Some recent radio talks.

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Some recent radio talks.

Authors
LIGHT LAND DEVELOPMENT IN THE SOUTH

By A. S. WILD, Assistant Superintendent of Wheat Farming, Department of Agriculture

It is only since World War II ended that successful large scale development of light land near the south coast of this State has been undertaken, although the many millions of acres of treeless plain country throughout the agricultural areas have, for many years, presented a challenge to the pioneering ability of Western Australians.

Since the establishment of the Wongan Hills Research Station over 30 years ago, we have gathered a fund of information and experience in this type of country and, with our increased knowledge of these light soil types, we are better equipped to undertake their large-scale development.

Although most of our light land is inherently low in phosphate, nitrogen and certain trace elements and the physical condition of the soil presents certain problems, we are fortunate in being able to overcome many of these disabilities. Both phosphate and trace elements are comparatively easy to apply and with suitable leguminous pastures, it is possible and practicable to build up the nitrogen content and improve the physical condition of the soils whilst at the same time we can expect returns of produce sufficient to make their development an economic proposition.

The southern light land, especially that within about 30 miles of the south coast area, is favoured by a sure and adequate rainfall and a growing period which ensures ample scope for profitable development in a reasonably short time. Much of this country, although sandy on the surface, has a clay sub-soil within a reasonable depth which assists in the retention of moisture and plant nutrients as they are accumulated in the soil.

The large tracts of light land, extending from Albany to beyond Esperance, were included in those under consideration for settlement of ex-servicemen, and much of this has been, or is being, utilised for this purpose. The classification, appraisal and survey of this country and the subsequent construction of roads, planning of farms, construction of buildings, fencing and water supplies and the operation of clearing and preparing the land for pastures, sowing, makes an interesting and creditable story of land development. This has been made possible by the employment of equipment and organisation with adequate finance to ensure that a large number of farms will be brought to a highly productive stage in a short space of time, and that facilities and amenities of a modern farming community will follow without undue delay.

It was logical to develop, as the first venture, the Mt. Manypeaks area as that lying closest to the port of Albany with
its existing facilities, and for some years now, all the farms contained in the area of the original soil survey conducted by the Department of Agriculture, have been occupied.

With its 30 in. of annual rainfall, 8½ months growing period and good soil types, the farm size has been determined as smaller than that required for the South Stirling area and others such as Jerramungup and Gairdner.

The development of these areas has also stimulated the development by private persons of farms situated in the intermediate areas north, south and east of the Stirling Ranges.

At present also, extensive private development is taking place near Hopetoun and in the large tract of country referred to as the Esperance Downs. Information has been made available from experience at the Departmental Research Station at Esperance and much of this is applicable to the problems of development and future farming of our South coast areas.

The most recent area of about a third of a million acres on which large-scale development has been commenced by the Land Settlement Board is that lying east of the Coracherup Creek and west of the Gairdner River, extending south from Jerramungup to the Bremer Bay road. This project area, some 25 to 45 miles south-east of Ongerup is, in effect, an extension of the Jerramungup project where surrounding light land was developed in conjunction with the heavier land on a repurchased estate. The organisation established for Jerramungup has been extended into the Gairdner project where 100 farms are in the process of developing into ex-servicemen's properties.

The annual rainfall ranges from 16 in. to 22 in. and this factor has determined that the area of pasture developed per farm should vary from 1,800 acres down to 1,200 acres. The soil types developed are those mainly with a sandy surface and with clay within 2 ft. of the surface, and often, at much shallower depths. After the initial design of sub-division was prepared and while the surveying was in process, a complete road system was constructed in the area and the development of the individual farms proceeded according to the information which had been made available by the Department of Agriculture and the large-scale experience of the Land Settlement Board.

The development of farms is directed towards making them mainly grazing properties and the establishment of clover and grass pastures for the running of sheep for meat and wool and some beef cattle.

The light scrub on the plain was knocked over during late spring by dragging heavy anchor chains, two tractors handling a swathe as wide as four chains in some situations. This is followed by burning the dead scrub in the late summer to ensure the thorough removal of the surface debris. Later, the ground was thoroughly ploughed to a depth of 4 in., sufficient to get below the main root system of the scrub and facilitate its more complete removal.

This ploughing was undertaken as early fallow so as to ensure that a resting period would intervene before planting in the autumn of the following year. Experience has shown that without this long fallow period, it is difficult to obtain an adequate removal of the fine scrub root material. Also even if the land is brought to a satisfactory tilth, considerable loss is still sustained with the young clover plants after they have germinated.

In the Gairdner project, if the fallow has not been ploughed sufficiently early in the preceding winter, it is left for a further year as two-year fallow before the seed is planted.

The basic pasture plant is subterranean clover and the southern portion of the project lends itself to the utilisation of a midseason variety such as Bacchus Marsh, the northern portion being planted with the early variety Dwalganup. On the farms midway between these two zones a mixture of these two varieties of clover is planted to ensure that there will be a survival through the early variety and under favourable conditions, the greater growth will be obtained from the later and slower-growing variety.

In common with many of our sandplain soils, it is necessary to apply not only heavy dressings of superphosphate but the trace elements copper and zinc, the initial fertiliser on this project being a bag per
acre of superphosphate mixed with copper and zinc. The following year at least 150 lb. per acre of superphosphate is applied.

The clover is planted at the rate of 6 lb. per acre and a small quantity of Wimmera ryegrass as low as \( \frac{1}{4} \) lb. per acre is also included to ensure that in later years, this will help to make up the sward and balance the pasture.

The planting is carried out by means of disc drills fitted with the small seed attachment, each 24-run drill planting 1,400 acres per season.

Last year 80,000 acres of pasture were thus established thoroughly and well on good fallow, and a special field day conducted by the Gnowangerup Road Board provided an opportunity for farmers to inspect the area and view the undeniable success of the establishment of these pastures over extensive areas.

A similar area of land, that is 80,000 acres, is under fallow and being worked in preparation for an early start for the season of this coming year. Side by side of this development the business of constructing fences, houses, sheds and dams is proceeding. Water catchment has been facilitated by the large extensive use of roaded catchment areas so as to ensure that even comparatively light falls of rain will contribute towards the catchment in the dams.

The Gairdner project provides an object lesson for organisation and thorough execution based on sound knowledge and appreciation of the technical aspects of what is required for this class of country. Even on these newly developed areas, the Department of Agriculture has its experimental plots to determine the problems which will arise in the early years of production.

The results there leave no doubt that the successful development of light land in the southern parts of the State can be successfully accomplished and substantial numbers of stock may be carried in a comparatively short space of time provided the appropriate recommended methods of development are employed.

THE USE OF HORMONES IN VITICULTURE

By L. T. JONES, Senior Plant Research Officer

The discovery and proper use of plant hormones, or as they are more accurately termed, growth-regulating substances, probably represents the greatest contribution which science has made to agriculture in the past few decades. It was the discovery by Kogl in 1934 that indole acetic acid was an active growth substance which led rapidly to the preparation and testing of large numbers of compounds of similar chemical structure and among these were found many substances which were very potent and also comparatively cheap to produce.

The remarkable property of these materials is their great potency. They are capable of exerting profound physiological effects when applied to plants at concentrations of only a few parts per million.

By the use of these so-called plant hormones we are able to hold blossoms on, take blossoms off, prevent pre-harvest fruit drop, hasten maturity, delay maturity, hasten rooting, prevent sprouting, kill weeds and trees and improve fruiting. Although weed control accounts for the largest use of these materials our particular interest is in the sphere of fruit setting.

FRUIT SETTING

For the flowers of most plants to develop fruit, pollination and fertilisation must occur. As a result the embryonic fruit becomes a centre for the production and accumulation of the natural fruit-setting hormones. The failure to obtain good fruit setting may be due to the inadequate production of the natural fruit-setting hormones. In such instances certain synthetic growth-regulators applied to the flowers may correct the deficiency of natural hormones.

In this field one of our research projects was to determine a satisfactory and
safe commercial technique for the setting of the fruit of the currant grape vine using a hormone spray. I will now deal with this in more detail.

