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Contents

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Tuberculosis-Free Cattle Herds. (As at 25th October, 1957).

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Brucellosis-Tested Swine Herds (As at 25th October, 1957).

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The Past Decade in Agriculture—and the Next

By ARTHUR F. BELL, Under Secretary, Department of Agriculture and Stock.

(Delivered at a Public Meeting of the Queensland Branch of The Australian Institute of Agricultural Science, Brisbane—25th September, 1957.)

In presenting this public address on behalf of the Institute of Agricultural Science I propose to direct my main attention to the subject of plant industry, since this is essentially the sphere of interest of this Institute. I shall, however, necessarily make some reference to the complementary animal industries. I propose, also, to discuss Queensland agriculture in particular and to emphasise the social and applied aspects of agriculture rather than the purely scientific. Finally, in the uncertain role of prophet, peering a decade ahead, I hope I shall be forgiven if the wish appears to father some of the prophecy.

The past decade is essentially the post-war period. It has been a period of great change and of great importance, and history may well record that this was our decade of decision. The changes we have made, and the foundations we have laid, will determine the pattern of our agriculture for many years ahead.

We are presently experiencing the growing pains attendant upon the change from extensive to intensive production. In the past we have followed the pattern of the frontier State with broad acres and emphasis on production per man. We are now passing into the stage when, with increasing pressure for land, we must also promote emphasis on production per acre or per animal.

Our scientific problems in Queensland are accentuated by the fact that the world areas of comparable latitude are populated by coloured races who have not, as yet, developed agricultural science to any considerable extent. We are thrown upon our own scientific resources much more than are the agricultural communities of southern Australia.

The complexity of the problem is further increased in that Queensland is a large State. It is as big as England, Scotland, Wales, Ireland, Norway, Sweden, Denmark, Netherlands, Belgium, and France. We have one-third of the usable land of Australia; the range of variation in climate is probably as great as for the rest of Australia; and the range of commercial crops is certainly greater than over the rest of Australia.

As a preliminary to discussion of the subject in hand it may be as well to record recent progress as measured by production statistics.

Since 1945-46 the area under crops has increased from 1.8 million acres to 2.6 millions; 2.6 million acres is, however, very little more than one-half of one per cent. of the area of Queensland. Crop production has increased at a much greater rate: Of our major crops, total grain production has doubled; sugar has almost doubled; tobacco has trebled; pineapple, our major fruit, has more than doubled. Beef has more than doubled; and wool has increased by 25 per cent.

These increases have been achieved in the face of an actual decline in the number of holdings devoted to crop production. Total milk production has been increased by about 10 per cent., while the number of dairy farms has declined by the same percentage.

Obviously our quantity production per acre and production per man in the field are increasing at a good rate, from which it may be deduced that our efficiency as primary producers is increasing similarly.

CHANGE IN MARKETING STRUCTURE.

During the war, and for varying periods afterwards, the United Kingdom Government purchased Australia's exportable surpluses of some important primary products. These purchases were made in bulk at prices determined from time to time by agreement between the two governments. The prices were usually considerably below those then ruling on the world's markets.

Post-war efforts were made by Australian producers to carry on these agreements in amended form but the negotiations usually foundered on the rock of prices. Only two price agreements remain—the satisfactory Commonwealth Sugar Agreement and the not-so-satisfactory 15-Year Meat Agreement.

The war and immediate post-war bulk purchase system left two unfavourable legacies. Firstly, the United Kingdom's need had been quantity rather than quality; in the absence of adequate incentive payments the quality of much of Australian produce deteriorated, or at least failed to advance. Secondly, Australian exporters lost their experience in sales negotiation and there grew up a generation of producers who did not know the uncertainties and complexities of competitive marketing.

These circumstances, coupled with a recovery in world production and falling world prices, have made the export market difficult. We must readjust our attitude to quality and to competition; we must improve production techniques; we must establish farming as a business with continuous cost analysis; and above all we must attain greater flexibility in farming so that we can switch quickly from less profitable lines to those which are more profitable for the time being.

Thus we enter an era when primary production calls for even greater and more intensified technical research, assistance, and guidance.

The export market for grain, canned fruit, and dried fruit has tightened, but although selling has at times been slow, the exportable surpluses have been sold. Sugar, covered by a long-term agreement negotiated mainly by the sugar industry itself, has achieved stability and at present has an export earning capacity of more than £25 million annually.

Fortunately, the market for wool remains relatively stable. Whilst synthetic and vegetable fibres are strong competitors, nevertheless rising world standards of living maintain a good demand for the available wool. It is fortunate that this is so, since Australia is over-dependent on wool; last year wool contributed £500 million to our record export earnings of £1,000 million.

The export market for other animal produce is less favourable. Dairy produce has been in oversupply on the London market and has suffered in competition with that of more favourably situated countries. The United Kingdom egg market has almost disappeared. By virtue of annual subsidies of some £30 million sterling, the United Kingdom is now producing 95 per cent. of its eggs-in-shell.

For various reasons, including distance from markets, our meat suffers from variable quality and uncertain deliveries. Over the past two years the British Government has made deficiency payments in accordance with its guarantee of average prices under the 15-Year Agreement.

The difficulties of export marketing have been accentuated by the accumulation of vast surpluses of farm produce within the United States. Due to over-long retention of wartime price support schemes the United States has produced far beyond its capacity either to consume or to export with profit. These surpluses are now being sold to various needy countries at bargain prices, and inevitably the result is disadvantageous to young developing countries such as Australia, New Zealand, and South Africa.

So far the various steps taken by the United States Government to curb production seem only to have increased it. The latest proposal is a "soil bank" and its impact on future production will be a matter of concern to us.

The heavily subsidised British agricultural industries have seriously reduced the traditional markets for Australian produce in the United Kingdom. Having been caught seriously short of food in two world wars, it appears likely that this support policy will be continued.

The European Common Market, which proposes a more or less free-trade Customs Union for Western European countries and their colonies, is also a potential threat to Australia's export business.

New Approach Needed.

All this adds up to the conclusion that not only must we keep on improving our technical efficiency, but we must develop a much more positive approach to the marketing of our primary produce. In short, we must henceforth *sell* our goods and not just merely produce them for sale.

The marketing organisations of primary producers must study the purchaser's requirements and preferences and see that he gets them. They must advertise; they must seek out new markets; they must insist on graded and quality produce; and they must study the art of packaging.

It might here be interposed that the Queensland Butter Marketing Board is doing a good job along these lines in seeking new markets in the East.

Likewise the domestic market needs much more study than it has had in the past. Stability can rarely be attained in any industry unless the domestic market absorbs a high proportion of production. Where exports are large, the home market needs developing to the limit.

This is well exemplified in the dairy industry. Falling export prices, and the threat of margarine, make it essential that the Australian dairy industry reduce its dependence on a "butter economy." This it can do only by finding profitable alternative outlets for butterfat, such as greatly increased sales of cheese, ice-cream, and fresh cream. To achieve this, the quality of cheese must be standardised and greatly improved, whilst cream must be presented in the varying strengths and forms which have so increased consumption overseas.

Most people will be surprised to learn that the consumption of fresh cream in Brisbane is about one salt-spoonful per person per day.

Primary industries, as such, are somewhat reluctant to enter upon advertising, and have been content to leave this field to the processors and distributors of primary produce. There seems a need for them to develop a concept of primary and secondary advertising. Primary advertising is concerned with creating increased overall demand for a commodity, be it dairy produce, fruit

Plate 1.

Queensland's Dairy Industry Must Reduce Its Dependence on a Butter Economy.

juices, meat, or stock feeds. Advertising in this field is the legitimate province of the primary producer; after all, it is he who is most directly interested in the volume of total sales.

Secondary advertising is competitive advertising in the distribution of a commodity; one processor or distributor claims that his wares are a little better (or perhaps a whole lot better) than the next. It is true that this form of secondary advertising does in itself help to raise the overall demand, but it should be supplemented by primary advertising by the appropriate producing industry.

AGRICULTURAL SCIENCE SERVICES.

The scientific services available to the primary producer in Queensland have been very considerably expanded during the past decade.

The Commonwealth Scientific and Industrial Research Organization has established five important research centres—an animal parasitology laboratory at Yeerongpilly; a pasture research institute and a soil science laboratory in the University grounds; a tobacco research station in North Queensland; and a cattle breeding research station at Rockhampton. These centres are rightly concerned more with long-term researches than with immediate problems.

Over this period the Department of Agriculture and Stock has established 12 more experiment stations devoted to crop and/or animal production, and has decentralised research work by the equipment of 12 more branch laboratories in country centres. Within the Animal Research Institute there has been set up an Animal Husbandry Research Farm at Rocklea and a Biochemical Laboratory at Yeerongpilly. A Wool Technology Laboratory and a Tobacco Research Laboratory have also been added to the laboratories previously established in Brisbane. A Food Technology Laboratory is projected at Hamilton and construction is expected to commence this year.

While satisfactory progress has thus been made in the provision of material facilities, this has not been matched by the recruitment or the retention of scientifically trained personnel. The available butter has been spread very thinly over the bread, and this is particularly true of the Department of Agriculture and Stock.

Excluding overseas students, only 32 men have graduated from the Faculty of Agricultural Science within the University of Queensland during the past five years. Of these, 11 have gone into commerce and industry, leaving only 21 to fill vacancies in the teaching services, agricultural research, and agricultural extension.

This average of four graduates a year is a long way from being sufficient even to replace wastage. And that is by no means the last word; a survey now being carried out by the Institute in Queensland indicates that over the past few years the relative intellectual standard of the students attracted to Agriculture has declined in comparison with other Science Faculties. It is a sad state of affairs in a country which in the main earns its living by primary production.

The reasons are not far to seek. The material rewards in the profession of agricultural science are not attractive in competition with other professions, and agriculture inevitably loses out.

From what has been said earlier it is clear that the need for highly-trained agricultural scientists will become progressively greater, not less. This view is well substantiated by the increasing clamour from farmers and farmers' organisations for more and more technical and economic research and guidance. We are in a competitive business and we will be left behind if we do not keep pace with other countries.

We not only want many more graduates in agriculture and allied sciences, we want more facilities for post-graduate study. As buildings grow higher we can no longer afford to ascend them step by step but must use an elevator. As the store of scientific knowledge grows in quantity and complexity so must men be progressively more highly trained before they enter the various professions. For specialised work, be it plant breeding, virus research, or any other avenue, the graduate in Agricultural Science now requires at least some post-graduate training.

Australia suffers from isolation; there is not the concentration of scientists to provide mutual stimulation as there is in Europe, for example. It is therefore essential that selected men be sent overseas at intervals to see what other people are doing. In this respect we have fared very well; since the war 37 officers of the Department of Agriculture and Stock have made 48 visits overseas. You may be interested to know that in the case of 43 of these 48 visits the money for the fares and expenses has come from sources other than State revenue; this we feel is a tangible expression of appreciation from outside. In the majority of cases the Department has met the salaries of these officers during their study tours.

An important facet of the developing agricultural science services has been the employment of scientifically trained personnel by the distributors of agricultural chemicals. The activities of these trained consultants have rationalised and stimulated the growth of this increasingly important industry.

PROGRESS OF SCIENCE AND PRACTICE.

Let us now turn to consideration of some of the achievements which have stemmed and will stem from the harnessing of science with practice. Naturally, time will not permit a full catalogue and I will record but a few examples quite briefly, and then treat two important subjects at more length.

Science is universal and every advanced country makes its contribution to the common stock of knowledge. But after the basic discovery has been made, in one country or another, a great deal of further research and experimentation is necessary before treatments or processes are adapted to local conditions. The speed with which new discoveries are applied in a country is dependent upon the number and calibre of scientifically trained personnel in that country.

Pest Control.

The control of insect pests has been completely revolutionised by the post-war insecticides. The sugar industry, for example, saves half a million pounds a year through the control of one pest. But the insects are still in the fight and one by one they are building up resistance to this or that insecticide. Constant vigilance and constant research are therefore necessary if we are to maintain our advantage. And vigilance and research, be it remembered, need trained men and money.

Weed control has been placed on a new basis by the discovery and application of selective hormone weedicides. These are used mainly for the control of broad-leaved weeds. Further great economic advance would come from the discovery of weedicides which are selective within the grass family and which would, for instance, control summer grass in a maize crop with a spray which kills the summer grass without harming the maize. This type of weedicide, and economic killers of nut-grass and Johnson grass, are fit subjects for further research.

One of the important developments which has followed local research is the destruction of brigalow scrub by spraying with very small amounts of hormones from aeroplanes.

Plate 2.

Pest and Weed Control Has Taken to the Air. In this scene, a ground crew prepares a hormone solution for aerial spraying of brigalow.

Trace Elements.

The understanding of the role of minor elements in the soil is destined to have a tremendous influence on production. There are a number of minerals essential to plant growth but required in amazingly small quantities. Whiptail, a striking malformation of cauliflowers, is corrected by the addition of only three-quarters of a pound of molybdenum sulphate to the acre.

Current research is demonstrating increasingly large areas of so-called waste land which can be brought into production by adding a little copper, or zinc, or boron, or molybdenum to the soil in addition to the usual fertilizers.

In the coastal strip running north from Brisbane there are some millions of acres commonly called wallum country. These are soils of low fertility but enjoy a good rainfall, are handy to centres of population, are

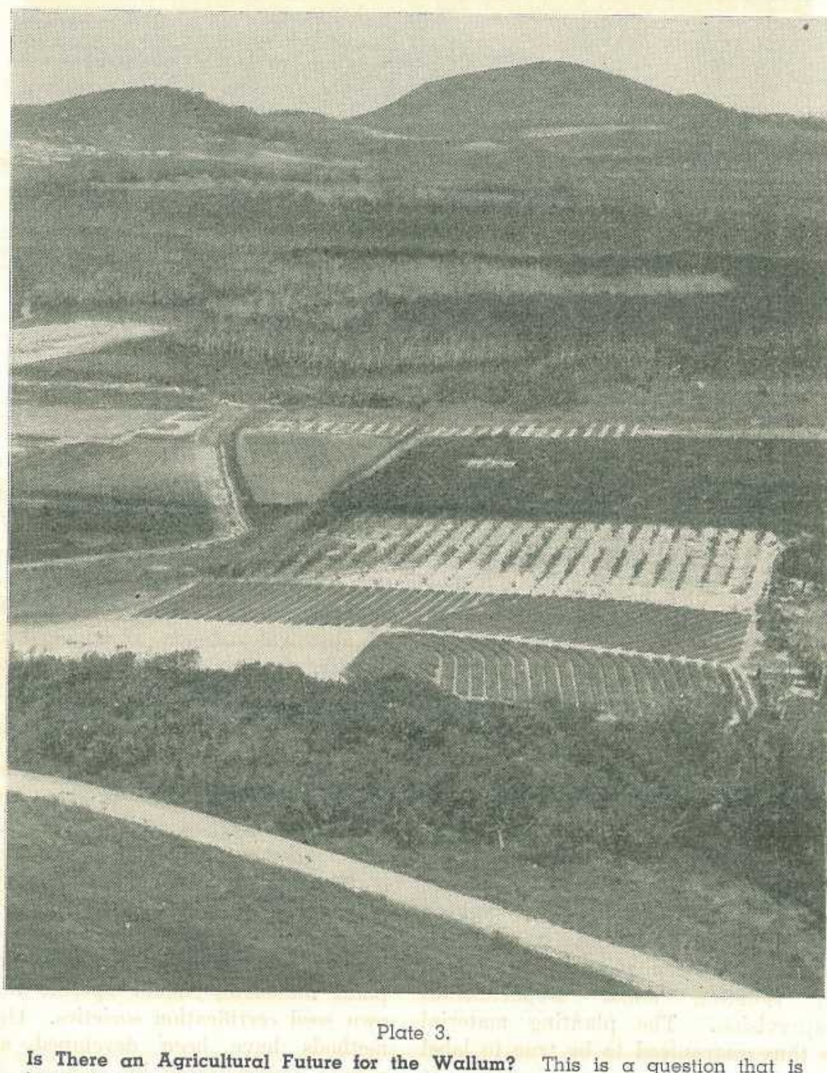


Plate 3.

Is There an Agricultural Future for the Wallum? This is a question that is being investigated on the Department's Field Station at Coolum, pictured here.

Plate 4.

Seed With a Pedigree. Pictured here is Alpha grain sorghum, one of the many crops of which certified seed is available to farmers.

well served by transport and other public services, and are easy to clear. At present they are wastelands, but some day, after a lot more soil and plant research, they will be a food bowl for the then great metropolis of Brisbane.

Coonalpyn Downs in South Australia and Wongan Hills in Western Australia bear witness that this is not idle speculation.

Crop Improvement.

Seed certification is an important post-war development. The seed or cuttings are produced from crops which have been planted and grown in isolation under Departmental supervision. The planting material is thus guaranteed to be true to label and free from inherent diseases. It is, in fact, pedigreed seed. The demand has outstripped the capacity to supply. Most of the grain crops are now planted from certified seed and certification or some other form of approval extends to horticultural planting material such as tomato seed, strawberry runners, pineapple suckers, and citrus budwood.

A crop grown from such pedigreed planting material will produce uniform grain or fruit and so raise yield and marketing standards. The time is fast approaching when all major crops, at least, will be produced from certified planting material. The time is also approaching when individual plant industries should operate their own seed certification societies. Once methods have been developed and results demonstrated by Departments of Agriculture or other institutions, then industry should accept responsibility for the maintenance of quality standards.

Few phases of agricultural science can produce so valuable a return, from so little outlay, as plant breeding. We have suffered severely from the lack of advanced training available in genetics in Australian universities, and facilities are still far below the desirable level.

Nevertheless, a great deal has been done: About three-quarters of the grain crop is produced from new varieties, or new strains of old varieties, bred in Queensland. More than 80 per cent. of the sugar crop is produced from locally bred varieties. Cotton and peanuts register 100 per cent. Horticultural crops are increasingly depending on local varieties.

The locally produced variety has the great advantage that it is selected under the conditions of climate, soil, disease and pest complex, harvesting, and marketing requirements of the area in which it is to be grown. Its chances of dovetailing into local requirements are therefore obviously much greater than the imported variety.

