MANAGING GRASS WEEDS IN A ROTATIONAL CROPPING SYSTEM

R.E. Bentley[1]
ICI Crop Care, Adelaide, S.A. 5000

Summary. The relationship between grass weeds and root diseases of cereals has been well demonstrated by various researchers (1) (2) in Australia. By removing grass weeds with a selective herbicide from the break crop or pasture, higher cereal yields can be obtained from the following cereal crop(s).

This practice, despite the benefits, could lead to problems if grasses became resistant to the selective herbicides. This could occur if selective herbicides from the same chemical family were used repetitively in both crops and pastures.(3)

To secure the benefits to cereal crops of grass control in pastures and avoid the risk of developing herbicide resistance in the grass, it is advised that a broader range of control options be utilized in all phases of the rotation. This would include a range of chemical control methods, grazing, crop competition and hay cutting.

Selective chemical control is the preferred method in some situations, but it should be complimented and alternated with the other methods.

INTRODUCTION

With an increase in herbicide resistance likely if the same selective chemical control methods are used repeatedly, it is imperative that a strategy encompassing a broader range of control measures be implemented. While the strategy is not proven, it is better that change be implemented to try and avoid a problem, rather than allow resistance to develop.

GRASSES IN THE FARMING SYSTEM

It is believed (A. Singh, pers. comm. 1989) that grasses will continue to have a role in farming systems. Farmers sow oats and in the past ryegrass has been sown regularly. While rye grass has a problem with annual ryegrass toxicity (4), it is possible that this problem will be overcome and farmers will once again consider sowing ryegrass. Grasses can provide feed and valuable fibre in a balanced livestock diet. (A. Singh, pers. comm. 1989) Grass root systems have also been recognised as having beneficial effects on soil structure. (5) Unfortunately the above benefits are often outweighed by other detrimental features when grasses are considered in a full crop rotational cycle. These features include:

(1) The ability of grasses to host cereal root diseases (1) .
(2) The competitive nature of grass weeds in the following crop cycle (6).
(3) The damaging effects of grass seeds on animal health and the amount and quality of animal products - meat, hides and wool (7).
(4) The development of toxic ryegrass heads as a result of a bacterial infestation of nematodes found in ryegrass seed heads. This toxin can be lethal if consumed by livestock (4).

The development of selective grass herbicides to control the grasses in the non-cereal phase heralded a new era in crop and animal productivity. Grasses can be retained when and where they are beneficial and removed when their continued presence would lead to production losses in the future.

[1] The opinions expressed in this paper belong to the author, and are not to be interpreted as the agreed position of ICI Crop Care in Australia.

THE THREAT OF RESISTANCE

The use of selective herbicidal grass control is now threatened by the development of herbicide resistance in annual ryegrass and wild oats. Resistance is encouraged by repetitive use of chemically related herbicides (3). Therefore, a strategy must be developed whereby a broader range of chemical and non chemical controls is implemented in all phases of the cropping rotation.

The concepts outlined below are suggested as being suitable control measures to include in a broader strategy.

The number of measures required can not be determined with our present level of knowledge. It is better, however, to avoid resistance than to deal with it once it is present. In most cases the control measures suggested are cost effective, so will not necessarily lead to higher cost weed control. The end result is confidence in efficacious selective weed control when it is clearly required.

THE RANGE OF WEED CONTROL MEASURES AVAILABLE

Selective herbicides. The application of these is justified in the following situations.

(i) Grass weeds present in crop will reduce crop yield sufficiently to reduce nett profit as compared to the yield after a selective herbicide has been applied.
(ii) Grass weeds present in crop or pasture will host diseases that will reduce yield of planned following crops.
(iii) The summer grazing value will be reduced by the presence of grass weeds.
(iv) The higher legume pasture seed set obtainable following grass removal will secure a regenerating pasture in the year following cereal crop.