**Fruit Setting in Currant Vines.**

The cincturing of currant grape vines at flowering time has been adopted as the standard method for improving fruit set since its introduction from Greece into Australia by Catton-Grasby in 1897.

An important commercial characteristic of currant fruit is that it is normally seedless. Therefore, in the absence of seeds, cincturing is necessary to induce a satisfactory berry size. Cincturing involves the complete removal of a narrow strip of bark from the stem of the vine when the grape flowers are in full bloom which locally would be early in November.

Because it was believed that cincturing was one of the factors involved in the deterioration of currant vines in the Swan Valley, trials were commenced in 1951 to work out a satisfactory commercial technique of applying two selected materials, namely 2,4-D and PCPA. Earlier work elsewhere had indicated that these two hormones were those most likely to be successful. After two seasons it was possible to recommend with confidence a technique of application which could not only replace cincturing but was an improvement on the old method. Concisely the method was to spray PCAP at 20 parts per million, on the grape flowers in full bloom. It is only necessary to thoroughly wet the bunches. It is estimated that through the labour saved and extra production consequent from increased vine vigour, the commercial adoption of the hormone spray method has been worth £50,000 annually to local currant growers. It is interesting to record that the method was so well received that within two seasons hormone spray had practically replaced cincturing in the Swan Valley. I think it can be fairly claimed that local Departmental research has played an important part in working out a safe and satisfactory technique and thereby hastening the adoption of the method both locally and throughout the Commonwealth.

**Gibberellic Acid.**

Last November a new material called gibberellic acid was used locally mainly as a possible replacement for PCPA on the setting of currants. It was also tried on some table grapes, which contain seeds, to test whether it would increase the size of the berry and the bunch.

It has been known for some 30 years that a metabolic product of the fungus *Gibberella fujikuroi* which is responsible for a soil-borne disease of rice, has a striking effect on plant growth. It was observed that many infected seedlings grew taller than the healthy plants.

This fungus was cultured, and finally one of the three related active compounds namely gibberellic acid was obtained in pure form. Some workers have put forward a guarded case in favour of gibberellic acid being akin to, if not, actually a natural plant hormone. This material (G.A.) can now be produced commercially by the same fermentation methods used industrially for the production of such antibiotics as penicillin and streptomycin. The present price appears to be about £100 to £250 an ounce but it is a very potent material and the cost must come down as sales increase. Fantastic claims have been reported of the effects of gibberellic acid but the true potential of this new agricultural tool has yet to be determined. At this early stage no assured major crop use can be noted but the indications are that gibberellic acid may soon have some commercial uses. At present we can only indicate possible promising fields such as stem elongation, increased yields, dormancy breaking and flowering and fruit-setting effects.

The pronounced fruit-setting ability of gibberellic acid is of interest both economically and physiologically. There has been a continual search for better growth regulators to replace a variety of chemicals which, commercially and experimentally, have only been partially satisfactory. The perfect material should be harmless and should be effective over a wide range of concentrations.

It was with these objects in mind that gibberellic acid was used on the varieties Early Madeleine and Zante Currant to replace PCPA for fruit-setting in these seedless grapes. The results were substantially the same in both varieties.
The material was used in these exploratory trials at the very low concentrations of one-half and two parts million. Gibberellic acid was sprayed on the bunches at about the time of full bloom. At first both concentrations had a marked effect in increasing berry size but the effect did not continue at the same rate and finally 2 p.p.m. was better than ½ p.p.m. The berry size was finally inferior to cincturing or hormone spray but definitely superior to no treatment at all. These results point to gibberellic acid being of value in fruit-setting in seedless grapes. Next season we plan to increase the concentration to 10 and 50 p.p.m. and expect that in the light of recently published Californian work better results should be obtained.

However it should be mentioned that, probably due to vine vigour and climatic factors, fruit-setting in currants this season was abnormally difficult and this may have affected our experimental results.

It has been recorded that while gibberellic acid may stimulate top growth it does not similarly stimulate root growth. Our experience of moisture stress on vines at two sites being induced by treatment with gibberellic acid would suggest that this possible harmful effect will need to be watched in the future. Some seeded table grapes (namely Red Prince, Ohanez and Waltham Cross) were also treated with the same low concentrations of gibberellic acid. The results were inconsistent but in two out of three sites there was obtained bigger berries, and larger bunches and a tendency to earlier maturity. Such results show that when the techniques are mastered there could be quite a promising future for the use of gibberellic acid in viticulture.

Vine Killing with 2,4,5-T.

It was thought at one stage that there may be a use for hormone killing of old vines before replanting. The method used was the same as that used to kill the Mesquite tree which is such a problem in parts of our North-West. The basal 9 in. of the vine was sprayed with a solution of 1 lb. of acid equivalent of 2,4,5-T ester in 10 gallons of dieselene.

It was found that, judged from final effects, vines may be treated at any time of the year and there is no advantage from “frilling.”

However the method appears to have only a limited application in vineyards because it is usually no cheaper than normal methods and there is always the danger of hormone damage to surrounding vines from drifting vapour and contaminated equipment.

RECENT TRENDS IN VITICULTURE IN WESTERN AUSTRALIA

By W. R. JAMIESON, Viticulturist, Department of Agriculture, Perth

Today I want to talk very briefly about some of the more recent trends in viticulture in this State. The commercial production of grapevines is centred mainly around the Swan Valley and as most of the suitable vineyard land in this area has been planted, growers are exploring avenues to increase the returns per acre.

This has led to the following results:—

(1) The replanting of vineyards with more popular varieties.
(2) More satisfactory disease control.
(3) A more extensive use of irrigation.

Let us consider each point in more detail.

Replanting.

On the fertile banks of the Swan River there is a tendency to replant land growing currant vines with table or export varieties. This is not a violent trend as many growers have a reluctance to rely solely on the fresh fruit market. There is also considerable money invested in drying racks and trays, and replanting...
with other varieties is not warranted before the currant vines have reached the end of their economic life.

On less fertile soils, the trend has been to replant with early fresh fruit varieties or else with wine grapes. In this regard, I would point out that the wine grape variety, Grenache, is overplanted in relation to other wine varieties, and growers are strongly advised to plant on suitable soils, Shiraz, Pedro and perhaps Semillon.

Disease Control.

Diseases of grapevines are much more efficiently controlled than formerly. The research work of the Department of Agriculture leading to the use of Ziram as a fungicide against black spot or anthracnose has given benefits impossible to estimate.

Sulphur is still the best protection against Oidium or powdery mildew but it is more commonly realised that it is essential to commence sulphur sprays or dusts early in the season when the shoots are two to four inches long and to follow this up with another two or three applications at regular intervals.

Vignerons are fully aware of the possibility that nematode and other soil-borne parasites may be lowering the vigor of their vines on very sandy soils. Preliminary work has indicated that the hybrid rootstock, Teleki, may be an advantage on such soils.

Fortunately, only a few vines in this State show typical symptoms of “degeneration” the most serious virus disease of vines. It is only spread by cuttings and most growers realise the necessity to select cuttings for propagation from vigorous, fruitful vines. These vines should be marked with a dab of paint in the Springtime to allow easy and positive recognition during the pruning season.

The Irrigation of Grapevines.

There has been a great exploitation of underground water supplies and a spectacular increase in the irrigation of vines during recent years.

Though irrigation is desirable, indeed necessary for heavy production of late table grapes, I would strongly urge the utmost caution in its application.

Generally speaking, our soils are not ideally suited for irrigation, and therefore care and attention during watering and a thorough understanding of the principles of irrigation are absolutely essential.

The adverse effects of excessive or untimely irrigation can be very serious. Not only is the soil structure destroyed but the soluble nutrients are leached from the soil and with the rise in the water table, salt tends to accumulate near the surface.

If the deeper roots are subject to water-logging during the growing period they will die and this leads to the formation of a shallow-rooted vine.

Finally, irrigation should be kept to a minimum during the ripening stage of the grapes, otherwise the sugar content of the fruit is affected and maturation delayed.