There is a great need for expansion of plant breeding activities and this especially applies to the pasture field. Little has been attempted here and virtually nothing has been done in the important direction of breeding and selecting from our native grasses. The State badly needs at least half a dozen more plant breeders.

Soil Conservation.

Soil conservation is another post-war development. As a result of a

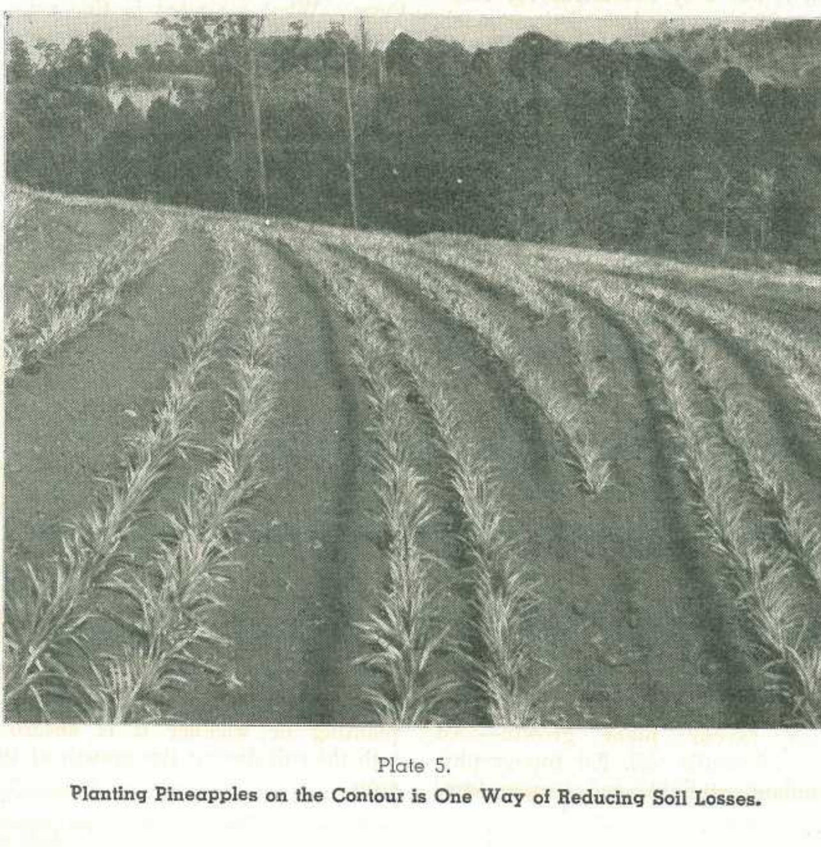


Plate 5.

Planting Pineapples on the Contour is One Way of Reducing Soil Losses.

lot of field work, methods of soil conservation suitable to Queensland conditions have been developed on the basis supplied by American research.

It is estimated that about 800,000 acres of agricultural land requires protection in some form or other; at present the area needing treatment is growing at a rate about four times as great as the area being protected. In the majority of cases the form of protection needed is only common sense land use, including judicious use of pasture. Whilst there is a great need for increased technical staff, there is an equal need for positive personal action, and a changed attitude towards balanced farming, on the part of landholders.

THE MOISTURE STORY.

Australia is the driest of the Continents. Although having a similar area, it has only two-thirds the rainfall of Europe, but, being much nearer the equator, evaporation is much higher and the need for moisture is greater. The quantity of water flowing down the river Danube is greater than all the stream flow of all the rivers of Australia.

Not only is the rainfall low but it is unusually capricious; the coefficient of variability is greatest in Australia and hence droughts are more frequent.

All this can be said equally of most of Queensland. Whilst it is true that we have a rainfall higher than the Australian average, we also have temperatures and evaporation above average. Moreover, the summer rainfall characteristic of Queensland is heavy and wasteful, and the rainy season is more pronounced and restricted in length.

We have, in Queensland, an abundance of most of the factors which favour plant growth—vast areas of fertile soil, flat topography, abundant sunlight, and temperatures favourable to growth throughout the year. We lack only moisture.

The study of soil moisture is therefore of the greatest importance to Queensland and it must receive the close attention of the present and future generations of scientists.

Water in the Soil.

Our farming forebears came from Western Europe, where rain is gentle and regular, and where the agricultural problem is to get rid of excess moisture. Naturally, they brought to Australia their traditional farming practices of turning *over* the soil, harrowing to fine smooth tilth, and the continuous cultivation of row-cultivated crops.

Actually, the Australian problem is the reverse of this; our task, in most seasons, is to get as much moisture as possible into the soil—and to keep it there. What we want is tine rather than mouldboard tillage; leaving the soil with a rough absorbent surface during the rainy season; and the reduction of inter-row cultivation to a minimum.

It is only in very recent years that we have really begun to discard the European system and evolve our own.

Work carried out at the Biloela Regional Experiment Station over the past 30 years, and later on the Darling Downs, has given us a good insight into soil moisture storage and the water requirements of crops.

Working with wheat and grain sorghum (as examples of typical winter and summer crops respectively), it has been ascertained that five or six bushels of grain per acre can be produced from each available inch of water in the soil. It does not matter much whether this water is already stored in the soil before planting or whether it is absorbed into the soil during the growth of the crop.

You will understand, of course, that I am talking about an inch of absorbed water—not an inch of rain. It normally takes a great deal more than an inch of rain to get an inch of water into the soil. And, of course, it is only the water in the top three feet or so of soil which is available to these crops. In our good agricultural soils it usually requires about six inches of soil to hold one inch of available water.

Now let us consider what this means in practice in the case of wheat on the Darling Downs. A roughly cultivated field is left fallow through the summer rainy season and absorbs a proportion of the rain. After a heavy rainy season, such as we had last year, the soil may hold water to capacity to a depth of several feet; following a dry year such as this one the water content may be far below capacity.

After the rainy season ends the fields are kept free of weeds by very shallow cultivation which does not dry out the soil. Then, following the first winter rains, the seedbed is prepared and the wheat is planted. Very soon the roots penetrate far enough down to draw on the stored moisture. If this is considerable, the crop needs very little more rain to produce a satisfactory yield, although, naturally, freshening spring rains are very acceptable.

On the Biloela Station we have produced over 40 bushels of wheat per acre with less than two inches of rain between germination of the wheat and its harvest. Our average wheat crop in Queensland is about 20 bushels per acre—the highest average in Australia. It is safe to say that in an average season more than 12 of these bushels are produced from water which was in the soil before planting.

The story is much the same for the summer crops such as sorghum when grown in lower rainfall areas. In this case, however, rough fallowing during the summer rainy season means that the land must then remain unplanted until the following late spring or early summer. This in turn means that a plot of ground would yield only one crop in two years.

Although there is, of course, plenty of land where the summer rain is sufficient in quantity and distribution to grow a good summer crop every year, this is not the case in areas with lower rainfall and shorter rainy season. It was the non-acceptance of this fact which was one of the contributing causes of the failure of the Queensland-British Food Corporation's sorghum growing venture in the Central Highlands.

I have dealt with this summer fallow-moisture storage question at some length because the principles are of transcendental importance to our future development.

There is a great deal of Queensland, including much of the beef country and most of the sheep country, which is not farming land in the accepted sense. The rainfall in most years is too low, and the growing season too short, to produce reasonable forage crops or to carry grain crops to maturity. They would be less than half-grown before the rain and soil moisture petered out.

However, you will readily see that with summer fallow and biennial cropping there opens up a stupendous possibility of producing forage crops and ensilage.

Whilst this practice may not become widespread until the pressure for land becomes greater, it has already started among imaginative landholders. Once adopted it would minimise or eliminate catastrophic drought losses and would stabilise production through the year. It could entirely alter the pattern of our pastoral industries.

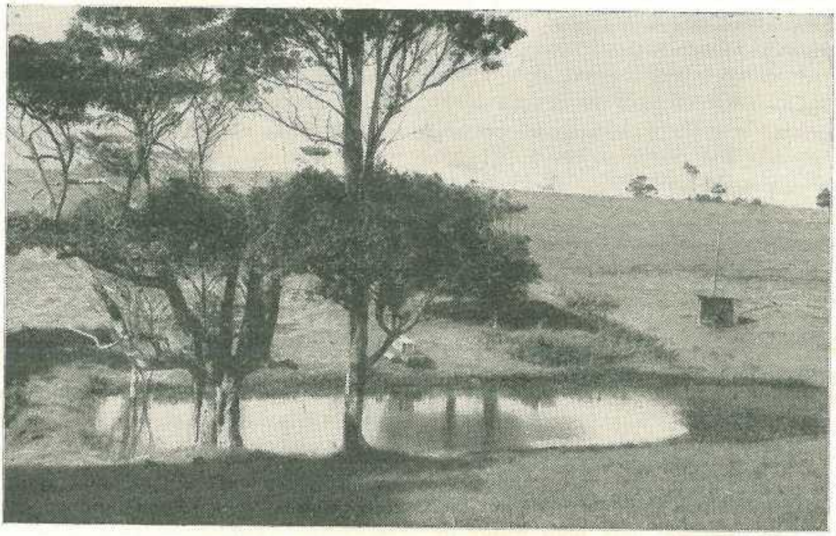


Plate 6.

Water Harvested for Irrigation and Livestock. The runoff from the hills has been dammed in this watercourse for future use.

Water Harvesting.

And while on the subject of water, perhaps I should mention "water harvesting." This consists in a farmer throwing a bank across a stream or billabong on his farm and catching and storing storm runoff instead of letting it flow away; it is only the rooftop and household tank on a large scale. Water harvesting on New South Wales properties has been publicised by Messrs. H. J. Geddes and P. A. Yeomans, but the biggest single scheme is on the Atherton Tableland of North Queensland.

The impounded water, harvested on the farm, is used for irrigation. Naturally, water harvesting cannot be practised on a perfectly flat farm, or on a farm with very broken terrain. However, there seems little doubt that where conditions are suitable it can and will be developed in the future.

There are two directions in which research can help. In Queensland the minimum evaporation from a free water surface is four feet a year; it is much greater inland. The top four feet of a shallow dam represents a big proportion of the water and it would be a great achievement if this evaporation could be prevented. Industrial chemists have already achieved results by the use of cetyl alcohol but there is still a long way to go.

The second problem is the elimination of loss by seepage. The development of a cheap impervious plastic which could be used to line dams and channels could greatly increase the water available for irrigation.

THE PASTURE STORY.

Grass is the most important crop in Australia—and the most neglected. This is particularly true of Queensland. The sheep and beef cattle industries are almost entirely based on pasture grass, while dairy cattle are grass-fed to almost the same degree. These animal industries are the mainstay of our National and State economy.

On dairy farms it has been the practice to sow an introduced grass—such as Rhodes grass or paspalum—immediately after the felling and burning of scrub. But largely the process rested there; topdressing, renovation, and systematic sub-division were largely unknown; native grasses have gradually invaded a large proportion of the sown areas.

In the beef cattle industry pasture improvement has heretofore been restricted to ring-barking to relieve the native grasses from shade and the competition of the trees for soil moisture. In sheep country the native grasses have been largely left to look after themselves.

These remarks are to be construed primarily as statement of fact—not as criticism of landholders. The farmer and the pastoralist are in their businesses to make a living and that has usually been hard enough in all conscience. (We must not judge the long-term financial rewards of primary producers by the conditions of the post-war years.)

When land is cheap, and pressure for land is not great, the most profitable and indeed the reasonable policy for primary producers is to have broad acres, and concentrate upon output per man and not output per unit area. It is only when values rise, and pressure for land increases, that change of emphasis becomes necessary.

This is the phase upon which we have now entered—the change from extensive methods of production to intensive methods. We have only just started along the track; we have a long way to go.

In current jargon, the economic climate was not favourable to the promulgation of the pasture doctrine until the higher values of the post-war period began to assert themselves.

At the end of the war the Department of Agriculture and Stock had, I think, but one man engaged upon agrostology. At present we have, directly and indirectly, the equivalent of at least 50 men engaged on pasture work. And in the meantime C.S.I.R.O. has multiplied its pasture team several times.

As an example of the indirect association with pasture development, it is interesting to quote that of the 1,603 samples analysed in the Analytical Section of the Agricultural Chemical Laboratory during the year 1956-57, no less than 1,195 samples were grasses and fodders.

The native grasses of Queensland have, down the ages, adapted themselves to the temperature and rainfall distribution. They are characterised by flush growth during the short hot wet season, but this is followed by their rapid drying and loss of nutritive value during the late autumn, winter, and spring. It is the loss of both nutritive value and palatability which is responsible for the pattern of growth of our beef cattle, the seasonal rise and decline of dairy production, and so on.

This pattern as applied to beef cattle is a fairly rapid gain in weight for the four months of late summer and autumn; then follows a loss of weight for the next four months; and then during the next four months a slow gain of weight to regain the late autumn position. In other words, there is a net growing period of about four months.

Dairy production follows a generally similar pattern, with late summer production being more than twice as great as winter production.

The objectives of pasture improvement are to raise the nutritional level of the pastures; to extend the growing season; to reduce the loss of nutritive value when the grass dies; to produce a pasture which would justify conservation as hay or silage; and to lift the palatability of both fresh and conserved pasture.

Only by such means can we hope to reduce the seasonal fluctuation in growth and production rates, control quality, and maintain a steady and reliable flow of animal produce to the domestic and world markets.

Achievement is complicated by the fact that most of the native legumes of Queensland, and indeed of the tropics generally, are not good pasture species under relatively dry conditions. A legume is a very desirable component of a pasture; it draws its own nitrogen from the air and shares it with the grasses. Part of our problem is to introduce or develop suitable legumes for incorporation in our pastures.

The past decade has been largely occupied in experimenting with as many species of grass and legume as have been available. The plant introduction section of C.S.I.R.O. has combed foreign countries with similar climates, and has imported hundreds of new species for trial. A great deal has been learned of pasture mixtures and pasture management; much valuable research has been carried out on the nitrogen-fixing bacteria associated with pasture legumes; the increased growth rates of grazing stock have been measured; and, finally, pasture improvement has been "sold" to increasing numbers of farmers and graziers.

About 200 pasture experiments are carried out each year, innumerable field days and lectures have been organised, and the Royal National Association's pasture competition has helped greatly to stimulate and sustain interest.

There is, of course, a tremendous amount of work still to be done. We have only scratched the surface of introduction and testing, grazing management, topdressing with major and minor elements, irrigation, and so on. We can expect handsome dividends from pasture research not only in the next decade but for decades to come.

However, we should not be appalled at the prospect of what waits to be done, but rather should we push on with the research job, while at the same time we make full use of what we have done.

An interesting experiment is now in progress at "Brian Pastures," a cattle husbandry research station near Gayndah. Here the land has been broken up and three introduced grasses (buffel, Rhodes, and green panic), plus legume, are being tested against native pasture, mainly spear grass.

The experiment has been in progress for 28 months and during that period the cattle have made the following weight gains per acre:—

Buffel	306 lb.
Green panic ..	280 lb.
Rhodes	261 lb.
Native	69 lb.

In other words, the improved pastures have produced four times the weight of beef produced by the native pastures. This serves to give some idea of the potential for increased production by the use of improved pastures. And what is more, the beef from the improved pastures has graded better at the meatworks.

I have mentioned buffel grass. This is a grass which is destined to become of great importance in beef production over a large area of Queensland. It is claimed to have been introduced into Australia a good many years ago as packing in the camel saddles imported by the Afghan cameleers. Whether this is strictly true or not, I cannot guarantee. Certain it is, however, buffel grass entered the country without passport or visa. It is becoming a good Australian and, in the process of test and selection, some very useful types are being developed.

No climate is uniform throughout the year and consequently pasture growth is uneven. We cannot stock on the basis of the maximum rate of growth or stock would suffer in the winter. Equally it is uneconomic to stock at the rate of minimum seasonal production and let pasture go to waste. In Queensland, however, we generally stock only at the rate which can be supported in a bad season and so waste fantastic quantities of pasture in all but the bad years.

Obviously we must follow, and we are starting to follow, the rational practice of conserving the excess growth in the flush season and holding it against the season of poor growth or drought.

It has been shown, and is beginning to be accepted, that grass is not merely something to be taken for granted; something for nothing, taken as it comes. It is a crop, our most important crop, and must be tended and grown as a crop. Reserves must be conserved so that a reasonably constant nutritional level may be maintained throughout the year.

No sane person would give his children one-half or one-third rations for a considerable part of the year and expect them to grow and behave normally. We are now realising that this is not good for animals—and that it can be avoided.

FARM MECHANISATION.

In no phase of primary production has change been more profound or significant than in the mechanisation of farming operations. Both the causes and the effects have been and will continue to be of great social and economic significance.

The mechanisation of farming operations developed very slowly until long after the advent of the tractor. The term "tractor" was, indeed, an unfortunate choice and for a long time hindered rather than promoted farm mechanisation. The name connoted hauling, and implied that the tractor was a substitute for the horse or the ox. And for many years that

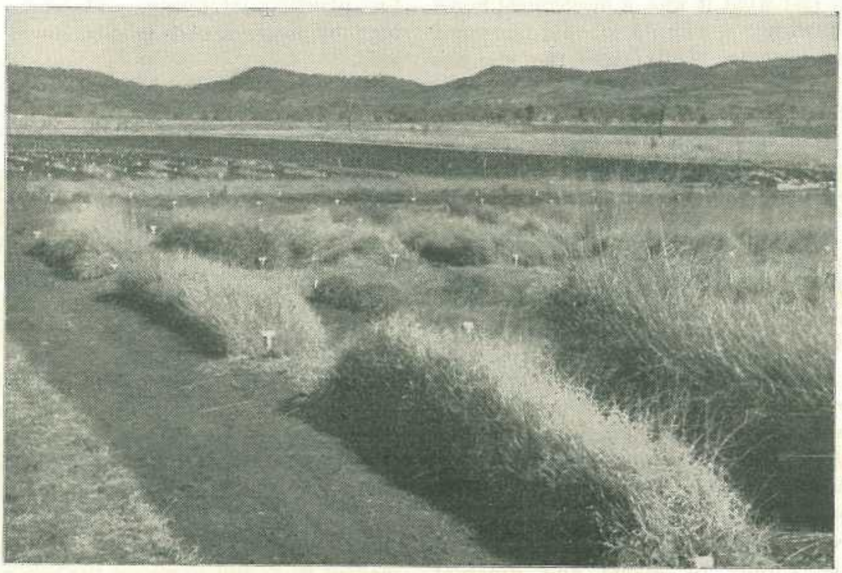


Plate 7.

