TECHNIQUES OF WEED CONTROL IN RELATION TO LAND USE - ROUGH GRAZINGS AND NON-AGRICULTURAL SITUATIONS

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Perhaps the wisest approach for any person discussing weeds and their control in Australia is not to generalize. We have such a wide range of climates, environments, political influences and so on, that as fast as a principle can be proposed it can be challenged, usually successfully.

Perhaps it may be best to look first at why and how we want to change the status of the so-called weed. I would suggest that there are two general philosophies.

In the simplest of these the weed competes with cultivated plants and so reduces the yield of the land. Ideally here we look for a method of control which will give a maximum crop yield for a minimum cost and the long-term fate of the weed elsewhere is usually of secondary importance. Because of the relationship between the cost of control and the yield per unit area, it is possible, within reason, to spend very large amounts of money on weed control with the knowledge, or perhaps hope, that it can be recouped when the crop is sold. This of course means that for the researcher the choice of control method is very wide, and exotic and perhaps expensive techniques can be considered.

In the other case (and I feel that this is our field in this session) productivity of the land is of course of primary importance, but also equal consideration has to be given to the future status of the weed. In most cases cost of treatment is a limiting factor, and the researcher has to cope with social and legislation problems as well as purely scientific ones. These points arise several times in papers presented for this session but in no case can clear-cut guidance be given.

Even more complex are those cases where the weed is not only an important pest to the grazing industry, but is also a declared noxious weed. This declaration carries with it the legal responsibility for the landholder to 'eradicate' the plant wherever it occurs, and in many cases even 'control' is a

practical impossibility. The legislative side of this will be discussed in a later session but I feel we could try to come up with some practical help for weed scientists asked to investigate the efficient use of land under these conditions.

Before I go on to discussing the points raised by our contributors, I would like to emphasize that researchers in northern Australia face an entirely different environment from those in southern regions, and in many respects results obtained in research in the southern, mediterranean climates cannot be extrapolated to northern conditions and, of course, vice versa. Further, land usage, particularly on the pastoral scene, is quite different both in terms of area of holdings and degree of development and the same weed may pose quite separate problems in different areas. In other words, while we can enunciate principles of weed control at this Conference we must regard them as what they are - generalities - but truly valuable for all that.

Biological control is of course the layman's magnificent dream, but in hard fact the number of successes, and the degrees of success, are limited to date, except for exceptional cases like the prickly pears. What can we expect of this technique? Eradication of the weed is unlikely and undesirable, which leaves suppression which can vary in different cases and in different environments from virtually complete, to insignificant. In other words, biological control of a weed should be regarded as a complementary study to be undertaken in context with other investigations rather than separately as an end unto itself. This is an expanding field of research in Australia and the number of contributions to this Conference I feel does not reflect the amount of work in progress. There is a note of optimism in Willson's paper, but it also indicates that biological control is a long-term technique which generally requires the involvement of several complementing organisms as well as some assistance from man in the form of competing beneficial plants and the careful management of stock. The use of plant pathogens in the future is worthy of greater consideration, as attested by Schmidl with his report of the apparent success of the rust disease on skeleton weed. There are many problems associated with the use of plant diseases but the potential of these factors is so great that further research seems well warranted. A criticism which has been levelled at biological control investigations in Australia in the past is that trial and error techniques have been favoured above comprehensive preliminary investigations. While there is always heavy social

and political pressure for urgency in these programs the observations by Weiss would indicate that a thorough knowledge of the biology of the candidate weed could give an indication of the type of damage most likely to significantly suppress it.

On reading through many of the contributions to this session I get the feeling that there is a sense of frustration in that in non-improved environments there are so many variables and restrictions that any general recommendation for control of a weed is at best a compromise. For a single property the adviser could probably formulate a successful management plan which would include the integration of chemical treatment and pasture and grazing management, but the details would vary from farm to farm and area to area. Scarsbrick makes this point in his duscussion of the lovegrass problem and Suckling *et al.* have doubts about the justification of controlling horehound in all situations in marginal land. Some hope for the management of bracken-infested pastures is given by Jacklin, Combellack and Martin in their papers, but again the economy of the operation is its limiting factor, not its efficiency. This is not to denigrate the value of these investigations but to emphasize the fact that in the rough grazing situation improvement of property management and usage as a whole is probably more important than concentration of efforts on a single weed problem. Scarsbrick probably has a good point when he suggests that the landholder should seriously consider 'living with' a weed as an alternative to attempting to control it.