METHODS OF IRRIGATION

By G. GAUNTLETT, Assistant Officer-in-Charge, Irrigation

The success of an irrigation scheme depends on several factors. Important among these is the choice and design of the method to be adopted. There are two methods of irrigation, viz., surface and spray irrigation.

The surface system consists of a head channel from which water is led into furrows or borders. The head channel must be large enough to carry the required amount of water and will contain certain structures in the form of checks and outlets. For surface irrigation it is essential that the land be graded prior to watering. This may cost from £4 to £25 per acre with an average cost of perhaps £10 per acre. Grading is also necessary for efficient drainage which is a necessity with any irrigation set-up.

The surface system can make use of large quantities of water and is suitable for all crops. It is applicable to all soils.
except those soils which have an extremely high or extremely low intake rate. Slopes of up to 3 per cent. can be safely irrigated.

If the system is to be watered gravitationally the highest land to be irrigated should be at least 9 in. below the water level at the supply point.

The spray or sprinkler system consists of a power unit, pump, main pipe line, laterals and spray beads. The laterals may be either fixed or movable.

This system is more costly to instal and can cost between £30 and £150 per acre. However, expensive grading is not so important and steeper slopes can be irrigated.

With the sprinkler system, greater control is exercised over the application of water and much smaller supplies can be used. Valuable land is not absorbed by head channels and a surface distributory system.

Labour costs are only slightly higher in this system.

Both systems should be well designed and a survey made of the area to be irrigated and the design worked out on paper first.

To briefly summarise the above:

1. If there is an adequate water supply, say of the order of 20,000 gallons per hour, and grading is a practical proposition then the surface system should be adopted.

2. If the supply is limited and grading is impracticable or too costly then the spray system should be used.

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**CANKER DISEASE OF RED-FLOWERED GUM**

By W. P. CASS SMITH, B.Sc. (Agric.), Government Plant Pathologist

Of the many beautiful native plants in Western Australia, few are esteemed more than the red-flowered gum known botanically as Eucalyptus ficifolia. This shapely tree commences blossoming about Christmas time—and provides a magnificent display for several weeks—the blossom shades varying from dark red to pink.

Formerly, the red-flowered gum was widely planted here in streets and home-gardens, but unfortunately it has been attacked by a canker disease, which has destroyed large numbers of trees in many parts of the State.

The symptoms of this disease are characteristic. Cankers develop on the branches, or the trunk, and the first sign of their presence is a splitting of the bark, together with a coating of white powdery material on the underlying wood. The cankers gradually enlarge until the branch is girdled, when the distal portions wilt and die.

Small branches may be girdled and killed by the cankers in a matter of weeks, whereas when the main trunk is attacked, several years may elapse before the tree dies.

Work by the Department of Agriculture has shown that the disease is caused by a new species of fungus which is unknown in any other part of the world.

The fungus is spread by means of its seeds or spores, which are produced abundantly on the surface of the cankers, and which, in mass, appear white and powdery.

New infections can only take place through the medium of wounds, which are commonly provided by the cutting back of trees in street plantings, or the breaking-off of flowering branches.

In home gardens, where only a few trees are grown, the surgical removal of cankered branches, together with applications of fungicidal spray may prolong the life of infected trees for many years; but in street plantings, these control methods are generally considered to be impracticable.

For this reason, search has been made for disease-resistant trees, and by means of artificial infection experiments, it has been found that while the majority of red-flowered gums are very susceptible, a limited number are highly resistant or immune.
Now if these resistant trees could be propagated vegetatively, by stem cuttings or grafts, the canker disease could be readily controlled—but unfortunately this method has not yet proved possible.

Control by cross-breeding is therefore being attempted, but this is a lengthy task which involves artificial transfer of pollen from one resistant tree to another, under insect-proof conditions.

First generation, hybrid seedlings produced in this way have been planted in an isolated area at the Gnangara Pine Plantation and inoculated with a culture of the canker-causing fungus. A percentage of these seedlings show resistance to the disease and when large enough, the best specimens will again be artificially pollinated to produce a second hybrid generation.

Ultimately, by cross-breeding and selection in this way for several generations, it is hoped that supplies of seed will be obtained, which will breed true to type and give a high percentage of resistant seedlings.

Now finally, a word about the origin of this disease may be of interest.

As the causal fungus is a new species unrecorded elsewhere in the world, it must be indigenous to Western Australia.

However, in the Nornalup-Walpole area, which is the native home of the red-flowered gum, the disease has never been found—and one certainly would expect to find it there if it had originated on this species.

Where then did it come from? The answer was not obtained until other trees were tested experimentally, when it was shown that the native red-gum or marri is also susceptible to the same disease.

Subsequently, naturally-infected marri trees have been discovered in many localities in our lower South-West—miles away from any red-flowered gums.

There is little doubt therefore that the canker disease originated on the marri, and spread to red-flowered gums, when the latter species was grown away from its native home.

WHY MANY BEANS GROW CROOKED

By M. HARDIE, Vegetable Instructor

Sometimes in the process of growing a crop, bean growers find a number of pods which, instead of being long and straight and suitable for marketing, are crooked or bent and quite unsuitable for sale unless beans are in very short supply. It is not unusual for a small number of pods to be affected in this way, generally at the tail-end of the crop, but occasionally the percentage may be high. When this happens the grower is often at a loss to account for his failure to grow a marketable crop. To the best of his ability he has followed methods which normally return a crop of first-grade pods and yet for some reason, his crop is an unpayable one and he is anxious to ascertain the cause.

Bean flowers are self-fertilising, and pollination usually takes place just before the flower opens. Under ideal conditions, complete fertilisation of the ovules or undeveloped seeds is effected and normal growth of the seeds and pod follows. The bean is then ready for picking in two to four weeks, depending on seasonal conditions. If none of the ovules are fertilised and there is no seed development, the tiny pods usually turn yellow, wither, and fall off. This is commonly called "flower drop" and has no doubt, been experienced by both commercial and home-garden growers at some time or other.

When there is interference with pollination, some of the ovules may not be fertilised and consequently, do not develop, whilst those which have been fertilised grow normally. Each pod usually contains from six to ten seeds and if only one or perhaps two are undeveloped, it is still possible to obtain a marketable pod. However, when there is more than this number unfertilised, then the bean usually develops an abnormal shape which makes it unsuitable for marketing. The most troublesome condition is when only one or two ovules are fertilised, because even if only one seed develops the
pod will have the required stimulation to remain on the plant and continue to grow though its shape will not be normal.

When only one or two seeds develop they are usually at the end of the pod farthest from the stem and, conversely, those which most often fail to be fertilised are at the stem end. Occasionally, one or two seeds in the centre of the pod may not develop and when this happens the pod becomes bent at a sharp angle at the middle and is considered a cull.

To the market gardener whose livelihood depends on his ability to grow beans of good quality, it is important to know what causes this abnormality and what can be done about it.

Undoubtedly the factor which causes most of the trouble is temperature. Even though temperatures are not low enough to cause damage to the plant itself, prolonged low temperatures or cold drying winds at flowering time will adversely affect the crop. Many of the flowers may set pods but the seeds will not develop and the pods will be dwarfed or curved. Similarly, where beans are exposed to abnormally high temperatures, the pollen is either destroyed or fertilisation of the ovules is faulty and abnormalities result.

Critical temperatures at which damage occurs to the varieties grown here have not been ascertained but generally when temperatures approach the hundred degree mark and the humidity is low, damage results.

The soil moisture level is also an important factor as hot, dry winds which cause a temporary moisture stress in the plants can also cause a heavy flower drop or serious distortion of the young beans which are setting at that particular time. In addition, pods which develop on spurs that are fully exposed to the effects of wind and sun are often noted to be thickened or otherwise poorly shaped because of incomplete pollination. This is particularly noticeable on the outside rows of a patch of beans.

Another very important casual factor is the feeding of insects within the blossom before pollination is completed. At this stage, the miniature pod is very easily injured by the rasping feeding action of thrips which are often found within the flower. Damage from this cause can sometimes be very puzzling as unless a very close scrutiny is made, the presence of such tiny insects may easily be overlooked.