The Pasture Plant Nursery on "Brian Pastures" Research Station.

Plate 8.

Farm Mechanisation is Gradually Being Reduced to a Fine Art.

is just what it was, a mechanical horse drawing simple old-fashioned implements. Only since the war has it been fully appreciated that the so-called tractor is, in fact, a mobile power unit on which may be fitted an infinite array of directly-operated, specialised tools.

It is high time we discarded the name "tractor"—and with it that dreadful word so beloved of farm machinery firms, the word "tractorisation."

The post-war period has been an era of full employment and in countries with high living standards it has seen the advent of the "welfare" State. Men are not forced to tramp the countryside looking for work. The result has been a rapid dwindling of the supply of casual and itinerant labour in rural areas. The farmer can no longer rely upon seasonal labour for planting, chipping, and harvesting; or upon casual labour for odd jobs.

Farmers' families are smaller and the children are no longer content to remain under the parental roof as a compliant and cheap labour force. The ready employment, high wages, short hours and the varied pleasures of the towns and cities are strong magnets.

In these circumstances the only alternative is mechanisation. A small skilled labour force, with suitable power units and appropriate implements for each job, can carry out all the operations on a large farm. Moreover, each operation can be carried out expeditiously, and so at the proper time. Skilled work is essentially permanent work and so we see the passing of the farm labourer and his replacement with an artisan.

There are now available implements to clear land, break it up, and perform the operations of planting, cultivation, weed control, pest control, and harvesting, for nearly all field crops. There are mechanical levellers and ditchers for irrigation; scoops, loaders, unloaders, and cranes; post-hole diggers and portable power saws; silo fillers and unloaders. All these are operated by the power unit we have called a "tractor."

Much of this development has taken place since the war; it does not represent the culmination of mechanisation but rather a preview of things to come. Up to the present the construction of particular farm machines and implements has grown largely from the native genius of farmers. The inventive farmer, with his own hands and at his own expense, builds a contraption which does a particular job. At this stage it is taken over by mechanical engineers and converted into a durable machine.

Until very recently there has been little scientific research into the functions (as distinct from the construction) of farm machinery. The industrial chemist requires to know the manner of each phase and step in a complex chemical reaction. Similarly, engineers cannot design the near-perfect machine or implement until they have analysed and integrated each operation. Research of this type has now been initiated in Australia, and, as it grows, must influence profoundly the construction and efficacy of the farm machinery of the future.

The replacement of labour by machines obviously requires a greatly increased capital investment in the farm. The machines cannot, like casual and seasonal labour, be paid off when they are not working; interest, redemption, and depreciation costs continue every day of the year. There is a minimum economic usage for any machine or implement and the farmer must keep it operating above this level. The extent to which he achieves this will determine the profitability of his farming.

The farm of the future must become a larger farm, either by the acquisition of more land or by the intensive cultivation of a greater proportion of the land on existing large holdings. The capital investment will continue to increase and the organisation and management will become more complex.

In short, farming is becoming more a business, and less a personal way of life.

This trend is already pronounced in the United States. Excluding week-end, hobby, and "tax deduction" farms, there are about 4½ million farms in the United States, but 90 per cent. of the production comes from less than 2 million of these. The average farm is now 40 per cent. larger than it was 20 years ago; since the small farms tend to get smaller it seems likely that the fully-productive farm has considerably more than doubled in size over that period.

Another important social question associated with increasing farm mechanisation is the steadily decreasing proportion of the population classified by the Statistician as being "engaged in rural pursuits"; contemplation of this downward trend casts a great gloom upon some people.

Every morning in the United States there are 7,000 new mouths around the national breakfast table; and every morning there are 1,000 less farm workers on the national payroll.

An operator with an appropriate power unit and implements does not liquidate the drivers of six horse teams; he displaces them *on the farm*. Power units, machines, and implements must be manufactured, distributed, and serviced; spare and replacement parts must be manufactured, distributed, and fitted; liquid fuel and oil must be won from the earth, refined, and distributed. The man in the service station, or on the farm machinery assembly line, or in transport service, may be just as much an agricultural worker as the man on the farm.

I suggest that our best yardstick is not the number of people working on a given area of farmland, but the volume of crop and animal produce being yielded by that land.

Finally, increasing mechanisation is raising the production of food and fibre for human consumption by reducing the need to grow fodder for draught and saddle animals. It has been estimated that full mechanisation thereby increases food and fibre production for humans by about 15 per cent. The number of tractors in use in Queensland has trebled in the period under review and farm horse traction is now of minor consequence.

FARM MANAGEMENT OR FARM ECONOMICS.

Heretofore the advisory services provided by Departments of Agriculture, and the like, have been restricted to tendering what is commonly called "technical" advice—that is to say, advice on the biological and mechanical aspects of farming.

There is a growing realisation that the primary producer needs, and is entitled to expect, more than this. Although considerable capital is involved he is running a small unit business; he cannot employ trained executives; he is more often than not his own manager, technician, and one of the operatives.

There is no reason why he should be less in need of advice on management problems than he is in need of advice on technical problems. Indeed, quite the reverse; there are far more institutions ready to give him technical training than to give him farm management training.

This question has received a good deal of attention in the post-war period, particularly in the United States. Indeed, it is probable that the great advances recently made in farming in that country are due in considerable measure to the development of farm management advisory services.

It is true that sound advice on farm management requiries the prior investigation of at least the more pressing technical problems; good management cannot be superimposed on faulty technical practices. However, it is clear that we have now reached the stage of technical knowledge which justifies the establishment of a service for the investigation of the economics of various farm practices and the subsequent advice on farm management.

The Assistant Director of Marketing in the Department of Agriculture and Stock has just returned from the United States, where he has been studying the structure and functions of the farm economics and farm management advisory services.

It is proposed to lay the foundations of such a service here. The value of technical processes will be measured in economic terms and overall farm advisory services will thereby become more precise—and less evangelical.

There is no dearth of things to determine or do:

What really are the economics of feeding skim-milk to pigs?

When does it cease to be economic to ratoon sugar cane?

What maximum cost of irrigation water can be borne in the irrigation of pasture, or of potatoes, in a given locality?

What proportion of costs should be allocated to equipment, or to buildings, on a dairy farm?

And so we might go on, and on. Most people have an opinion, and perhaps a firm opinion on these questions, but how few really know?

The conservative farmer will not freely accept or act upon management advisory services; he will hold that such advice could only come from the so-called "practical" man. In my experience, the conservative farmer said that very thing about technical advice about 30 years ago. But he slowly changed with the times and now freely accepts technical advice from young scientists; he now appreciates that they are not advising out of their own limited personal experience but from the accumulated knowledge and experience of many people. And he will eventually adopt the same attitude towards advice on farm management.

THE FUTURE IN TABLOID FORM.

Assembling and condensing the thoughts which have been expressed, it would appear that we can expect the development of the following broad trends in the next decade:

Farms will generally become larger and produce a wider range of animal and plant crops. (Sugar farms will be a notable exception to the latter for special reasons.)

Progressive mechanisation of farm operations will continue, with the farm labour force growing smaller, more skilled, and more highly paid.

Farm power will move away from the jack-of-all-trades tractor in favour of separate tractors for primary and secondary tillage.

Tined implements will largely replace sod-turning implements.

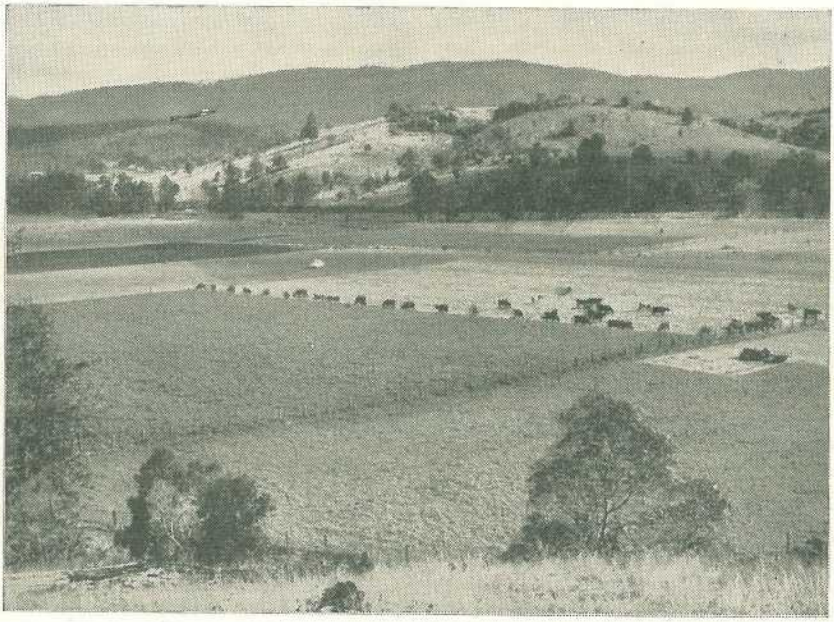


Plate 9.

Rotational Farming is the Key to Agricultural Progress. The grazing animal is an essential feature of permanent farming.

There will be a rapidly multiplying increase in use of improved pastures and in fodder conservation.

Cultivation of fodder crops, in association with animal production, will move inland.

The use of fertilizers for field crops will increase greatly.

Water harvesting will develop slowly at first, but exploitation of farm underground water supplies will proceed rapidly. Dairy farmers will increasingly develop an "insurance patch" of irrigated pasture.

Weed control will be increasingly effected by the spray plant.

Crop plants will be almost entirely grown from certified or pedigreed seed or cuttings of locally-bred varieties.

Beef cattle will carry a growing proportion of *Bos indicus* or "Indian" blood.

Herd recording will gradually become the basis for dairy herd management.

With the increasing importance of the market milk trade there will be a breed shift towards greater volume and lower fat content.

Producers' marketing organisations will adopt more positive selling programmes and will be forced to enter the advertising field.

Price structures will include quality incentives.

There may be some better realisation of the tremendous potential, in many fields, for co-ordination and co-operation between individual primary industries.

Farm management advisory services will become established and freely accepted.

There will be some recasting and extension of the technical and scientific training available to farmers and professional agriculturists.

The community will realise that a country in Australia's position cannot afford to allow agricultural science to remain the Cinderella of the professions.

GRADING OF PUMPKINS.

The Regulations under the Fruit and Vegetables Act of 1947 with respect to grade standards for pumpkins have caused considerable confusion in the minds of some growers in preparing their produce for markets.

The Hon. O. O. Madsen, M.L.A., Minister for Agriculture and Stock, has announced that these Regulations have been amended to state the requirements for marketing in Queensland more precisely. Pumpkins must now be graded into three sizes, viz.:—Small, medium and large, and the respective grade should be marked on the outside of the bag.

''Small'' means pumpkins not less than 5 inches in diameter but not more than 7½ inches in diameter.

''Medium'' means pumpkins not less than 7½ inches in diameter but not more than 10 inches in diameter.

''Large'' means pumpkins not less than 10 inches in diameter.

The amended Regulation states further that pumpkins shall be sound, clean, mature, well formed, of even size, free from sunburn, of similar varietal characteristics and not less than 5 inches in diameter.

Mr. Madsen also drew attention to the fact that it was no longer necessary for growers to mark the word ''Pumpkins'' on the bag as this marking serves no useful purpose and has accordingly been deleted from the Regulations.

Some Exploratory Trace Element Trials on Pastures in the Gympie District

By G. J. CASSIDY, Adviser in Agriculture.

Pasture trials in the Gympie district have resulted in two important discoveries: (1) no discernible response was received from the application of trace elements, and (2) vigorous clover growth came from the use of superphosphate.

Since the discovery and spectacular correction of trace element deficiencies in other parts of Australia, wide interest in the possible use of trace elements has been aroused in south-eastern Queensland.

Farmers have seized on trace elements as a possible simple solution to their very obvious problems of lowered soil fertility and declining pasture yields. Widespread trials have been carried out by private land-owners with various trace element mixtures based on the farmers' own observations of plant symptoms.

The possibility of trace element deficiency has been considered in routine exploratory work by the Department of Agriculture and Stock in the Gympie district.

During the last six years observations have been recorded on a total of 10 trace element exploratory trials strategically placed throughout the area at Maleny, Conondale, Imbil, Gympie, Cedar Pocket, Wolvi, Cooroy, Kia Ora, and Kin Kin.

The results have been disappointing. At the rates of application used no trace element has, so far, brought about a discernible growth response in pasture when applied to the soil—with the exception of sulphur responses obtained on alluvial soils at Conondale.

Although no trace element effects were recorded, the trials have done much to confirm and clarify the main soil deficiencies of the district.

TYPE OF TRIAL.

Most of the experiments referred to above followed a uniform pattern as set down by A. J. Anderson of the C.S.I.R.O. The layout is simple and is designed to isolate deficiencies of major and minor elements in the field. Materials and rates of application used were as follows:—

Material.	Per acre.
Lime	2 cwt.
Superphosphate	10 cwt.
Molybdenum trioxide	1 oz.
Borax	3½ lb.
Potassium sulphate	1 cwt.
Copper sulphate	7 lb.
Zinc sulphate	7 lb.
Manganese sulphate	14 lb.
Magnesium sulphate	56 lb.

These trials consisted of 20 plots side by side. Alternate plots received the complete mixture of all elements. The remainder each have one different element missing. It follows, therefore, that lack of growth on any plot could be reasonably attributed to the lack of the element left out of that particular treatment. For example, if the plot receiving all plant foods except molybdenum was poor compared with the rest, it would point to a molybdenum deficiency in the soil.

One plot received no fertilizer at all. In one or two cases the plan was varied slightly to allow for more "no fertilizer" plots—but results were not affected.

One trial at Conondale compared the effects of gypsum, sulphur and superphosphate, while two at West Cooroy and Maleny compared the effects of various rates of lime when superimposed on superphosphate and potash, with and without a mixed dressing of copper, zinc, molybdenum and boron.

PLANTING MIXTURE.

A standard planting mixture was used for each trial. This consisted of:—

Red clover ..	2 lb. per acre
White clover ..	2 lb. per acre
Lucerne	2 lb. per acre

The legume seeds were inoculated before planting.

OBSERVATIONS AND RESPONSES.

Superphosphate.

Except for one trial at Wolvi and one at Maleny, the response pattern at every site has followed an unmistakably uniform trend. All treatments except two grew vigorous, healthy red and white clovers. The exceptions were no superphosphate, and no fertilizer at all.

Both treatments showed a direct contrast to all others in the trial (Plate 1). On soils known by analyses to be very deficient in phosphate, red and white clovers failed completely on these two treatments, at the same time exhibiting rapid and vigorous establishment on all others.

Plate 1.

Phosphate Response by Red and White Clovers. A. Badham, Cooroy. Photo. taken 3 years after treatment. Plots on left and right dressed with super (10 cwt. per acre) at planting time. Centre plot (note mat grass), no super at planting time.

This occurred at Gympie, Cooroy and Kia Ora. No quantitative yield data were compiled, but responses were clear-cut and definite to the eye. The results pointed to phosphate deficiency as the dominant factor (apart from low moisture) limiting clover growth on the soils concerned.

Sulphur.

On better class Mary Valley soils at Imbil and Conondale, legume establishment was successful, but comparatively poor growth and colour on the two treatments lacking superphosphate indicated a very obvious response to superphosphate.

As it was known from analysis that these Mary Valley alluvial and colluvial soils had reasonable phosphate levels, a simple trial comparing gypsum, superphosphate and sulphur was established at Conondale. The rates of application are shown in the following table:—

Treatment.	Rate per acre.	Amount of Sulphur per acre.
		lb.
Superphosphate	1 cwt.	11.2
Superphosphate	2 cwt.	22.4
Gypsum ..	1 cwt.	20.8
Sulphur ..	21 lb.	21
Control	Nil	Nil

Results from all treatments showed a marked increase in clover growth over control plots, suggesting that sulphur is lacking in these soils. This trial site and the trace element trial at Conondale became waterlogged and one season's observations only are available.

Trace Elements.

No discernible response to the application of any individual trace element applied during the course of these exploratory trials was recorded. Neither did any combination of trace elements make any difference. Every treatment which received superphosphate grew uniformly vigorous clover—whether trace elements were applied or not.

What About Lime?

Of great interest and significance is the fact that lime appeared to have no effect on clover growth at the level of phosphate (10 cwt. per acre) used in some of the exploratory trace element trials.

Three of the trials (Wolvi, Imbil and Conondale) included a strip of lime at 1 ton per acre put down across all other treatments. Red and white clovers showed no increase in growth or vigour on the limed section. This indicates that both red clover and white clover will nodulate and grow satisfactorily under very acid soil conditions, provided available phosphate is at a sufficiently high level.

Soil analyses from trial sites record pH as follows:—

Cooroy .. 5.1 to 5.3 (strongly acid)
Gympie .. 5.1 to 5.2 (strongly acid)
Wolvi .. 5.7 (medium acid)

On the other hand, the survival and growth of lucerne on all the plots was practically confined to the limed strip. This observation is in accordance with its well known sensitivity to acid conditions.

OTHER OBSERVATIONS.

It has long been realised that applied phosphate becomes "fixed" or unavailable to plants on these acid coastal soils. This has been demonstrated also in the work under discussion.

At Cooroy, analyses of soil samples taken three years after the initial 10 cwt. dressing of superphosphate revealed the same critically low level of available phosphate in both superphosphate and no-fertilizer treatments (32 to 34 parts per million P_2O_5). Following this, an immediate response to a topdressing of superphosphate at 3 cwt. per acre was achieved (see Plate 2).

Plate 2.

Phosphate Response to 3 cwt. Super per acre Applied 3 Years After original 10 cwt. Dressing. A. Badham, Cooroy. Left: 10 cwt. per acre super 1953, plus 3 cwt. per acre in 1956. Right: 10 cwt. per acre super in 1953.

