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Some recent radio talks.

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SALT MOVEMENT IN SOIL

By T. C. STONEMAN, B.Sc. (Agric.), Adviser, Soil Conservation Service

ALTHOUGH this subject may sound rather remote from practical farming, it is, nevertheless, a field of study which has a most important bearing on the measures used in the handling and reclamation of salt-affected country.

As you may be aware, a survey carried out in 1955 indicated that there are now something like 180,000 acres of salt affected country which had, at one time, been used for cropping. This is a considerable area of land, much of which however, can be put to worthwhile use, given the necessary knowledge of reclamation techniques and the ability to recognise the most appropriate method to adopt for a particular problem area.

The Department of Agriculture provides an advisory service for farmers and it is one of the duties of these officers to give farmers helpful suggestions and advice as to how to go about improving the productivity of salt-affected soils.

These Departmental recommendations are based on many years of experimental work both in the laboratory and in the field, plus, of course, observations made during visits to farmers.

It was recognised very early, that the problem of soil salinity as it affects plant growth, is one of an undesirably high salt concentration occurring within the rootzone of the plants concerned and, in particular, near and at the soil surface. From a practical point of view then, it doesn't matter greatly what concentration of salt exists below the rootzone, as long as the salt can be kept there. That is to say, handling methods have to be used which will result in the downward removal of salt from the upper soil to the subsoil and these methods have to ensure that the salt stays there.

It is important to understand that salt movement in a soil can only occur when the salt is dissolved in water. For instance, in winter, the rainfall soaking down through a soil dissolves much of the salt and takes it down with it. Conversely, in hot dry weather, evaporation of moisture from the soil surface sets up an upward movement of moisture by capillary action, and this water also carries salt with it. Therefore, in controlling salt movements we are really trying to control soil moisture movements.

Early experience and theoretical reasoning indicated that, when land is subjected to overgrazing or fallowing, accumulation of salt near the surface is accelerated greatly. Both these undesirable practices have the effect of removing plant cover. While a good cover of grasses is maintained on an area, two very important factors exist. Firstly, the surface soil is kept open and porous by the grass roots, and hence the soil can absorb rainfall much more readily than if bare. This

business of the condition of the surface soil is most important in the control of salt movement, as everything possible has to be done to encourage rain to soak in where it falls and so wash or leach salt down below the rootzone.

The second benefit from a good grass cover is reduction of evaporation. Aboveground parts of the grass provide a zone just above the soil surface in which the wind velocity is greatly reduced. Also the soil is kept cooler. These factors combine to keep the rate of evaporation of soil moisture down. If evaporation from the soil surface could be eliminated, the build up in concentration of salt at the surface would cease.

So far then, we have seen that it is most desirable on potentially salt-affected country to keep a grass cover by avoiding overgrazing and fallowing. The same principle applies on soils which are already obviously salt-affected—that is, we have to try to achieve a complete plant cover over the area. In this regard, the somewhat salt-tolerant Wimmera ryegrass, particularly the Early Strain, has proved extremely useful.

However, it has been necessary to devise appropriate cultivation techniques to combine with the sowing of grasses in order to achieve and maintain a grass cover.

This matter of cultivation of salt affected soil is very important and has received quite a lot of attention in recent years, particularly as to the best time to cultivate. It is now clear that in most cases the ideal time to cultivate is just before or just after the opening rains, preferably a little before. Breaking up the surface soil at this stage enables the maximum penetration of early winter rainfall with the resultant leaching down of salt, even if only for a few inches. This, then, gives any seed on the soil surface a much better chance to germinate in a salt-free medium. It should be emphasised that the timing of this cultivation is most important, because, if left until several weeks after the opening rains, it will then result in a severe thinning out of most of the plants which have germinated and managed to survive.

Early light cultivations of this nature carried out with any type of tyned implement are, as mentioned just now, a good thing in encouraging the leaching down of salt and they also have a beneficial renovating effect on stands of Wimmera ryegrass. So, in practice, the use of this grass and the light cultivation at the beginning of winter combine very well.

To sum up again we can see that:—

(1) It is essential to avoid overgrazing and fallowing on soil that is potentially or actually salt-affected.

(2) Wimmera ryegrass, particularly the Early Strain, is the most useful of the commercially available pasture and crop plants.

