line with unbiased scientific thought and free from old notions and prejudices. The stud breeder is working for the improvement of his chosen breed; the efficiency of his breeding policy will be most apparent in improved production of the grade herds to which he supplies bulls.

The introduction of a purebred bull into a grade herd should be accompanied by the knowledge that he has the potential to maintain or improve the average production of the cows in the herd. Where all cows in the purebred herd from which the bull derives are not recorded, it is difficult for the commercial dairyman who has a herd with known high production to be sure on the point.

Purebred breeders should justify their position as bull breeders by keeping reliable records and by maintaining the average production of their herd above that of the grade herds in their immediate neighbourhood.

## APPENDIX A.

### Type Score Card for Dairy Cattle.

It has been stressed in this article that undue attention should not be given to show points of conformation in evaluating a dairy cow, but a knowledge of the type to which show exhibitors are endeavouring to breed is desirable for all young breeders. For this reason a score card for a typical dairy cow irrespective of breed is reproduced herewith. Young breeders are warned not to regard all of the desirable features stressed here as being associated with high production.

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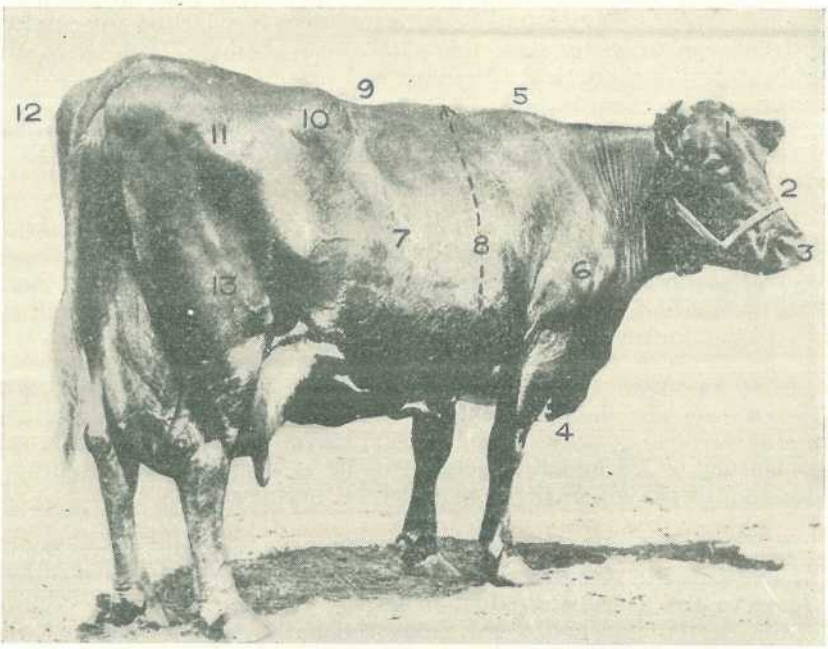



Plate 7.

**Points of a Dairy Cow.**—1, forehead; 2, face; 3, muzzle; 4, brisket; 5, withers; 6, shoulder; 7, barrel; 8, heart girth; 9, loin; 10, hip; 11, rump; 12, pinbone; 13, thigh.

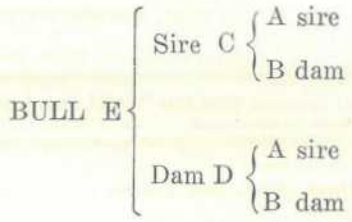
# POINTS OF A TYPICAL DAIRY COW.

| Scale of Points. | | Maximum Points. |
|---|---|---|
| *General Appearance.* | | |
| Constitutional Vigour: As shown by heart room, apparent health, strength, activity, and general appearance | 5 | 19 |
| Form: Wedge-shaped, as viewed from front, side and top (additional points given in detailed section) | 3 | |
| Quality: Hair fine and skin soft, medium thickness, loose, mellow, and unctuous with yellow secretion | 6 | |
| Temperament: Active and nervous (but not "wild"). Indicated by movement, eyes, and lean appearance | 2 | |
| Colour | 3 | |
| *Head, Neck, and Throat.* | | |
| Forehead: Broad and full | | 8 |
| Horns: Fine and of medium size | | |
| Eyes: Large, bright and yet placid | | |
| Face: Lean, medium length, straight or slightly dished | | |
| Muzzle: Clean and strong mouth and nostril large | | |
| Ears: Medium size, fine in texture, yellow pigment inside | | |
| Neck: Rather long and thin, fine, clean throat and dewlap | | |
| *Forequarters.* | | |
| Chest: Broad and deep | | 3 |
| Brisket: Lean and not fleshy | | |
| Withers: Well defined, and not coarse at point of shoulders | | |
| Shoulders: Light, sloping, not too fleshy and oblique | | |
| Legs: Straight, rather short, and not too large or coarse | | |
| *Body.* | | |
| Backbone: Well defined, lean, open-jointed and level | 3 | 21 |
| Barrel or Body: Long and large, ribs broad, well arched, open and set wide at finish; a large strong body in proportion to size | | |
| Heart Girth: Large and deep, abundant room for active heart and lungs | 18 | |
| Belly: Large, broad, and deep, with a large and strong navel | | |
| Loin: Broad and strong | | |
| *Hindquarters.* | | |
| Hips: Wide apart, lean, and refined | | 16 |
| Pelvic Arch: Prominent and strong | 6 | |
| Rump: Long and wide, with pin bones wide apart and well defined | | |
| Tail: Long, fine with good switch and neatly set on | 2 | |
| Thighs: Long and lean, flat inside and out, no beefiness, thin arched flanks | | |
| Legs: Rather short, wide apart and not coarse, placed squarely under the body | 8 | |
| *Udder.* | | |
| Fore udder: Full, broad and extending well forward, not fleshy | | 31 |
| Hind udder: Broad, full and attached high, not fleshy, plenty of loose skin with a silky touch, without pronounced quartering | 18 | |
| Teats: Of good size and form, evenly placed and hanging perpendicularly, texture soft | 5 | |
| Milk Veins: Upon the udder and in front of it, prominent, large and tortuous, leading to open milk wells | 5 | |
| Escutcheon: Good of its kind | 3 | |
| | | 100 |

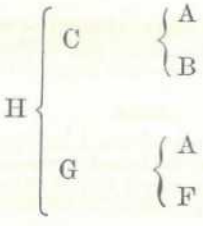
## APPENDIX B.

### Breeding Systems.

*Inbreeding.*—By inbreeding is meant the mating together of two closely related animals.




In this case the bull E would be inbred as he is the result of mating bull C to his full sister D, Similarly, mating father and daughter, or son and dam, would be considered inbreeding. The mating of even less closely related animals may still be considered inbreeding, as in the following case where H is the offspring of half-brother and half-sister:—




It has been aptly said that inbreeding is a negative method. By inbreeding, the breeder does not hope to gain anything new. By its use, he expects to purify the gene make-up of the animals with which he is working. In other words, he concentrates the genes for which he is selecting, and eliminates the undesirable genes with his culls, thus eventually building up a herd of relatively homozygous animals from a herd which was originally heterozygous.

Inbreeding is the only means by which the breeder can get uniformity in his herd, but a breeder should never begin inbreeding unless he is satisfied that the best animals in his herd are of sufficiently high merit, for by inbreeding he cannot produce animals better than the best he already has. Inbreeding concentrates the qualities of the animals, and there is no discrimination between the good and bad qualities, so the practice is fraught with danger and must necessarily be accompanied by a very heavy culling programme. Often, in fact, whole strains of animals must be culled.

Inbreeding, therefore, is something which should be avoided by the small man, and where practised by the large breeder, should always be undertaken in parallel lines with prearranged design for assessment of results and a heavy culling programme based on progeny testing.

Culling must go beyond the culling of individuals. Where a strain is found to contain defective animals, the strain should be abandoned and future breeders selected from those strains which have not shown defectives.

*Line Breeding.*—Line breeding is the term used by practical breeders to indicate a less intensive form of inbreeding, usually the mating of cousins or animals more remotely related. Breeders frequently so differentiate between the terms close breeding and inbreeding and line breeding, but they are terms which differ only in degree.

*Outcrossing.*—Outcrossing is the crossing of two unrelated strains, within the same breed which have no common ancestors closer than four generations back.

Inbreeding is the tool used to produce uniformity in the strain; outcrossing is the tool used to introduce variation.

For instance, a breeder may have produced an inbred strain which, because of an oversight in the early selection, has a low butterfat percentage. While he continues with that particular strain, no matter how he selects he will not be able to increase the butterfat percentage, for the genes responsible will be fixed and no amount of selection within the strain will alter that percentage. However, if he selects another strain of the same breed of cattle with a higher butterfat percentage, and makes an outcross with that strain, sufficient variation will be introduced into his original strain for further selection for higher butterfat content to be made.

*Cross Breeding.*—Cross breeding is going one step further along the line to variation than outcrossing, for cross breeding is the crossing of two distinct breeds. When cross breeding is undertaken intentionally, it is usually done in search of so-called "hybrid vigour".

Crosses made between two breeds usually give a very uniform type of first generation offspring, with strong constitutions and excellent production qualities. Why this should be is not so evident. However, it is suggested that certain genes are responsible for the good qualities in each breed of animal and that each breed may be lacking in some genes which the other possesses. When the two breeds are brought together, there is a blanketing effect, whereby genes lacking in one breed are covered by those in the other, with a resultant improvement in the qualities transmitted by both parents and the development of hybrid vigour in the offspring.

Unfortunately, however, the improvement ends with the first generation, and further crossing leads to a multiplicity of types, most of which prove inferior to the original parent breeds.

*Hybrid Breeding.*—Hybrid breeding is the term used when two distinct species of cattle are crossed, as, for example, when Indian or Brahman (Zebu) cattle are crossed with one of the British breeds of dairy cattle. Hybrids resulting from such a cross are fully fertile and will breed freely with either parent breed or amongst themselves.

*Grading Up.*—Grading up is the term used when purebred bulls are mated with crossbred or "mongrel" cows and subsequently with their offspring, generation after generation, until (after four or five generations) the original mongrel herd is raised to a status which approximates that of a purebred herd.

## APPENDIX C.

### An Informative Pedigree.

*Stud Name :* FAIRYDALE.

*Name :* Fairydale Mary's Prince.

*Born :* 20–11–50. *Tatoo :* 353.

*Address :* J. Smith, "Fairydale," *via* Ipswich.

*Breed :* Jersey. *Sex :* Male.

*H.B. No.* 56,331. *Colour :* Broken.

*Sire :* Fairydale Desire's Duke.

10 A.R. daughters
10 daughters over 300 lb., fat as Jnr. 2's
8 daughters over 400 lb., fat as Jnr. 3's
1st R.N.A. 1949 Bull, 4 years and over

*Sire :* Oaklea Grand Duke.

12 A.R. daughters
12 daughters over 270 lb., fat as Jnr. 2's
6 daughters over 420 lb., fat as Jnr. 3's
Champion R.N.A. 1946

*Dam :* Fairydale Ideal's Mary.

8,000 lb. milk, 5·5% test, 440 lb. B. fat as a Jnr. 2
10,000 lb. milk, 5·2% test, 520 lb. B. fat as a Jnr. 3
10,755 lb. milk, 5·3% test, 570 lb. B. fat as a Jnr. 4
11,765 lb. milk, 5·1% test, 600 lb. B. fat mature
2nd R.N.A. 1950 Cow, 4 and under 5 yrs. dry class
1st R.N.A. 1949 Cow, 3 and under 4 yrs. in milk

*Dam :* Craigview Desire.

10,577 lb. milk, 5·2% test, 550 lb. B. fat Jnr. 2
12,745 lb. milk, 5·1% test, 650 lb. B. fat Jnr. 3
13,396 lb. milk, 5·3% test, 710 lb. B. fat Jnr. 4
14,327 lb. milk, 5·2% test, 745 lb. B. fat mature

*Sire :* Fairydale Ideal.

5 A.R. daughters
3 daughters over 270 lb., fat as Jnr. 2's
2 daughters failed as Jnr. 2's
1 daughter over 400 lb. fat as Jnr. 3's
1st R.N.A. 1947 Sire and his progeny group

*Dam :* Daydawn Prince's Doris.