Analyses of samples from Gympie six months after treatment showed the following levels of available phosphate:—

Plot receiving all elements including superphosphate at 10 cwt. per acre	82 p.p.m.
Plot receiving no fertilizer	44 p.p.m.

It is evident therefore that regular annual dressings are necessary to replenish phosphate in the topsoil.

CONCLUSIONS.

Evidence accumulated from this series of experiments provides a good basis for the following conclusions:—

(1) Phosphate deficiency is the most important single *chemical* factor limiting growth of white and red clovers in the district.

(2) Strongly acid soil conditions do not in themselves prevent nodulation and growth of white and red clovers.

(3) Lime is not necessary for establishment of red and white clovers provided available phosphate is at a sufficiently high level. The effect of lime on the availability of applied superphosphate remains to be investigated. There is much field evidence to support the contention that reducing the soil acidity assists the availability of more conventional and economic dressings of super (2-3 cwt. per acre).

(4) No trace element applied to the soil at the rates described in this article had a discernible effect on the growth of red and white clovers.

Plate 3.

General Standard of Clover Growth on Super-treated Plots, Regardless of Trace Element Treatments, 1954.

Plate 4.

Close-up of Pasture Mixture in the Same Paddock as the Trial Area and on the Same Soil Type. A. Badham, Cooroy. 1954. Treatment—lime 1 ton per acre and super 2 cwt. per acre.

(5) On some Mary Valley alluvial soils, sulphur alone has a beneficial effect on clover growth.

FURTHER WORK.

The next step is to examine the relationship between available phosphate and soil acidity in trials with various dressings of lime and phosphate and the testing of higher rates of trace elements. This work is being initiated. Meanwhile, there is little economic justification for abandoning lime dressings in favour of the heavy superphosphate application made necessary by using the broadcast technique.

Where sod-seeding machines are available, of course, this does not apply. The fertilizer placement principle of these machines is so designed as to make 2 cwt. of drilled superphosphate do the work of 10 cwt. broadcast.

ACKNOWLEDGMENTS.

The assistance of the co-operating farmers is gratefully acknowledged. Trials were established on the following properties:—

Mr. A. Badham, East Cooroy.
Mr. T. McNaught, Pound Hill, Gympie.
Mr. H. Meyers, Imbil.
Mr. J. Ahern, Conondale.
Mr. E. K. Beattie, Wolvi.
Mr. A. Webster, Maleny.
Mr. L. Amiet, Cedar Pocket.
Mr. A. Neal, West Cooroy.

Access to private trials put down by Mr. E. A. Edwards (Kia Ora) and Mr. W. J. Blackwood (Kin Kin) was given by these farmers.

BE READY FOR MITES IN THE FOWLHOUSE.

Mites in the fowlhouse are difficult to see, but they're readily felt. These small parasites, often not much bigger than the point of a pin, crawl onto people entering infested fowlhouses and cause great irritation.

This mite is the tropical fowl mite and is also known as the sparrow or starling mite, says Mr. B. W. Moffatt, Poultry Adviser, Department of Agriculture and Stock. In summer, an infestation of both the tropical fowl mite and the fowl louse can build up quickly. Through irritation and in some cases blood sucking, these parasites can cause loss of production and unthriftiness in poultry.

Tropical fowl mites usually live on the birds, but in a heavy infestation they may be found on the walls of the fowlhouse and in the litter. Lice are seldom found off the birds.

With modern insecticides, control is not difficult. Lice and mites can be readily killed by painting the perches with a special BHC perch paint. When the birds perch at night, the insecticide acts as a fumigant and destroys lice and mites in the birds' feathers without harming the birds. The BHC paint has a residual effect for a few days.

If tropical fowl mites are present in the fowlhouse itself, you can get rid of them by removing and burning the litter and spraying the walls with BHC. Extreme care must be used in spraying near food or nest boxes, as BHC will cause objectionable taints in flesh and eggs. When nest boxes are treated, remove and burn the nesting litter, spray the nest and then replenish with new litter.

Manage Your Pastures and Grazing Crops for Maximum Production

By N. J. DOUGLAS, Assistant Adviser in Agriculture.

To get the best use out of improved pastures and supplementary grazing crops, many farmers are turning to strip grazing—a system that provides a succession of small sections, or narrow strips, of fodder or pasture to the grazing animal for short periods of time.

Increased areas of improved pastures and supplementary grazing crops are now being grown in south-eastern Queensland. However, in coastal districts only limited areas of high quality grazing are available on individual farms.

Every dairyman will have observed that if cows are allowed an "open go" on any crop they tend to graze in patches and to soil and trample a considerable amount of the available feed.

The same thing happens to pastures and they often become overgrazed in localised areas. The grass which is untouched then grows rank and unpalatable, while the concentrated grazing on small areas tends to weaken the best grasses, paving the way for weeds to take control.

It is usually necessary therefore to use some form of grazing management to ensure maximum utilisation of this feed, with the minimum amount of injury to the fodder plants.

Strip grazing is used on many farms to provide this increased efficiency. This type of grazing, as its name implies, is based on the

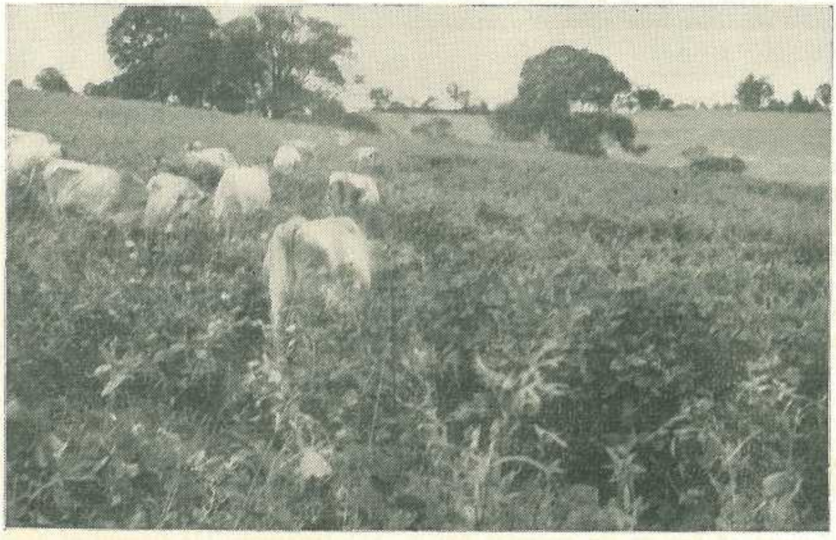


Plate 1.

Poona Cowpea and White Panicum Crop, Cooran. This crop is being strip grazed for the second time. Electric fencing assures maximum utilisation of the crop.

system of providing a succession of small sections or narrow strips of fodder crop or pasture to the grazing animals for short periods of time.

Some form of cheap and easily shifted fence is essential for this method of forage management. The electric fence is the most common type of subdivision used for the purpose.

It is estimated that in highly productive crops and pastures strip grazing increases the effective productivity by as much as 20 per cent.

What Crops Can be Strip Grazed?

Practically all types of fodder crops and pastures can be strip grazed. Crops such as the summer-growing white panicum, millets, Sudan grass and cowpeas, and winter crops of oats and field peas, are ideally suited to this form of management.

Pastures also respond to strip grazing. By this method the high-protein irrigated pastures can be rationed, while rain-grown pastures are maintained in a uniformly productive condition over a longer grazing season by strip grazing.

When to Graze.

An important aspect of grazing management is to ensure maximum forage production with the minimum amount of damage to the crops or pastures.

The stage of growth of the crop or grass at which grazing occurs plays an important part in its future production.

With many annual crops, if grazing is delayed until the flower heads are formed, much of the ratooning or regrowth potential of the crop is lost. For example, it may make the difference of five or six grazings for correctly managed oats as compared with only two for a crop which was showing flower heads when first stocked.

Crops such as white panicum and oats can usually be grazed safely when they are 9–12 in. high, provided they are well rooted.

With permanent pastures, on the other hand, it is essential that sufficient food reserves be held in the roots and crowns to ensure rapid and vigorous regrowth after grazing. At the same time, the accumulation of old rank growth of low protein value should be avoided.

With improved pastures of the paspalum-kikuyu type, the ideal height at which to commence grazing at each cycle is about 6 in. On the other hand, it would be harmful to keep a green panic pasture grazed down to that height.

Young pastures often benefit by a quick light grazing. The young plants benefit from the consolidation by trampling. With this treatment, white clover, ryegrass and phalaris plants, for example, will develop more lateral spread at an early date, and eventually grow into a firm sward.

What Size Strip?

The area of the strips depends on the herd size, the amount of feed available and the length of the grazing period. Where it is not a case of eking out a limited amount of feed a simple method will help any farmer to determine the size of the strip required by any particular herd size.

Two simple steps are involved. First—estimate the amount of feed available. Then, using this figure, calculate the area required by any number of cows for any number of days.

The following example will explain the method.

(1) *Determine the amount of green feed available in tons per acre.*—To do this cut a square yard of the crop or pasture and weigh the green material. A set of kitchen scales will

be quite suitable. Multiply the pounds of green material per square yard by 2, and the answer will be tons per acre.

For example, a crop or pasture cutting 4 lb. per square yard multiplied by 2 would give a yield of 8 tons green material per acre.

(2) *Calculate the daily strip size.*—If the available feed will provide full grazing for the herd, allowing 140 lb. of green matter per cow, the following simple rule is used, giving the answer in acres:

$$\frac{\text{Number of cows}}{\text{Tons green matter per acre x 16}}$$

For example, the crop measured above yielded 8 tons of green matter per acre. For 32 milking cows the strip size would therefore be as follows:

$$\frac{\text{32 cows}}{\text{8 tons green matter per acre x 16}} = \tfrac{1}{4} \text{ acre}$$

This simple quantitative approach will be most useful and can be readily applied to any crop or pasture.

It will be realised that when the area of feed available is small or the yield is low, it will be necessary to adjust either the size of strip or the daily grazing period.

Table 1 gives the various sizes of strips required when rationing is necessary. It is based on a 100-cow herd. The top line gives the yield in tons per acre of green feed ranging from 5 tons to 10 tons.

The column on the left gives the feed to be eaten per cow per day ranging from 50 lb. to 140 lb.

The figures within the table represent the areas required to provide various amounts of feed.

For example, if 8 tons per acre of green feed are available and it is considered daily intake from the pasture must be restricted to 50 lb. per cow, the strip size will be ·28 acre. This is arrived at by following along the row of figures opposite the 50 lb. intake figure until it meets the column under the 8 ton yield figure.

Similarly, if it was decided to allow each cow 110 lb. per day in a pasture yielding 8 tons per acre, the daily strip size would be ·61 acre.

How Long a Grazing Period?

The requirements of the grazing animal have to be balanced with the available food and the regrowth ability of the particular crop or pasture.

Very few plants can stand constant heavy grazing. Constant defoliation will eventually weaken any plant, and when planning grazing management it is necessary to recognise this feature. The pastures or crops should be given time to make vigorous regrowth between each grazing period. The daily grazing time may have to vary from as little as one hour per day to full grazing requirements, depending on the local conditions.

SIZE OF STRIP REQUIRED FOR 100 COWS.

—	Feed available in tons/acre.					
	5	6	7	8	9	10
Feed to be eaten in lb./cow/day 50	.45	.37	.32	.28	.25	.22
60	.54	.45	.38	.33	.30	.27
70	.62	.52	.45	.39	.35	.31
80	.71	.60	.51	.45	.40	.36
90	.80	.67	.57	.50	.45	.40
100	.89	.74	.64	.56	.50	.45
110	.98	.82	.70	.61	.55	.49
120	1.07	.89	.77	.67	.60	.54
130	1.16	.97	.83	.73	.64	.58
140	1.25	1.04	.89	.78	.69	.62

Plate 2.

Irrigated Pasture, Kybong. This legume-rich pasture is ready for grazing.

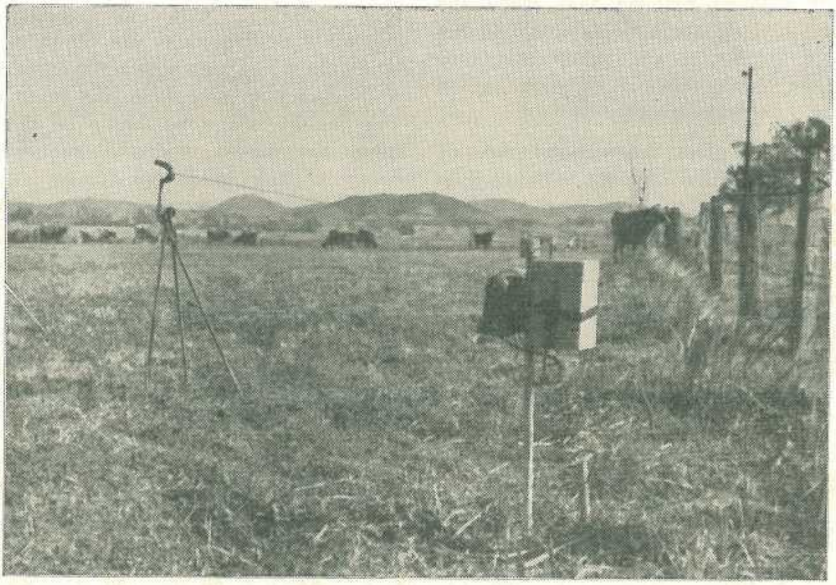


Plate 3.

Electric Fence Layout, Kybong. This portable electric fencing unit is useful for strip grazing management.

For example, at one farm at Imbil, 10 cows are continually strip grazed during their lactation period on 7 acres of irrigated pasture. The daily grazing strip is 30 ft. wide by 4–5 chains long. Thus each strip is heavily grazed for one day and then spelled for 30 days, which is ample time for regrowth. Following grazing, the strips are irrigated. Regular annual topdressing is also undertaken to keep the pasture productive.

Strip Grazing and the Farming Programme?

Strip grazing is an operation that combines well with the usual farm routine. It is a common practice to graze a pasture immediately after the morning milking. If there is plenty of feed the herd could again be allowed access prior to the afternoon milking.

Management and Maintenance.

One important operation that must be combined with strip grazing of pastures, and particularly of irrigated pastures, is manure spreading. This may be accomplished in a number of ways.

On irrigated pastures a weatherboard spreader similar to a clod crusher smears and spreads manure without damaging the sward. Diamond harrows turned on their backs also do a fairly efficient job of manure spreading. Another method is to drag a number of old car tyres cut in half and linked together.

On non-irrigated pastures where paddocks are being grazed in rotation, pasture harrows are ideal.

Unless the manure is spread, rank unpalatable patches will develop in the pasture. This rank pasture is ignored by stock. In night paddocks the total area of rank growth on untreated pastures can be quite significant.

After a strip of pasture has been grazed it will sometimes be necessary to mow the area for weed control. This mowing also cuts off the stalky pasture which remains after grazing. Following mowing, the pasture will resume a uniform appearance with even growth.

For reasons mentioned earlier, tall-growing grasses such as green panic should not be mown close to the ground. A height of 6 in. is the minimum for this grass.

Where irrigation is used it is recommended that the area be watered immediately after it has been strip grazed. This irrigation ensures a continuity of growth. Do not overgraze irrigated pastures during the hot months of November to January. It is essential to leave sufficient ground coverage to keep evaporation low and to prevent soil temperatures rising above a critical level for ryegrass and clover.

Deferred Grazing.

Although strip grazing gives more efficient use of the available pasturage and provides a period between grazings for regrowth, there will be no regrowth in rain-grown pastures during dry periods of the year.

To overcome the shortage of grass which usually occurs for this reason in late spring, a system of deferred grazing may be practised. This method has been used with success on the Maleny Plateau. Kikuyu and paspalum paddocks after being grazed during the summer are closed to stock in the autumn while some regrowth is still occurring. Strip grazing is again commenced in spring, thereby utilising efficiently the fodder conserved in the field.

Given satisfactory growing conditions, one farmer at Maleny has been able to defer the grazing of a kikuyu-paspalum pasture from autumn until September. Five acres of this pasture

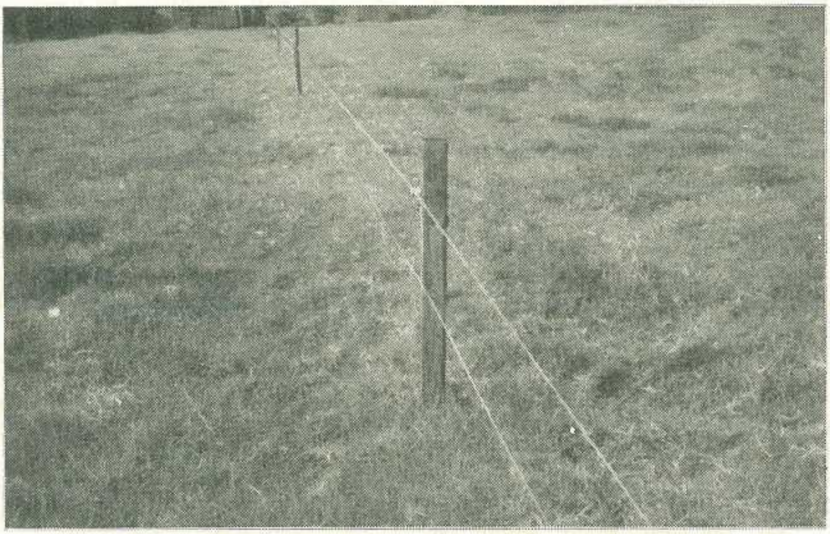


Plate 4.

Semi-permanent Electric Fence, Maleny. This type of fencing is suitable for permanent kikuyu and paspalum pastures. Maintenance charges are small.