(3) It is necessary to make use of a judiciously-timed cultivation every two or three years to improve rainfall absorption and hence salt leaching, and to provide a stimulation for the stand of Wimmera ryegrass.

At what time of the year does salt rise to the soil surface at the greatest rate? This aspect of salt movement in soil has been investigated fairly intensively recently. Some very detailed soil sampling carried out in the last couple of years has made it clear that the spring period is normally the time of most rapid salt rise. This is the season when the soil is still moist after the winter rain and temperatures are rising—ideal conditions for salt movement from the subsoil to the surface. It is most desirable then that great care should be exercised in the grazing management of slightly salty areas at this time of the year to prevent them becoming bare.

The various factors mentioned so far which affect salt movement in soil become of importance when the question of depth of sowing on salt land is discussed. Farmers often ask whether any particular depth of seeding is recommended for various plants on salty soil. It should be clear by now that no **one** particular depth **can** be selected as the zone of highest or lowest salt concentration, because these will be dependent mainly on what rain falls and what dry periods occur after seeding. Therefore, the only possible recommendations are to seed at normal recognised depths or, alternatively, to vary the depths during seeding operations. This latter method

has quite a lot in its favour, particularly if dealing with rather severely salt-affected areas.

So, it can be seen then, that salt movement and concentration in soils depends mainly on two things—the amount of plant cover and the physical condition of the soil surface.

In conclusion, a brief resumé of the Department's recommendations for handling salt land may be in order and, in all of these, you will see those two points just mentioned.

Firstly, all salt-affected areas should be fenced to allow separate grazing control.

Secondly, slightly affected areas should be cultivated and sown with a cereal and Wimmera ryegrass. Subsequent light soil renovations should be carried out every couple of years.

On severely salt-affected areas which are completely bare or almost so, grazing should be entirely eliminated for several years. During this time, the surface should be kept in a roughened condition so that wind blown seeds of native salt tolerant plants can be trapped.

And, finally, on summer wet seepage areas, *Paspalum vaginatum* will provide a useful ground cover.

PASTURES AND DISEASE

By J. CRAIG, M.R.C.V.S., Senior Veterinary Surgeon

IF we were to ask the man on the land what his purpose was in farming, we would probably get many different sorts of answers. But certainly an answer common to each, would include, in general terms, a desire to farm his land to its potential, build up his livestock numbers and maintain them in positive health.

An initial and important requirement would of course, be high fertility with the resultant birth of large numbers of calves or lambs. But this surely, is only the first stage since these must be reared into healthy, well-grown weaners, and eventually pay their way as high quality animal products such as milk, meat and wool. To achieve all this is no mean undertaking and depends largely on good nutrition, sound animal husbandry practices and effective disease control.

Over the last few decades, great progress has been achieved in the control of the major infectious diseases of livestock. So much so, that the heavy losses that were almost inevitable each year where such infections as pulpy kidney, toxic paralysis and contagious abortion were concerned, are now almost a thing of the past. It is fortunate that vaccines to prevent these diseaes are available and that vaccination programmes have become standard practices on most properties these days.

Recent veterinary attention has been focused not so much on the infectious disease conditions of livestock, but on the diseases due to other causes, and a great deal of knowledge has been accumulated about the influence on animal health of the various mineral deficiencies and imbalances; and of the effects of certain pasture species on the grazing animal. There is no doubt that the introduction of improved or sown pastures has created new problems of animal health, but despite these, the gains in animal production far out-weigh the losses from disease associated with such pastures. It is reasonable to assume that a mixed pasture is best for the grazing animal and that the requirements of that animal cannot be met fully by any one pasture plant. The safest diet is a mixed diet, although our insistence on this, often covers a vast ignorance of the specific value and the specific danger of individual pasture species.

POISON PLANTS

One of the main causes of animal disease on native pastures is the consumption by the grazing animal of poison plants, and the early history of stock raising in Western Australia abounds with

records of losses from "York Road," "Box," "Zamia Palm" and many other native poison plants.

The mineral deficiencies of animals in Australia are to be found more particularly among stock grazing native pastures. Most of the mineral deficiencies in the soil have to be made good before sown or improved pastures can be developed, and in this way the grazing animal is protected. Futhermore, the development of improved pastures usually means the complete elimination of native poison plants, although in some instances it may even result in the accidental introduction of certain exotic poison plants such as the "Cape Tulip."