NOW that summer is over and winter approaches, the time has come to decide what you’ll do with that salt problem on your farm. What you SHOULD do, will depend on how severely the area is affected. To make quite clear how the recommendations made by the Department of Agriculture can be applied I will deal with each degree of severity in turn.

Firstly any area where you’ve noticed that short stunted type of barley-grass becoming dominant over the other native grasses should be treated with suspicion because this is usually an indication that the spot is becoming salt-affected. These areas and the somewhat worse ones in which up to about one-third or even one-half of the area is taken up with bare patches should be approached in the same way. They can best be tackled by sowing in oats, or barley, and early strain Wimmera ryegrass as a scratched in crop. This can either be sown dry or soon after the opening rains. It is quite important not to seed them too long after the opening rains—the aim is not to get a clean crop, but rather the reverse, that is to avoid killing any of the native salt-tolerant grasses. But the areas shouldn’t be left out as the super and cultivation improve the plant cover.

Secondly, on the more severely salt-affected areas which are not, however, completely bare, the easiest and most effective approach is to cultivate the area very roughly as soon as possible—the idea of this is merely to improve rainfall pene-
tration and hence leaching down of salt when the opening rains begin and to catch windblown seeds of such native salt-tolerant plants as *Spergularia*, curly ryegrass, barley-grass, bluebush and the various saltbushes.

Also, on this type of area, it would be worthwhile trying a seeding of creeping and Old Man saltbush. These seeds are available commercially at the moment from at least one of the major stock firms. So far our knowledge of seeding techniques and rates for these plants is a bit sketchy, but we do know that successful stands can be established by mixing the seeds with super in a combine and seeding onto the surface of cultivated soil with or without a very light covering with harrows. It appears to be important that the seeds should not be buried deeper than about half an inch. As for seeding rates, we would suggest something in the order of about 2 lb. to the acre. These salt-tolerant perennials can be sown anytime between now and about July, care being taken, as mentioned earlier, to avoid killing the barley-grass by late cultivating.

The "cultivation only" approach is also used for the almost completely bare, severely salt-affected areas. The reclamation of these types of salt "problem areas" is still very dependent on encouraging plant colonisation of the area by trapping windblown seeds of native salt-tolerant plants.

If you have any areas you’re seriously concerned about, now might be an opportune time to emphasise the importance of fencing off salt-affected areas from the remainder of the paddock. This is the only way these problem areas can receive the separate and special management they need. It is essential for salt-affected areas of all degrees of severity that plant growth be encouraged and this implies that overgrazing, late cultivation and fallowing must be avoided.

This last point—the avoidance of fallowing is one which will be well worthwhile keeping in mind later in the season. In any area already salt-affected or any situation that you think could become salt-affected, it is a sound safety precaution not to fallow.

To summarise these points as they relate to this autumn and winter:

A scratched crop of oats or barley and early strain Wimmera ryegrass should be sown on to slightly salt-affected areas.

It is important that any such seeding should not be carried out very long after the opening rains to avoid killing natural grass.

More seriously salt-affected areas will benefit from a cultivation aimed at producing a rough surface—this can be carried out anytime between now and soon after the opening rains.

Fencing off of salt-affected areas is one of the most important factors in their reclamation.

Finally, overgrazing and fallowing must be avoided.

**ORCHARD COVER CROPS**

By J. CRIPPS, Horticultural Adviser

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THE sowing of a cover crop is one of those routine operations which the orchardist often undertakes without much thought, but it is an operation worthy of consideration.

Why is a cover crop sown? Firstly to add organic matter to the soil with the intention of improving soil structure and retaining moisture. Secondly to stop erosion by preventing soil movement and thirdly to add nitrogen to the soil.

Generally speaking, a volunteer weed crop does not add much organic matter to the soil, since the volume of plant material available for turning in at the end of winter is small and contains a high percentage of moisture. The sowing of a cover crop is preferable and should be regarded as good orchard husbandry.

What cover crops are available? New Zealand blue lupins come to mind first but oats and subterranean clover are alternatives which should be considered.
The lupin has been grown because it adds some nitrogen to the soil and can be disced in early spring, before it can compete with the trees for moisture. The disadvantages of a lupin cover crop are felt to be that it is liable to slug damage, it has to be sown early in the autumn and seed is expensive.

It is usual to sow one bushel of lupin seed to the acre, but a better stand often results from an increase in the seeding rate to 1 1/2 bushels per acre. Dry seeding may be practised, that is the seed may be sown before the first rains. The area to be sown should be dressed with superphosphate at one bag per acre.

Oats are a possible alternative too and have some advantages over lupins. For instance they can be sown later and seed is relatively cheap. On the other hand, no nitrogen is added to the soil, although this may not be a serious drawback. The soil in which oats are to be sown should receive a dressing of super as for lupins, and the Algerian variety is possibly the most suitable and is sown at 60 lb. to the acre. In general, I do not think that it is advisable to economise in cover crop seed.

Oats add a considerable quantity of organic matter to the soil; indeed in an experiment carried out last winter, the average dry weight harvested from plots of oats was greater than that obtained from plots of lupins. Some difficulty has been experienced in turning in an oat crop, but I do not think that the leaving of a proportion of a cover crop on the surface is any great disadvantage since it will be buried during later cultivation.

Subterranean clover has not been tried extensively in orchards but it has the advantage of probably increasing soil nitrogen more than any other cover crop and is less subject to slug damage than are lupins. Seed should be sown at 10 to 20 lb. to the acre if the crop has not been established previously, and should be inoculated. Super at up to 2 cwts. per acre must be applied when the crop is sown if a satisfactory establishment is to be assured. Yarloop seems to be the best variety so far tried.

If this crop is left to seed down it may compete with the trees for moisture and to overcome this it is suggested that it be cultivated in at the same time as other cover crops and resown the following autumn, 5 lb. of seed to the acre being sufficient.

On the other hand limited reseeding may be achieved by cultivating one way and leaving strips of clover to seed down.

Lastly is there any alternative to summer cultivation and winter cover crops? I think that there is, although the possible alternatives are still largely in the experimental stage. One of these is a sawdust mulch and this was applied to a small area of two apple orchards in the hills almost three years ago by the Department. Results so far have been quite good, moisture has been conserved, weeds smothered, the trees have cropped heavily and the mulch has remained in position. The main drawback would appear to be the high initial cost and the heavy dressing of nitrogen, up to half a ton of sulphate of ammonia per acre, which must be given in the first year. This dressing can be reduced by at least 50 per cent. in subsequent years. The advantages are that no cultivation and less irrigation are necessary and that a greater volume of soil is made available to the tree roots. Anyone wishing to try this type of soil management should contact the Department for advice before proceeding.

It is, I think, evident from what I have said, that there are several possible orchard cover crops and that careful consideration should always precede the decision to sow any particular one.
THE three types of lupins which we grow in this State are the New Zealand, the W.A. blue, and the yellow lupin. The first two types are very common, the New Zealand lupin being grown mainly in the South-West, while the W.A. lupin is grown over extensive areas of the central and northern wheatbelt, particularly on the sandier types of soil.

The yellow lupin is a roadside weed in parts of the South-West, and is cultivated by a few farmers who believe that it is superior to the New Zealand lupin. Frequently this type is referred to as the “Sweet” yellow lupin—this is very much a misnomer. The sweetness or bitterness of the seed varies according to its alkaloid content. In Europe, where lupins are extensively grown, seeds with an alkaloid content higher than 0.1 per cent. are normally looked upon as “bitter.” The sweet strains of lupin, which they grow, have very low alkaloid contents down to .01 per cent. The yellow lupins growing wild and under cultivation in this State have alkaloid contents around the 1.5 to 2.0 per cent. mark and are very much a “bitter” type. As regards other aspects they do not compare favourably with the New Zealand lupin and can hardly be recommended for planting. The genuine German “Weiko” strain of sweet yellow lupin is under trial at some of the Research Stations but so far is not very promising.