Other chemical control measures

(i) Post seeding application of residual herbicides. The use of simazine in legumes and diuron in legume or cereals in this manner when utilized in a limited soil disturbance system can give substantial weed control. (3). The objective is to keep weed seeds on the surface where the residual herbicide will have maximum effect. The residual can be complimented by mixing with a dessicant herbicide to ensure control of weeds that have germinated prior to crop emergence.
(ii) The use of dessicant herbicide for seed set control (8). Where low populations of grass are present and the only objective is weed control or where the objective is to lock protein into the grass component prior to maturity for grazing utilization, this is a preferential option.
(iii) Dessication of legume or other podded crops prior to harvest. This technique has been employed to advance harvesting and to improve quality of harvested products (9). If the dessicant action extended to reducing weed seed viability the practice may increase. It must be noted this concept has not been proven.
(iv) A herbicide regularly used for residual weed control in tree and vine crops and amenity horticulture, oxyfluorfen, has been proposed as an in crop weed control method for some problem weeds in high rainfall areas (10). This herbicide forms an impenetrable herbicide barrier that controls germinating weeds. The barrier is broken by disturbing the barrier with cultivation. A narrow point seeding system would break the barrier along the seeding row, but leave the barrier intact between the rows to control weeds.
(v) There is potential for new herbicides to be developed.
(vi) There is a possibility for the weed gene pool to be manipulated to convert resistant grass populations back to herbicide susceptible enabling selective control to re-commence. (J. Matthews, pers.comm., 1989).

(vii) Delaying seeding and sowing crops such as safflower in the spring following a short chemical fallow will allow a change in the pattern of herbicide use to match weed species expected to germinate at this later date.

Non chemical control measures.

(i) Haycutting of pasture or sown crop species will give effective control of most weed species if timing is correct. If paddocks designated for hay cutting are rotated around the farm, an additional control measure will have been included in the weed control programme.
(ii) By ensuring an adequate clover seed population, both pasture productivity and competition with weeds will be improved.
(iii) In many situations, higher stocking rates than have traditionally been carried are justified (11). This will reduce the domination of grass weeds and increase the proportion of clover (12).
(iv) Increasing seeding rates in the cereal phase; particularly in higher rainfall districts. Competition is an effective means of weed control and at higher crop densities the relationship between weed numbers and economics of weed control thresholds should change (13).

CONCLUSIONS

The benefits of selective grass control have been weel proven. With the threat of herbicide resistance growing a defensive strategy is required to extend the life of the presently available herbicides. The range of alternative and complimentary control measures described in this paper may be sufficient to achieve this purpose. If all techniques are employed, herbicide resistance may be prevented.

REFERENCES

1. MacNish, G.C. and Nicholas, D.A. 1987. Aust. J. of Agric. Research 38, 1011-1018.
2. Roget D.K., Venn, N.R. and Rovira, A.D. 1987. Aust. J. or Exp. Agric. 27, 425-435.
3. Powles, S.B. and Howat, P.D. 1990. Weed Technology 4, 179-185.
4. Price, P.C., Fisher, J.M. and Kerr, A. 1979. Annals of Applied Bioloty 91, 359-369.
5. Tisdall, J.M., and Oades, J.M. 1979. Aust. J. of Soil Res. 17, 429-441.
6. Williams, J.D., Leigh, J.H., Wimbush, D.J. and Holgate, M.D. 1986. Proc. Annual Grass Weeds in Winter Crops Workshop, Adelaide. 55-59.
7. Heap, J.W. and Stephenson, D.W. 1986. Proc. Annual Grass Weeds in Winter Crops Workshop, Adelaide p. 180.
8. Smart, W.L. 1986. Proc. Annual Grass Weeds in Winter Crops Workshop, Adelaide 13-26.
9. Croshey, J.F.H. 1961. Weed Res. 1, 68-77.
10. Fua, J.M., Wright, T., and Crocker, C. 1984. ICI Aust. Op. Pty. Ltd. Technical Memorandum.
11. Carter, E.D. 1968. Proc. Aust. Grasslands Conf., Perth, Vol. 1, Sect. 1a 9-11.
12. Carter, E.D. 1977. Proc. XIII Int. Grasslands Congress, Leipzig, G.D.R., Section 6, 348-354.
13. Medd, R.W., Auld, B.A., Kemp, D.R. and Murison, R.D. 1985. Aust. J. of Agric. Res. 36, 361-371.