8,727 lb. milk, 5·5% test, 480 lb. B. fat as Jnr. 2
10,865 lb. milk, 5·2% test, 565 lb. B. fat as Jnr. 3
11,509 lb. milk, 5·3% test, 610 lb. B. fat as Jnr. 4
12,500 lb. milk, 5·2% test, 650 lb B. fat mature

## An Uninformative Pedigree.

*Stud Name :* FAIRYDALE.
*Name :* Fairydale Mary's Prince.
*Born :* 20–11–50. *Tattoo :* 353.
*Address :* J. Smith," Fairydale," *via* Ipswich.
*Breed :* Jersey. *Sex :* Male.
*H.B. No.* 56,332. *Colour :* Broken.

| | | |
|---|---|---|
| *Sire :* Fairydale Desire's Duke 1st R.N.A. 1949 | *Sire :* Oaklea Grand Duke Champion R.N.A. 1946 | *Sire :* Karama Pioneer |
| | | *Dam :* Oaklea Madiera |
| | *Dam :* Craigview Desire, 745 lb. B. fat mature | *Sire :* Fancy Prince 2nd |
| | | *Dam :* Craigview Bess |
| *Dam :* Fairydale Ideal's Mary 2nd R.N.A. 1950 1st R.N.A. 1949 720 lb. B. fat | *Sire :* Fairydale Ideal | *Sire :* Karama Golden Duke |
| | | *Dam :* Fairydale Hazel |
| | *Dam :* Daydawn Prince's Doris | *Sire :* Daydawn Prince |
| | | *Dam :* Daydawn Rosella IV. |

# A Trap Gate for Cattle.

K. F. HOWARD, Adviser, Cattle Husbandry Branch.

TRAPPING of cattle has been practised in Queensland in the past and is still used on some beef cattle properties. Trap gates have many limitations, but when used intelligently under specific conditions they can prove a labour-saving device.

As the principle of the gate is to trap cattle when watering, it is essential that all fences be stock-proof and that alternative sources of water be fenced off and preferably fitted with trap gates.

The value of an effectively constructed trap is highest in country that is difficult to muster, and trap gates should prove particularly useful in brigalow country.

When using the trap for cows and calves, the presence of dingoes should be borne in mind, as some calves will no doubt find themselves outside the trap and so separated from their mothers.

Trap gates are still used in parts of southern Texas (U.S.A.) and are considered to be a great asset in country carrying heavy mesquite scrub. The following description is of the type of trap that has proved its worth on some of the larger cattle properties in Texas.

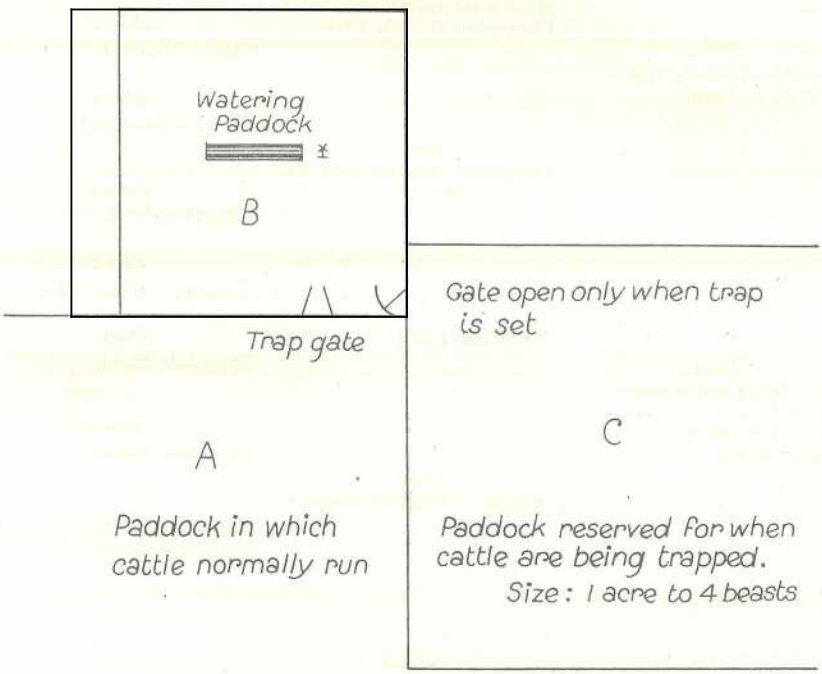



Plate 1.

**Diagram Showing Position of Trap Gate in Relation to Paddocks.**

## Principles of Operation.

These are best explained by referring to Plate 1. Normally, cattle pass from paddock A to paddock B through the opened trap gate. Paddock C is normally shut off, but when "setting" the trap gate it is opened to paddock B, so that the cattle, though unable to return to their paddock, can obtain feed. The size of paddock C varies according to the number of cattle being run in paddock A; a quarter of an acre per beast is a good guide.

The time elapsing between the setting of the gate and the trapping of all the cattle varies according to the wildness and education of the herd as well as the weather and the moisture content of the pasture.

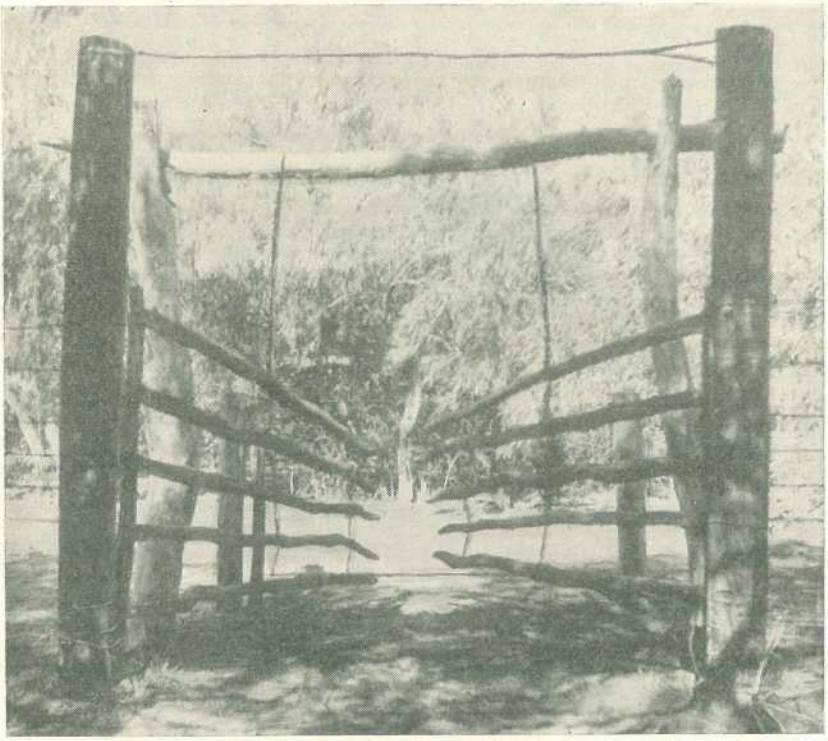


Plate 2.

**Trap Gate in the Set Position.**

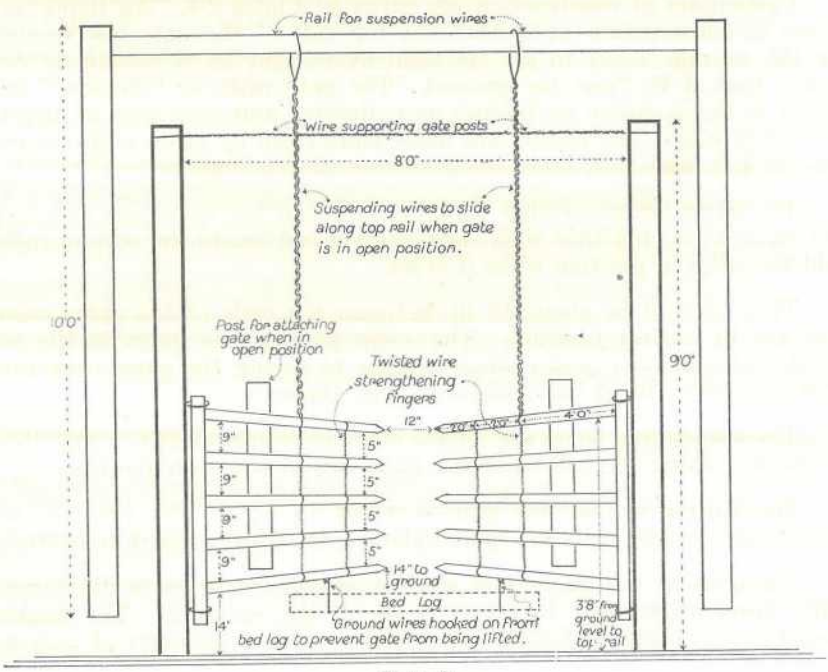



Plate 3.

**Details of Construction and Suspension of Trap Gate.**

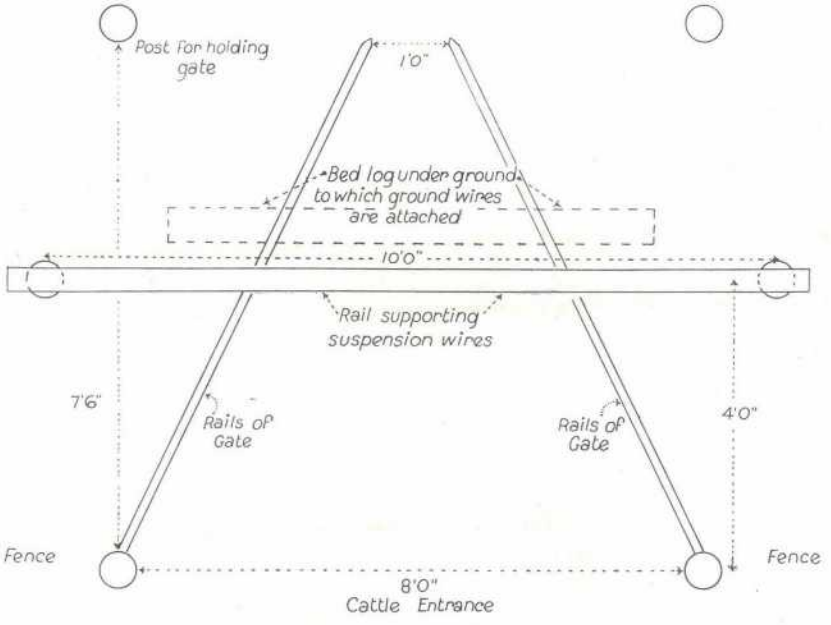



Plate 4.

**Diagram of Trap Gate Viewed from Above.**

## Construction.

Particulars of construction are given in Plates 2-4. An important factor in construction is to have the top rail of the gate low enough for the average beast to get its head over—that is, it should be not higher than 4 ft. from the ground. The gate rails, or "fingers," are joined to the uprights by bolting or twitching, and each gate is hinged to its gate post. The fingers are made more rigid by tying with twisted wire at 4 ft. and 2 ft. from the free ends of the fingers.

The gates are suspended from an overhead log by means of wires, and these wires, together with those from a bed log to the bottom rails, hold the gates in position when it is set.

There should be about 12 in. between the ends of the gates when they are in the set position. The wires holding the gates in the set position should have just enough tension to spring the gates back into position after a beast has pushed its way through.

The suspending wires are looped over the overhead rail so that they can be slid along the rail when the gates are in the open position.

The bottom rail of the gate is about 14 in. off the ground and the rails at the free ends are spaced about 7 in. apart (centre to centre).

The ends of the fingers are slightly sharpened so as to discourage cattle from attempting to return through the set gate. The fingers should be constructed of strong bush timber with a diameter of 2-2½ in.


# The Influence of Feeding Practice on Baconer Carcase Quality.

K. J. HUTCHINSON (formerly Assistant Husbandry Officer, Pig Branch).

THE undesirability of marketing overfat pigs is being constantly publicised. This is necessary because consumer resistance to over-finished bacon and ham is a constant problem of the bacon factory. Public preference for the product which contains a relatively high proportion of lean meat is possibly most marked in subtropical and tropical areas such as Queensland, where fats play a far less important role in the human diet and are regarded by many as distasteful.

Under such influences, quality improvement of baconer carcases becomes largely a question of reducing the incidence of "overfatness."

There are several general approaches to the solution of this problem. Firstly, the farmer should exercise a more thorough selection of his marketable stock and dispose of them before they become "overfat". However, in many cases he is faced with the problem of an inherited "too early" maturity in his growing stock, and if he wishes to carry his pigs on to bacon weight, in most cases they will be "overfat" when marketed. A long-range plan to correct this should be to replace or intensify selection for later maturity in the breeding herd. At the same time, some immediate improvement may be effected by altering the feeding practices.

## FEEDING PRACTICES CAN INFLUENCE CARCASE QUALITY.

It is universally accepted that in the later stages of an animal's growth fat develops at a faster rate than either bone or muscle. Quality improvement of pig carcases through feeding practice has been largely based on restricting growth during this period. For bacon pigs this restriction can be practised between 100 lb. and 200 lb. liveweight.