New Zealand blue lupins have been grown in our South-West for many years. They have been used mainly as summer stock feed or as a green manure crop in orchards. Up to fairly recently, most of the seed was imported from the Eastern States or New Zealand. A very pleasing feature over the last three years has been the rapid increase in locally-produced seed. Over 200 tons per annum are produced, and the State is now virtually self sufficient. Although harvesting New Zealand lupin seed is by no means straight-forward, the general quality of the locally-produced seed is good, and compares favourably with imported seed. There is obviously plenty of opportunity for increasing the production of this particular type of seed—the main limiting factor being the rather variable wholesale prices being offered.

The West Australian blue lupin is widely grown, and is a very important pasture plant, particularly on many of our sandy soils. From a seed production side however the position is far from satisfactory. Up to a few years ago it was not unusual to find lines of seed being offered for sale with up to 80 per cent. dead seeds. More recently the use of the Oliver specific gravity graders has enabled the dead seed content to be lowered but even so most lines still have between 30 to 40 per cent. dead seed. Of the viable seed in the samples only 20-30 per cent. germinate, the remainder being hard seeds.

To say that West Australian lupins are a difficult crop to harvest is an understatement. The extremely uneven ripening, and the necessity to thoroughly dry the seed immediately after harvest make the production of a high-germinating line virtually impossible. Experiments aiming to improve the general quality of the seed have been carried out both by the Department and by the Institute of Agriculture over the last few years.

The study of the hard seed content of this particular species has produced some rather interesting results. It appears that West Australian lupins have no natural hard seededness, and, with hand-harvested seed almost 100 per cent. emergence is possible if the seeds are germinated immediately after harvesting in November or December. However, as the seeds lose their moisture during the dry summer, they become hard; and by March the following year the same seed will only give a germination of 10 per cent. or less. If, however, such seed is kept in an airtight container, it will retain its high germination right through the summer.

This is interesting, but as yet, is of little practical significance as very little commercial seed is hand-harvested. The main difficulty with seed harvesting in the
normal way with a header or an Allcrop harvester is the uneven ripening with the subsequent high percentage of dead seeds in the sample. In the United States chemical defoliants are used on some crops to obtain uniform ripening, and over the last few years we have been testing a number of these chemicals on the West Australian lupin. Some have dried off all the foliage and for this reason alone would possibly be of some use, but no chemical so far has produced any significant improvement in the uniformity of seed ripening.

CEREAL RYE WILL GROW ON WIND-ERODED AREAS

By G. H. BURVILL, Chief Plant Research Officer.

TRAVELLING around the wheatbelt, one often sees areas of sandy soil quite bare, due to wind erosion. Surface soil blown from these patches has built up against fences, or as mounds in the nearby scrub. Many of the eroded places are quite small—perhaps less than an acre or only a few acres. But some are large, with one to three hundred acres of bare yellow sand. As much as two feet of soil has been blown from big areas.

This wind erosion trouble is seldom a major problem on a single farm. It attracts little attention from farmers or the public unless the patches are large and the drift sand affects adjacent roads or neighbouring properties. Yet the affected areas are not difficult to cure if action is taken before they become too large. Cereal rye will grow on these wind eroded areas.

Recently I have flown over parts of the wheatbelt, and from what I saw from the plane, I am convinced that there are more sand drifts and bare wind-eroded areas than there need be. Farmers with light lands which show any tendency to drift badly should not fallow such patches, even if the remainder of a paddock is being fallowed. Often a farmer says that a sand drift started in a particularly windy period when a paddock was fallow. Then the drift continues because the fertile topsoil has gone and any crop planted on it, or any volunteer weeds or pasture makes very sparse growth. Any plants which do grow are sandblasted by drifting surface soil.

Cereal rye is a remarkably tough plant both as a seedling and when mature. Many of you can still remember that tough rye straw was used as padding in horse collars. The seedlings, even when only a few inches high, can survive sandblast which destroys wheat, oats, or barley. Roots of rye seedlings can be exposed by sand drifting away, without killing the plant.

I refer to this plant as cereal rye to avoid any confusion with Wimmera rye-grass. Cereal rye or rye corn is the cereal from which the so-called black bread of Europe is made.

Wind-eroded areas of sandy soil deserve special treatment before they increase in size. They may need to be fenced off as well as planted with rye. The banks of piled-up sand will grow rye three to six feet high if it is sown with superphosphate and not grazed. On the blown-out parts, rye with only super may grow only a foot tall. But experiments in recent years both in Western Australia and South Australia have shown that very good growth can be obtained on the wind scoured areas if ammonium sulphate as well as super is used as fertiliser. The nitrogen from the ammonia is necessary, as all the surface soil and humus have been blown away.
Here then is the way to handle your wind-scoured and sand-drift areas. Plant after good autumn rains, with a disc drill or combine 40 to 60 lb. per acre of cereal rye seed. On the wind-scoured, blown-out areas use a mixture of super and sulphate of ammonia which will provide 28 to 56 lb. of sulphate of ammonia per acre. That means use a hundredweight of a three to one or one to one mixture of super and ammonia. On the banks of drift sand, super by itself at normal rates will be sufficient fertiliser. Fence the affected area if necessary to allow the rye to grow to maturity. Do not stock the area till late in the following summer. At this time, some breaking down of the crop to shed seed, and to trample in seed, may assist in giving a better growth in the second year. In the third year, consider introducing lupins or subterranean clover.

At all times remember that to check soil erosion by wind a cover of living or dead plant material on the surface is required.

If you have wind-scoured patches do not delay in starting a reclamation programme.

AUTUMN-WINTER FEEDING FOR THE FAT LAMB FLOCK

By N. DAVENPORT, Senior Adviser, Meat Production

THE autumn-winter period is the most important part of the year for the fat lamb crop from a feed point of view. It is important not only from the aspect of the wellbeing of the sheep, but also of the pasture. Pasture plants are living things, too, and they also require consideration and care for their development. When a new season pasture is kept hard grazed in those critical first few weeks of growth it cannot carry as many sheep over the season as one which is lightly stocked during that time.

Paddock feed in the autumn is usually quite inadequate for the pregnant ewe close to lambing. Paddocks generally are in that condition now. Ample additional feed must therefore be provided to “steam up” the ewe so that she will lamb normally and deliver strong, healthy lambs with minimum losses.

In many flocks, steaming up is already well under way but even if lambing as late as early June all flocks should now be receiving adequate supplement to prepare them for a safe and successful lambing.

A good deal of research has been carried out into the levels of feeding required to ensure a successful lambing. It should be such that the ewes gain in weight at least about 10 lb. and preferably more during the last third of pregnancy. This result can be achieved by feeding ¾-1 lb. of oats or an ounce or two less of wheat or barley per day according to the extent and value of the paddock grazing. If the paddocks are fairly bare 1 lb. of hay should be fed out as well. It is preferable to feed three times or even twice a week instead of daily, but the change over must be gradual. High quality meadow hay can replace grain, 2 lb. of hay for each pound of grain. Also silage can replace hay—3 lb. of silage to one of hay.

The aim of the lamb breeder is to have his lambs growing strongly and continuously from birth to marketing. For the first month to six weeks they are dependent entirely on the mothers' milk. It is obvious then that the ewes require to be well fed after lambing so that their milk...
production will be ample. If early sown cereal crops are not available, or the pastures are not sufficiently developed for grazing, the supplementary feeding of the prelambing period should be continued but the rates increased by a third.

After the opening rains and until the pastures become well established is always a critical time in the feeding programme and the ewes should not be permitted to roam over large paddocks chasing that early bite as they are so prone to do. This results in deserted lambs which means dead lambs. Confining the ewes and lambs to restricted areas allows the main pastures to get away more quickly and so provides earlier paddock grazing.

In the young stage, when pastures are first ready for grazing the growth is lush and high in protein. Such a high protein diet is wasteful and the pasture can be used more efficiently by providing hay in addition. In view of its lower protein content, cereal hay is just as well suited if not more so for this purpose as good meadow hay.