The cost of attempting to bring under control a widely dispersed, declared noxious weed growing in a rough grazing situation is indicated by Armstrong and doubts can be expressed about the long-term justification of spending such relatively enormous sums of money even if the plant is controlled. However, decisions to initiate programs such as this are usually political ones, and may be at variance with purely scientific opinion and "theirs but to do and die"!

While Dowling at this stage does not offer firm recommendations on the use of what are really property management techniques as alternatives to chemicals, I feel that his approach is a logical and rational one in areas where the country is probably only suitable for rough grazing - and in Australia we must face the fact that most of our prime country is now either developed or is being brought under intensive use, and with a projected population increase much of the vast area of country now considered rough or marginal will need to be brought under efficient

production. We can no longer afford the luxury of exploiting newly cleared land and moving on somewhere else when it is exhausted.

The advantages of the prior study of the biology of a weed before looking at control techniques are brought out in several papers including those of Combellack (bracken), Martin (bracken), Harvey (Harrisia cactus) and Weiss (spiny emex). The approach by Harvey is worthy of further consideration when suggesting that many of our old tried and true herbicides such as the phenoxy group can be modified, either by using different salts or in formulation, to increase their efficiency against specific hard-to-kill weeds. It would seem that this line of research will probably need to be followed more by public service scientists than by those in industry as all of these materials are well out of patent time and no legal protection for a marketing right would be expected. However, as we have been told that the number of new herbicides which may become available in the future is to be severely limited because of the costs of development and registration, perhaps it would be a good idea to 're-process the mullock heaps'.

Of interest in Harvey's second paper is his comment about application methods using hexaflurate. Trials now 6 months old show this material applied from the air at 20 ℓ/ha through a canopy of trees and an under-canopy of brush is effectively controlling Harrisia cactus without any discernible damage to other vegetation. Of such selectivity are dreams made!

The problem of roadside weeds such as the one discussed by Marley is one which causes many headaches in all sorts of situations and again the cost of treatment is the limiting factor when large areas are involved. Further, this is a no-man's-land where, while adjoining landholders may benefit from the control of the weed, they have no legal obligation, in most States, to treat it themselves. In Queensland responsibility for treatment of roadsides lies with the local authorities, who are reluctant to act on a plant which is not a declared noxious weed and which probably only affects one section of the community. I feel in a situation like this the researcher must consider motivation and practicability to the persons charged with its control even at a cost to efficiency and this is what Marley has done.

A related problem lies in nature reserves as described by Yorston *et al.* and Lane. Problems in these situations are

compounded by the reluctance of the 'authorities' to allow the large-scale use of chemicals or other non-selective control measures or to significantly change the plant community even when this may remove or minimize the weed problem. And of course these projects do not usually attract worthwhile endowments. The approach by these researchers to manipulate the plant community by detailed removal of unwanted species and their replacement by desirable ones is certainly long term, but it will probably have the effect in the long run of developing a healthy community which will protect itself. Fire, as suggested by Lane, is a common component in many Australian situations and its judicious use may both control the weed and encourage native plants. One is led to wonder whether the protection from fire in some reserves may not by itself change the environment to allow domination by alien species.

I feel that there is something to learn from the experiences of Boardman *et al.* in their weed management, rather than weed elimination, approach. While it is not possible to draw close parallels between rough grazing and forestry situations, I feel it is the long-term approach perhaps involving planned property management which will give the greater dividends, and weed control should be regarded as part of this and not as an imposition which must be treated as something separate.

From my experience too many landholders are inclined to regard the invasion of weeds as an act of God or Government and that it is therefore the responsibility of these 'authorities' to remove them. Perhaps this point can be discussed in the later session devoted to extension, but in the rough grazing scene motivation to take action against a weed is usually the primary requirement and one which the field researcher must take into account in his deliberations.