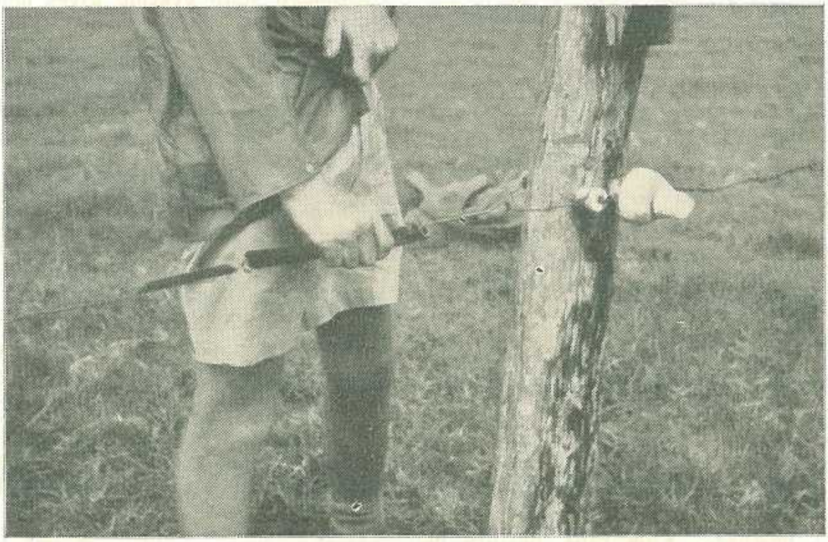


Plate 5.

Spring-loaded Gateway for Electric Fence, Maleny. This insulated gate-hook, suitably spring-loaded, provides effective gateway control in all kinds of weather.

provided 60 cows with seven hours' grazing per day over a period of 20 days, at a time when regrowth from normally grazed areas was very slight.

Using the Electric Fence.

An initial outlay of approximately £30 for a complete electric fencing unit buys the following advantages—

(1) Higher stocking rate per unit area of feed.

(2) Controlled grazing of a crop or pasture at the best time.

(3) An overall saving of feed by better utilisation.

(4) Conservation of surplus growth not immediately required for grazing.

(5) Under certain conditions, control of bloat on highly productive pastures containing clovers or lucerne.

Electric fencing units are now being widely used throughout all dairying districts. Some very useful hints have been gathered and the following points may help farmers to gain maximum advantages from strip grazing techniques when using electric fences.

(1) It is essential to keep all wires properly insulated and strained.

(2) The battery and breaker mechanism should be protected and kept clean.

(3) Light-weight electric fence droppers should be used. These droppers may be purchased or made out of ⅜ in. steel reinforcing rods. These rods should be cut into 3 ft. 6 in. lengths, and then curled at the top to make a pigtail. Insulation can be achieved by slipping a short length of plastic or milking machine rubber over the pigtail.

(4) It is recommended that an access laneway be provided along the headland of the paddock being strip grazed. The milking herd is thus confined to this laneway when going and coming from the grazing strip.

Semi-Permanent Electric Fences.

Some farmers find it an economical practice to dispense with permanent fence lines for subdivision. These farmers rely on a system of semi-permanent electric fencing to control the milking cattle. The paddocks are usually subdivided into areas of 2–3 acres, depending on the herd size. Steel pickets or heavy wooden stakes are used to carry the wire. Electric fencing wire (14-gauge) can be used in conjunction with a single strand of 12-gauge barb wire. In some instances two strands of barb wire are used.

To overcome the gate problem in such a system of subdivision, a spring hook may be used for gateways. This hook can be suitably insulated with old milking machine rubbers.

A CHEAP WHEEL FOR THE FARM.

Mr. Jack Evans, of Moola, on the western Darling Downs, has hit on an idea for making cheap wheels for various light farm duties.

The wheel is made simply by clamping two old plough or sundercut discs into the bead on each side of an old tyre.

The discs are clamped together by tightening two backing nuts on a short length of ¾-in. pipe threaded at each end. Mr. Evans welded one end and used a ¾-in. coupling (cut in two) at the other, but a backing nut would be simpler.

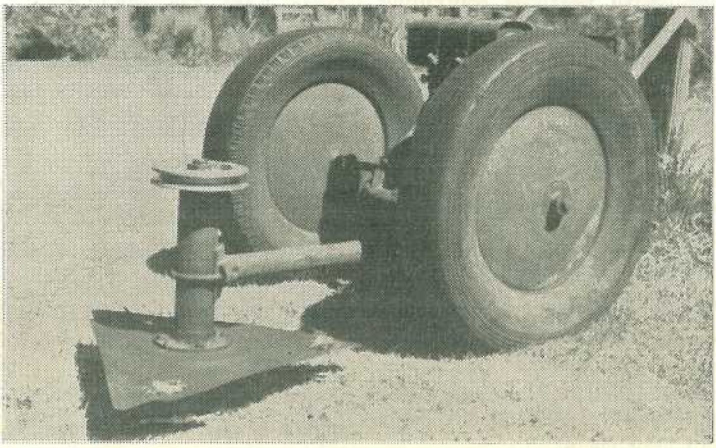
The axle is made from ¾-in. material.

The choice of disc size, tyres and other material must be governed by what is available on the farm. Most of the items mentioned are usually in plentiful supply.

Mr. Evans found that 14-in. discs fitted old 6.40 x 13 tyres.

The photograph shows how this idea has been used by Mr. Evans to make wheels for a weed slasher and grass cutter.

R. F. KELSEY, Soil Conservation Officer.



Avocado Root Rot

By D. S. TEAKLE, Assistant Pathologist.

Since 1949, a disease has caused the unthriftiness or death of some hundreds of avocado trees in south-eastern Queensland.

The trouble has been investigated and has been shown to be due to a root rot identical with that which occurs under wet soil conditions in the U.S.A. and South Africa.

The early symptoms shown by a tree affected with root rot are a lightening of the foliage colour and a tendency for the leaves to hang downwards more than normally (Plate 1). As the disease develops, yellowing of the foliage becomes pronounced, there is a heavy leaf fall and an abnormal amount of twig die-back becomes apparent. In the final stages of attack the tree is reduced to an almost bare framework of dying branches (Plate 2).

Symptoms below ground level can be easily seen by scraping away some of the surface soil beneath the trees. Healthy trees have many white feeder roots near ground level, while below

Plate 1.

Early Symptoms of Root Rot. Note the yellowing and drooping of the foliage of the plant in the foreground compared with healthy trees beyond.

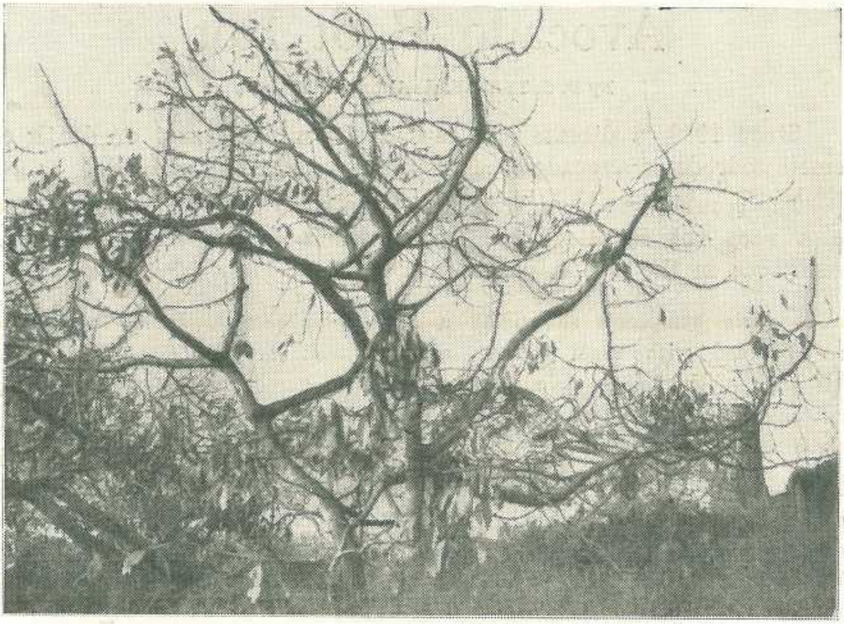


Plate 2.

Advanced Stage of Root Rot. Note the defoliation and die-back.

affected trees most of the smaller roots are black and shrivelled. This root rot is most pronounced following long periods of wet weather.

The development of advanced symptoms may take a considerable time—sometimes a year or more—and because of this slow death of the trees the name "avocado decline" has been applied to the disease.

Plate 3 illustrates the way in which this disease can spread gradually through a plantation and a careful study of the symbols used will show that the onset of advanced symptoms has in some cases been delayed as long as three years.

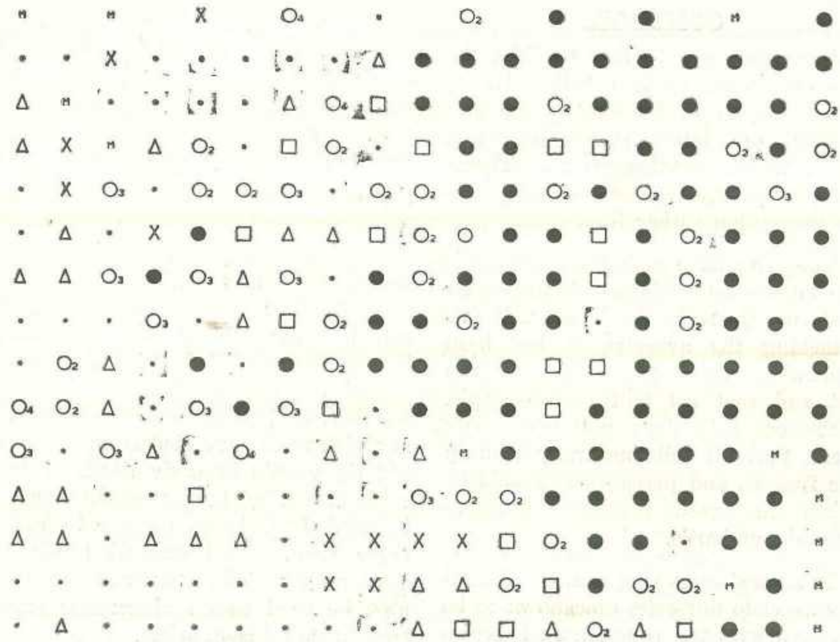
Trees in the early stages of decline frequently make a partial recovery under good growing conditions. However, particularly if wet conditions recur, this improvement is often only temporary.

Under conditions of severe waterlogging, a rapid decline of trees may occur. In this case the foliage rapidly wilts and dies and the tree is left covered with a canopy of brown dead leaves.

A FUNGOUS DISEASE.

The organism responsible for avocado root rot is a fungus, *Phytophthora cinnamomi* Rands, which is one of the "water moulds." Under high soil moisture conditions this fungus causes a rot of the succulent feeder roots; the larger roots are less susceptible to the fungous attack. If wet conditions continue for a considerable time or recur frequently, so many feeder roots are destroyed that the tree is gradually starved.

Because most of the feeder roots are already rotted when the tree first shows decline symptoms, it is often



• = Healthy trees. M = Missing trees.

● = Trees which exhibited pronounced symptoms on 19/4/51.

O = *Trees which exhibited only slight symptoms on 19/4/51.

□ = Previously healthy trees exhibiting disease symptoms on 3/4/52.

Δ = Previously healthy trees exhibiting disease symptoms on 26/5/53.

X = Previously healthy trees exhibiting disease symptoms on 28/10/54.

* The figures 2, 3, 4 beside the light circles indicate that by 3/4/52, 26/5/53 or 28/10/54 respectively the initial slight symptoms showing on 19/4/51 had become pronounced and the decline was advanced.

Plate 3.

Diagrammatic Illustration of the Actual Spread of Avocado Root Disease within an Affected Plantation. (From observations made by J. H. Simmonds, Chief Pathologist.)

difficult to find roots containing the fungus, and thus to prove that the root rot organism is present. However, by using the fact that the fungus will grow readily from infested soil into apples, it has been possible to show its presence near declining avocadoes in the Ormiston, Redland Bay, Sunnybank and Tamborine districts of south-eastern Queensland.

Evidence that this fungus is responsible for avocado root rot in Queensland is given by glasshouse experiments in which young avocado plants were killed or stunted when the fungus was mixed in with the soil.

CONTROL.

Once an avocado tree exhibits the disease symptoms it usually already has lost most of its root system and sooner or later succumbs when excessive wet weather recurs. Therefore, control of the disease depends on prevention rather than cure.

The fungus causing root rot is known to be widespread in south-eastern Queensland. As well as attacking the avocado, it has been known for many years to cause top rot and root rot wilt of pineapple. However, this does not necessarily mean that all soils naturally contain the fungus, and precautions should be taken to avoid introducing it to avocado orchards.

In several cases properties maintaining avocado nurseries are known to be infested with the fungus and it seems likely that on occasions the organism has been disseminated on nursery plants. If wet conditions prevail after infected stock have been planted, the avocadoes sometimes fail to establish properly and gradually die out. If conditions remain dry for some time, the build-up of the fungus will be slower and plants may live for many years.

The obvious way of decreasing the risk of introducing the fungus is by the grower propagating his own avocado stock in new or sterilized soil.

Because the root rot fungus is stimulated to activity by high soil moisture, all possible precautions should be taken to ensure that waterlogging does not occur. This can be done by establishing plantings only on deep, well-drained soils and by providing surface drainage to remove run-off quickly during periods of heavy rainfall.

With many diseases, use of resistant varieties is a valuable method of control. In the case of avocado root rot, however, investigations overseas have so far failed to reveal any varieties with adequate resistance. Further, replanting avocadoes in land in which trees have died from root rot usually results in early death of the replant. The best procedure with infested land is to change to some other crop. The custard apple is apparently resistant to the fungus and may be used as an alternative fruit tree in suitable districts.

Summary of Control Measures.

(1) Plant avocadoes only in deep, well-drained soils.

(2) Install surface drainage in order to minimise waterlogging during periods of wet weather.

(3) Raise avocado trees on the property to eliminate the risk of introducing the fungus in the roots of nursery stock.

(4) Do not replant avocadoes where trees have died from root rot.

ERRATUM.

The photograph on page 604 of the October issue showed members of a Beekeeping School at the honey packing plant of Smith Bros., Darra, not at an apiary, as stated.

The Pea Crop at Stanthorpe

By A. R. CARR, Experimentalist, Horticulture Branch.

Peas are grown in Queensland solely for the fresh vegetable market and not for canning, as they are in the southern States. As price levels fluctuate a great deal with market supplies, and climatic conditions are not wholly favourable for the crop, production is somewhat speculative. This is a pity, for the pea, like most other vegetables, grows quickly and requires a considerable amount of attention in the field.

Importance.

The crop is produced commercially both on the coast and in the Stanthorpe area. In the latter district it appeals to growers because it provides a cash return early in the season. Every effort is therefore made to produce early crops.

Stanthorpe production is approximately two-fifths of that of the State as a whole. Figures for the past five years are listed in Table 1.

TABLE 1.
PEA PRODUCTION IN QUEENSLAND.

Season.	Stanthorpe.	Queensland.
	bus.	bus.
1956–57 ..	43,177	Not available
1955–56 ..	20,264	55,318
1954–55 ..	27,197	45,777
1953–54 ..	10,426	55,601
1952–53 ..	12,140	52,528

The increased production during the 1956-57 season is noteworthy. Without a doubt this was brought about by very severe damage to stone fruits caused by spring frosts. Peas were planted immediately afterwards to make up an anticipated deficiency in the farm income. The crop obviously provides some insurance against setbacks in the fruit industry.

Varieties.

A number of pea varieties have been tested in the Granite Belt.

Some canning types do well under local conditions, but they have been selected for uniformity of maturity and the bulk of their crop is harvested in one pick. This is not necessarily an advantage; many crops are grown on a speculative basis for the fresh vegetable market, where price levels fluctuate sharply.

The canning varieties are very vigorous; they have a pale green bush and large pods. However, the pods do not normally retain their fresh colour after harvesting. The best known varieties are Canner 75, Shasta, Emperor and Meteor.

The green pea types are more suited for Stanthorpe conditions and in favourable seasons produce good crops. The two most popular varieties are Greenfeast and Massey.

Greenfeast has a semi-erect habit of growth. It branches well and produces a crop fairly evenly over a number of harvests. The pods from the early picks are of good quality but there is some deterioration in the later part of the harvesting period.

Massey is an early-maturing variety in which harvesting commences approximately 14 days ahead of Greenfeast. It is a dwarf, semi-erect type with relatively few branches. The pods are of good quality but overall yields at Stanthorpe are much lower than those of Greenfeast.

Time of Planting.

As it is necessary to produce peas early at Stanthorpe, the crop is grown out-of-season. Quite a number of growers plant in mid-June—that is, at the beginning of winter. The seed germinates slowly, and the young plants branch freely, possibly because of the low temperatures. The plants must not be too forward in winter, as they then become susceptible to frost damage; preferably they should be not more than 2–3 in. high until the onset of spring. Rapid growth then occurs.

A second planting is made in early August. This crop grows much faster than the June planting and produces pods about a fortnight later than it. This fortnight is often enough for the crop to catch an early payable market. However, yields from the late-planted crop are usually lower than those from the early-planted one. This may be due to the characteristically fewer branches on the plants.

Planting seldom extends beyond the end of September because of the hot, dry conditions usually experienced in the later part of the year when the crop is maturing, and because of the lack of irrigation facilities on most farms.

Crop Management.

The pea, like all other vegetables, requires proper attention. The ground must be thoroughly cultivated some time prior to planting and a basal application of a 4:15:2.5 fertilizer is needed. Seed treatment with inoculum and a pre-emergence fungicide before planting usually pays.

Planting distances vary considerably. In dry-farmed areas, the rows are usually spaced 3–4 ft. apart. The rows are rarely closer than this, except on irrigated farms, where the crop may be planted in rows as close as 2½ ft.

Depth of sowing is particularly important under dry-farming conditions. The seed is frequently planted too deep and this results in irregular and slow germination. A depth of 1 in. is satisfactory on heavy, moist soils, but on dry sandy loams a sowing at a depth of 1½–2 in. is better. Planting at depths in excess of 2 in. is undesirable.

It is commonly believed that wide spacings in the row produce large plants and high yields per acre. This is not the case. Plantings at 3–4 in. apart within the row give higher yields than plantings at 6 in.

Once the crop is established, it must be kept free of weeds and cultivated regularly. At early flowering, a nitrogenous side dressing is often needed, especially after a wet winter. Lack of nitrogen is indicated by the yellow colour of the leaves and a general unthrifty appearance of the plants.

Harvesting is the most expensive operation in pea production, and if market prices are low it is often advisable to abandon a maturing crop and divert labour to a younger one which will crop at a later date.