Probably the most vital factor resulting from the use of improved or sown pastures is the high productivity per unit of area, which permits far greater concentration of stock, or as an alternative, longer periods of grazing.

It must be remembered that pastures are not only a source of foodstuff to livestock, but provide animals with their environment. Consequently, the effects of increased stocking levels on those diseases that are spread by contact are obvious. An example of this is the fungal disease, ringworm, which is commonly seen in calves and yearlings under such conditions. But probably the best example is bovine tuberculosis which, prior the advent of tuberculin testing some ten years ago, was responsible for severe losses to the dairying industry.

An increase in the incidence of footrot in cattle and foot abscess in sheep is especially common under improved pasture conditions, although in these diseases there must also be other definite predisposing factors such as some injury to the hooves and skin of the claws, together with muddy contaminated paddocks or yards, which allow the infection to build up.

WORM INFESTATION

The ill-effects that may arise in young stock especially from worm infestation are well known to all of you. Internal parasitism both in sheep and cattle, is not so much a disease of improved pastures, but of the higher stocking rate made possible by these pastures. The development of parasitic worms in grazing stock is a complex process. It is governed by the state of resistance of the animals, and this in turn depends on their age, their previous experience of infestation and their nutritional state. The control of parasitic disease is not necessarily a simple task, since it involves not only a definite drenching programme to eliminate the worms inside the animal, but a routine involving the rotation and spelling of paddocks to reduce the vast numbers of parasitic larvae which contaminate the pastures, and the maintenance of livestock at a high level of nutrition.

In Western Australia, a widespread phosphorus deficiency which becomes more serious as pastures mature, may be encountered in natural grazing. Early symptoms of this are depraved appetite, bone chewing, stunting of growth in young animals, reduced milk yield in cows and prolonged intervals between calvings. There may be further complications in that cattle may develop toxic paralysis and over the years serious losses have been incurred from this disease. It is only fair to emphasise however, that true phosphorus deficiency and botulism are now relatively rare in the heavy rainfall districts of the State, where topdressing with superphosphate has been a regular practice for many years.

A form of staggers in sheep and cattle on perennial ryegrass pastures has been known for years. It occurs in the autumn usually after the first rains and makes the movement of stock difficult or impossible over a period of some weeks. If affected animals can be removed from these ryegrass-dominant pastures, recovery takes place quickly, but the disease sometimes leads to stock becoming cast and dying from exhaustion.

A more serious form of staggers occurs on Phalaris pastures. This disease is also prevalent during the autumn and is somewhat similar in its early stages to the staggers that occurs on ryegrass pastures, but the nervous disorder quickly becomes more serious and persistent. After a time, paralysis develops due to destruction of nervous tissue and this may bring about the death of affected animals. Even those which do not die remain permanently affected with some degree of

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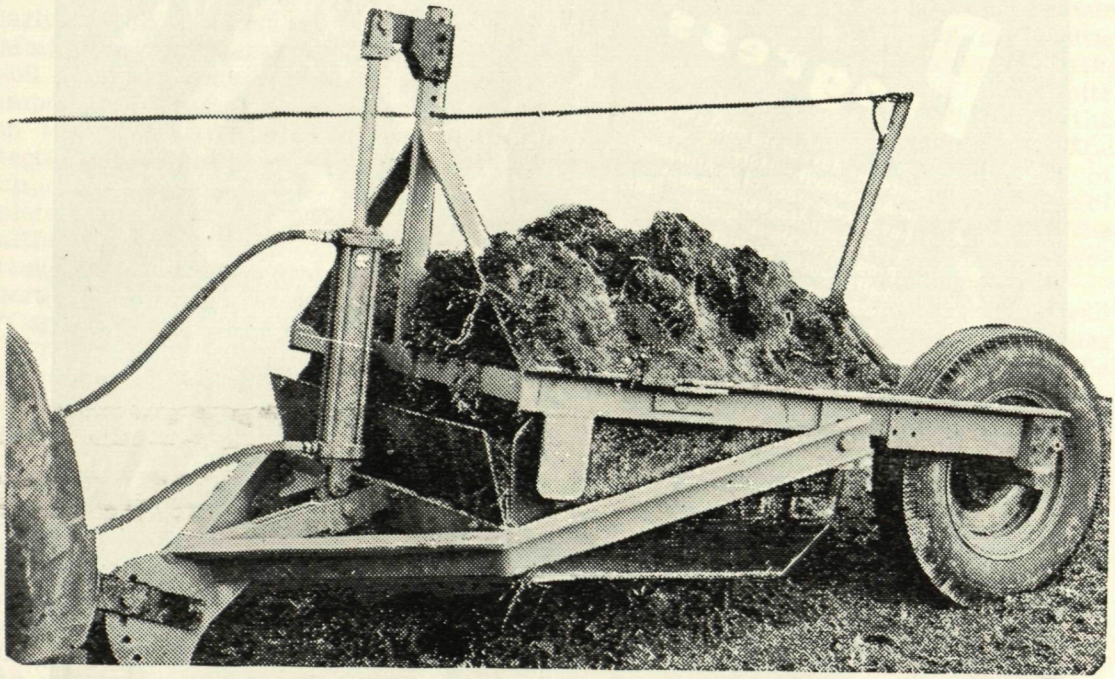