Growth restriction in the "finishing off" stage is of course brought about by reducing feed intake. There are two ways by which this can be done. Firstly, the actual gross amount of ration feed can be reduced. The success of this practice in bringing about an improvement in carcase quality has been shown by many overseas trials. For example, in Great Britain experiments with Large White pigs showed that by reducing the feed intake by one-quarter in the 65-200 lb. liveweight stage, a marked improvement in grade resulted. Some 66% of the pigs receiving restricted rations achieved bonus grade, compared with only 18% in the group which received a full ration allowance.

The second way is in effect a reduction of the net feed intake and depends upon lowering the overall digestibility of the ration by adding a relatively indigestible component. Feeding-stuffs which are relatively indigestible for pigs, largely because of their crude fibre content, include wheat bran, oats, lucerne chaff, lucerne meal, chaffed peanut hay and brewers' grains.

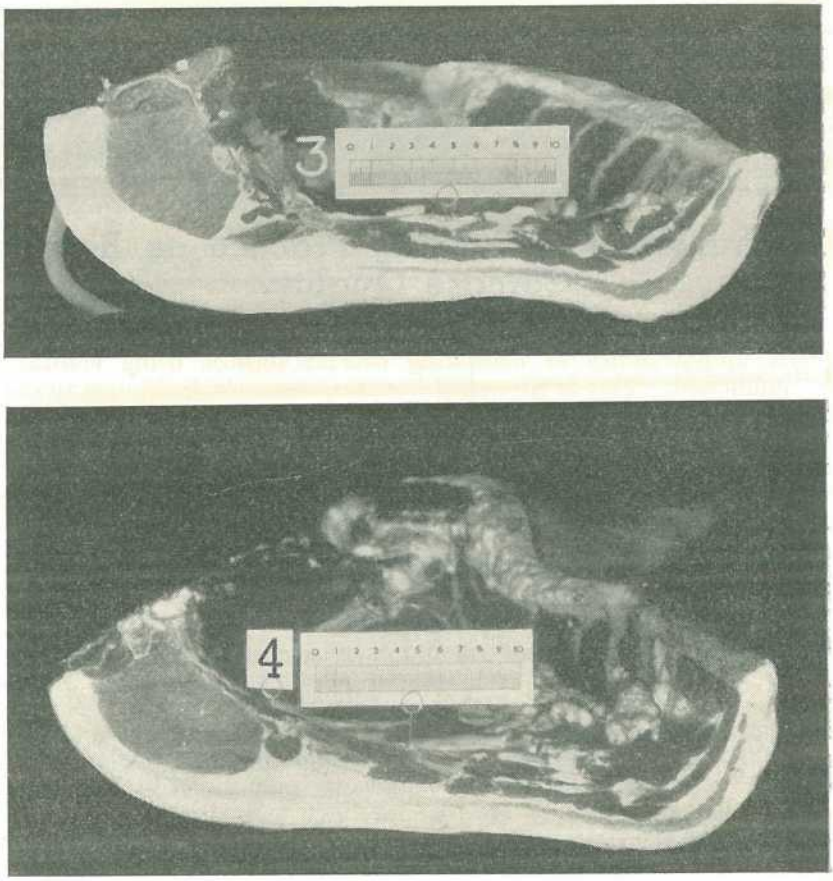



Plate 1.

**Backfat Thickness Has Been Reduced by Feeding Lucerne Chaff in the "Finishing Off" Stage.** Pig No. 4 received lucerne chaff as a substitute in the ration. Pig No. 3, a carefully selected litter brother, did not.

There are several advantages attached to the method which causes a feed intake restriction by indirect means. They include the following:—

(1) Self-feeding methods can still be used provided the mixture will "run" satisfactorily and the indigestible component is sufficiently palatable to discourage selective feeding.

(2) Because his pigs can feed to appetite, the farmer does not have to worry about the problem of determining how much should be fed to obtain effective restriction.

## QUEENSLAND FEEDING TRIALS TO IMPROVE CARCASE QUALITY.

The method by which a reduction in the net feed intake is effected has been investigated by the Department of Agriculture and Stock. Lucerne chaff, because of its availability, was chosen as the relatively indigestible component of the "finishing off" ration.

### Trial 1.

This trial was carried out at H.M. State Farm, Palen Creek. Two groups of Berkshire pigs were employed. Group A as control was fed a meatmeal-grain ration with mineral and vitamin supplements. Group B was fed a ration similar to A but with the following levels of lucerne chaff substituted pound for pound for grain:—

| Liveweight. lb. | Percentage of Grain Progressively Substituted by Lucerne Chaff. |
|---|---|
| 100–135 | 5 |
| 135–165 | 10 |
| 165–200 | 15 |

In contrast to trial 2 (see later), which was carried out under field conditions, the fullest possible experimental control was exercised. Ten pairs of pigs were selected for similarity in conformation, sex, litter and initial weight at approximately 70 lb. liveweight. Each pair was housed in an experimental pen and fed a ration of grain and meatmeal until 100 lb. liveweight. At this weight one of each pair was allotted at random to each group. Experimental treatment was then commenced and carried through until individuals reached approximately 200 lb., when they were slaughtered, appraised and photographed.

Pairs were housed together but fed individually twice daily. Consumption was accurately recorded and offerings so arranged that the total feed consumptions of the individuals in each pair were equal. In this way differences in gross feed intake, which would affect growth rate, were eliminated. As confirmed by palatability observations in trial 2, there was no difficulty in maintaining consumption in relation to normal allowances. It was observed, however, that pigs receiving the lucerne chaff substituted ration fed longer than the control animals.

Plate 2 shows the average liveweight of the two groups throughout the trial and Table 1 presents the more important results.

TABLE 1.

SUMMARY OF DATA FROM TRIAL 1.

| | Control Ration. (Group A) | Substituted Ration. (Group B) |
|---|---|---|
| *(1) Growth rate (lb. per week) | 10·03 | 8·84 |
| *(2) Thickness of backfat at loin (mms.) | 23·2 | 21·2 |
| *(3) Area of fat in sq. in. (in loin section) | 116·7 | 103·2 |
| *(4) Ratio of lean to fat | 0·58 | 0·68 |
| Average dressed weight (lb.) for all pigs appraised | 152 | |

*Technical Notes.*—

(1) Difference significant at 0·1% level.

(2) Difference approached significance at 5% level.

(3) Difference significant at 5% level. Area of fat was obtained by measuring total area and area of lean on full-scale photographs with a planimeter, and subtracting the latter from the former.

(4) Difference significant at 5% level.

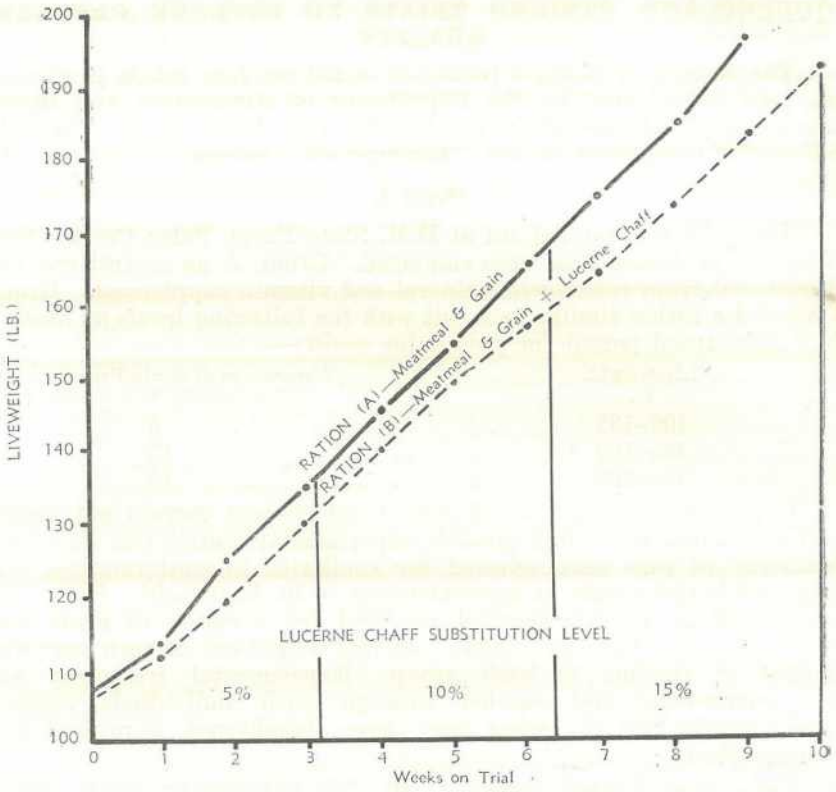



Plate 2.

**Graph Showing How Growth Has Been Slowed Down in the Fat Developing Stage by Substituting Lucerne Chaff for Portions of the Grain Component of the Ration.**

The effect of including lucerne chaff at the stated levels in the "finishing off" ration can be seen from inspecting Table 1. Growth rate has been slowed down in the fat developing stage by approximately 12%. At the same time there has been a consequent reduction in the amount of fat produced in the carcase, as shown by the appraisal figures, remembering that both groups were slaughtered at comparable weights. In other words, by this feeding practice, maturity has been delayed and hence the danger of overfatness has been reduced.

## Trial 2.

This further trial, under field conditions, was carried out at Kairi Regional Experiment Station, on the Atherton Tableland. Because the farmer must necessarily feed a group of animals of various weights, it is not possible for him to maintain a feeding programme for each individual pig. This field trial was necessary then to demonstrate that the detailed results obtained in trial 1 would be effective in improving carcase quality under field conditions.

Twenty Tamworth pigs of various weights and mixed sexes were available from a number of different litters. However, since the value of this trial was one of field comparison, this variability coupled with the practice of group feeding to appetite was similar to practical farm feed-lot conditions.

Two groups each of 10 pigs of an average liveweight of approximately 100 lb. were formed, one being kept as a check and fed a meatmeal-grain mixture and the other receiving lucerne chaff substituted for grain as in trial 1. The pigs were slaughtered upon reaching 200 lb. liveweight, and the carcases graded according to the Northern Pig Marketing Board's standards and appraised by the Hammond method.

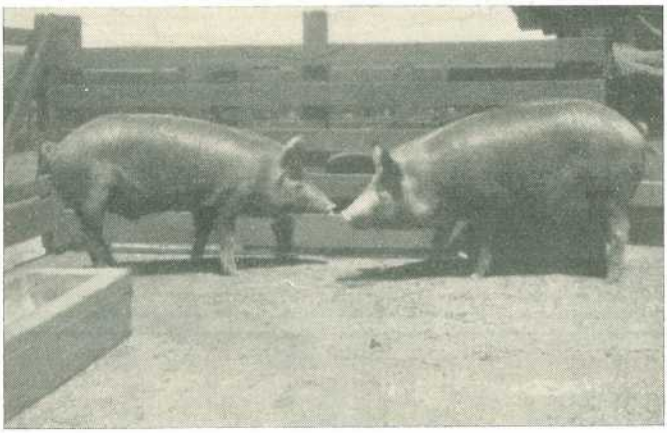


Plate 3.

**The Effect of the Ration on Fat Development Can be Seen by Comparing These Two Pigs.** The one on the left received lucerne chaff, while the other was fed on meatmeal-grain mixture alone.

Results again showed a growth rate restriction (10%) in the lucerne chaff group (Plate 3), which was accompanied by a marked improvement in grade (N.P.M.B.) and restriction of fat development (decrease 15% in loin backfat thickness).

## THE ECONOMICS OF SUBSTITUTION.

In those areas where marketing systems are such that carcase grade does not affect payment, the economics of this feeding practice can be based mainly on the comparative prices of grain and lucerne chaff or substitute, provided that such things as the additional ration consumption brought about by the longer growing period are taken into account. Another minor factor is the additional labour cost to the farmer for having the pigs on his farm for this additional 10-12 days due to slower growth.

Considering lucerne chaff substitution at the 5-15% levels mentioned, the growth and ration consumption figures for trial 2 can be used as a practical example to illustrate the economics of the practice. Taking all factors into account, it was estimated that for group B, as compared with A, the grain saving due to lucerne chaff substitution was 233 lb., while at the same time the amount of lucerne chaff used was 396 lb.

From these two figures, a relationship can be drawn up showing the critical price of lucerne chaff beyond which substitution is uneconomical (Plate 4).

