ECOLOGICAL ASPECTS OF WEED CONTROL IN PASTURES

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A knowledge of ecology, which is the study of the relationship between plants and their surroundings, is most desirable if the significance of the plants which we call weeds is to be fully appreciated. This significance was expressed very clearly by A.H. Cockayne when he wrote:-
"Under natural conditions no plant of any kind can be looked upon as a weed.
"In such circumstances the mastery of one plant over another and of one type of vegetation over another is only a natural sequence occurring through the aggressive plant or aggressive type being more suitable for the existing conditions of the locality than were the previous dominant types of vegetation. Wherever artificial conditions are introduced by man they should in all cases be such as favour the development of the plants that it is desired to grow, as otherwise they must increase the difficulty of reducing the growth of the undesirable elements to a minimum and thus intensify the weed problem." In other words, man, in his endeavour to replace one type of vegetation with another, creates a weed problem chiefly when his endeavours to make this change are not wholly successful.

As far as grassland is concerned, weeds present an ever-recurring problem, whether they appear as hakea in North Auckland, as Nassella tussock in Canterbury, as manuka in Otago, or as catsear or daisy in most people's closely-mown back lawns. In every case these weeds are present because conditions are more suitable for them to grow and thrive than they are for, what farming regards as, useful plants.

While there are a number of methods of control, the majority of these have one of two main and important effects. The first effect is purely temporary, while the second is permanent or nearly permanent.

(A) TEMPORARY CONTROL: The value of temporary control has been proved in connection with annual crops when the competing weeds have been so much reduced in quantity or vigour that the crop is allowed to grow to maturity relatively unhampered. Wild turnip in cereals, nighshade in peas, and fathen in linseed, can all be sufficiently reduced for a relatively short period to enable payable crops to be harvested. In each of the cases quoted the weeds concerned are of no importance in grassland, except during the period of establishment. Their permanent elimination is therefore of no major importance; they do not appear again until or unless the land is brought into cultivation.

In a few special types of grassland the temporary control of some weeds has proved to be of value. For example, the temporary control of docks in red clover seed-crops would be of great benefit to the seed producer. Permanent control would not be necessary, as the docks are of little importance in sheep pastures.

While there are instances of the value of temporary control in grassland, it is generally realised that such temporary control is of little value on by far the greater portion of the country's grasslands. Yet temporary control of weeds is the most common practice.

1. ON UNPLOUGHABLE HILL COUNTRY: The burning of shrubby unpalatable plants such as gorse is probably the commonest form of temporary control and at the same time the least satisfactory. Such burning usually fails to kill the parent plants, usually leaves a forest of more-or-less impenetrable sticks and nearly always lets in enough light to enable gorse seed to germinate in the bare ash below. Repeated burning will occasionally result in some reduction in gorse, but each burn also results in a loss of grass cover, a loss of plant competition and in a loss of humus in the soil. Burning alone can only result in more gorse and an impoverished soil. In general, the same applies to the burning of many other shrubby unpalatable weeds. The repeated burning

of manuka, hakea and heath ultimately results in more manuka, more hakea, and more heath.

The mere cutting or removal of the same group of plants will, as a rule, result in more-or-less parallel conditions, that is, the return to dominance of the undesirable plants. This applies to plants such as tauhinu, tutsan and lupins, which will all tend to re-establish if they are only cut, pulled or otherwise destroyed.

Two other weeds of hill country, namely, bracken fern and hard fern, burn readily enough, but burning alone results in temporary control only. Although hard fern regenerates most strongly on the perimeter of its well-known rings, bracken fern, because of its maze of underground stems, regenerates to no specific pattern but comes away with a dense, widespread and rapid growth, the control being only temporary.

2. ON PLOUGHABLE LAND: On ploughable land there is a wide variety of pasture weeds which under certain conditions tend to increase. Of these, the one that over the years has attracted most attention is ragwort. This is essentially a weed of waste places and of pastures that are grazed almost entirely by cattle. Similarly, oxeye daisy and broad-leaved dock are primarily weeds of cattle pastures. Rayless chamomile is particularly common in places such as pig runs. The removal or destruction of these weeds by various means, while exerting some measure of control, does not result in their permanent elimination.

While there are a number of weeds that are peculiar to cattle grazing there are relatively few that are peculiar to sheep grazing only. Plants such as catsear, storksbill, viper's buglos and St. John's wort are commonest on sheep pastures, largely on account of the fact that the type of land on which they are growing determines the type of farming practised.

A number of grassland weeds are purely transitory and come and go according to the conditions that are existing. Many of these plants are relatively palatable, and, even if they do establish, will not survive under normal grazing. Plants in this group include fennel, greater bindweed and cape weed.

The important point about all these weeds is that their removal by any means gives only temporary relief, as they can and will regenerate rapidly and thrive from shed seed or portions of surviving plants.

The foregoing comments regarding temporary control of weeds on different types of grassland have been made to emphasise the fact that such control is seldom of lasting value when attempted on its own and not accompanied by other measures that will render the control permanent. Such measures can only be regarded as a negative approach to weed control.