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inco-ordination of movement. It is now well known that a supplement of cobalt is an effective preventive treatment. It seems, therefore, that Phalaris staggers may be expected to occur especially in those areas where the soil has already a low cobalt content.

CLOVER DISEASE

The most amazing condition of all, is of course, clover disease. The occurrence of this disease in sheep grazing pastures dominated by the Dwalganup variety of subterranean clover, led to a disaster in animal production during the decade 1940-50. The disease is a complex with three main manifestations—infertility, difficult birth and prolapse in the ewe, and milk production in wethers and unmated ewes. The lambing may fall to 10 per cent. or lower and the ewe wastage may reach 30 per cent. With improved methods of pasture management, by incorporating Wimmera ryegrass and thus reducing clover dominance, and by the use of normal applications of superphosphate, the disease appears to have been brought under control.

The conditions described do not, by any means, exhaust all the possibilities involving the untoward effects of certain pastures and animal disease. One may think of photosensitisation, of lupin poisoning, of Sudan grass poisoning; of the various forms of the trace element deficiencies copper and cobalt—either in combination or singly; and of the metabolic diseases hypocalcaemia in sheep and acetonaemia and milk fever in dairy cattle.

The lesson we can learn from this, is that everything possible must be done to ensure the establishment and maintenance of mixed pastures, and especially to avoid pastures becoming dominated by one single plant species. At the same time, since improved pastures naturally lead to increased stocking levels, the dangers to animal health from overcrowding and overstocking must be realised. Faulty hygiene must be corrected, animal nutrition, particularly at periods critical to the animal, must be kept on an adequate plane, and lastly, effective disease control methods must at all times be carried out.

(From a Country Hour broadcast talk. Script made available by courtesy of the Australian Broadcasting Commission).

SPRING BUDDING OF CITRUS

By H. S. ARGYLE, Horticultural Instructor

A horticulturally-inclined member of the fair sex, recently sought information regarding the mysteries of budding citrus trees. "Of course," she said, "I know that the top part grows from a bud, but where do you get the bit at the bottom?"

For those readers equally unacquainted with the basic principle of plant propagation—very briefly it's this:—Fruit trees don't reproduce reliably from seed, therefore seedling trees are grown, which—though not necessarily producers of good fruit—are strong and vigorous. On these trees—or stocks—buds are grafted which have been taken from other trees of proved quality and production. Eventually the bud becomes the fruit-bearing part of the tree and the stock the root system—or "the bit at the bottom."

Citrus tree stocks should be grown quickly, and according to variety, are ready to bud at two to three years of age. Budding may be done at any time from October to March. Autumn is the usual time for this work and the bud remains dormant until the following spring—and then is forced into growth by cutting off the stock immediately above the bud. Even under good conditions, some buds will fail to take; if wet weather occurs during budding, the number of failures is likely to be high.

If you have buds which missed last autumn, they can be re-budded now—also any small trees left unbudded which have since grown to size. Trees obviously below standard should be discarded.