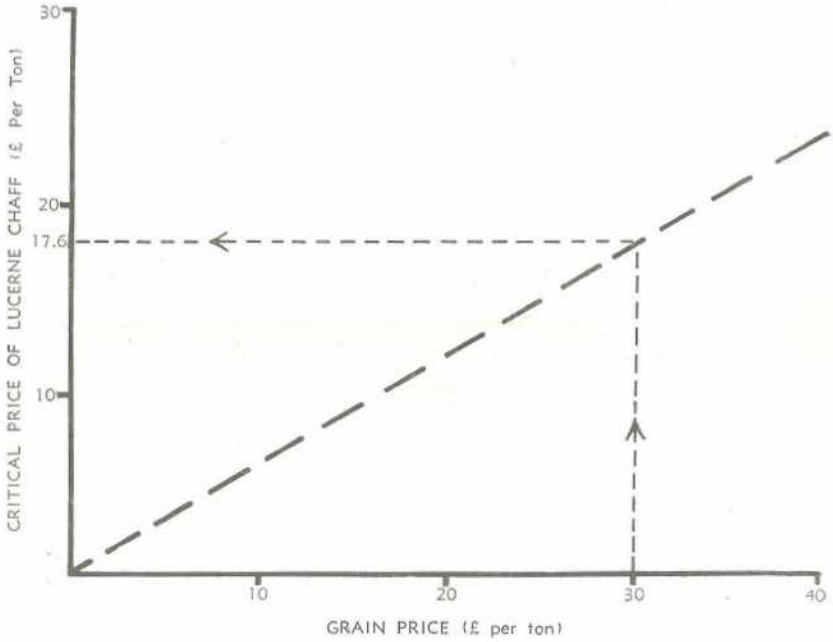



Plate 4.

**Graph Showing the Economics of Substituting Lucerne Chaff for Grain Under Conditions Where There is no Premium for Quality.** The dotted lines indicate how the graph is read. They show that if grain is £30 per ton, lucerne chaff cannot be substituted economically unless it costs £17.6 or less per ton.

Reading from the graph, if grain was purchasable at £30 per ton then it would be uneconomical to substitute lucerne chaff at the recommended levels if its purchase cost was more than £17·6 per ton.

There are several other points, however, which are worthy of note:—

(1) If grading was uniformly introduced, the practice would become increasingly economical.

(2) A similar improvement in grade can be expected by using feeding-stuffs other than lucerne chaff as the relatively indigestible component. These feeding-stuffs (oats, wheaten bran, chaffed peanut hay, etc.) have been mentioned previously and often may be obtained at a relatively lower cost.

(3) Even though the feeding practice may prove uneconomical to some degree, the quality improvement which results is in the best interests of the pig industry.

## SUMMARY.

Feeding practice can play an important part in improving pig carcase quality. The feeding principle which brings about this improvement is a restriction of growth rate in the "finishing off" stage (100-200 lb. liveweight), where emphasis is laid on fat development. A practical method of achieving this is to substitute lucerne chaff for 5-15% of the grain in the ration at this period. Alternatives to lucerne chaff have been suggested.

Insofar as maturity is delayed and the danger of overfatness decreased, this method has been shown both by detailed experiment and by practical trial to improve carcase quality. When the value of grain saved is measured against the cost of the chaff substituted, the method is often economical even in the absence of a premium for quality.

**ACKNOWLEDGMENT.**

The enthusiastic co-operation of the staff of H.M. State Farm, Palen Creek, was a major contribution towards the success of trial 1.

# Suitable Feeds for Pigs.

F. BOSTOCK, Officer in Charge, Pig Branch.

**Maize.**

Of all cereals, maize is the richest, or one of the richest, in carbohydrates and fat. Maize when fed alone does not supply an efficient ration, especially for growing pigs; and when being hogged down, or fed either on the cob or shelled, it should be supplemented with some protein-rich food.

Pigs fatten well on maize; but, as it produces a softer bacon than that from pigs fed on most other grains, it should not be fed to excess in the later stages of the preparation of baconers.

**Sorghum.**

Grain sorghum seed has a fattening value equivalent to 80 to 85 per cent. of that of maize; when fed alone it is an insufficient ration, and should therefore be supplemented with a protein-rich feed. Because of the hardness and size of the grain, grinding may be necessary, especially for young pigs. Outstanding qualities of these grains are their drought-resistance and sureness of cropping. Grain sorghums will fatten pigs, but unless properly balanced with protein supplements are inclined to produce bacon of inferior quality.

**Barley.**

Of all grains, barley is recognised as the best for fattening pigs. It produces pork and bacon of the finest quality, and, particularly, the fat produced is hard, white, and free from greasiness. Barley may be fed alone or with other grains.

**Wheat.**

Wheat may be fed alone or with other grains. It is an excellent feed for pigs, yielding firm flesh and a satisfactory fat, and possessing a nutritive value equal to barley, while from a protein point of view it is superior to barley. One disadvantage is that if finely ground it is inclined to become doughy when moistened, and for this reason it should only be cracked.

**Oats.**

Oats are not ordinarily used as pig food because of the large percentage of husk; also, when fed to young pigs scouring sometimes develops. Oats produce a good quality pork or bacon, but should be

finely ground if used for young pigs and coarsely ground for porkers, baconers and brood sows. This grain is useful for increasing the fibre or bulk in rations fed to baconers during the closing stages of the finishing period.

**Peas.**

Peas are rich in protein and are therefore useful in balancing such grains as have a high carbohydrate content. Fed alone, they produce a very hard, lean flesh, and young pigs do not thrive on them. Good results are obtained when peas are mixed with other grains, but they should not constitute more than 25 to 30 per cent. of the ration.

**Millet.**

If fed alone, millet will produce pork or bacon of inferior quality and inclined to be soft. For best results, millet should be mixed with other grains and should never exceed more than 30 to 35 per cent. of the ration.

**Beans.**

Beans also produce pork or bacon of inferior quality when fed alone, but can be profitably used with other grains, although they should not form more than 10 per cent. of the ration. Beans are not very palatable to pigs of any age. For best results they should be cooked or steamed, when up to 30 per cent. may be used.

**Canary Seed.**

An analysis of this grain indicates that the fat and protein contents are greater than for most other grains. However, the additional protein is not so great that it would materially reduce the protein supplements necessary to balance the ration.

With a high fat content, excessive feeding of canary seed would tend to produce a soft fat and for this reason it is recommended that it constitutes not more than 50 per cent. of the grain ration.

**Rice.**

Rice, if fed in excessive quantity, will produce flesh inclined to be soft. Because of the large percentage of husk, rice should not exceed 25 to 30 per cent. of any ration, except for light baconers to baconers, when it may form 50-55 per cent. of the grain ration.

**Lentils.**

An average analysis for lentils is crude protein 24.42 per cent., fat 0.58 per cent., carbohydrates 56.07 per cent., fibre 2.96 per cent. This suggests that lentils if fed excessively to pigs would produce a hard, lean flesh; therefore it is recommended that they constitute not more than 30 per cent. of the ration fed.

**Arrowroot.**

Arrowroot is a useful crop, as it is heavy yielding and hardy, and will stand in the field for long periods before it need be harvested. Although most of the nutriment is in the bulbs, pigs will eat the tops, which are usually succulent. Arrowroot may be fed raw or boiled, or the pigs may be allowed to harvest the crop themselves. This feed is a carbonaceous roughage and should be fed in combination with more concentrated and protein-rich foods.

**Flour.**

Flour may be used to replace up to 30 per cent. of the grain ration, but would have to be fed in conjunction with either milk by-products or meatmeal. If fed as suggested no trouble should be experienced with the pigs, but excessive amounts may lead to digestive disorders.

**Potatoes.**

Potatoes consist of about 75 per cent. water and 25 per cent. dry matter, which for the most part is composed of starch. In view of the large quantity of water, 4 lb. of potatoes are generally accepted as being equal to 1 lb. of maize or wheat. This raises the question of bulk. While potatoes may be fed to all classes of pigs, best results will be obtained when pigs are 16 to 18 weeks old, at which stage the digestive tract will have grown sufficiently to cope with the necessary bulk, and one-third of the grain ration may be replaced by potatoes. As pigs become older the proportion may be increased. Thus, by the time pigs are about 23 weeks old, two-thirds to three-quarters of the ration could be replaced, but it would not be advisable to go beyond this point.

Usually potatoes are too valuable to be used as pig feed. When they are available they should be boiled.

**Sweet Potatoes.**

Sweet potatoes are a bulky carbonaceous food which may be used to replace portion of the grain ration; about 4 lb. of sweet potatoes are considered equal to 1 lb. of grain. Pigs of all ages relish sweet potatoes, and they may be dug and fed in the yards, or pigs may be turned on to the crop and allowed to do the harvesting themselves. The vines make good green feed but there have been cases of poisoning; this risk, however, is very slight when compared with the large number of pigs which are fed on this crop. When pigs are fed on sweet potatoes, protein-rich foods such as separated milk or meatmeal should be included in the ration.

**Cassava.**

The root of cassava has a similar analysis to sweet potatoes. However, care must be taken unless the variety intended for feeding is known to be safe, because several varieties contain a prussic-acid yielding glucoside. Overseas feeding tests have shown that when cassava constitutes one-half of the ration severe scours result, but if only forming one-third of the ration good results are obtained.

Cassava has a value as a "stand-over" or reserve crop.

**Mangolds.**

These are a bulky carbonaceous food containing approximately 85 per cent. of water. They may be fed to all classes of pigs, best results being secured when pigs are 16 to 18 weeks of age, at which time up to one-third of the grain ration may be replaced by mangolds.

While there have been no reported cases of loss when feeding mangolds fresh, it is a good practice to store or allow to wilt for one or two days in a cool place before feeding. Reports have been received of poisoning when mangolds have been cooked.

**Beetroot.**

An average analysis for beetroot is crude protein 0.9 per cent., carbohydrates 9.1 per cent., fat 0.1 per cent., indicating that this crop can only be considered as a poor food for pigs and regarded as suitable only to supplement grazing or green food.

**Tomatoes.**

Tomatoes contain approximately 1 per cent. protein and 5 per cent. carbonates. They provide copper and their vitamin A content is good. However, the water content is high and they are therefore a bulky food. They are palatable to pigs and are best fed raw.

Tomatoes may be fed in combination with grain, milk or meatmeal and green feed. Should large quantities be available, 8-9 lb. may be used to replace 1 lb. of the grain ration.

**Pumpkins.**

Pumpkins contain over 80 per cent. of water and are therefore a bulky food, but they are palatable to pigs. They are best fed raw.

The seeds of pumpkins contain a fair amount of oil and protein and also act as a mild vermifuge. For these reasons they should not be wasted, but they should be fed with caution, as digestive troubles sometimes occur when excessive amounts of seeds are fed without the flesh of the pumpkin.

Pumpkins can be ready for feeding in good seasons from December onwards, and if stored in a dry, cool place and picked over frequently to remove the rotting ones the pumpkin supply may be kept up till the following summer.

Pigs relish pumpkins and the crop fits into the cropping system very well. Pumpkins are useful when fed in combination with grain, milk and lucerne. Cases of yellow colouration in the flesh of pigs fed heavily on pumpkins have been reported; therefore, care should be taken not to overdo pumpkin feeding with porkers or baconers.

**Melons.**

Melons are sometimes used as pig food, but contain approximately 95 per cent. of water. They are therefore not so nutritious as pumpkins.

**Peanuts.**

Peanuts may be fed to pigs of all ages, but because of their very high oil content (about 36 per cent.) will produce soft or oily bacon, and therefore should be eliminated from the ration at least six weeks before the pigs are ready for market.

**Soybeans.**

Soybeans also are an excellent food for young pigs, but they should be used in the same way as peanuts. The high oil content of the soybean (about 17 per cent.) will produce soft pork or bacon if care is not exercised.

**Molasses.**

Molasses contains approximately 57 per cent. of carbohydrates in the form of sugar, and is therefore a heat and energy producing food. It has a laxative effect on pigs, and is useful in dry seasons when green feed is not available or in short supply. Molasses should be fed in only small quantities, as careless feeding may cause severe diarrhoea.

**Sugar-cane and Cow Cane.**

These feeds contain large amounts of fibre not digested by pigs, and are of low food value, but during dry periods or when green feed is not available they may serve a useful purpose. Plenty of cane should always be fed, otherwise constipation may result from pigs feeding on the fibre.

**Pollard.**

Pollard is a valuable addition to grain foods, helping very considerably in balancing the ration, and its fineness makes it very suitable for young pigs. When fed alone, it has a tendency to produce soft flesh. The best results are obtained when it is used as a supplement to grain foods.

**Bran.**

Bran, when fed wet, has a laxative action, so is useful in preventing constipation in sows. It is usually given just before or after farrowing. It is not recommended as a fattening food.