(B) PERMANENT CONTROL: Permanent control of weeds in pastures involves two main phases. First, there is the removal or destruction of the plant, and second, there is the changing of the habitat conditions to such a degree that the weeds are unable to dominate again.

The first is the necessary preliminary to the all-important second phase. The first phase may be carried out in a number of ways, such as cutting, burning, grubbing, or poisoning - the method adopted being determined by cost.

It is with regard to the second phase that an appreciation of the biological aspects of weed control is so desirable. Although in common parlance biological control infers the use of insects only, this is basically a matter of competition - plant with plant, plant with animal, and plant with insect. In general, biological control is both permanent and relatively cheap. Its cheapness is due to the fact that living and often mobile organisms do the work of control and in many cases produce revenue at the same time. The best example of this is in the control of bracken fern with sheep or cattle, in which control measures over very large areas have proved to be both possible and profitable.

Biological control embraces three main features:- (1) Control of plants by insects; (2) Control of plants by plants; (3) Control of plants by animals.

1. CONTROL OF PLANTS BY INSECTS: There is no doubt that control of weeds by insects has a great deal to commend it. Insects are mobile and spread from plant to plant themselves, and they increase or decrease in relation to the food supply available. In New Zealand partial or complete control of several weeds has been achieved. St. John's wort is well on the way to satisfactory control, the gorse weevil, which eats the seeds, is widely distributed, and the so-called "manuka blight" is spreading. However, it is often very difficult to locate an insect that will control the particular plant, and it is equally difficult to locate one that will not even harm other valuable plants. Consequently, while there is always a possibility of an increase in the insect control of weeds, other means must be persevered with until such insects have been introduced successfully.

It is necessary to bear in mind that the control of plants by insects does not necessarily mean that the weed problem in that particular place has been ended. This is exemplified by what is happening in connection with the "manuka blight", which has received so much publicity lately. In many cases there is no question that the manuka is dying out, but in a great many cases it is being replaced not by good pasture but by other and possibly worse weeds, such as blackberry and gorse. This is an example of the insect completing the first phase of control, namely, the elimination of the weed. It is also an example of the failure to change conditions to suit the growth of the desirable plants.

2. CONTROL OF PLANTS BY PLANTS: In all living associations there is constant strife between individuals for supremacy. The individuals that survive are those best fitted to live under the existing conditions.

The dominance of manuka, pennyroyal, hairgrass, Nassella tussock, and even flatweeds in lawns is an indication that those plants are better fitted to live there than are the other plants that are gradually disappearing from the association.

In the absence of grazing, a tall-growing, shade-producing vegetation tends to replace a shorter-growing vegetation. This principle is recognised by those people who plant trees in order to smother out gorse. It should be remembered, however, that the tall vegetation does not necessarily have to be many times greater in height than the shorter vegetation. For example, cocksfoot and red clover, if left ungrazed, will smother ryegrass and white clover. Tall fescue will smother cocksfoot, and gorse will smother out tall fescue. Many native trees will smother out gorse, provided that there is no burning. Many similar sequences can be seen. It is of more than passing interest to note that hard fern, which thrives under close grazing, will ultimately give way to the taller-growing, shade-producing bracken fern.

It has been observed that, where conditions of moisture and fertility are suitable for the vigorous growth of cocksfoot, this grass will reduce the spread of Nassella tussock. It is well worth while endeavouring to locate some plant that is easy to establish and that will grow appreciably taller than will Nassella tussock. While trees appear, at the moment, to be the only means of smothering Nassella tussock, it is not at all unlikely that some other type of smother, much easier to establish, will be found.

One of the most important means of encouraging plant competition along the desired lines is by stimulating the desirable plants at the expense of the undesirable plants. This is the underlying principle in the maintenance of weed-free lawns. The grass is encouraged to form a dense mat on a sour soil. The weeds are unable to either establish or survive under such conditions. In pasture land the approach is on somewhat parallel lines, and has been the underlying feature of pasture improvement throughout the country.

Grassland improvement is based on the knowledge that a vigorous high-producing pasture tends to defeat many of our shrubby unpalatable weeds. This objective is attained, in part at least, by the stimulation of the desirable plants by the application of lime and phosphate. This initiates a change in conditions that assists materially in the complete suppression of weeds such as manuka and tauhinu. One only needs to observe the common spectacle of adjoining paddocks, one with poor pasture and gorse and the other with good pasture and no gorse, to realise this fact.

It is well recognised that when sowing down pasture, a good strike is a valuable weed deterrent, whether the weeds are rushes or pennyroyal, gorse or bracken fern. This is essentially the stimulation of competition, or, in other words, the creation of a biological barrier against the invasion of undesirable plants. The foregoing should serve to illustrate the necessity for the changing of conditions if weed control is to be effective. If gorse, fern, manuka, or any other weeds are to be eliminated and kept out of the pastures, then conditions must be created to enable the more desirable plants to flourish. If this cannot be done, and often it cannot, then frequent temporary control measures must be taken. Therein lies one of the major problems of weed control on hill country.