The budding knife must be sharp with a chisel edge—the bevel on the underside of the blade. Make a T-cut just

through the bark, six to eight inches above the ground. Remove the bud from the budwood by commencing your cut one-third of an inch below the leaf stalk—then drawing the knife-blade flatly underneath the bud, make a boat-shaped shield about an inch long. Removal of the small sliver of wood beneath the bud shield is desirable though not essential, and should not be attempted with thorny or angular wood if this is likely to injure the bud. Now raise slightly the flaps of bark made by the T-cut and slide the bud well underneath; wrap with raffia, rubber, or other suitable material, firmly enough to exclude air and moisture. In about two weeks the bud should have united with the stock, and the wrapping may be removed to check up. If the bud is green and fresh-looking, wrap again more loosely, allowing room for the bud to move and cut off the stock just above. When the bud shoots, in about ten days, remove the wrapping. From then on it should grow rapidly. When about six inches high, a light 3ft. stake can be driven in beside the trunk and the bud-shoot tied to it as required during growth. This will act as a protection from wind damage and insure a well shaped tree.

Spring is also a suitable time for reworking mature trees from one variety to another. The buds are inserted directly into the main limbs of the tree to be worked, about a foot above the crotch. One or more buds are placed in each branch, dependent on the number and size of the limbs. If possible, more buds should be inserted than required; this will allow for losses—or permit selection of the better shoots when finally shaping the new top. Except for the heavier bark, which is more difficult to handle, the budding operation and subsequent care is basically the same as in nursery work. When the buds have taken—usually in about three weeks—cut off the branches just above the buds, seal the cuts with a tar or oil based preparation and whitewash the main limbs to guard against sunburn. As unwanted shoots develop, they should be rubbed off and care taken to prevent insect damage.

On limbs where buds fail to take, allow four to six well-placed shoots of the original tree to grow. In the autumn bud on to these shoots in the normal way.

Budding will not be successful unless the bark of the stock lifts freely from the wood underneath—indicating an active root system—so don't neglect to feed and water that important part—"The bit at the bottom."

THE CITRUS WHITE FLY

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

WHITE flies or snow flies are tiny insects easily recognised by their short rounded wings and the white flocculent powder which covers the entire body. Several native species exist in Western Australia and they may be found feeding upon gum leaves and various bush plants, but fortunately they have not turned their attention to cultivated crops. In some parts of the world, however, white flies cause considerable damage and attack such things as citrus, tomatoes and other vegetables.

Perhaps the two most destructive species are the citrus white fly of America and the widely distributed greenhouse white fly, but fortunately neither type occurs in Western Australia.

Unfortunately, however, in the last few years an Eastern States species of white fly has appeared in our citrus areas and is causing some concern.

The habits of the white fly are somewhat similar to those of the better-known aphis. The flies cluster on the undersides of the fresh young leaves and suck the sap. The females arrange their eggs in neat open circles or horse-shoes on the leaves and, after hatching, the tiny wingless crawlers settle down and cover themselves with a flat scale-like shell. In addition to draining the sap of the plant by their constant sucking, the white flies cover the leaves with a glistening sugary excretion popularly known as honeydew. This honeydew is commonly excreted by scale insects, aphides and their relatives

and forms an admirable medium for the growth of fungas. For this reason trees and shrubs badly affected with sap-suckers are often disfigured by growths of black sooty mould. The soot-like powder not only clings to the leaves and twigs but gets onto the skin of citrus fruits and often necessitates washing or scrubbing. Such operations of course add to the labour costs and may also reduce the keeping quality of the fruit.

The white fly may be controlled by similar treatments to those used against scale and aphis, but thorough spray applications are necessary if satisfactory results are to be obtained. Mixtures of black leaf 40 and white oil or malathion and white oil are suggested because although parathion and DDT will give good kills of white fly they may have undesirable side-effects. For instance, it has been shown that soft brown scale is sometimes encouraged by the use of parathion and that red scale may increase following the use of DDT.

The spray mixtures recommended are:—

White oil—2 gallons.
Black leaf 40 or 50 per cent. malathion —1¼ pints.
Water—100 gallons.

A second spraying about two to three weeks after the first may be necessary to control a bad outbreak, but in such cases the white oil concentration may be halved.

The proportions for a backyard grower would be:—

White oil—1 tablespoonful.
Black leaf 40 or 50 per cent. malathion —2 teaspoonfuls.
Water—1 gallon.

At the present time the white fly infestations are mainly confined to the Maddington-Armadale zone and the hills orchards, although many backyard trees in the metropolitan area are also affected.