With our annual type pastures there appears no advantage to be gained in actual pasture production by rotational grazing as against set stocking. However, in spite of this it is a very good practice to move the sheep periodically to fresh paddocks as they appear to do better and it is a valuable aid to worm control. Pasture should certainly not be grazed too short if this can be avoided. There is a mistaken idea that the sheep do better on the short bite, but it has been shown that this not so.

At about 12 weeks old those lambs which are not ready—and that will be a good proportion of them—should be weaned and finished on pasture alone. This will enable the ewes to be given restricted grazing, to get them in good store condition ready for flushing.

The lambs can then be assured of the best feed available prior to marketing.

Such a practice of early weaning means better use of feed. When the lambs are left on the ewes until marketed, the latter eat more than they require and get too fat. It is far better to keep them down in condition and have that extra feed available for summer grazing by mowing and leaving it in the paddock.

PLANT DISEASES IN THE HOME GARDEN

By W. P. CASS-SMITH, B.Sc. (Agric.), Government Plant Pathologist

RECENTLY many home-gardeners have complained that plantings of vegetables or ornamentals are making unthrifty growth, in spite of liberal waterings and fertilisation. These symptoms are commonly caused by root-knot eelworm, a pest which has unfortunately become very widespread in the sandy soils adjacent to Perth, and in many other parts of this State. This eelworm parasite attacks the roots of many kinds of plants causing them to rot and to develop bead-like swellings or galls. As a result, the intake of plant food and water is restricted and stunting of the above-ground parts occurs.

Soil which is infested with eelworm should be fumigated with DD or EDB compounds before the next crop is planted, and the improvement in growth resulting from this treatment is often spectacular.

Unfortunately, both DD and EDB are too damaging for application to living plants, but tests with a new fumigant named Nemagon, which is said to be safe for this purpose, are giving promising results.

Home gardeners who take a pride in their lawns are often puzzled by the rather sudden development of withered areas, which do not recover even with heavy watering.

This trouble which is usually referred to as turf brown patch, is caused by certain soil-inhabiting fungi and it is generally

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most prevalent during autumn and early summer, when the weather is warm and humid.

As a result of this fungal attack the rotted grass tends to form a scum over the surface of the affected patch, which water-proofs the soil.

Remedial treatment should be commenced when the patches first become evident, and it comprises—pricking the soil with a tyned fork to a depth of two to three inches to aid water penetration; and applying a fungicidal drench at fortnightly intervals, until the grass recovers. There are a number of proprietary turf fungicides suitable for this purpose which may be obtained from seedsmen.

A comparatively new disease to Western Australia and one which is proving very devastating is the rust which attacks snapdragons. This disease was first recorded in New South Wales about six years ago and it rapidly spread to all States of the Commonwealth and to New Zealand.

The rust becomes obvious by the appearance of yellow spots and reddish-brown spore pustules on the leaves, and it causes blighting of foliage and often death of plants. Snapdragon rust may be controlled to some extent by spraying, and zineb-type fungicides are the most effective for this purpose.

Two snapdragon varieties which are said to have some resistance to the rust are Pink Freedom and University of California Rust-Proof, and although we have not yet tested these varieties, they may be worth a trial.

Turning lastly to citrus it is noteworthy that citrus trees may benefit considerably from a copper-containing spray applied in April or early May, before the winter rains commence. This spray will have a tonic effect on trees growing in copper-deficient soils and it will help to prevent the serious citrus brown rot disease which causes a blighting of leaves and rotting of fruits.

Bordeaux mixture or copper oxychloride are suitable materials and they should be thoroughly applied both to the trees, and the soil under the branches.

Persons interested in these plant diseases may obtain additional information from the Department of Agriculture.

PRINCIPLES OF COMMERCIAL BEEKEEPING

By R. S. COLEMAN, R.D.A., Government Apiculturist

We have many queries from small beekeepers, and from people who have never opened a hive, on how to break into full-time beekeeping. So it was thought that you would like to know just what are the principles of successful bee farming.

There is an old saying which well expresses the kernel of the whole business: "Go into bees for money and you'll go broke. Go into bees because you like them and you'll make money." Remember that saying, because beekeeping is a way of life before it is a business. Once you are bitten (or should I say stung), the spell seldom lets you go. Now you see where the expression "Bees in your Bonnet" comes from.

It is obvious that first you must know something about bees. Learn from every available source and the best of the lot is your own hive.

Read every good book on beekeeping you can lay your hands on. Remember that experience and theory are the two legs that success stands upon. Each is almost useless without the other. The Department of Agriculture will help you with any advice you may need and with a list of textbooks. Two libraries lend textbooks on bees. One is the Adult Education Library and the other is the Library Board of W.A., through your local Road Board Library.

Once you have your basic knowledge of bees, three other things are necessary for success.
ALWAYS BUY
Western Australian
DRIED FRUITS

FRESHEST STOCK-HIGHEST QUALITY

CURRANTS  SEEDED RAISINS  SULTANAS

REVIVE RAISIN FUDGE CAKE with ALMONDS

⅔ cup butter or substitute.
1½ cups sifted brown sugar.
2 egg yolks.
⅛ cup brown sugar.
1 cup chopped raisins.
4 oz. melted chocolate.
⅜ cup hot water.
⅛ cup thick sour milk.
2⅔ cups S.R. flour.
¼ teaspoon cinnamon.
¼ teaspoon powdered cloves.
2 egg whites.
⅛ cup blanched almonds.
2 tablespoons granulated sugar.

METHOD.
Beat the butter to a cream and gradually work in the first measure of sugar. Beat yolks of eggs, beat in second measure of sugar, raisins and melted chocolate. Sift together flour and spice, add to first mixture alternatively with water and sour milk, lastly fold in egg whites, beaten very lightly. Turn into cake tin. Split almonds and press on edge each half nut in the top of the cake. Sift sugar over the almonds and top of cake. Bake 50 minutes in a moderate oven.

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The first is the ability to work. Commercial beekeeping is hard work. Only a man who can work and has the ability to keep his mind on his job will succeed. The second is to have a sound business and organising head. All farmers must have these two qualifications for success, but the third and last is an added key to success in bee farming—knowledge of the nectar producing plants.

There is no point in keeping bees unless you gain a honey crop from them. This knowledge of the flora must be learnt mainly from experience, for although we can help considerably, your judgment must be developed from your study of the bush. We can tell you what plants to look for and where they are found and believe me, Western Australia has its fair share of honey-producing plants, far more than any other State in the Commonwealth. This is shown by the fact that the average production per productive hive in Western Australia was double the average of the productive hives in Australia, including Western Australia, for last year. The credit for this yield cannot be given entirely to the karri. The other States very seldom reach our average per hive and are usually 50 per cent, below.

Once the problem of finding the honey flow is covered, you will appreciate that the next thing is to get the maximum amount of honey from the flow. It is then that the need for high-producing stock appears. This depends upon two factors. First is proper management of the stocks so that they are ready to go to work as soon as the flowers start to yield nectar, and the other is a good strain of bees. Like all animals there are good high-producing strains in bees as well as very poor ones.

This was shown during the last karri flow where the better beekeepers averaged over 5 cwt. per hive, while beekeepers scattered amongst them only extracted between 1½ to 3 cwt. per hive.

When you start beekeeping it pays to keep good stock in your hives from the beginning as they cost the same to keep but the yield is consistently higher. These good strains of bees can be procured from any recognised queen breeder or some commercial beekeepers who may raise a few more queens than they actually need.

It does not matter what race of bees you have, as long as they are quiet and high-producing. When you introduce these good strains into your hives the next step is to learn how to raise queens to replace your old queens in your hives. There are many books written on queen raising, and if you care to write to me I will supply the titles, authors and where they can be obtained, together with remarks on each book. The next factor in high production is good combs. It is necessary to have the maximum amount of worker comb in your hive and only full depth foundation should be used as this cuts down the production of drone comb.