Peas are usually harvested over three or four picks, but where labour costs are high or prices low, it often pays to harvest only the better quality pods in a single pick.

Poor quality pods are sometimes a problem when the crop matures during hot weather. Under these conditions great care is needed to harvest the pods at the correct stage of maturity; a close watch on the crop is necessary to prevent wastage from this cause.

Cooling and Storing Cream in a Combination Charcoal and Tower Cooler

By T. W. SMITH, Dairy Adviser.

Dairying in the subtropical and tropical climatic conditions of Queensland has always presented one major problem in the production of a choice quality cream. That is suitable cream storage.

During the hot summer months, because of high atmospheric temperatures it is essential that cream be stored under cool conditions. Various methods have been employed to achieve this, such as standing the cream in shallow water troughs, keeping wet bags draped around the cans, and in some instances storing cream in special charcoal coolers.

These methods were employed largely in the days when machine milking was in its infancy and most milking was done by hand, but there are still many who use these methods today.

With the almost universal use of milking machines in present times, however, the way has been opened for the adoption of some methods of cooling utilising the power unit in the dairy building.

The availability of this driving power has enabled the introduction of refrigeration on to many farms. There are several models available to producers, and the large number installed on market milk farms indicates that producers appreciate the importance of cooling and storage. These units are available to dairymen on very reasonable repayment terms.

A second type of power cooling which has found ready acceptance by producers is that utilising recirculation of atmospherically cooled water. In this method, water is pumped over a special spray tower for cooling to the atmospheric wet bulb temperature and thence recirculated through the tubular cooler before return to the tower to complete another cycle.

Tower Modification.

Recently a system of cooling has been developed whereby shock cooling of the cream has been combined with cool storage. The cost of this unit to the farmer is less than £100 if he erects it himself.

This modification is a combination of the charcoal cooler and the tower cooler. Several units are now in use throughout the State.

The first "charcoal-tower" type cooler in the Dalby district was erected on Mr. M. Reimers' farm at Moola. When a charcoal cooler was built under the existing tower cooler, it was found that this combination of charcoal cooler and tower cooler combined was successful.

The second unit was erected on Mr. J. Farquharson's farm at Bell. In this unit the charcoal cooler was built as part of the existing tower cooler. Excellent results were obtained in cooling and storing cream.

Demonstrations of this type of dual cooling unit have been arranged under the Commonwealth Dairy Industry Extension Grant.

Construction.

Plates 1, 2 and 3 show the charcoal-tower cooler unit under construction.

Plate 1.

Building the Frame for the Combination Cooler.

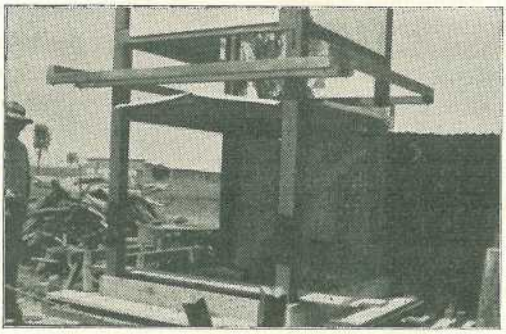


Plate 2.

Preliminary Work on the Charcoal Cooler.

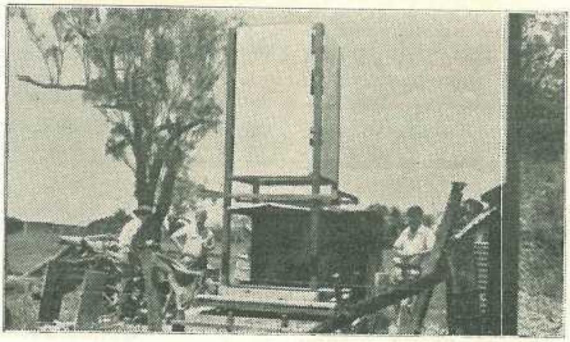


Plate 3.

Tower Cooler Completed.

It consists of a concrete pit 6 ft. square by 1 ft. deep. The walls are 12–14 in. thick, leaving a water pit in the centre of 60–70 gallons capacity. Above this pit a superstructure of 11 ft. is erected, consisting of four 3 in. x 3 in. uprights, braced at three points and set into the concrete. The charcoal cooler is approximately 3 ft. high and the water cooling tower 8 ft. high. The unit is 3 ft. 6 in. square. Baffle boards are inserted at intervals of approximately 3 ft. and each side is then covered with fibro sheets. A galvanised iron tray pitted with nail holes is set in the top of the tower.

The charcoal cream storage cabinet is made by nailing slats at suitable intervals, say $\frac{1}{2}$ in. spacing, on the upright frame. Plain galvanised iron forms a suitable roof from which the water can drain freely onto the surrounding charcoal. To prevent rusting this roof is given a one inch coating of concrete.

The outside frame of the charcoal cabinet is again constructed of slats (Plate 4.). The intervening space is packed with charcoal, and the roof is also covered with charcoal to a depth of 10 in. or more.

To complete the unit, piping is laid complete with foot-valve from the water in the pit to a $\frac{3}{4}$ in. centrifugal pump. From there a plastic hose connects to a tubular cooler, and thence to an overhead pipe for return to the tower cooler.

The overhead pipe terminates above the tray in the top of the cooler tower.

An effort has been made to minimise the use of metal such as netting, etc., as the corrosive properties of some waters causes rapid deterioration through rusting.

Operation.

During milking, the water in the pit is pumped through the tubular cooler and delivered from there into the tower tray. During its passage through the tower it is broken up into droplets to enable the greatest possible cooling from the atmosphere.

The water, which has been appreciably cooled by this action, then falls on to the charcoal, thoroughly saturating it. The intermediate roof diverts the flow through the charcoal walls, Further cooling of the water takes place, ensuring cool conditions within the cabinet.

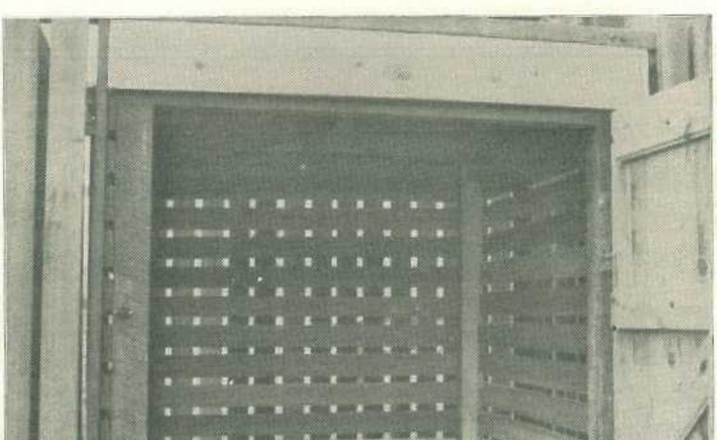


Plate 4.

Outside Frame of the Charcoal Cooler.

Thus it will be seen that cold water is continually passing through the tubular cooler during milking. When the cream is separated and flows over the tubular cooler, heat is removed from it by the cooled water.

Lowered Temperatures.

It has been found in practice that cream temperature is reduced by approximately 20 deg. F. between the separator and the can by this method.

Having cooled the cream, the storage cabinet provides suitable cool storage, as shown by the following figures, which were obtained during summer.

Temperature in Separator Room (°F.)	Temperature in Charcoal-Tower Cooler (°F.)	Temperature Difference (°F.)
100	68	32
101	74	27
102	76	26
99	73	26
93	70	23
85	69	16
80	62	18

It will be seen that there is a difference in temperatures ranging from 16 to 32 deg. F.

An important factor governing this low temperature in the cabinet is the location of the tower cooler.

With this particular unit it was found that the location of the dairy buildings prevented the northerly winds from exerting their full effect on the cooling cabinet, while any southerly, easterly and westerly breezes had direct access. The illustrations of this unit show its position in relation to the dairy buildings. It is essential that full benefit be obtained from these breezes, as the movement of air through the tower is necessary for efficient cooling of water.

With minimum night temperature during mild weather, the difference between atmospheric and inside cabinet temperatures is only very slight. When really cold conditions prevail, the internal temperature of the cabinet during the night could register higher than external atmospheric temperature. For this reason, when winter conditions operate, particularly with the heavy frosts experienced on the Darling Downs, it is recommended that the door of the cabinet be left open during the night.

Pig Testing

By A. L. CLAY, Director, Pig and Poultry Branch.

A Pig Testing Station will shortly be opened by the Department of Agriculture and Stock at its Rocklea Animal Husbandry Farm.

The purpose of the Station and the rules relating to testing are described in this article.

Pig testing is a special kind of progeny testing. Newly weaned pigs are taken to the pig testing station, where they are kept and fed under conditions which are made as uniform as possible.

In this respect much depends on the building that is provided and the facilities available therein. Ideally, the temperature in the pig testing station should not vary more than 5-10 deg. F. at any time during the year. This is because similar pigs on similar rations grow and fatten at different rates according to the temperature conditions under which they are kept.

The chemical composition of the ration fed must also be kept as constant as possible. Grain and hay grown in different districts may vary quite surprisingly in the amount of food nutrients they supply. Meatmeals from different meatworks likewise may contain vastly different amounts.

Because of these considerations it is usual for pig testing stations to purchase supplies of feedstuffs in especially large consignments so as to have even lines available throughout a test. Chemical checks at the beginning of a test and at strategic intervals thereafter will then ensure

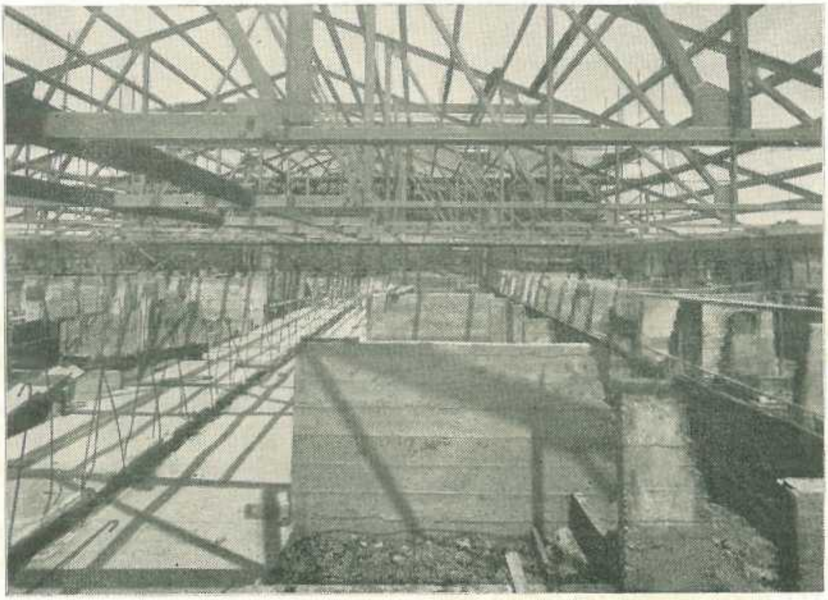


Plate 1.
Interior of the Pig Testing Station Under Construction at Rocklea. Photo taken 30/9/57.

that the ration fed is according to label; any small adjustment required can be easily effected.

Another important point is that each and every pig in the testing station should have easy access to its feed and be free from any molestation by its fellows. Unless this is so, some pigs will get more than their share of the feed and others correspondingly less. In that event, all are not given equal opportunity of showing what they are capable of doing.

In the Department's station at the Animal Husbandry Research Farm at Rocklea, ideal conditions for pig testing will be approached just about as closely as practicable. The air conditioning to be provided will keep the temperature virtually constant throughout the year. Facilities for storing large quantities of grain and other feedstuffs will be available, and modern milling and mixing machinery will enable the ration to be made up on the premises. The Biochemical Laboratory at Yeerongpilly is conveniently placed to supply the required chemical checks on the components of the ration. Each and every pig will be penned separately and have its own feed trough and waterer.

The industry can therefore be assured that pig testing as conducted at Rocklea will be on an exceptionally sound basis.

Pig Testing Rules.

Although the rules to be followed in the testing of pigs at Rocklea have not been quite finalised, the following have been agreed upon by the Department's Pig Technical Advisory Committee.

(*Note*.—An explanatory note (in brackets) follows a rule where the reason for that particular rule may not be immediately apparent).

(1) Boars selected for testing must be standing in herds which have at least six breeding sows.

(This is because of the limited accommodation available in the testing station, coupled with the fact that pig testing is of more use to the larger breeding establishments than to small ones. Actually, studs in which two or three boars are standing are preferable).

(2) No certificate of performance will be given with respect to any boar until four litters sired by him out of different sows (none of which is a full sister to another) have been tested.

(A good result on one sow does not prove very much so far as the boar is concerned, as it may be due as much to the influence of the former as the latter. On the other hand the results on four sows when averaged allow a reliable measure of the boar's worth to be made).

(3) Breeders who desire to have litters tested must notify the Department two months prior to due date of farrowing. Any such litter must be the progeny of a boar and sow registered in the Australian Pig Herd Book.

(It is essential that accommodation in the pig testing station be allotted well ahead, otherwise confusion is bound to arise).

(4) Advice of the birth of a litter is to be given to the District Adviser (Pigs) or his agent as soon as practicable, but in any event not later than 12 hours after the said birth.

(5) All litters provisionally accepted for testing will be inspected and identified in an approved manner by the District Adviser (Pigs) or his agent within 48 hours after their birth. Litters will be again inspected within 24 hours prior to the due time of despatch of the four selected pigs to the test station.

(Identification will be by ear notching and the recording of sex and surface markings).

(6) No litter will be accepted for testing which does not contain (*a*) in

the case of first litter sows, seven pigs living; and (*b*) in the case of sows on their second or later litter, eight pigs living when the four test pigs are due for despatch to the testing station.

(7) Litters to be tested must be not less than six weeks and not more than nine weeks old at time of despatch of the four selected pigs. The test pigs will comprise two castrated males and two females and each of the four must be not less than 30 lb. and not more than 40 lb. liveweight and as close to the average liveweight of the litter as possible, at time of despatch. The males in a litter that are castrated (all males need not be castrated) must be operated upon when not more than five weeks old.

(In the ordinary way all the males would be castrated, but the rule is designed to allow a breeder to retain one or two males entire should numbers permit this to be done).

(8) In special circumstances permission may be granted for submission of uneven numbers of castrated males and females in the four test pigs.

(This, of course, is to permit of a test proceeding should only one pig of either sex be avaliable in the required weight range at time of despatch).

(9) Test pigs will be accepted only from brucellosis-tested herds and subject to a satisfactory inspection of the piggery of origin by an approved officer of the Department within 24 hours prior to time of despatch.

(It is most important that only healthy pigs be admitted to the testing station).

(10) Test pigs will be purchased by the Department from their owners at a price per lb. liveweight to be determined from time to time according to the prevailing market, and the pigs will then become the absolute property of the Department. The liveweight on which payment will be made will be that of the pigs at time of despatch to the testing station.

(11) Metal crates will be supplied by the Department for the transport of test pigs to the testing station and such transport will be the responsibility of the Department.

(Metal crates have been decided upon because they can be sterilized effectively).

(12) All pigs will be wormed and sprayed upon arrival at the test station.

(This is to ensure that worms or other parasites do not affect the results).

(13) Feeding shall be twice daily and based on liveweight according to a standard schedule.

(As much feed as a pig will clean up in half an hour will be given at each feed. It will therefore be a modified "to appetite" system of feeding. There will be two changes in the actual make-up of the ration, the first being made when the pigs reach a liveweight of 80 lb. and the other when they reach 130 lb. liveweight. This is primarily to provide for altered protein requirements at different stages of growth).

(14) Testing will start as soon as pigs reach 45 lb. liveweight. The test pigs will then be weighed at intervals of seven days until they reach a liveweight of 200 lb.; they will then be sent for slaughter to an approved bacon factory, where a carcase quality assessment will be made.

(15) No test pigs will be disposed of in any way other than for slaughter as baconers unless so ordered by the Department.

(16) All test pigs will be slaughtered, cut and trimmed by an approved standardised method and all carcases will be assessed according to a system determined by the Department.

(This will be based on the Hammond system but some additional measurements may be used).

(17) One test pig may be removed from a test group on the grounds of ill health and the group allowed to continue under test, but if two pigs have to be removed, then the testing of the group will lapse.

(Insufficient information would be obtainable to make a continuation worthwhile).

(18) A report on the results of pig testing will be issued annually in the *Queensland Agricultural Journal* unless it is impracticable to do so.

(19) No casual visitors or parties will be allowed to visit the testing station, but the Department will arrange inspection at its discretion.

(This is considered essential for the safe and efficient working of the station).

(20) These rules may be altered or varied from time to time by the Department in the light of experience or changed circumstances.

Feeding Schedule.

Feeding will be related to three growth phases, as follows—

Phase 1— 45 to 80 lb. liveweight.
Phase 2— 81 to 130 lb. liveweight.
Phase 3—131 to 200 lb. liveweight.

The ration will be in the form of a dry meal mixture with a crude protein content of 17 per cent. in phase 1, 15 per cent. in phase 2, and 13 per cent. in phase 3.

In phase 1 the grain component of the ration will be wheat alone, in phase 2 wheat 75 per cent. and sorghum 25 per cent., and in phase 3 wheat 50 per cent.and sorghum 50 per cent.

The fibre content of the ration will be progressively increased by including lucerne hay, nil in phase 1, 5 per cent. in phase 2, and 7½ per cent. in phase 3.

A mineral mixture made up of limestone and salt equal parts plus sulphate of iron 5 per cent. and copper sulphate 1 per cent. will be included in the ration at a level of 1 per cent. in all three phases.

Vitamin supplementation will be effected by including proprietary preparations at such a rate as to provide 100,000 I.U. of vitamin A, 10,000 I.U. of vitamin D and 50 mg. of riboflavin (vitamin B_2).

Interpreting the Results.

Test pigs will be scored for food conversion efficiency (F.C.E. or lb. of feed to produce 1 lb. liveweight gain), days to reach 200 lb. liveweight from 45 lb. liveweight, and carcase characteristics.

It will thus be possible to compare the results given by the progeny of any one boar with those given by the progeny of any other boar that passes through the testing station. Boars can thus be placed in order according to the results and at the same time these results can be compared with a set standard of excellence.