**Meatmeal.**

Meatmeal, a protein-rich food, is a meatworks by-product. It is very valuable in balancing grain rations when milk or milk by-products are unavailable.

**Blood Meal.**

Blood meal is a protein concentrate containing 60–75 per cent. protein. Its palatability varies, but if mixed with other supplements it gives good results.

**Fish Meal.**

As a protein supplement, fish meal is equal to meatmeal, but if fed in excessive quantities may give a fishy flavour to the carcase.

**Calf Meat.**

In 100 lb. of calf meat there would be approximately 19 lb. of protein and 4 lb. of fat available as food. Boiled calf meat could be used successfully as a supplement to balance the grain ration and in this respect 100 lb. of meat when cooked is approximately $\frac{1}{3}$ the value of 100 lb. of 55 per cent. meat meal.

**Linseed Meal.**

Linseed meal should form only 6 per cent of a ration. It is a protein-rich food, has a fairly high oil content and exerts a laxative action.

**Cottonseed Meal.**

Cottonseed meal, a by-product, is a protein supplement. Its use has been limited because some cases of poisoning have been reported from feeding in too large a proportion or over lengthy periods. Recent experiments, however, have indicated that up to half the protein supplement of a ration may consist of cottonseed meal.

**Cocoa Meal.**

Cocoa meal cannot be recommended as a food for pigs, and has been known to cause abortion in sows.

**Peanut Meal.**

Peanut meal is a source of protein supply which gives good results, but it is preferably mixed with equal parts of meatmeal, the mixture being fed at the same rate as recommended for meatmeal. Peanut meal should not be fed in excess, because the bacon produced may be soft and have an unsatisfactory flavour.

**Candlenut.**

Refined oil from the candlenut has been used as a substitute for linseed oil, but as in the case of raw oil it causes severe scouring when included in the ration fed to pigs. The residue after extraction is known to contain poison and when fed to brood sows may cause abortion due to severe pain associated with the scouring. Candlenut meal or oil is not recommended as pig food.

**Silage.**

Silage is not recommended as a suitable food for pigs. However, it has been used for brood sows and older stock during times of drought, and growing stock have been allowed a small percentage in their ration when green feed or root crops have not been available. Its palatability is usually poor.

**Skim Milk and Buttermilk.**

In supplementary value, skim milk and buttermilk excel any other single feed. They are especially recommended for pigs just weaned, as they are very palatable and digestible. They usually contain between 3 and 4 per cent. protein, and supplement well the proteins of farm grains. Skim milk and buttermilk also are rich in essential mineral elements.

While these feeding stuffs are of equal value for pigs, precautions should be taken to see that the buttermilk has not been diluted with wash water. Both should be pasteurized or boiled in order to prevent the possibility of tuberculosis. Their high value is shown by the fact that roughly 500 lb. can be considered worth as much as a bushel of maize.

When these by-products are fed in small amounts they have a higher value per pound than when they form a large proportion of the ration. Young pigs require larger proportions of milk to grain than do older pigs. It will be found that about one gallon of skim milk or buttermilk per day will balance a maize ration for pigs from weaning age to market weights. During the period of rapid growth (between 90 and 130 lb.), $1\frac{1}{2}$ to $1\frac{3}{4}$ gallons may be utilized very profitably.

**Buttermilk Powder.**

Buttermilk powder has an approximate analysis of protein 35 per cent., fat 4 per cent., ash 10 per cent., and moisture 8.5 per cent. As a source of protein, buttermilk powder has approximately three-fifths the value of 55 per cent. meatmeal. Due to the high biological value of milk foods, the quantity fed could be the same as meatmeal, provided a vegetable protein is fed as additional supplement. The cost of this product is usually too great to permit its use as pig food, but small quantities could be fed with meatmeal and in this way relieve the meatmeal supply position.

**Whey.**

Whey is a good food for all classes of pigs, and if used in proper balance with other foods gives results similar to those obtained by feeding separated milk. Whey is lower in protein content, and its total food value is only half that of skim milk. This does not necessarily mean that twice the volume of whey must be fed to obtain similar results in pig feeding.

Whey must be fed while fresh, and should be kept as clean as possible; this means collecting the whey daily if practicable. Never put fresh whey into drums containing stale whey. Dirty and stale whey is responsible for many of the digestive disorders occurring in whey-fed pigs, particularly weaners and stores.

Pigs should be given small amounts of fresh whey at about six weeks of age to accustom them to the ration that they will receive when weaned. They should also receive a small amount of grain at this stage. Start with a pint of whey daily per pig, and gradually increase the whey so that at eight weeks of age each pig receives one gallon daily. The grain should have been increased to 1½ lb. daily by this time. A week before weaning commence feeding a protein-rich food such as meatmeal (55 per cent. protein); 2 oz. is sufficient to start with, but gradually increase so that at weaning each pig receives 4 oz. daily. This amount of meatmeal is not increased further as the pigs grow, but the whey and grain are increased gradually, grain at the rate of 4 oz. per week per pig, and whey just as much as the pig will drink comfortably. The feeding of large quantities of whey to young pigs is responsible for the unthrifty pot-bellied appearance often seen in whey-fed pigs.

### Relative Value of Feeding Stuffs.

One pound of grain (barley, wheat, maize or sorghum) is approximately equal to—

4 lb. sweet potatoes.
4 lb. English potatoes (boiled) or artichokes.
5 lb. arrowroot.
6–8 lb. pumpkins or apples.
8–9 lb. mangolds, turnips, or carrots.
5–10 lb. green pasture or forage crops.
10 lb. separated milk or buttermilk.
9–15 lb. kale, kohl rabi, cabbage, cauliflower or melons.

### Advice on Feeding.

If you have a feeding or husbandry problem consult one of the following Advisers, Pig Branch, stationed at the undermentioned centres:—

| | | | |
|---|---|---|---|
| Atherton .. | T. Abell | Murgon .. | C. R. Grieve |
| Biloela .. | J. Christensen | Toowoomba .. | C. Porter |
| Brisbane .. | E. L. Melville | Warwick .. | J. N. Liddell |

# Brucellosis Testing of Swine.

The Department of Agriculture and Stock is operating a scheme whereby pig herds are tested at intervals for the occurrence of swine brucellosis (contagious abortion).

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

In order for a herd to be retained on the list of Tested Herds, a semi-annual or annual re-test of the herd, as determined by the Director, is required. If at a re-test any animal gives a positive reaction to the test the herd is removed from the list; it is not listed again until subsequent tests, as determined by the Director, have been carried out.

Full particulars of the Brucellosis Testing of Swine and application forms may be obtained from the Under Secretary, Department of Agriculture and Stock, William Street, Brisbane.

## TESTED HERDS.
## (AS AT 25th JUNE, 1953.)

| Breed. | Owner's Name and Address. |
|---|---|
| Berkshire .. .. | J. J. Bailey, " Lucydale " Stud, East Greenmount |
| | S. Cochrane, " Stanroy " Stud, Felton |
| | Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield |
| | G. Handley, " Handleigh " Stud, Murphy's Creek |
| | J. L. Handley, " Meadow Vale " Stud, Lockyer |
| | R. G. Koplick, " Melan Terez " Stud, Rochedale |
| | O'Brien and Hickey, " Kildurham " Stud, Jandowae East |
| | E. Pukallus, " Plainby " Stud, Crow's Nest |
| | G. C. Traves, " Wynwood " Stud, Oakey |
| | E. Tumbridge, " Bidwell " Stud, Oakey |
| | Westbrook Farm Home for Boys, Westbrook |
| | H.M. State Farm, " Palen " Stud, Palen Creek |
| | A. R. Ludwig and Sons, " Cryna " Stud, Beaudesert |
| | H. H. Sellars, " Tabooba " Stud, Beaudesert |
| | F. Thomas, " Rosevale " Stud, M.S. 373, Beaudesert |
| | D. T. Law, " Rossvill " Stud, Trout road, Aspley |
| | R. H. Crawley, " Rockthorpe " Stud *via* Pittsworth |
| | F. R. J. Cook, " Alstonvilla," Woolvi, *via* Gympie |
| | Mrs. I. M. James, " Kenmore " Stud, Cambooya |
| | H. L. Stark, " Florida," Kalbar |
| | J. H. N. Stoodley, " Stoodville," Ormiston |
| | H.M. State Farm, Numinbah |
| | V. G. M. and A. G. Brown, " Bardell," Goovigen |
| | R. E. Paulsen, " Crest " Stud, Binjour Plateau, M.S. 670, Gayndah |
| | M. G. and R. H. Atkins, " Diamond Valley " Stud, Mooloolah |
| | L. Puschmann, " Tayfeld " Stud, Taylor |
| | Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes |
| | W. F. Ruhle, " Felbar " Stud, Kalbar |
| Large White .. .. | H. J. Franke and Sons, " Delvue " Stud, Cawdor |
| | Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield |
| | J. A. Heading, " Highfields," Murgon |
| | K. B. Jones, " Cefn " Stud, Pilton |
| | R. G. Koplick, " Melan Terez " Stud, Rochedale |
| | R. Postle, " Yarralla " Stud, Pittsworth |
| | E. J. Bell, " Dorne " Stud, Chinchilla |
| | L. C. Lobegeiger, " Bremer Valley " Stud, Moorang, *via* Rosewood |
| | J. H. G. Blakeney, " Talgai " Stud, Clifton |
| | H. R. Gibson, " Thistleton " Stud, Maleny |
| | H.M. State Farm, Numinbah |

**TESTED HERDS**—continued.

| Breed. | Owner's Name and Address. |
|---|---|
| Large White .. .. | K. A. Hancock, " Laurestonvale " Stud, Murgon<br>V. P. McGoldrick, " Fairymeadow " Stud, Cooroy<br>N. Woltmann and Sons, Wooroolin<br>R. S. Powell, " Kybong " Stud, Kybong, *via* Gympie<br>E. B. Horne, " Kalringal," Wooroolin<br>S. T. Fowler, " Kenstan " Stud, Pittsworth<br>J. A. and J. McNicol, " Camden," Canning Vale, Warwick<br>H. L. Larsen, " Oakway," Kingaroy<br>C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek<br>E. G. Evans, " Lauraven " Stud, Box 22, Maleny<br>Mrs. I. G. Utting, "White Lodge," Mountain Road, Cooroy<br>N. E. Meyers, Halpine Plantation, Kallangur<br>Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes<br>G. I. Skyring, " Bellwood " Stud, *via* Pomona |
| Tamworth .. .. | S. Kanowski, " Miecho " Stud, Pinelands<br>N. R. Potter, " Actonvale " Stud, Wellcamp<br>D. F. L. Skerman, " Waverley " Stud, Kaimkillenbun<br>A. C. Fletcher, " Myola " Stud, Jimbour<br>Salvation Army Home for Boys, " Canaan " Stud, Riverview<br>F. Thomas, " Rosevale " Stud, M.S. 373, Beaudesert<br>A. J. Surman, " Namrus " Stud, Noble road, Goodna<br>Department of Agriculture and Stock, Regional Experiment Station, Kairi<br>E. C. Phillips, " Sunny View," M.S. 90, Kingaroy<br>T. A. Stephen, " Withcott," Helidon<br>W. F. Kajewski, " Glenroy " Stud, Glencoe<br>A. A. Herbst, Bahr Scrub, *via* Beenleigh<br>R. G. Koplick, " Melan Terez " Stud, Rochedale<br>H.M. State Farm, Numinbah<br>D. B. Alexander, " Debreczen " Stud, Kinleymore, *via* Murgon<br>Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes |
| Wessex Saddleback .. | W. S. Douglas, " Greylight " Stud, Goombungee<br>D. Kay and P. Hunting, " Kazan " Stud, Goodna<br>E. Sirett, " Iona Vale " Stud, Kuraby<br>C. R. Smith, " Belton Park " Stud, Nara<br>H. H. Sellars, " Tabooba " Stud, Beaudesert<br>H. Thomas, " Eurara " Stud, Beaudesert<br>D. T. Law, " Rossvill " Stud, Trout road, Aspley<br>J. B. Dunlop, " Kurrawyn " Stud, Acacia road, Kuraby<br>A. Curd, " Kilrock " Stud, Box 35, Jandowae<br>C. Allison, " Colrene " Stud, Lake and Reserve roads, Slacks Creek<br>R. A. Collings, " Rutholme " Stud, Waterford<br>M. Nielsen, " Cressbrook " Stud, Goomburra |

## CHANGE OF ADDRESS.

Journal subscribers notifying change of address should state their full Christian names and surname as well as their full former and new addresses.

Address all communications to the Under Secretary, Department of Agriculture and Stock, Brisbane.