To actually start beekeeping, follow the example of the majority of our commercial beekeepers, by starting off with a few hives and increasing gradually. Three hives are the minimum to allow the efficient working of the bees. Check with your local Road Board first to see if you can keep them in your area. It is best to buy the hives as going concerns, or buy the equipment in the flat and put in small nucleus hives or swarms. As you gain experience, gradually extend. Try to make the bees pay for the expansion.

Remember that 20 hives are the minimum that will repay you for the labour and 80 are as many as can be handled, working over the weekend. It takes about 50 days per year to handle 40 hives properly and 200 hives is as much as one man can handle by himself, working full time.
GRASSHOPPERS AND LOCUSTS

By C. F. H. JENKINS, M.A., Government Entomologist

Grasshoppers and locusts are among the most ancient enemies of mankind for they figured prominently in Biblical times, and periodically throughout the ages have devastated crops in all parts of the world.

The term grasshopper covers a wide range of insects differing greatly in size and habits, but characterised by the fact that they are vegetable feeders and have the hind legs especially developed for jumping. There are many different species of grasshoppers and locusts in Western Australia, but the difference between the two groups is not generally understood. When conditions are suitable, the species usually termed locusts are much more gregarious or social in their habits than grasshoppers, and may undertake long migratory flights of several hundred miles.

Another common species frequently found around Perth and often quite troublesome during the summer months in the Lower South-West is the so-called wingless grasshopper. The damage done by this species may sometimes be very severe although outbreaks are usually fairly localised due to the fact that only a small proportion of the grasshoppers ever become winged and so migration can only take place by hopping.

A rather conspicuous member of the group which favours grassy paddocks and swampy situations is the yellow-winged locust. This is one of the larger types and one which may at times be troublesome in various cultivated plots. In the northern portions of the State it forms dense swarms and behaves like a true locust, but in the South-West, although often quite numerous, it does not appear in plague numbers.

One of the largest members of the grasshopper group found in the South-West is the spur-throated locust. Like the yellow-winged locust and the migratory locust, it swarms in the more northern regions of summer rainfall and about 10 years ago did very serious damage to the Carnarvon banana plantations. In the South-West, however, it inhabits overgrown grassy situations and is not of major economic importance.

In addition to the species described, numerous other native grasshoppers may appear in different situations throughout the summer months and cause local damage.

The control measures which have been successfully used against the wheatbelt grasshoppers have proved universally effective against other members of the group and can be applied just as appropriately to home gardens and orchards as they can to wheat farms. Poison bran bait is one of the most universal methods.
of combating locusts and grasshoppers, and the following mixture is recommended:—

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<th>Ingredient</th>
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<tr>
<td>Bran</td>
<td>10 per cent.</td>
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<tr>
<td>Benzene hexachloride dust</td>
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<td>Water</td>
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2½ gallons

The poison dust should be mixed dry into the bran and sufficient water should be gradually added to produce a moist crumbling mash. The bait should be lightly scattered among the grasshoppers, preferably in the early morning, as maximum feeding usually takes place after the insects have been warmed up by the morning sun.

Some of the new insecticides as spray preparations have been found particularly effective against grasshoppers. Among the most useful are dieldrin and chlor-dane. DDT, although toxic to hoppers, is not outstanding. Dieldrin has been used effectively to kill grasshoppers at rates as low as one ounce to the acre, and where vegetable gardens and backyard infestations require treatment, a general spraying with 0.1 per cent. dieldrin is recommended. The actual dilution which can be recommended for grasshopper spraying will depend upon the type of concentrate, which is purchased but, where large areas require treatment, ½ pint of 20 per cent. dieldrin should be applied to the acre, and where small areas only need attention a 20 per cent mixture could be broken down at the rate of 1 part to 200 parts of water and a general treatment applied.

It is not uncommon for grasshoppers to invade gardens and orchards from adjacent grass paddocks and waste land. Where this is observed, it is often possible to stop the invasion by heavily spraying a strip of grass across the line of advance. Hoppers passing through this treated area will be killed and the number reaching their destination will be greatly reduced. Dieldrin is toxic to poultry and stock and so where heavy treatments have been applied to grass or pasture, grazing animals should be excluded.

ACETONAEMIA IN DAIRY CATTLE

By P. M. A. HARWOOD, M.R.C.V.S., Veterinary Officer

ACETONAEMIA, more correctly known as ketosis is a metabolic disease. Unlike infectious diseases such as tuberculosis or mastitis, which are caused by microbes, metabolic diseases result from an upset in the normal bodily processes.

In the case of acetonaemia, substances known as ketone bodies appear in the blood stream of affected cows. In turn these ketone bodies may also be transferred to the milk and urine.

The cause of the disease is almost certainly a nutritional disorder. Dairy cows are quite frequently affected and most cases are seen in freshly-calved cows; that is cows that have been milking for from one to six weeks.

HOW THE DISEASE IS CAUSED

In order to understand the disease, it is essential first to understand the normal process of digestion. A cow receives most of its energy from carbohydrates which are starches, fibres and sugars present in pasture grasses, hay, cereals and other foods. The amount of carbohydrate in any food is measured in terms of its starch equivalent which is the amount of carbohydrate in a given food compared to 100 lb. of starch. It is highest in young green pasture grasses and lowest in poor quality dry grass.

Carbohydrates are broken down within the body to carbon dioxide, gas and water, energy being produced in the process. They can be visualised in the role of the fuel that drives an engine.

If the amount of carbohydrates in the food does not provide sufficient energy for the requirement of the cow, body fat is broken down by a similar process to give energy. Normally this takes place in the same manner as carbohydrate digestion, the fat being broken down to yield energy, carbon dioxide gas and water. In this carbohydrates are also required to provide what may be visualised as the draught needed to completely burn the fuel.
If insufficient carbohydrates are being taken with the food, the fat is not completely broken down and a similar condition to a smoking fire exists. Instead of a complete digestion of fat with maximum yield of energy, ketone bodies are formed and become present in the blood stream. These ketone bodies possess poisonous properties and it is this poisonous effect that causes the disease.

From what I have just mentioned about the causes of the disease you can see that it is most likely to occur under two conditions. Firstly it should occur when the feed is of inferior quality and low in starch equivalent, and secondly it should also occur when the cow needs its greatest amount of energy which is in the early part of its lactation. And this is exactly what we find in the field.

Acetonaemia is almost always seen in freshly-calved dairy cows which are high producers and is commonest towards the end of the summer when the feed is at its worst.

**TWO FORMS OF ACETONAEMIA**

The symptoms of acetonaemia take two forms, the most common one being the digestive type. There is loss of appetite, particularly in regard to concentrates, and a rapid fall in milk yield. The cow stops feeding and appears to be dull and listless. Usually she falls away in condition. The odour of the ketone bodies can often be smelled in the breath as a sweet odour like chloroform. This smell may also be quite strong in the milk. Some people notice it immediately whereas others just cannot pick it up at all.

Another type of acetonaemia known as the nervous form also occurs occasionally. Usually the cow licks incessantly either at herself or at the feeder, other cows grind their teeth, champ their jaws, roll their eyes or even stagger about and fall over. Quiet cows may suddenly become wild. I must stress that this form of the disease is not common and is easily confused with another metabolic disease, grass tetany.

Most cases of acetonaemia cure themselves in time. The affected cow stops milking thereby reducing her energy requirement so she does not have to call on her fat reserves and therefore recovers. However, there is a good deal of economic loss due to loss of milk production and also loss of condition when the cow is not eating. Other cows have recurrent attacks.

It is not often that a cow dies of acetonaemia but she may become so weak and low in condition as to fall an easy prey to other conditions.

When a freshly-calved cow suddenly loses her appetite and goes off her milk, there is good reason to suspect acetonaemia. If, in addition, a sweetish smell can be noticed on the breath and in the milk the diagnosis can be made with a fair degree of certainty. Definite diagnosis, however, can only be made by the use of a simple chemical test which is carried out by the Department of Agriculture. Small samples of about 1 oz. of either milk or urine should be clearly labelled and sent in immediately after collection in tightly-stoppered bottles.