Some time must necessarily elapse before completely acceptable standards of excellence can be laid down. For the time being, however, a F.C.E. figure of 3.50, 115 days to increase in liveweight from 45 lb. to 200 lb., and 70 per cent. for carcase characteristics might serve quite well.

The Marketing Situation in 1956-57

By Officers of the Division of Marketing.

The improved balance of payments, the dependence of the economy on wool exports, and the continuation of falling prices and increasing costs were the main features of the Australian economy in 1956-57.

The most significant feature of the year was the improvement in the Australian balance of payments. During this period the value of exports exceeded that of imports by £276m., whereas in 1955-56 imports exceeded exports to the extent of £39m. Import and credit restrictions cloud the whole issue and the extent of the dependence of the balance of the economy on wool is not fully evident.

A reversal of the balance of payments position could easily follow a fall in the volume of wool exports resulting, say, from severe drought conditions, or from a fall in prices which might result from increased competition from synthetic fibres.

This potential instability of the economy serves to emphasise the need for increased efficiency in all sections of industry, including rural industry other than wool.

From this must follow higher quality standards. Without this the effort now being expended on trade promotion by the Commonwealth Government, in association with marketing organisations, in both recognised and potential markets, will be of little or no avail.

In many countries considered predominantly industrial, of which the United Kingdom and the United States of America are outstanding examples, policy since the war years has been to support primary industries with guaranteed prices. The result has been greatly increased primary production, and formerly satisfactory markets for our rural products are not only vanishing rapidly but surpluses have accrued in these countries and are being dumped on world markets.

As a result of this increased pressure on the necessity of attaining a high level of national economic self-sufficiency, greater attention is being directed in Australia to import-saving industries. The extension of these import saving industries has particular significance for Queensland farmers in some areas, as they offer the opportunity of alternative crops—for example, tobacco and cotton.

An analysis of the overall marketing situation falls naturally into two parts—exports and import savers, and it is proposed to deal with the subject on that basis.

EXPORT COMMODITIES.

Wool.

Wool exports in 1955-56 were already higher than in the previous year and further increased in 1956-57. Queensland sales for the season totalled 798,906 bales and exceeded the record 1942-43 selling season of 659,536 bales. With a rise in world living standards and a continuation of sound economic conditions the outlook for wool must be regarded as favourable.

Sugar.

The international sugar situation has changed radically from its depressed state 12 months ago. Although partly influenced by the Suez crisis, the increase in price was solidly influenced by a shortage of sugar. World consumption since 1951 has risen faster than production and in the short run a high demand is meeting a low supply. Restrictions on exports under the International Sugar Agreement have been temporarily suspended and this enables Australia to export freely; already, 100,000 tons have been sold to Japan. With control of production, markets are not a major problem for Australia. Bulk handling, mechanical harvesting and handling are some lines of approach being followed by the industry to improve productivity in the face of rising costs.

Meat.

The beef cattle industry again experienced a very favourable season and new production records were established. Prices for beef on the United Kingdom market, however, continued to be depressed because of large imports from other countries, particularly the Argentine, and the high level of United Kingdom domestic production.

Excluding deficiency payments under the 15-Year Meat Agreement, export earnings were about 15 per cent. below 1955-56. It is of interest in gauging the value of the Agreement that payments by the United Kingdom Government with respect to 1956 sales of beef amounted to £3,250,000.

The export of live cattle from northern Queensland to Asia is an aspect of the cattle industry which has become of value to Australia. This year, it is expected, more than 10,000 head of cattle will be exported.

Dairy Products.

Queensland butter and cheese production were both lower than in 1955-56. Overseas market conditions are still very much influenced by the depressing effect on prices of the heavy stock position in the United States of America. Prices for Australian butter fell as low as 247s. per cwt. early in 1957 and did not recover until May; at the end of June the price had risen to 319s. per cwt. Cheese prices also declined with the building up of stocks during the year.

During the year a new Five-Year Stabilisation Plan was approved by the Federal Government. This will operate from July 1, 1957; it substantially follows the previous plan.

Eggs.

The year under review proved a difficult one for the poultry industry. This is attributable directly to the collapse of the market in the United Kingdom and Western Germany for eggs in shell. In Queensland this was aggravated by an increase of 12 per cent. in commercial production in comparison with the previous season. The United Kingdom currently produces about 95 per cent. of her annual domestic requirements and it is not likely that remunerative prices will be obtainable on that market.

The unprofitability of exports, together with low prices offered for poultry for slaughtering, must result in the elimination of uneconomic flocks. The marketing organisation itself realises the necessity of concentrating on exploring new markets and increasing local sales. To achieve this, higher proficiency and service are imperative, whilst it seems likely that even lower local prices must be determined in an endeavour to achieve this objective.

Fruit.

Canned pineapple products make up the bulk of Queensland's fruit exports, and the United Kingdom is the main outlet. Sales on this market in the past year have been very slow due to over-supply, itself a result of intense competition from other exporters, in particular Formosa and Malaya. To meet this increasing competition, Queensland producers are limiting their offerings on the United Kingdom market to choice grade only.

Grains.

The grain situation in Queensland has this year been dominated by a shortage of local supplies for both flour milling and stock feed. Total production of all grains normally used for stock feeding from the last winter and summer harvests was only about 17 million bushels, compared with 26 million bushels the previous year. Smaller harvests were recorded for all of these crops, but wheat contributed most to the reduction. The 1956-57 wheat harvest, estimated at 8 million bushels, was little more than half the previous year's production.

Unsatisfactory planting conditions resulted in a fall of approximately 100,000 acres in the area sown to grain and seed crops. The fall in the wheat crop was, however, nearer 200,000 acres, due to a substantial swing to linseed and canary seed. Yields generally were also about 16 per cent. less than the previous season's.

As a result of these factors the export trade in premium flour from Queensland was restricted in an endeavour to ensure adequate supplies of wheat for domestic flour consumption, and wheat was imported from southern States to meet a deficiency in supplies of stock feed. The Barley Marketing Board stopped export of barley early in the year and reserved all available supplies to meet local demand for stock feed.

The present position highlights the need for greatly increased acreage under grain crops in this State. The acreage under wheat could be expanded considerably. Queensland wheat has been in strong demand at premium prices on overseas markets, particularly Japan, and there is no reason to fear that increased production would result in unsaleable surpluses, *provided quality is maintained or improved.* In the meantime these markets have had to be sacrificed because of inadequate supply.

IMPORT-SAVING INDUSTRIES.

There is considerable scope for expanding these industries to meet Australian domestic requirements. The problem is not to establish a market but to ensure stable and satisfactory returns to growers and thereby increasing production. The problem is common to all import-saving industries.

Tobacco.

The 1956-57 tobacco crop was a record for the State. About 2,200 tons of Queensland grown leaf and 560 tons of New South Wales leaf were delivered to The Tobacco Leaf Marketing Board.

The marketing situation continues to be the subject of much attention, the present auction system being made less effective by the absence of buyer competition and by the concentration of a large proportion of manufacture in the hands of one company. Some form of long-term price agreement between manufacturers and growers' organisations would seem to be essential to the stability of the industry.

The tobacco industry has taken a major step towards efficiency and stability by the setting up of The Tobacco Industry Trust Fund.

Oilseeds.

The production of vegetable oilseeds is chiefly confined to Queensland and, of these crops, linseed alone is grown primarily for oil extraction. The high measure of stability and permanency attained by linseed is due in no small measure to the satisfactory price of £70 per ton offered by the Linseed Crushers' Association and to the announcement of a guaranteed price early in the planting season. Advance knowledge of a firm and satisfactory price and its prompt payment on delivery has influenced farmers to sow increased acreages to linseed.

The peanut industry is another industry which is alive to the necessity of improving its efficiency and the quality of its product. This year the Peanut Marketing Board has instituted a grading system to encourage production of a better quality nut. The Board is to carry out experiments in the artificial drying of peanuts, and last December the industry was instrumental in C.S.I.R.O. undertaking rain-making efforts in the South Burnett in an attempt to alleviate the very dry conditions then existing. The Australian market is able to absorb considerably larger quantities of peanuts than the estimated 9,000 tons produced this year.

The cotton crop, due to good harvesting conditions, was of much better quality than in the previous two seasons. Difficulties in disposal of low-grade cotton from previous seasons resulted in acute financial problems in the industry. To assist the industry the Cotton Bounty Act 1955, was amended to provide for advance Bounty payments. The Cotton Marketing Board has applied to the Commonwealth Government for extension of the period of guaranteed prices. Without the confidence inspired by a long-term guarantee, growers seem unprepared to risk investment on specialised machinery, a necessary prerequisite to expansion in the industry.

Two other crops to be mentioned are ginger and navy beans. Demand for both crops remains firm, and production in both cases falls short of domestic requirements.

THE NEXT STEP.

Rising production and distribution costs; increasing competition on world markets; possible loss of traditional markets; in some cases production insufficient to meet domestic requirements. These are the dark spots on the marketing picture. The problem is how to get rid of these blemishes.

Our Watchword must be Efficiency and Quality.

Mention has already been made of how some industries—peanut, sugar and tobacco, for example—are trying to put their own house in order.

To assist these industries, and others, the Division of Marketing is pushing ahead with economic research. The main project in the past year was a survey of the pineapple industry, which has recently been completed.

Further farm surveys are projected for the coming year. The major work will be an investigation into certain economic aspects of dairy production. A study of the economics of pasture improvement and fodder conservation is also being designed.

Farmers must not only have some idea of the structure of their industry, but must place the management of their farms upon as sound a business basis as possible. Farm management decisions must be made with a due appreciation of the costs involved and of the influence of various factors upon economic efficiency.

Nosema Disease

By C. ROFF, Adviser in Apiculture.

Since Nosema disease was recorded for the first time in Queensland in one hive at Yeronga during August 1952, other infections have been found in apiaries at Burpengary, Torquay, St. Lucia, Rochedale, Kuraby, Grantham, Millmerran, Turallin, Bowen, Barcaldine, Beerwah, Camp Hill and Cunnamulla.

This infectious disease of adult honeybees is found in all the principal beekeeping regions of the world. Individual bees and sometimes colonies die from its effects, but rarely is an entire apiary destroyed.

The organism that causes Nosema disease (*Nosema apis* Zander) is a microscopic, single-celled animal parasite (Plate 1), which during one stage of its life history forms resting bodies or spores. The spores after being ingested by the bee germinate within the stomach, and the resultant new parasites invade the cells lining the inner surface of the mid-intestine, where in 3-5 days they mature and produce a further crop of spores. These pass into the rectum and are ejected with the faeces, which some infected bees abnormally void within the hive. Beecombs soiled in this manner become residual sources of infection. Other bees in the same manner contaminate watering places.

Transmission of Nosema disease to other bees and to other hives is brought about by the ingestion of water and food contaminated with the droppings of infected bees. The interchange of infected beecombs and robber and drifting bees are responsible for hive-to-hive infections. Overseas experience indicates that the disease is unlikely to be transmitted by tools, or by the clothes or hands of the beekeeper.

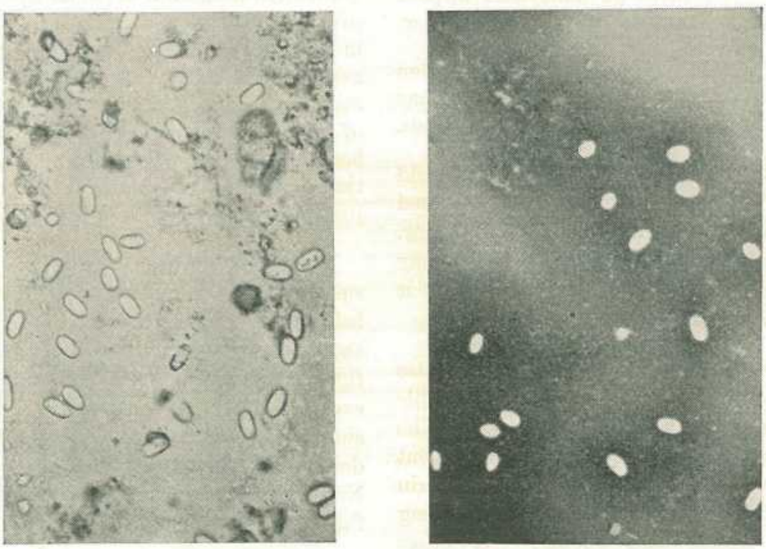


Plate 1.

Spores of Nosema apis in Water (left) and in Stain (right). Magnified 600 times. (After Dade).

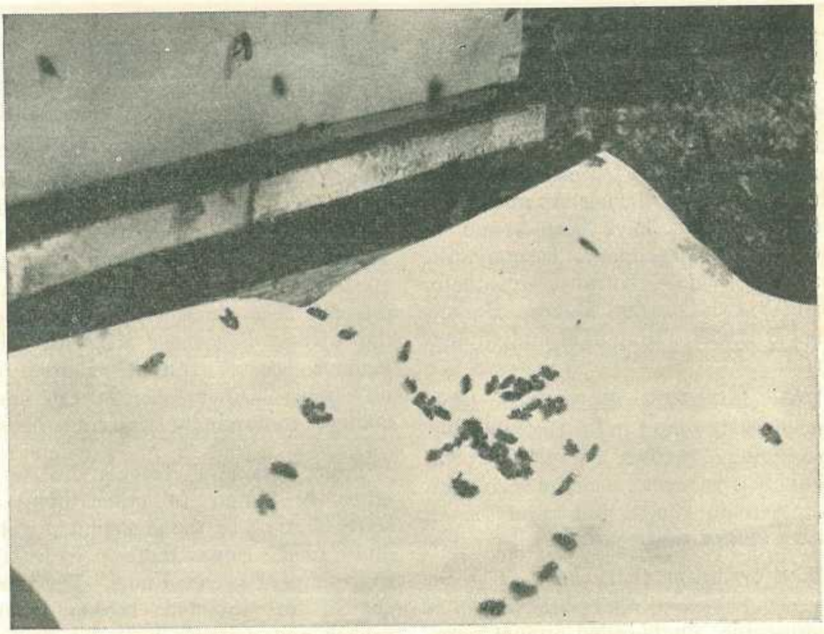


Plate 2.

Dead Bees, Infected with Nosema Disease, in Front of a Hive.

Features of Disease.

(1) All races of honeybees appear to be susceptible to Nosema disease.

(2) Workers are most often infected, although the parasite has been found in drones and queenbees.

(3) Nosema is widespread in cold regions, where the bees are confined to the hives during most of the winter. In warmer regions, where bees may fly almost every day in the year, it is found less frequently.

(4) The occurrence of the disease is seasonal. It is most noticeable during late winter and spring. The infection subsides during summer, but increases in late autumn and again reaches a peak during the following late winter and spring. At other times, however, the disease may be aggravated by periods of cold, damp weather.

Symptoms.

Positive diagnosis depends upon the presence of spores of *Nosema apis* in the mid-intestine, and this can be ascertained only by microscopic examination. Obvious symptoms are of limited value, as apparently healthy bees may, upon microscopic examination of the stomach, show the presence of spores in large numbers.

Nevertheless, the disease may be suspected if the symptoms described below are present, and specimens should then be submitted for examination. It should be kept in mind, however, that other disorders exhibit similar symptoms, and therefore it does not follow that the trouble is Nosema disease if any or all of the following symptoms are present.

(1) The colony is noticeably restless and weak. Dead and dying adult bees may be noticed in front of the hive

(Plate 2), or the colony may dwindle slowly in strength due to steady loss of bees which die inconspicuously away from the hive.

(2) Dysentery may occur and this is evidenced by yellow, crusty faecal spots on the hive floor and alighting board.

(3) Heavily infected bees crawl feebly on the ground and are unable to fly or sting. The abdomen is often distended, shiny and hairless, the wings unhooked and askew, and the legs dragged as if paralysed.

Preventive Measures.

The following measures will minimise the incidence and spread of Nosema disease. If these are adopted as standard beekeeping practice it is unlikely that the Queensland beekeeper will encounter the disease.

(1) The apiary and flight approach of all hives should be kept clean and dry, and colony strength maintained by providing the food, hive space and protection required for each particular period of the year.

(2) Stagnant watering places (Plate 3) should be eliminated, as these are easily contaminated with spores from infected bees. If running water is not available and containers for water are used, these should be cleaned and recharged regularly, and *always* placed in sunny positions. The spores of *Nosema apis* in water exposed to sunlight are killed in about three days.

(3) Colonies should be kept separated at least six feet apart to prevent drift, and apiaries should be situated where they will obtain full sunlight (Plate 4). Nosema disease is more likely to occur in apiaries situated in shade or partial shade with attendant dampness (Plate 5).

(4) Beekeepers should ensure that they do not obtain queenbees, colonies, nuclei or swarms from an infected

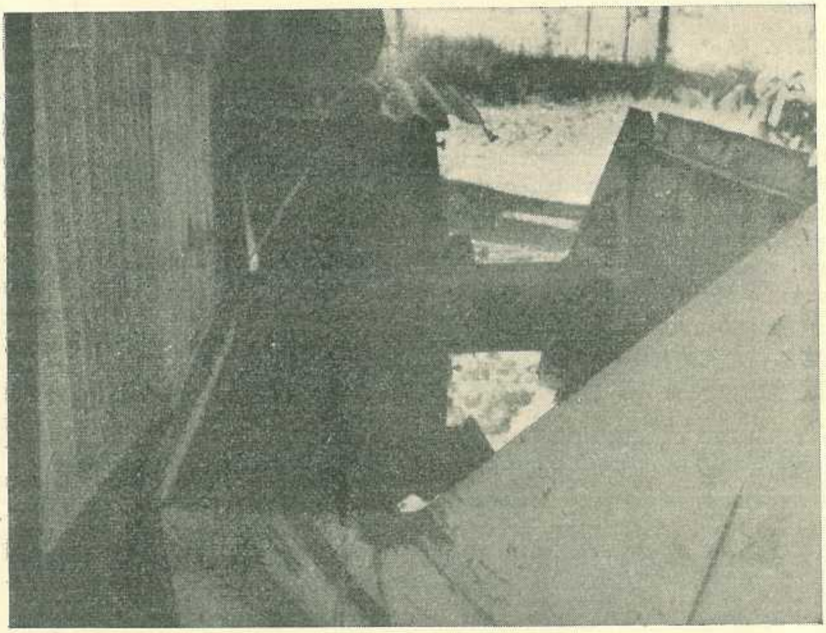


Plate 3.