## TUBERCULOSIS-FREE CATTLE HERDS.
## (AS AT 25th JUNE, 1953.)

| Breed. | Owner's Name and Address. |
|---|---|
| Aberdeen Angus .. | The Scottish Australian Company Ltd., Texas Station, Texas |
| | F. H. Hutton, " Bingegang," Dingo |
| A.I.S. .. .. .. | F. B. Sullivan, " Fermanagh," Pittsworth |
| | D. Sullivan, " Bantry " Stud, Rossvale, *via* Pittsworth |
| | W. Henschell, " Yarranvale," Yarranlea |
| | Con. O'Sullivan, " Navillus Stud," Greenmount |
| | H. V. Littleton, " Wongalea Stud," Hillview, Crow's Nest |
| | J. Phillips and Sons, " Sunny View," Benair, *via* Kingaroy |
| | Sullivan Bros. " Valera " Stud, Pittsworth |
| | Reushle Bros., " Reubydale " Stud, Ravensbourne |
| | H. F. Marquardt, " Chelmer " Stud, Wondai |
| | W. G. Marquardt, " Springlands," Wondai |
| | A. C. and C. R. Marquardt, " Cedar Valley," Wondai |
| | A. H. Sokoll, " Sunny Crest " Stud, Wondai |
| | W. and A. G. Scott, " Welena," A.I.S. Stud, Blackbutt |
| | G. Sperling, " Kooravale " Stud, Kooralgin, *via* Cooyar |
| | C. J. Schloss, " Shady Glen," Rocky Creek, Yarraman |
| | W. H. Thompson, " Alfa Vale," Nanango |
| | S. R. Moore, Sunnyside, West Wooroolin |
| | H.M. State Farm, Numinbah |
| | D. G. Neale, " Grovely," M.S. 195, Pittsworth |
| Ayrshire .. .. | L. Holmes, " Benbecula," Yarranlea |
| | J. N. Scott, " Auchen Eden," Camp Mountain |
| | " St. Christopher's and Iona " Studs, Brookfield road, Brisbane |
| | E. Mathie and Son, " Ainslie " Ayrshire Stud, Maleny |
| | C. E. R. Dudgeon, " Marionville " Ayrshire Stud, Landsborough |
| Friesian .. .. | C. H. Naumann, " Yarrabine Stud," Yarraman |
| Guernsey .. .. | C. D. Holmes, " Springview," Yarraman |
| | A. B. Fletcher, Cossart Vale, Boonah |
| | W. H. Doss, Degilbo, *via* Biggenden |
| Jersey .. .. .. | Queensland Agricultural High School and College, Lawes |
| | J. S. McCarthy, " Glen Erin " Jersey Stud, Greenmount |
| | J. F. Lau, " Rosallen " Jersey Stud, Goombungee |
| | G. Harley, Hopewell, Kingaroy |
| | Toowoomba Mental Hospital, Willowburn |
| | Farm Home for Boys, Westbrook |
| | F. J. Cox and Sons, " Rosel " Stud, Crawford, Kingaroy Line |
| | R. J. Browne, Hill 60, Yangan |
| | P. J. L. Bygrave, " The Craigan Farm," Aspley |
| | R. J. Crawford, " Inverlaw " Jersey Stud, Inverlaw, Kingaroy |
| | P. H. F. Gregory, " Carlton," Rosevale, *via* Rosewood |
| | E. A. Matthews, " Yarradale," Yarraman |
| | A. L. Semgreen, " Tecoma," Coolabunia |
| | G. & V. Beattie, " Beauvern," Antigua, Maryborough |
| | L. E. Meier, " Ardath " Stud, Boonah |
| | A. M. and L. J. Noone, " Winbirra," Stud, Mt. Esk Pocket, Esk |
| | W. S. Conochie and Sons, " Brookland " Stud, Sherwood road, Sherwood |
| | Estate of J. A. Scott, " Kiaora," Manumbar road, Nanango |
| | F. W. Verrall, " Coleburn," Walloon |
| | C. Beckingham, Trout road, Everton Park |
| | W. E. O. Meier and Son, " Kingsford " Stud, Alberton, *via* Yatala |
| | G. H. Ralph, " Ryecome," Ravensbourne |
| Polled Hereford .. | W. Maller, " Boreview," Pickanjinnie |

# MARKETING

## Movements in the Wholesale Price of Lucerne—Brisbane, 1948-52.

PREPARED BY OFFICERS OF THE DIVISION OF MARKETING.

THIS analysis of lucerne chaff and lucerne hay prices on the Brisbane market is intended to throw some light on the nature of the market, its fluctuations, seasonal movements and existing trends, and also to provide a detailed picture of the course of prices since the beginning of 1948.

### GENERAL REMARKS ON PRODUCTION AND MARKETING.

In order that the various price movements might be more fully understood, a cursory examination of the basic price data and certain aspects of production and marketing is essential.

#### Prices Information Collected.

Data relating to the Brisbane market have been collected by the Market Price Reporting Section of the Division of Marketing. Complete recordings are made in respect of consignments submitted to auction, the items enumerated being quantity displayed for sale, quantity sold at auction and the various prices realised. The bulk of the produce offered each day at auction usually comprises consignments direct from grower to agent, and these consignments account for about half of the total receivals for both auction and private sale. Also auctioned is a portion of those consignments which represent purchases in the producing districts by various merchants. The balance of these latter consignments is either sold by private treaty prior to the commencement of auction sales or taken direct into store.

It is estimated that the recorded data of daily auction sales directly covers about 80% of total receivals in Brisbane, and inasmuch as some private treaty sales are made at "market rates", the overall coverage is even higher. Consequently, it is considered that the various averages which have been based on these data are fully representative. Detailed figures of average monthly prices of both lucerne chaff and hay are given in Tables 3 and 4.

#### Production.

The bulk of Queensland's commercial lucerne crop is produced in the Statistical Division of Moreton, principally on the deep fertile soils of the Brisbane, Fassifern, Lockyer and Logan Valleys. During the 5-year period 1947-48 to 1951-52, production in this division accounted for 62·5% of the State total, which averaged 89,788 tons per annum. Comparative figures for the other main statistical divisions were Downs

20%, Maryborough 13% and Rockhampton 4%. The relevant production figures are set out in Table 1. It should be borne in mind when referring to this table that at the time of harvest all cut lucerne is classified as hay and naturally includes that which is later converted into chaff.

TABLE 1.

LUCERNE HAY.

*Area and Production in Main Statistical Divisions.*

(Source—Queensland Government Statistician).

| Statistical Division. | | 1947–48. | 1948–49. | 1949–50. | 1950–51. | 1951–52. |
|---|---|---|---|---|---|---|
| Moreton .. | .. Acres | 22,407 | 21,434 | 21,744 | 16,693 | 14,744 |
| | Tons | 62,927 | 60,232 | 63,252 | 52,664 | 41,893 |
| Maryborough | .. Acres | 6,176 | 5,373 | 6,258 | 4,443 | 3,925 |
| | Tons | 13,783 | 11,732 | 14,483 | 10,612 | 7,678 |
| Downs .. | .. Acres | 16,158 | 11,530 | 11,250 | 11,084 | 9,037 |
| | Tons | 22,756 | 16,665 | 16,753 | 19,923 | 13,225 |
| Rockhampton | .. Acres | 1,773 | 1,724 | 1,983 | 1,586 | 1,956 |
| | Tons | 3,389 | 3,695 | 3,608 | 3,644 | 4,088 |
| Rest of State | .. Acres | 284 | 270 | 220 | 141 | 129 |
| | Tons | 501 | 494 | 388 | 334 | 222 |
| Total State.. | .. Acres | 46,798 | 40,331 | 41,455 | 33,947 | 29,791 |
| | Tons | 103,356 | 92,818 | 98,484 | 87,177 | 67,106 |

It will be seen from the table that during the last five years there has been a decline in both the area planted to lucerne for commercial purposes and the quantity harvested. In 1947-48, 103,356 tons of hay were harvested from an area of 46,798 acres, whereas in 1951-52 the corresponding figures were 67,106 tons from 29,791 acres, a fall of approximately 35%.

## Marketing.

Lucerne is marketed either as chaff or as hay. Over the last few years, receivals on the Brisbane Market have shown a tendency for the proportion of hay to increase at the expense of chaff. The average weekly receivals during 1948 were approximately 5,550 bags of chaff and 2,220 trusses of hay. Much the same ratio was preserved during 1949 and 1950, but in 1951 the average weekly figures were 4,140 bags of chaff and 4,170 trusses of hay. The apparent swing in favour of hay as the marketing medium continued during 1952, when comparative averages were 2,710 bags and 3,310 trusses respectively.

Various reasons can be advanced to explain this development but the relative importance of each is not readily apparent. However, the prime causes would seem to include (i) the more extensive use of mechanised balers; (ii) the high cost of bags; and (iii) the greater demand for hay for the hand feeding of stock during prolonged dry weather. The third cause is seasonal, and as the last two years of the period studied were "drought" years from the point of view of the livestock industries, the actual trend in favour of hay is probably less marked than the above figures seem to indicate.

With reference to the cost of bags, the maximum price of No. 1 quality chaff bags within the City of Brisbane area was 22s. per dozen.

in July, 1947, and rose steadily to 50s. 3d. by August, 1951. The position eased slightly during the first half of 1952 and the maximum price was reduced to 43s. 3d. per dozen by the middle of the year.

These changes in the proportions of hay and chaff marketed comprise the only significant divergence between the two types over the period. A comparison of the data relating to all other aspects, including weekly fluctuations, seasonal pattern and general trend, reveals a marked similarity. Consequently, for the sake of brevity, the detailed description which follows is confined to lucerne chaff.

## SEASONAL PATTERN OF PRICES.

*There is a definite and fairly regular seasonal pattern in lucerne prices. This results mainly from the nature of demand and is affected only to a minor extent by supply.*

### Demand Factors.

In normal seasons the demand for lucerne comes almost entirely from the dairying and poultry industries, and as this demand follows a fairly regular and well-defined pattern, it is naturally reflected in lucerne prices.

The demand for lucerne by the dairying industry, which is by far the largest consumer, is quite different in character from that of the poultry industry, being essentially of a seasonal nature, and it is evident that this factor is primarily responsible for the fairly regular seasonal pattern apparent in lucerne prices. Table 2 shows dairy cattle populations in each of the main statistical divisions of the State.

TABLE 2.

DAIRY CATTLE IN MAIN STATISTICAL DIVISIONS.

(Source—Queensland Government Statistician).

| Statistical Division. | Number at 31st March (Thousands). | | | | | |
|---|---|---|---|---|---|---|
| | 1947. | 1948. | 1949. | 1950. | 1951. | 1952. |
| Moreton .. | 403 | 427 | 429 | 417 | 416 | 387 |
| Maryborough | 346 | 358 | 376 | 380 | 388 | 331 |
| Downs .. | 311 | 298 | 302 | 315 | 315 | 291 |
| Rockhampton | 170 | 185 | 198 | 202 | 203 | 177 |
| Rest of State | 102 | 115 | 118 | 119 | 118 | 111 |
| Total State | 1,332 | 1,383 | 1,423 | 1,433 | 1,440 | 1,297 |

The requirements of the poultry industry take the form of green leafy lucerne for use either as green feed or in the preparation of poultry foods. The factor determining the strength of this demand at any time is the total number of fowls, and this is governed more by general economic conditions in the industry than by any seasonal influence. Consequently, the cause of seasonal pattern in lucerne prices lies elsewhere than in the demand from the poultry industry.

Another outlet for lucerne is the pastoral industry. With much of this industry located in the drier portions of the State, where natural grasses provide the main source of fodder, its demand is somewhat erratic. This is largely responsible for the recurrent episodic disturbances to the normal seasonal pattern. This aspect is dealt with later.

### Supply Factors.

The supply of lucerne chaff and hay to the Brisbane Market itself exhibits a definite seasonal pattern. Good supplies come forward during the first two or three weeks in January but fall off rapidly towards the end of that month. The next eight weeks (that is, February and March) mark the period of lightest supply and thereafter receivals increase until September. A slight decline occurs during October but supplies reach their peak in November. Then follows a fairly sharp reduction during December, when quantities available are somewhat on a par with January.

Although supplies exhibit a fairly regular seasonal pattern, their influence as a factor causing seasonal variation in the price of lucerne is comparatively slight. In the first place, most of the commercial stands are irrigated and cuttings can be made throughout the year. Moreover, yields are fairly constant and the volume of production is determined mainly by acreage. Secondly, with the exception of cuttings from fields carrying a heavy weed growth, lucerne need not be a perishable commodity. Provided sufficient skill is exercised during the cutting and curing, lucerne can be stored for very long periods. These factors tend to make supply rather elastic, and the quantities marketed are usually more sensitive to changes in price than are changes in price to the quantity marketed.