**TREATMENT**

And now we come to the treatment. Firstly the old methods which treated the disease by giving the cow extra carbohydrates in the form of sugar. Molasses are a good source of sugar and are more effective if chloral hydrate is added.

An ounce of chloral hydrate dissolved in a pint of hot water and a pint of molasses should be given morning and night for two days, followed by ½ oz. of chloral hydrate in the same quantities daily for the next six days.

Quicker in effect are injections of glucose. 8 oz. are dissolved in a pint of boiling water and allowed to cool. When at blood temperature this solution is injected under the skin in several places. The injections may be repeated daily until a cure is effected.

An entirely new line of treatment is with the new wonder drug A.C.T.H. which is available only to veterinarians but now the cost is low enough to make its use well worth while. Most cases recover within one or two days of a single injection.
SUBTERRANEAN clover is undoubtedly the most important pasture species in this State. Because it is a legume, it can make excellent growth on soils with a low nitrogen content. The nitrogen it needs is, of course, provided by bacteria which inhabit the nodules found on its roots. These bacteria provide nitrogen by taking it from the air and converting it to a form which can be used by the clover. However, it is now known that the bacteria can use the nitrogen of the air only if enough molybdenum is available to them.

On molybdenum-deficient areas, therefore, subterranean clover lacks sufficient nitrogen for healthy growth and only pale yellow weak clover plants are to be seen. The possibility of molybdenum deficiency occurring in our pastures is obviously of considerable importance to us.

Since molybdenum deficiency of subterranean clover was first recognised at Donnybrook we have tried to determine how much molybdenum should be applied to deficient areas. There were only two types of molybdenum fertiliser available in this State which warranted consideration—one was roasted molybdenite ore and the other was crude sodium molybdate. Other compounds such as those obtainable from chemists or drug houses are unnecessarily pure and are too expensive for use in agriculture.

The results of our trials have shown that the best growth was obtained from using either 2 oz. per acre of roasted molybdenite or alternatively 6 oz. per acre of crude sodium molybdate. Other compounds such as those obtainable from chemists or drug houses are unnecessarily pure and are too expensive for use in agriculture.

At Donnybrook, molybdenum deficiency was found to occur on the red and chocolate soils, associated with granite. It was reasonable to expect that it would also occur on similar soils extending North, South and West of Donnybrook. At Bridgetown, Mr. Don Reed on his own initiative laid out a trial which showed benefit from molybdenum. Last season his earlier results were confirmed on his and other farms at Bridgetown and deficiency was also determined in trials on the heavier soils associated with granite at Mullalyup, Nannup, Brunswick Junction and Harvey.

It may be that less serious deficiency also restricts clover growth on some of the gravelly soils—this is being investigated but still remains to be proved.

There are some places where pastures have been deficient in molybdenum for so long that no clover remains. In such cases reseeding will be necessary. Usually, however, the effect of using molybdenum on deficient pastures is a rapid regeneration of subterranean clover. Last year at Mullalyup for example an application of molybdenum increased the clover in the pasture from less than 9 cwt. per acre dry weight to over 27 cwt. per acre. These figures were obtained before growth had ceased and difference in growth would have been greater later on. At one stage treated pastures appeared to be all clover, but actually a satisfactory proportion of grass was present.

A number of last season's experimental areas were grazed after the pasture had matured and dried off. It became obvious that the increased clover content due to molybdenum had greatly increased the palatability of the dry feed. Plots which received molybdenum were grazed bare whereas adjacent untreated plots were scarcely touched.

Some of you have heard of injury to stock caused by molybdenum and wondered if yours were likely to be affected if you used molybdenum fertiliser. Molybdenum can be poisonous—but so can zinc and copper. In England there are pastures where molybdenum occurs naturally in poisonous quantities. In New Zealand on certain areas molybdenum fertiliser has caused trouble. In both countries however danger exists only where the molybdenum content of the pasture is too high.
In Western Australia, we have obtained a number of chemical analyses of treated pasture and in no case has the content of molybdenum in the clover reached a figure anywhere near that needed to cause trouble with grazing animals. When we find exceptions we will let you know.

As far as we can determine at present molybdenum deficiency is not widespread in this State but where it does occur it can be serious because of its effect on the growth and persistence of subterranean clover. It is fortunate that we have the means of overcoming this deficiency both cheaply and quickly.

COBALT DEFICIENCY IN SHEEP AND CATTLE

By C. R. TOOP, B.V.Sc., Chief Veterinary Officer

With the establishment of the group settlements at Denmark after the first world war, it was observed that young cattle, although running on lush pastures, developed symptoms of unthriftiness and wasting and usually died. Research conducted by Filmer and Underwood later revealed that this condition was caused by a deficiency of cobalt and that it could be cured and prevented by the addition of this mineral to the diet. Cobalt deficiency has since been met with in other parts of the State and it was recently diagnosed in sheep at Mount Manypeaks.

With cattle and sheep, minute amounts of cobalt are necessary for growth and health. It is required by the microbes which inhabit the first stomach for the synthesis of Vitamin B 12 and other nutrients which are essential for the maintenance of health. Although this requirement is extremely small the intake must be frequent and regular, and animals deprived of cobalt for more than three to four weeks will commence to show signs of unthriftiness.

The daily requirement of cobalt for the sheep is less than a milligram and for cattle it is about 10 milligrams or to put it in another way, one ounce of cobalt chloride will supply the needs of 1,000 sheep or 100 cattle for a week.

The symptoms of cobalt deficiency are progressive weakness, wasting and loss of appetite which virtually cause the animals to starve to death. Affected sheep have a watery discharge from the eyes, there is profound anaemia, the skin is pale and blanched and the wool appears dry and lifeless. Lambs become stunted and unthrifty and cease to grow. Cattle may develop a depraved appetite causing them to eat sticks, dirt and other rubbish and the coat becomes long and rough. Milking cows go dry and may abort or become affected by sterility. Without appropriate treatment death may occur in two or three months from the onset of the symptoms.

Cobalt deficiency may be corrected by top-dressing, the use of licks, drenching or the addition of cobalt salts to the drinking water, but the method employed will depend upon the circumstances.

For top-dressing, the application of cobalt chloride or sulphate incorporated in the superphosphate at the rate of 4 oz. to the acre every second year is recommended. This will make certain that every animal on the property obtains its cobalt requirements.

The use of cobalt as a top-dressing, however, is limited by the added cost and it is only justified on well-improved pastures with a high carrying capacity.
A suitable lick may be prepared by mixing 2 oz. of cobalt chloride or sulphate with 100 lb. of salt and provided it is consumed at the rate of 1 oz. weekly by sheep and 1 to 2 oz. daily by cattle it will prevent cobalt deficiency. Similar results will be obtained with Denmark lick which consists of a mixture of salt, bluestone and limonite which contains cobalt as an impurity. Licks are only satisfactory when consumed regularly and in the required amounts and this is by no means always the case. With dairy cattle the lick may be added in the recommended dosage to the feed.

To prepare a suitable drench, dissolve 1 oz. of cobalt chloride or sulphate in a gallon of rain water. The dose of this solution for sheep is 5 ccs. once weekly or 20 ccs. each fortnight and the equivalent dosage for cattle is 50 ccs. weekly and 200 ccs. fortnightly.

Drenching at weekly intervals will give the best result and once a fortnight will also prove effective. Monthly drenching will not, however, prevent the deficiency.

Because of the frequent mustering and handling involved and the cost of labour, drenching will in most cases be regarded as impracticable. In the case of dairy cattle the drench could be given to calves in their milk or to cows mixed with the feed in the bails.

The addition of cobalt chloride to the drinking water at the rate of an ounce to 7,000 gallons will supply the needs of both sheep and cattle. This method of control, however, is applicable only when the stock are watering from tanks and troughs and cannot be employed on properties with open waters. Furthermore on some deficient areas the water contains carbonates in solution which precipitate the cobalt making it unavailable to the stock when drinking. In addition sheep drink little water when green feed is abundant during the winter and spring and this is a further disadvantage.

The response of affected animals to the administration of cobalt is dramatic and early recovery may be expected even when the symptoms are far advanced.
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