Many orange growers are aware that the citrus white fly in America is subject to attack by various fungus diseases and insect parasites and that quite reasonable control is sometimes achieved by such means. The question is often asked therefore why similar biological control cannot be effected in Western Australia. Actually our own white fly is by no means immune from the attack of natural enemies for a small beetle and a lacewing fly feed upon the eggs. Efforts to find more effective foreign parasites however, have so far proved unsuccessful and local growers, at least for the present, must rely mainly on chemical treatments for the control of this relatively new pest in our citrus groves.

DRIVES FOR FOX DESTRUCTION

By A. G. VEITCH, Supervising Vermin Control Officer

THE Agricultural Protection Board has received a number of requests from branches of the Farmers' Union throughout the agricultural areas, for assistance in organising fox drives in their respective areas prior to the lambing season. It would be as well to say something about the procedure necessary to successfully carry out a fox destruction drive.

Officers of the Agriculture Protection Board at the time of the year most suitable for fox destruction, are almost wholly engaged on organising and carrying out "1080" drives for rabbit eradication and as a result, unfortunately, cannot give much time towards helping in organising any other drive. It is therefore, very necessary for interested branches of the Farmers' Union to endeavour to co-operate with each other and organise drives in their areas. All assistance possible will be given by this Department to any such movement.

Firstly for any fox drive to be a success all farmers need to be sufficiently in-

terested to carry out efficient baiting of their properties. Full co-operation must be obtained otherwise it cannot succeed.

The excellent results obtained in the Toodyay area last year were brought about by the friendly and co-operative attitude of the farmers of that area towards the officers of this Department responsible for the organising of the fox drive.

Wherever drives are being planned, I would earnestly ask all concerned for that same spirit of enthusiasm and help.

The most important procedure in any drive is for wholesale baiting over fox-infested areas at the same time by all landholders. Spasmodic baiting will not attain worthwhile results.

Tablet alkaloid strychnine is the most commonly used poison, 1 tablet which contains ½ grain of strychnine being placed in each bait. These can consist of birds heads, liver, meat, dripping or fat, etc. They should be cut into approximately ½ inch cubes and the tablet inserted into the middle of the cube. Should powdered strychnine be used make sure none is spilt on the outside of the bait or the fox may reject it.

Foxes are particularly attracted to fat type baits and these have an added advantage of not being so attractive to ants as other baits.

All baits should be placed on a scent trail made by dragging an old carcass, singed sheepskin or anything that will attract the fox to the vicinity of where the baits are laid. If necessary, the baits can be lightly buried in the ground on the trail—this gives added protection from ants, and crows and affords some safeguard against poisoning of domestic dogs, although in this respect it is much safer to either keep your dog chained up or, if loose, muzzled whilst baits are around.

The trail should be made near spots that foxes frequent such as creek beds, watering places or around areas where they are known to live.

If making your own baits approximately 100 can be made from 1 lb. of dripping or fat if they are made up into ½ inch cubes; larger ones are not necessary. Dripping baits will melt away fairly quickly and some farmers prefer this type of bait for that reason; fat baits will last for some time.

Strychnine tablets should be available from your local Vermin Board at approximately 4s. 9d. for a bottle of 100. Ready-made baits consisting of suet impregnated with 1 tablet of strychnine can also be procured in W.A. for £6 10s. per 1,000. Your local Board will be able to advise you further in this regard. I would like to make it clear that this Department does not supply any poison, or ready-made baits. Many inquiries have been made about this in the past.

Alkaloid tablet strychnine is fairly slow-acting so do not be disappointed when visiting your trail after baiting if you do not find many dead foxes close by as they have been known to travel up to three miles after taking a bait. You no doubt will come across many carcasses in out of the way spots on your farm later when topdressing, seeding, etc. In Toodyay last year very few foxes were found dead on the trail after baiting, but when inquiries were made from only 35 farmers it was found that they had eventually located 208 dead foxes as the results of their baiting.

The Protection Board has paid a bonus on 221,000 fox scalps over the past five years which is a small indication of the numbers of foxes that are prevalent in this State and the resultant damage that is being done to bird life, lambs, etc.

The Protection Board now has two Mobile Units working on Crown land, reserves and forestry areas, laying poison baits for fox destruction which procedure is proving very popular with farmers adjoining these lands.

Where your local Farmers' Union branches are organising a fox drive, I would sincerely appeal for your wholehearted support. If you do your part and carry out the work required, you can be assured that this Department will carry out its share also by baiting all necessary reserves and Crown land in your area during the drive and in any other way practicable.