### Description of Seasonal Pattern.

The seasonal patterns of both supplies and prices are illustrated by Plate 1, which has been prepared in part from the monthly price averages given in Tables 3 and 4.

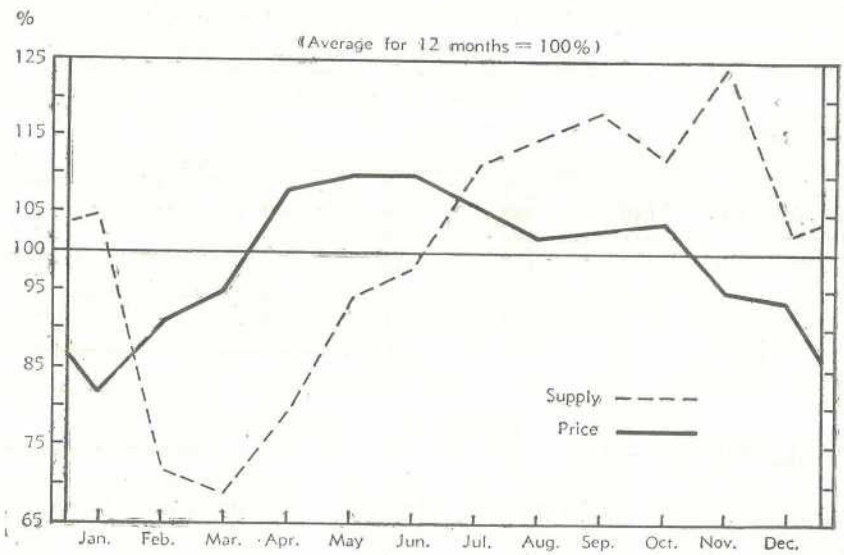



Plate 1.

**Lucerne Chaff.** Seasonal movements of supply and price computed from monthly averages for the period 1-1-48 to 31-12-50. (Average for 12 months—100%.)

TABLE 3.

LUCERNE CHAFF.

*Average Monthly Prices.*

(Auction Sales—Roma St. Goods Shed)

| Month. | Price per Ton. | | | | | |
|---|---|---|---|---|---|---|
| | 1948. | 1949. | 1950. | 1951. | 1952. | |
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | |
| January .. | 8 1 8 | 9 13 10 | 10 4 7 | 13 14 4 | 37 13 4 | |
| February .. | 10 7 9 | 10 6 0 | 10 14 3 | 15 4 10 | 48 9 5 | |
| March .. | 11 13 7 | 10 1 10 | 11 10 3 | 15 19 11 | 37 0 2 | |
| April .. .. | 12 2 9 | 11 17 10 | 14 3 3 | 18 4 2 | 33 19 8 | |
| May .. .. | 11 8 11 | 12 15 0 | 14 10 4 | 24 1 7 | 34 14 5 | |
| June .. .. | 10 15 7 | 13 1 3 | 15 0 10 | 24 11 10 | 30 2 10 | |
| July .. .. | 10 14 10 | 14 3 4 | 13 3 1 | 26 2 0 | 32 0 6 | |
| August .. | 11 8 7 | 13 4 7 | 12 0 5 | 34 19 5 | 25 4 1 | |
| September .. | 11 10 11 | 12 2 5 | 13 11 7 | 32 18 1 | 19 16 4 | |
| October .. | 12 19 8 | 11 3 3 | 13 17 2 | 35 12 0 | 16 1 4 | |
| November .. | 13 2 4 | 9 11 5 | 12 2 8 | 45 16 0 | 14 8 1 | |
| December .. | 11 11 0 | 9 16 6 | 13 12 2 | 55 16 9 | 16 15 2 | |

TABLE 4.

LUCERNE HAY.

*Average Monthly Prices.*

(Auction Sales—Roma St. Goods Shed)

| Month. | Price per Ton. | | | | | |
|---|---|---|---|---|---|---|
| | 1948. | 1949. | 1950. | 1951. | 1952. | |
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | |
| January .. | 4 12 2 | 6 9 5 | 6 8 1 | 6 19 11 | 22 15 3 | |
| February .. | 6 4 2 | 6 18 4 | 7 0 8 | 9 4 4 | 35 3 0 | |
| March .. | 6 8 8 | 5 10 4 | 7 12 10 | 9 8 0 | 24 15 7 | |
| April .. .. | 8 13 6 | 7 3 1 | 8 6 10 | 10 19 0 | 21 3 1 | |
| May .. .. | 8 7 0 | 7 9 0 | 8 9 9 | 13 13 6 | 20 4 7 | |
| June .. .. | 7 18 2 | 8 4 5 | 10 5 0 | 12 13 2 | 17 13 2 | |
| July .. .. | 6 7 0 | 8 1 7 | 9 7 4 | 13 0 2 | 19 11 1 | |
| August .. | 8 7 6 | 8 11 10 | 7 14 8 | 19 10 6 | 16 13 2 | |
| September .. | 8 1 8 | 8 1 9 | 8 9 3 | 21 4 9 | 13 0 0 | |
| October .. | 9 9 6 | 6 7 1 | 8 8 2 | 21 2 11 | 11 0 1 | |
| November .. | 9 6 0 | 5 19 0 | 7 2 0 | 36 15 3 | 10 0 5 | |
| December .. | 8 5 4 | 5 15 0 | 7 2 5 | 41 14 9 | 11 3 4 | |

The seasonal price pattern for lucerne consists of two distinct phases. A trough of low prices occurs during the summer months, with the lowest point in January, whilst during the cooler April-October period prices remain at a higher and more uniform level.

The low level of prices during January results from a combination of factors. Firstly, the dairying districts register their greatest rainfall during the summer, when excellent growing conditions exist. Consequently, there is usually an abundance of natural fodder, which results in a comparatively weak demand for lucerne. Secondly, good supplies of lucerne are usually placed on the market during January, especially during the first three weeks.

The reaction to the low January prices is a sharp drop in supplies which occurs about the fourth week. The quantities of lucerne received over the next eight weeks (that is, during February and March) continue to be very light, and a gradual recovery of prices is effected despite the prevailing weak demand. Trading in lucerne over this period nevertheless remains slack.

A brighter note is usually found in April, when an improvement in demand ensures that prices continue to rise even though an increase in supplies also occurs. Much the same factors operate during May and June, although the rate of increase in demand is diminishing during those months and prices are only slightly above the April level. Generally speaking, demand is fairly stable over the late winter months, but the grazing of winter grain crops is fairly extensive and as supplies continue to increase during July, August and September, prices tend to be somewhat lower. However, the general level remains fairly high.

There is another feature common to the winter period as a whole —this is the greater frequency and magnitude of fluctuations in weekly average prices. This feature is readily apparent in most of the years under consideration, and reference to the accompanying graphs roughly locates the general period of occurrence from the 18th to the 40th week of the year.

Although prices show a further slight rise during October, this month really marks a downward change in the seasonal pattern. This change becomes apparent over the closing stages of the month, with values becoming increasingly difficult to maintain, and during the next few weeks, when deliveries usually reach their peak, a fall in prices is experienced. This fall during November is largely explained by a reduction in the demand for lucerne following the normal seasonal improvement in the growth of natural grasses.

Much the same factors influence the market during December, yet the further drop in prices is usually only slight. The reason for this is that the effect of the continued decline in demand is to a large degree offset by a substantial reduction in the quantity of lucerne coming forward for sale. During the ensuing month a slightly greater volume of supplies is maintained and this results in a resumption of the falling price level, which, as explained earlier, is characteristic of trading during the first half of summer.

### Variations from Seasonal Pattern.

Nearly all variations from the seasonal pattern of lucerne prices are caused by episodic disturbances of a climatic nature. Most are of a minor character, but when drought occurs in the dairying and pastoral districts major variations result.

In the following paragraphs detailed comment is given on both minor and major variations during the whole of the period under review, the only major variation being in 1951-52. For the sake of ease of reference the variations are treated chronologically.

During 1948, prices rose more sharply than usual in February (from £7 10s. to £13 per ton) and the normal levelling out was advanced from April to March. This was primarily the result of a below-average rainfall in February. The next variation occurred during the late winter months, when dry, windy conditions caused a slight firming of prices at a time when the normal pattern shows a slight downward trend. An

extension of this movement followed the failure of the late spring and early summer rains, and prices continued at a fairly high level until the end of November.

Early 1949 was also dry and good summer rains were not experienced until February and March. As the market was fairly well supplied during those months, the normal rise in prices was delayed until April. However, the price rise in April was quite steep and reflected the rapid reduction in the nutritional value of pastures caused by severe early frosts. Prices held very well throughout the winter, as demand was better than usual because five successive months of below-average rainfall left the pastoral areas fairly dry.

During 1950, movements in prices for the most part showed a high degree of correlation with the normal seasonal pattern. However, a sharp drop in prices during July resulted from a temporary falling off in demand produced by mild midwinter conditions and exceptionally good rains.

The next two years found the dairying and pastoral industries in the grip of a prolonged drought and the normal price pattern just did not exist.

In 1951 the outlook for the winter was poor when April and May became the third and fourth successive dry months. Early frosts and persistent dry westerlies caused rapid deterioration in pastures and resulted in an abnormally strong winter demand, particularly from the dairying districts. In fact, average weekly prices advanced from £18 per ton at the end of April to £35 per ton in October.

Only scattered thunderstorms were received during the spring and summer, and these falls were mainly confined to the coastal areas. Consequently, demand from the dairying industry remained high and to it was added a very strong request from the pastoral areas, where the hand feeding of stock had become vital. Prices during this period rose quickly, reaching a peak of £60 per ton in the second week of December.

Early in 1952, useful relief rains in the dairying districts brought about a moderate fall in prices. This was accentuated in April, when most central and southern pastoral districts received above-average rainfall. However, these rains were hardly sufficient to replenish surface water and although prices dropped quickly to £35 per ton, there was only a slight easing over the next four months. August prices registered a drop of £10 per ton when further rains fell in the dairying districts, but it was not until the widespread heavy rain in October brought relief to the north-western pastoral districts that the demand for lucerne returned nearly to normal.

## TREND.

Lucerne prices covering the 5-year period 1948 to 1952 have been analysed for trend, but in view of the occurrence of marked episodic disturbances over the last two years, the actual mathematical fitting of a line of trend was restricted to the period from January 1948 to January 1951.

The analysis has revealed a steady upward movement in prices. This has resulted in a basic increase in values totalling about 40% over the five years, or an increase of approximately 18s. per ton per year in the basic average price of lucerne chaff.

This movement is subsequently referred to as the basic trend in lucerne prices and it is illustrated diagrammatically in Plate 2.

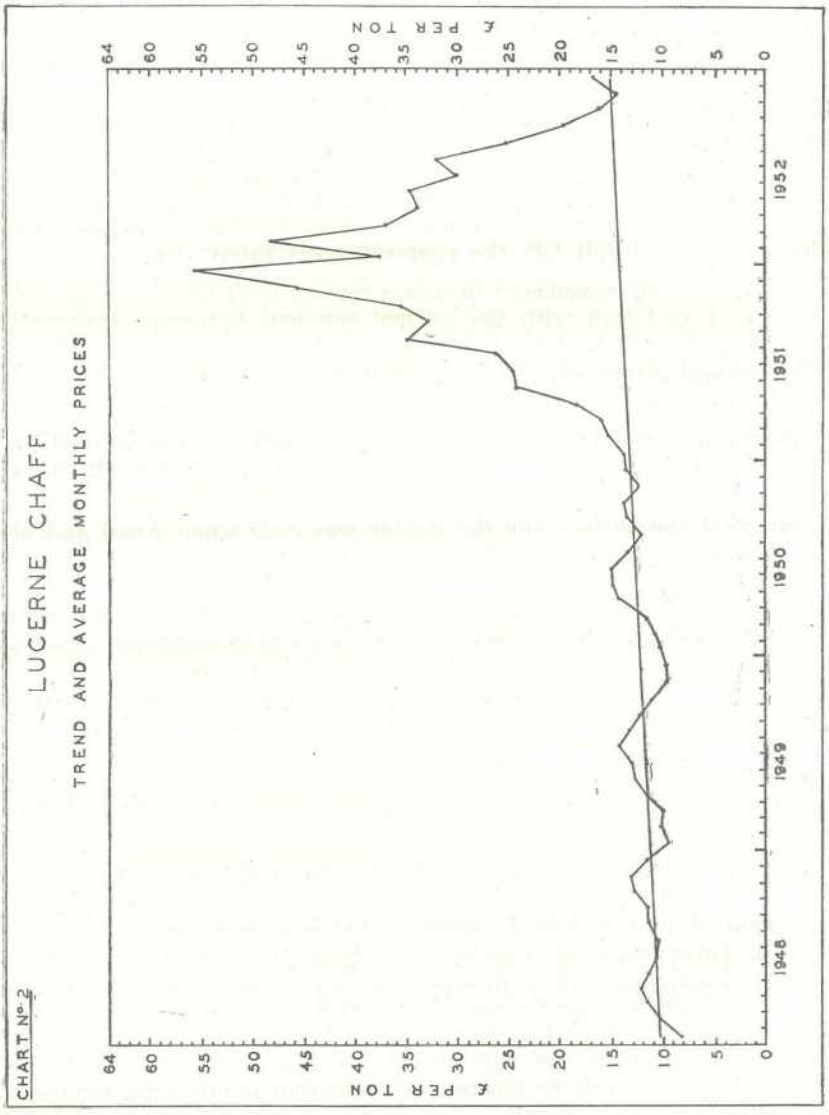



Plate 2.