The paper by Bowmer *et al.*, while it reports research in a field quite remote from the relatively low yield areas we have been discussing, does report incorporation of a number of desirable features. Biological studies indicate areas of susceptibility. Chemicals recommended are non-residual and their application is timed to coincide with manipulation of water flow, seed susceptibility and land utilization. In other words, the principles involved in this investigation - the integration of knowledge of biology, projected land use, physical factors, and weed killers - are those which I feel should be accepted when control of weeds in a rough grazing situation are contemplated.

REVIEW OF DISCUSSION

In general discussion the Conference agreed that this was a most difficult field in which to postulate principles of weed control and that, while it was probably worth while looking closely at general recommendations for smaller areas, this was probably impracticable for larger ones. It was suggested that in many circumstances where weed growth was a limiting factor a critical look should be given to the land use or to the crop or pasture being grown. It was suggested that rather than trying to maintain a marginal yield it might be more productive to change the use of the land drastically - planting of forest was proposed as one solution. The acceptance that improved land management practices were of greater value than weed control measures on their own was most marked.

The general attitude of Conference delegates towards biological control of weeds did not seem enthusiastic and there appeared to be a general lack of knowledge of the principles involved. While it was agreed that integration of biological methods with other control techniques was desirable, one was left with the feeling that most delegates felt that this field was one to leave to the 'experts' rather than become involved themselves. Examples of the value of this technique for use in conjunction with chemical and other control measures were given by workers in the field and practical details, including costs, were discussed. An assessment of the present status of the skeleton weed biological control program was given by Dr J.M. Cullen. A suggestion that goats could be used to change the environmental balance in some weedy situations was made but did not seem to be favoured, except for very limited situations, because of the reputed pasture degradation effects of the long-term grazing of these animals.

Considerable interest was aroused by the suggestion that further uses might be found for herbicides which have been available for many years but which have been displaced to varying degrees by the subsequent marketing of wide-spectrum and more active materials. While amine 2,4-D and 2,4,5-T esters are still 'bread and butter' herbicides, it was suggested that other phenoxy formulations might have a use, particularly to 'knock down' undesirable vegetation to allow the successful competition by beneficial species. The low price of these materials also made them attractive when the fact that cost of herbicides was often the limiting factor in pastoral situations

was taken into account. Delegates representing chemical companies were doubtful that the list of old materials for reconsideration could be widened to any extent because of difficulties in obtaining basic materials and the reluctance of a manufacturer or formulator to produce a herbicide which might have a very limited sales volume.

The problems surrounding the control of roadside vegetation aroused very spirited discussion in this and subsequent sessions, particularly those of Extension and Legislation. The limits imposed on treatment of weeds in these situations by costs, legal responsibility and practicability caused a number of novel solutions to be proposed, and the suggestion that roads should be engineered to reduce or obviate weed problems was well received. While it was generally accepted that the increased engineering of shoulders and water tables would be impracticable in more remote and difficult situations, there was general agreement that this practice should be recommended where feasible. Another well-received suggestion was that roadside vegetation could probably be left undisturbed in many areas and that the clearing of weeds for purely cosmetic reasons was probably wasteful, unnecessary and undesirable. During discussion of the ecology of roadsides it was pointed out that in many areas these were the only avenues for dispersal of native animals and that clearing of unwanted vegetation could be regarded as harmful to the district's fauna. The wisdom and desirability of clearing declared noxious weeds from roadsides was seriously questioned in situations where they did not offer a direct threat to surrounding pastures or cultivation.

To summarize, the following attitudes were very apparent:

1. There was a distinct appreciation of the 'property management' rather than a 'control or eradication' approach to weed problems.

2. Integration of several weed control measures was favoured above the use of a single technique, and particularly above chemical measures alone.

3. The use of chemicals was still favoured and very considerable reliance was being put on the development and availability of new herbicides.

4. Biological control was generally accepted as a very valuable concept, but there seemed to be a lack of knowledge of principles, methods of application and costs.

5. A more liberal attitude towards roadside weeds was favoured except in areas where they constituted a traffic hazard or were a threat to adjoining properties.

6. A common-sense approach was favoured towards weeds in nature reserve situations (including National Parks) and it was considered that all methods of control, including chemicals, could be used provided the long-term aim was the development of a self-sustaining plant community.