Watering Places Such as This on the Shaded Southern Side of a Shed are Readily Contaminated with Nosema Spores.

Plate 4.

This Apiary is in a Sunny Position and is Less Likely to Become Infected with Nosema Disease.

apiary. As a precautionary measure, queenbees received from elsewhere in Australia should be transferred on arrival to a clean cage and the escort bees should be replaced by young bees from within the apiary, before introduction to a colony. The old cage, together with any candy it may contain, and the escort bees should be burnt. This procedure is standard quarantine practice for all consignments of queenbees received from overseas.

Treatment of Infected Colonies.

Strong colonies with a mild infection often recover. However, colonies which are weakened seriously by the disease or which die out from its effects should be handled in a manner which ensures eradication, as is described below.

(1) The destruction of diseased colonies should take place in the evening when all bees are in the hives.

(2) Dig a small pit suitable to burn the bees to be destroyed.

(3) Kill all the surviving bees in the diseased hives with calcium cyanide; about two teaspoonfuls of the poisonous powder should be put through the entrance of each hive before closing it. *Extreme care should be taken to avoid inhaling the poisonous gas given off by the cyanide.*

(4) Build a fire in the pit, and as soon as it is burning well, add the bees that have been killed by the calcium cyanide and also any that have died previously from the disease.

(5) Scrape the inside surfaces of the various parts of the hives and burn the debris.

(6) After all diseased material has been burnt, spade the ground down, refill the pit, and pack well.

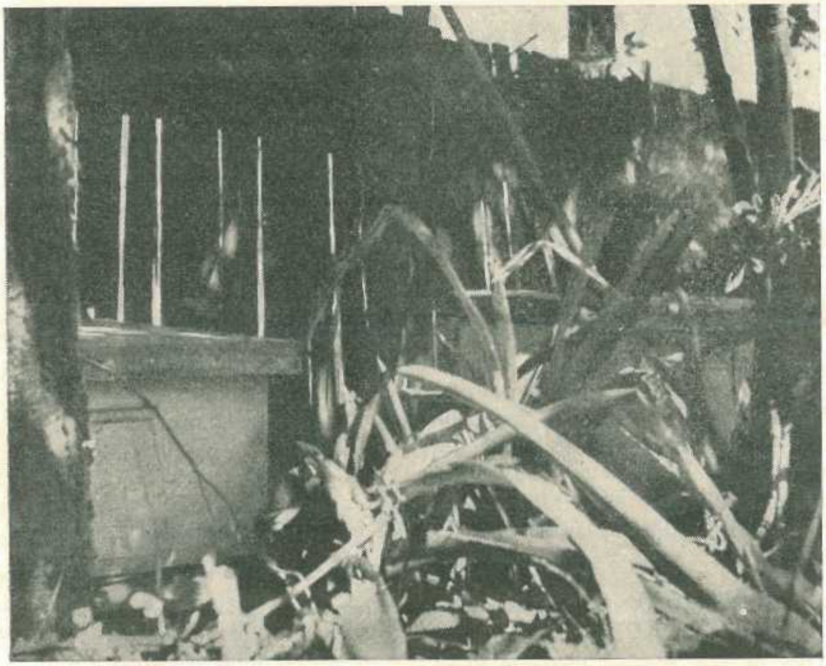


Plate 5.

The Hive in this Shady Location Developed Nosema Disease.

(7) Render all the beecombs down for wax. The Nosema organism is killed at the temperature of melting beeswax.

(8) Sterilize the contaminated hives, frames, and other hive parts by either boiling for half an hour in 1 per cent. caustic soda solution or scorching all the inner surfaces, edges, and alighting boards to a dark-brown colour with a blow torch.

(9) Turn over the soil beneath and around the infected hives and cover with quicklime.

Legislative Requirements.

Under *The Apiaries Act of* 1947 it is provided that any beekeeper in whose apiary any disease appears shall immediately notify, in writing, the Under Secretary, Department of Agriculture and Stock, Brisbane.

Irrespective of the legal requirements, any beekeeper who notices unusual bee symptoms in his apiary should, for his own sake, communicate with the Department in order that assistance may be given.

Disease Samples.

When sending samples for examination the following requirements should be observed.

(1) At least 20 bees are necessary for diagnosis and these should preferably be alive or recently dead. Dried-up bees are useless.

(2) Mail the sample in a wooden or strong cardboard box. Do not use a tin or glass container.

(3) The package should bear the name and address of the sender and be accompanied by an explanatory letter.

Stack, Wedge, Bun and Clamp Silos

By Officers of the Agriculture Branch.

Little, if any, capital outlay is necessary in the making of silage in various forms of stack for short-term storage.

This method is most useful when an immediate need to store a crop arises through weather damage or other causes.

Stack silage usually does not give a high recovery of well preserved silage. Losses from lack of temperature control, exposure and leaching are generally high. The clamp stack is undoubtedly the best type, having the advantages generally found in a trench silo.

RECTANGULAR AND ROUND STACKS.

One of the earliest methods used, it has considerable disadvantages, arising from the difficulty of packing down the crop material sufficiently. Undesirably high temperatures usually develop and considerable wastage occurs at the exposed surfaces.

The earlier stacks were rectangular structures built within a frame of upright poles, and weighted by either timber, earth, throw-over wires with side weights, or any combination of these three.

Round stacks have been found more desirable, as they remove the difficulty experienced in packing the corners of angular stacks.

There has been a resurgence of interest in round stacks since the introduction of the forage harvester, probably due to the greater degree of consolidation obtainable with chopped material. Weld mesh or wire netting lined with tar paper is being used as a form into which the chopped crop is blown, spread and consolidated. "Snow" fences, of vertical battens wired together, are also used successfully. A minimum of 6 ft. settled height (12 ft. at filling) is desirable to give adequate compaction and a low percentage wastage, so the ground dimensions of the stack should be calculated according to the amount of crop to be stored.

Other types of stacks used for storage of surplus fodder are the wedge, bun and clamp silos, described in the following sections.

WEDGE SILO.

The wedge silo can best be described as a sloping stack silo, shaped like a wedge laid on its side, without walls of any sort (Plate 1). The sloping upper surface enables the silage material to be carted into position without the use of the hay grab, which requires much time and labour.

As with the bun and clamp silos, the wedge silo is designed mainly for short-term storage of fodder. Its most effective use is likely to be in the conservation of excess pasture. Some promising results have already been obtained from demonstrations of this method in Queensland.

EQUIPMENT REQUIRED.

The basic implements required are a tractor with hydraulic lift, a mower and a buckrake.

In crops where tangling of legumes and grass is absent, it is possible that a horse mower is preferable to a power mower, if only one tractor is available, owing to the time required for detaching the power mower from the tractor. This factor may be important in south-eastern and central Queensland, where grass stands may dry out too rapidly if large areas are mowed before detaching the mower and then attaching the buckrake for raking and ensiling. The use of a mid-mounted mower will overcome this time loss.

MAKING A WEDGE SILO.

The silo may be from one to three buckrakes in width, but most are either two or three buckrakes wide. Where the mown grass is collected with the buckrake running across the swath, rather than with it, the effective width of material on the buckrake is at least 12 ft., compared with not over 9 ft. when the collecting is down the swath.

With pastures consisting of up to 70 per cent. of legumes it has been found that no wilting is required before stacking. The time which must elapse between mowing and ensiling will depend to a very large extent on the amount of legume in the material being used. Under Queensland conditions it is considered that except where pure lucerne stands are being ensiled, buckraking should immediately follow mowing.

The sections of the paddock furthest from the silo site should be mown and carted first. The extra time taken in transporting this material allows some wilting to occur. This encourages heating of the lower layers of the silo.

A major part in wedge silo making is played by the tractor in rolling the material already dumped during the process of stacking fresh loads.

As the buckrake is mounted on the back of the tractor, the tractor is reversed during loading in the field, driven in forward gear to the silo and then reversed up the wedge to unload the buckrake.

The buckrake is dropped on to the wedge stack and the tractor moved forward. The grass usually slides off the tines quite freely. To facilitate unloading of grass, it may be necessary to remove one or two of the central tines. Some forking is

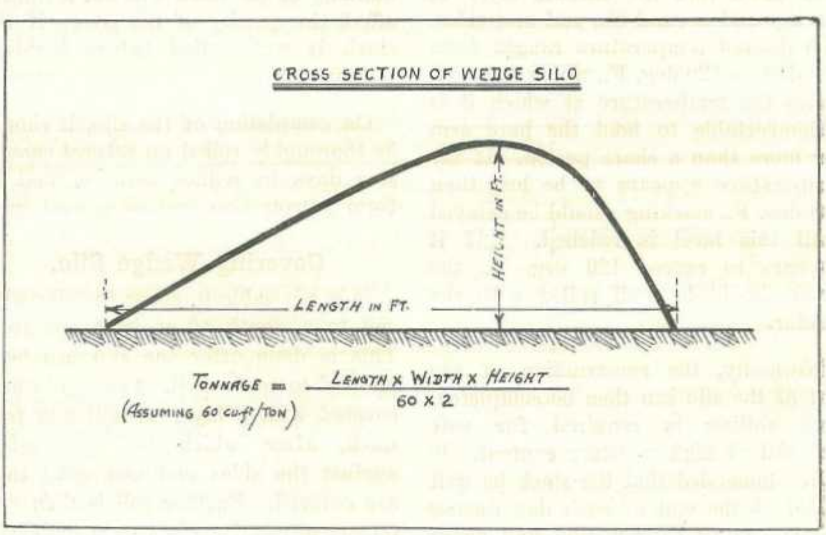


Plate 1.
Cross Section of Wedge Silo.

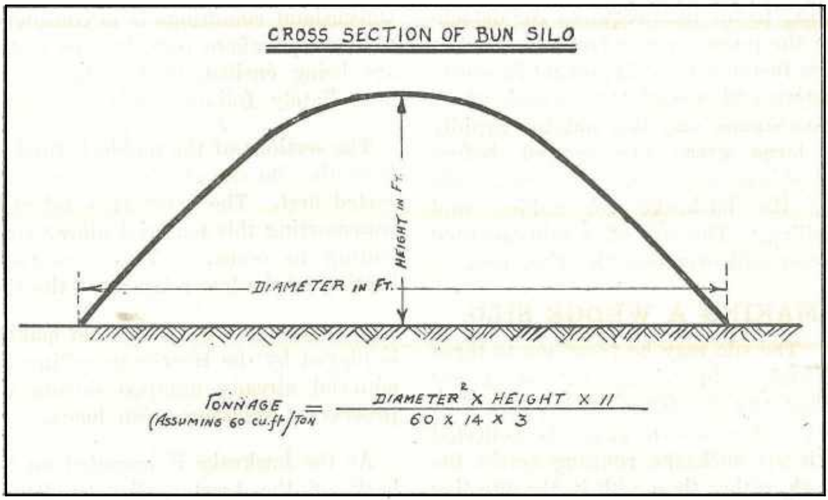


Plate 2.

Cross Section of Bun Silo.

required, however, to keep the surface even and the sides straight and approximately vertical.

When the silo is built up to a height of 4-5 ft. on the thicker end, the temperature of the material should be tested either by a suitably long thermometer or by pushing the bare arm well down into the surface layer of the top and around the end and sides. The desired temperature ranges from 100 deg. to 120 deg. F., which approximates the temperature at which it is uncomfortable to hold the bare arm for more than a short period. If the temperature appears to be less than 100 deg. F., stacking should be delayed until this level is reached. If it appears to exceed 120 deg. F., the stack should be well rolled with the tractor.

Normally, the construction of the rest of the silo can then be completed. Less rolling is required for soft material of high moisture content. It is recommended that the stack be well rolled at the end of each day during the period of construction and again next morning before starting the day's operation.

The construction of a stack need not be continuous until completed. The operations may be interrupted for a couple of days at any stage after the silo is at least 5 ft. high, provided attention is paid to controlling temperatures by appropriate rolling.

The occurrence of rain during the building of the stack will not seriously affect the quality of the silage if the stack is well rolled before building is resumed.

On completion of the silo, it should be thoroughly rolled on several successive days to reduce aeration and to form a protective surface against rain.

Covering Wedge Silo.

It is advisable to cover the silo with soil to a depth of at least one foot. This is done after the silo has been allowed to settle well. The top is first covered with a layer of soil one foot thick, after which soil is pushed against the sides and end until they are covered. Further soil is then put on the top and worked over the edges to make a good join of the sides and the top.

Because of its shape and the fact that it is built entirely above ground level, a large volume of soil is required to provide an effective seal.

When the silo is opened up for feeding, the soil is piled to each side to be available when the silo is rebuilt.

BUN SILO.

Bun silos (Plate 2) differ only in shape from wedge silos. Their advantage is that they present no steep edges over which tractors might fall during building or rolling the silo and they can be approached for loading from any angle.

CLAMP SILO.

The clamp silo is a more efficient form of storage than either the wedge or the bun silo. It is neat and tidy and reduces loss on the sides by permitting consolidation close to the edges.

In this method, above-ground walls of earth, timber or concrete slab are constructed and the space between is filled with either chopped or long plant material. Where light but strong movable sections have been used to construct the clamp, these may be moved and re-erected if desired after the silage has been made.

The clamp provides an efficient yet cheap method of storing silage above ground in districts where high water-tables or other soil drainage features make trench or pit silos impracticable.

Where shallow pits are possible, some farmers use the bulk of the soil they remove from the pit to build side walls so as to increase the final effective depth of the silo.

Whatever material is used for the walls, these should be sloped inwards towards the base. Then as the silage settles, it will remain tight against the walls and is thus sealed against the entry of air. The plant material is filled so that a well-defined crown exists to shed any rain. The whole

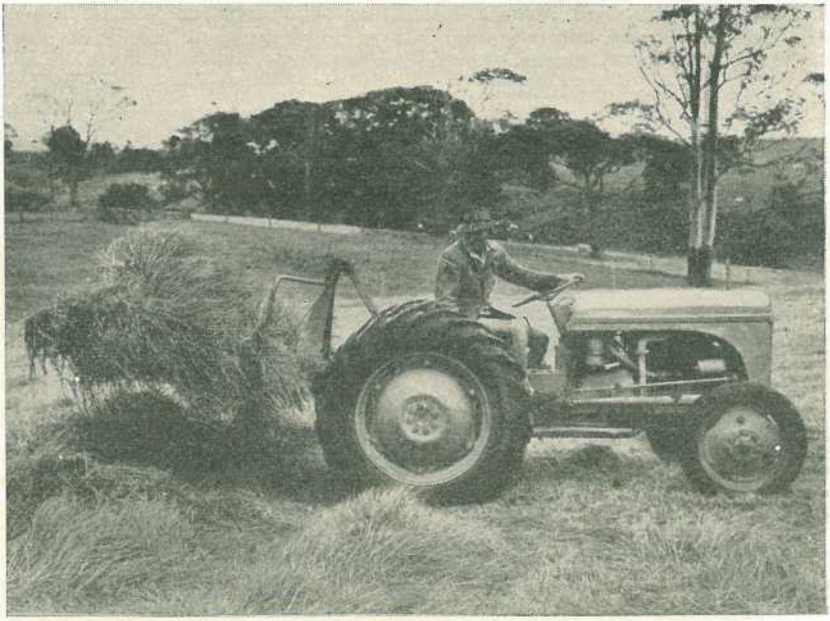


Plate 3.

A Buckrake Load of Kikuyu Grass Being Transported to a Clamp Silo.

mass is compacted regularly to protect the quality of the silage. Continued rolling of the silage over a period of at least a week following completion of the filling is desirable.

EARTH SEALING.

The principle of making uncovered silage in clamps, wedges or buns can only be justified when it is impracticable to cover the silage with earth, or when the stacks are so large and so deep that surface spoilage represents a very small percentage of the total quantity of silage stored in the silo. Under these conditions, the cost of covering might well outweigh the saving in crop material. The shorter the period of storage intended, the less need for covering with earth, though cost of covering versus value of silage saved by covering should always be considered.

Percentage losses from uncovered silo stacks can be excessively high.

The expulsion and exclusion of almost all the air is imperative in the making of good silage. Poor compaction of silage increases heating losses and the depth of top and side spoilage. Losses of 50 per cent. or more in food value may occur. Earth sealing reduces these losses.

RESISTANCE OF TICKS TO INSECTICIDES.

A resistance to some common insecticides besides arsenic has developed in cattle ticks during the last few years. These are a group of insecticides known as chlorinated hydrocarbons and include BHC, toxaphene, aldrin, dieldrin and DDT.

Mr. O. H. Brooks, Divisional Veterinary Officer, Department of Agriculture and Stock, Rockhampton, says the development of this resistance calls for special care in using these preparations. Probably the most important precaution is to charge the dip to the strength the manufacturer recommends.

Following the appearance of the arsenic-resistant tick, BHC gave spectacular results. There was an almost complete kill of ticks at all stages of growth within 24 hours of dipping. Unfortunately, it is now clear that some ticks develop a resistance to BHC after it has been used for periods of three to five years.

This problem of resistance has been encountered with all insecticides, but it has been most noticeable with BHC and toxaphene. Because of their close chemical relationship, toxaphene, aldrin and dieldrin give unsatisfactory kills in ticks that have become resistant to BHC. However, this does not apply to DDT to nearly the same extent. DDT is more stable and can be used to follow BHC.

It appears that resistance has developed more rapidly when ticks have been exposed to low concentrations of BHC, such as one-tenth of the normal dipping strength. In the past, many graziers have purposely kept the concentration low to reduce costs as the results at the outset were so spectacular, even at this low concentration.

Irrespective of concentration, however, ticks can develop a tolerance to BHC, so its continued use is uneconomic and unsound. It has been common to find cattle suffering from advanced tick worry before the owner has realised what has happened.

Because cattle ticks develop this resistance to these common insecticides, with the survival of the more resistant strains, it is important to keep dipping concentrations at the strength manufacturers recommend. Although a dipside test cannot be applied, a service is available from the manufacturers and the Department.

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