**Lucerne Chaff.** Trend and average monthly prices, 1-1-48 to 31-12-52.

Reference to this graph will show that during the first three years prices displayed a very definite tendency to fluctuate closely about the line of trend within the limits imposed by the seasonal pattern. The reason for this basic trend in lucerne prices cannot be found in any inherent changes in either the supply of or the demand for the commodity, but can only be ascribed to the underlying economic conditions of the period.

The trend line has been extrapolated through the abnormal years 1951 and 1952 without reference to the actual data of those two years. It is interesting to note that the average weekly prices over the last 10 weeks of 1952 showed a remarkable tendency to return to the level of the trend line fitted as above, and more recent data tend to confirm this.

Whilst it appears that the seasonal price pattern is again fluctuating about the same line of trend as existed during the 1948-50 period, it is possible that the somewhat changed economic conditions of the present may result in a new short-term trend with a more gentle upward slope.

Although some years must necessarily elapse before definite measurement of any such new trend will be possible, an extension of the trend line shown in Plate 2 should provide a reasonably good guide to the basic price level of the immediate future.

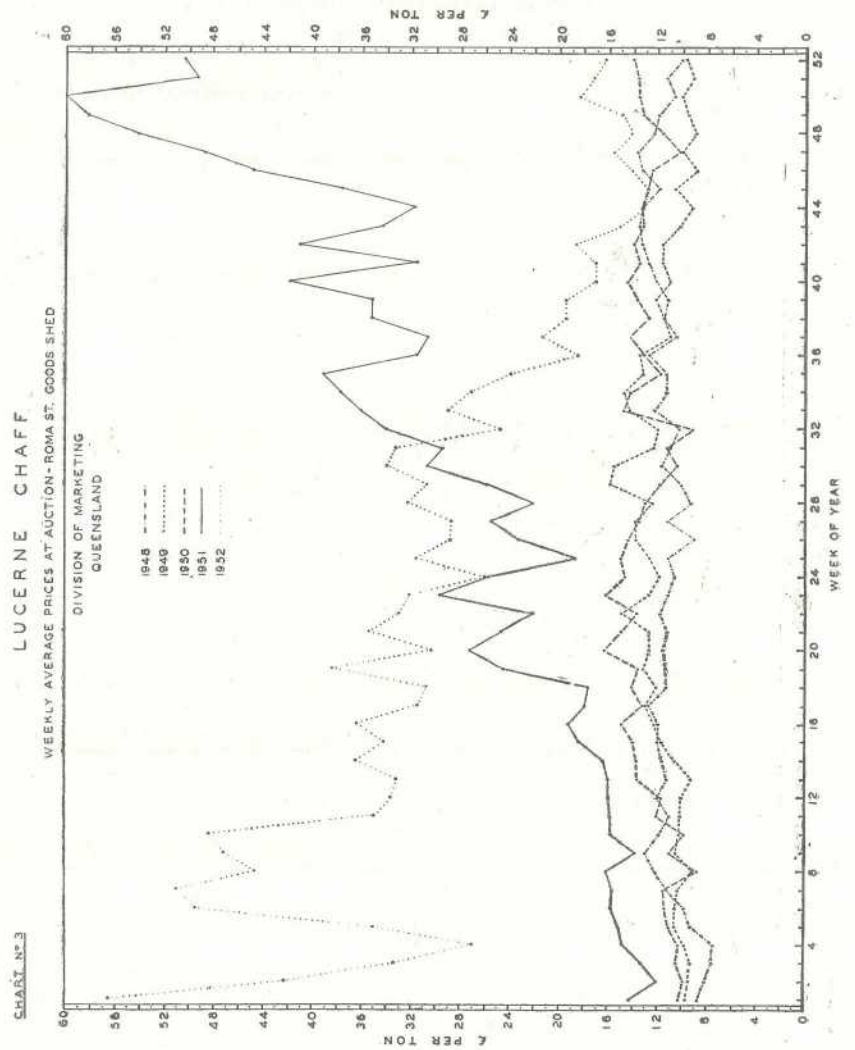



Plate 3.

**Lucerne Chaff.** Weekly average prices at auction, Roma Street goods shed. 1-1-48 to 31-12-52.

# ASTRONOMICAL DATA FOR QUEENSLAND.

## AUGUST

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

### TIMES OF SUNRISE AND SUNSET.

| At Brisbane. | | | MINUTES LATER THAN BRISBANE AT OTHER PLACES. | | | | | |
|---|---|---|---|---|---|---|---|---|
| Day. | Rise. | Set. | Place. | Rise. | Set. | Place. | Rise. | Set. |
| | a.m. | p.m. | | | | | | |
| 1 | 6.30 | 5.18 | Cairns .. .. | 17 | 41 | Longreach .. .. | 29 | 40 |
| 6 | 6.27 | 5.21 | Charleville .. .. | 26 | 28 | Quilpie .. .. | 36 | 34 |
| 11 | 6.23 | 5.23 | Cloncurry .. .. | 41 | 58 | Rockhampton .. | 4 | 16 |
| 16 | 6.19 | 5.26 | Cunnamulla .. | 30 | 28 | Roma .. .. | 16 | 18 |
| 21 | 6.14 | 5.28 | Dirranbandi .. | 21 | 17 | Townsville .. .. | 15 | 35 |
| 26 | 6.10 | 5.31 | Emerald .. .. | 14 | 24 | Winton .. .. | 33 | 47 |
| 31 | 6.04 | 5.33 | Hughenden .. | 26 | 44 | Warwick .. .. | 5 | 3 |

### TIMES OF MOONRISE AND MOONSET.

| At Brisbane. | | |
|---|---|---|
| Day. | Rise. | Set. |
| | p.m. | a.m. |
| 1 | 11.36 | 9.59 |
| 2 | .. | 10.40 |
| | a.m. | |
| 3 | 12.41 | 11.24 |
| | p.m. | |
| 4 | 1.45 | 12.13 |
| 5 | 2.46 | 1.08 |
| 6 | 3.42 | 2.05 |
| 7 | 4.33 | 3.04 |
| 8 | 5.17 | 4.02 |
| 9 | 5.55 | 4.59 |
| 10 | 6.29 | 5.54 |
| 11 | 7.00 | 6.47 |
| 12 | 7.29 | 7.39 |
| 13 | 7.57 | 8.30 |
| 14 | 8.25 | 9.22 |
| 15 | 8.54 | 10.15 |
| 16 | 9.27 | 11.10 |
| 17 | 10.03 | .. |
| | | a.m. |
| 18 | 10.44 | 12.07 |
| 19 | 11.32 | 1.05 |
| | p.m. | |
| 20 | 12.28 | 2.03 |
| 21 | 1.29 | 2.59 |
| 22 | 2.35 | 3.52 |
| 23 | 3.43 | 4.40 |
| 24 | 4.52 | 5.23 |
| 25 | 6.01 | 6.03 |
| 26 | 7.08 | 6.41 |
| 27 | 8.16 | 7.19 |
| 28 | 9.23 | 7.57 |
| 29 | 10.30 | 8.37 |
| 30 | 11.37 | 9.21 |
| 31 | .. | 10.10 |

MINUTES LATER THAN BRISBANE (SOUTHERN DISTRICTS).

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

MINUTES LATER THAN BRISBANE (CENTRAL DISTRICTS).

| Day. | Emerald. | | Longreach. | | Rockhampton. | | Winton. | |
|---|---|---|---|---|---|---|---|---|
| | Rise. | Set. | Rise. | Set. | Rise. | Set. | Rise. | Set. |
| 1 | 13 | 14 | 28 | 40 | 3 | 16 | 32 | 47 |
| 6 | 12 | 27 | 27 | 43 | 2 | 18 | 30 | 51 |
| 11 | 15 | 21 | 31 | 38 | 7 | 12 | 35 | 43 |
| 16 | 25 | 13 | 42 | 28 | 17 | 2 | 49 | 31 |
| 21 | 30 | 10 | 45 | 24 | 20 | 0 | 53 | 27 |
| 26 | 19 | 19 | 35 | 34 | 10 | 10 | 39 | 39 |
| 31 | 10 | 29 | 25 | 44 | 0 | 20 | 27 | 52 |

MINUTES LATER THAN BRISBANE (NORTHERN DISTRICTS).

| Day. | Cairns. | | Cloncurry. | | Hughenden. | | Townsville. | |
|---|---|---|---|---|---|---|---|---|
| | Rise. | Set. | Rise. | Set. | Rise. | Set. | Rise. | Set. |
| 1 | 14 | 41 | 39 | 58 | 24 | 44 | 13 | 35 |
| 3 | 10 | 46 | 37 | 61 | 22 | 47 | 9 | 38 |
| 5 | 5 | 55 | 35 | 67 | 19 | 52 | 5 | 45 |
| 7 | 6 | 51 | 35 | 64 | 20 | 50 | 6 | 43 |
| 9 | 13 | 43 | 39 | 59 | 24 | 45 | 12 | 36 |
| 11 | 21 | 34 | 44 | 54 | 29 | 39 | 18 | 29 |
| 13 | 31 | 24 | 51 | 46 | 35 | 32 | 25 | 21 |
| 15 | 40 | 15 | 57 | 41 | 42 | 26 | 33 | 14 |
| 17 | 48 | 11 | 63 | 38 | 48 | 23 | 40 | 11 |
| 19 | 54 | 5 | 67 | 34 | 51 | 20 | 44 | 6 |
| 21 | 54 | 4 | 67 | 33 | 51 | 19 | 44 | 5 |
| 23 | 45 | 10 | 61 | 37 | 46 | 23 | 37 | 10 |
| 25 | 34 | 21 | 53 | 44 | 38 | 29 | 28 | 18 |
| 27 | 22 | 33 | 45 | 54 | 30 | 38 | 19 | 29 |
| 29 | 11 | 44 | 38 | 60 | 23 | 46 | 10 | 37 |
| 31 | 5 | 52 | 35 | 65 | 19 | 50 | 5 | 44 |

*Phases of the Moon.*—Last Quarter, August 2, 1.16 p.m.; New Moon, August 10, 2.10 a.m.; First Quarter, August 18, 6.08 a.m.; Full Moon, August 25, 6.21 a.m.; Last Quarter, August 31, 8.46 p.m.

On August 15 the sun will rise and set 16 degrees north of true east and true west respectively, and on the 13th and 26th the moon will rise and set approximately at true east and true west respectively.

On August 9 there will be a partial eclipse of the sun, visible over the southern tip of South America and the adjacent Pacific Ocean.

*Mercury.*—A morning object all this month, On the 1st, in the constellation of Gemini, will rise ¾ hour before the sun. On the 13th it will reach greatest angle west of the sun and on the 23rd will pass close to Mars. At the end of August, in the constellation of Leo, near Regulus, it will rise only 15 minutes before the sun.

*Venus.*—At the beginning of the month, in the constellation of Taurus, will rise 2 hours 50 minutes before the sun, and on the 25th will pass close to Pollux. At the end of the month, in the constellation of Cancer, it will rise 2 hours before sunrise.

*Mars.*—In the constellation of Cancer, at the beginning of the month is still too close to the sun to be seen. At the end of the month, in the constellation of Leo, it will rise only 47 minutes before the sun.

*Jupiter.*—In the constellation of Taurus, will rise between 3 a.m. and 4.30 a.m. at the beginning of the month and between 1.30 a.m. and 3 a.m. at the end of the month.

*Saturn.*—In the constellation of Virgo, will set between 10.50 p.m. and midnight at the beginning of the month, and between 8.30 p.m. and 10 p.m. at the end of the month.