3. CONTROL OF PLANTS BY ANIMALS: While the control of plants by other plants is in itself important, the control of plants by animals is also very important, for two reasons. First, the effect of animals on plants must be considered, as it is an essential feature of grassland farming. Second, they are important, in that various animals with varying types of management can be used to make very important modification in plant associations.

Probably the most striking weed control effect exerted by animals is that in connection with ragwort. Where cattle alone are carried ragwort will thrive, but where from 4 to 10 sheep are carried to each cattle beast then ragwort becomes of little account. As long as fat lamb production is profitable, sufficient sheep can be carried on ragwort country to enable this weed to be kept under control.

One of the essential features in the control of bracken fern is the use of stock. Initial control is gained by burning; subsequent control is secured by the sowing of grass and clover, not only to provide feed for the stock but also to induce them to forage and incidentally destroy the fern fronds.

With hard fern and bibi-bidi the process is rather different. Both of these plants root from overground runners. The spelling of pastures results in grass growth that in turn causes the forming runners to grow up amongst the grass, thus preventing them from rooting. Subsequent feeding, particularly with cattle, tends to destroy these uplifted runners and thus prevents the weeds from spreading.

It is generally accepted that broad-leaved docks are weeds of dairy pastures only. This is due largely to the fact that dairy pastures are usually spelled more frequently than are sheep pastures. Close continuous grazing by sheep will control docks, but under rotational grazing with sheep docks are almost as abundant as they are in dairy pastures.

It should be recognised, however, that by altering the conditions to favour the elimination of one weed it is quite possible to create conditions that suit another. For example, much of the Hawkes Bay hill country was at one time covered with bracken fern. This was eliminated, and for many years danthonia took its place. In recent years, however, topdressing has tended to convert the danthonia pastures into ones dominated by subterranean clover and ryegrass. In addition to these species, storksbill has increased tremendously, and variegated thistle, which tends to come and go with the seasons, is on the increase as well. This instances the weed change from bracken fern to storksbill due to alteration in conditions of stock management and soil fertility.

In this paper an endeavour has been made to emphasise the fact that

weed control in pasture is a complex biological problem and can be best achieved by the creation and maintenance of "biological barriers" which will ensure that the return to dominance of specific weeds will not take place. The reason why we still have many weeds, especially on hill or unploughable country, is that the cost of creating and maintaining the barriers is too high in relation to the returns obtained.

QUESTIONS AND DISCUSSION

THE CHAIRMAN: You refer to the fact that where manuka is killed by the blight, blackberry follows: wouldn't that be largely neglect by those owners? Obviously the seed would be brought there by birds while the manuka was still there.

MR. SAXBY: Yes, I would agree with that. When the first phase is completed, it is up to the farmer to see that blackberry and other similar types do not come in. I have seen adjoining paddocks where good pasture is replacing manuka. Where fertility is very low manuka is being replaced by other plants. If the manuka blight is to do any good, and that is a very controversial point, it is certainly up to the person on whose property the manuka is dying out to take full advantage of it.

MR. GREEN (New South Wales): The practice we adopt in New South Wales is this: we know which are the fern-infested areas, and when we are top-dressing we put stock on those areas alone.

MR. SAXBY: When I was talking of bracken fern I was thinking all the time of ploughable country. Generally speaking, when you get bracken fern on a paddock, the rest of the paddock is good for cultivation. The same on hill country, except that you have burning, ploughing, grazing and encouragement of pastures.

MR. FRICKE (Tasmania): The practice adopted by a few graziers in Tasmania, where they have broken in new patches, is this:- They are fairly heavy users of wheat as winter feed for sheep and they throw it into the bracken. The sheep have to work into the bracken and this keeps the bracken down.

MR. SAXBY: As far as wheat is concerned our biggest bracken fern problems are in the North Island, where there is virtually no wheat grown, and a great deal of bracken fern is on country where hay is required mostly for feeding cattle. In the South Island there is a lot of bracken, but a great deal of it on poor country where it is a question of whether it will pay the farmer to clear it. The idea would be alright if we had wheat growing there.

MR. BLACK (Crop Research Division): There is a similar practice to that mentioned by Mr. Fricke carried on near Ruatoria where stock are hungry for salt - scatter it on the bracken. This is quite effective for eliminating patches.

MR. SAXBY: Anything that induces stock on those areas is most desirable.

MR. A. DINGWALL (Christchurch): Mr. Johnson, I think it is, of Wellington, has been controlling bracken by concentrating sheep over the winter feeding period on patches of it. He appears to have been quite successful with this method. I don't think he is quite down to the economics of it yet, but it might be practicable.

MR. SAXBY: I have heard that. The question of cost in relation to return was discussed at a meeting I was at and the impression was that it had not been going long enough to decide.

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