AN EVALUATION OF ADDITIVES TO PARAQUAT FOR THE CONTROL OF BARLEY GRASS

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Summary

Trials are reported which have evaluated additives to paraquat for the control of barley grass (*Hordeum murinum*). The mixtures have been measured against the parameters of vegetative stage, and residual activity, seed viability reduction and clover tolerance. In the trials described, simazine 1 lb and 2 lb a.i. per acre added to paraquat 0.5 lb a.i. per acre most closely approached the ideal. Of the new chemicals NIA 11092 and PP493 warrant further testing as additives.

INTRODUCTION

THE ACCEPTANCE by farmers of barley grass (*Hordeum murinum*) control programmes based on paraquat applied at the green seed-head stage, demonstrates the importance of offering farmers a method of control which can be used when the extent of the problem can be recognized.

Programmes which require application of chemicals such as 2,2-DPA at the vegetative stage, when identification is difficult, have not been as widely used, despite the fact that 2,2-DPA is currently the most cost-efficient chemical for barley grass control at the vegetative stage.

A unique feature of paraquat is its activity in reducing seed viability when applied in the green seed-head stage (Meeklah, 1964; Thompson, 1964).

A limitation to control programmes based solely on paraquat, however, is that viable seeds can escape application for each of the following reasons:

- (1) Early seed setting by some plants.
- (2) Protection of viable seed under logs.
- (3) Reintroduction by livestock and hay.

There is therefore a need for some residual activity to control subsequent seedlings. The recommended programme for paraquat is to simulate the properties of a residual chemical by repeating application throughout the year. Whilst this programme is effective if properly carried out, it is rather demanding. The alternative approach would be to add a residual herbicide to paraquat. The ideal mixture of paraquat plus residual would have the following properties: enable vegetative phase activity to be retained or increased; retain or increase paraquat's effect to reduce seed viability; provide residual activity for a period at least from flowering to autumn germination, and retain clover tolerance.

This paper describes screening trials laid down to investigate the addition of residual herbicides to paraquat for barley grass control. (All rates are in lb a.i. per acre.)

RESULTS

Screening trials were laid down to test for the parameters of the ideal mixture as described previously.

VEGETATIVE PHASE ACTIVITY

Treatments and results are given in Table 1.

TABLE 1: EFFECT OF MIXTURE ON BARLEY GRASS APPLIED AT VEGETATIVE STAGE

(Assessed 2 to 3 months after treatment)

<i>Treatment (lb)</i>	<i>Hawke's Bay September Trial Estimated % Cover</i>	<i>Waikato September Trial Chemical Effect*</i>
paraquat 0.5	20	8
paraquat 1.0	5	8
paraquat 0.5/prometon 0.1		7
paraquat 0.5/prometon 0.5		8
paraquat 0.5/prometon 1.0	5	9
paraquat 0.5/prometon 2.0	0	
paraquat 0.5/diuron 0.1		7
paraquat 0.5/diuron 0.5		9
paraquat 0.5/diuron 1.0	5	10
paraquat 0.5/diuron 2.0	0	
paraquat 0.5/PP493† 0.1	20	7
paraquat 0.5/PP493 0.5	0	7
paraquat 0.5/PP493 1.0	0	8
paraquat 0.5/VCS 438 0.1		8
paraquat 0.5/VCS 438 0.5	15	8
paraquat 0.5/VCS 1.0	10	9
paraquat 0.5/VCS 2.0	5	
paraquat 0.5/atrazine 0.1		9
paraquat 0.5/atrazine 0.5		10
paraquat 0.5/atrazine 1.0		10
paraquat 0.5/simazine 1.0	0	
paraquat 0.5/simazine 2.0	0	
Control	35	

*10 = Complete control, 0 = No effect

†PP493 = Haloxydine

In the Hawke's Bay trial, all of the additives improved the effectiveness of paraquat at the vegetative stage, particularly prometon and diuron 2 lb, PP493 0.5 and 1 lb, and simazine 1 and 2 lb.

In the Waikato trial, the most promising additives were diuron at 1 lb and atrazine 0.5 and 1 lb.

RESIDUAL ACTIVITY

An assessment made six months after treatment and after the 1969-70 drought had broken, gives a guide to the residual activity of the mixtures in the Hawke's Bay and Waikato trials.

In the Hawke's Bay trial, only the 2 lb simazine and 1 lb PP493 treatments had no barley grass seedlings in them.

In the Waikato trial, barley grass seedlings were present on all plots after the drought had broken. However, there were differences in abundance of seedlings. Paraquat plus the additives atrazine 0.5 and 1 lb, and PP493 1 lb were the mixtures containing the least. In this trial, two applications of paraquat, September 1 lb, and January 0.5 lb, was the most effective treatment.

SEED VIABILITY

Paraquat alone and in combination with some residual herbicides was applied to barley grass in the green seed-head stage and a measure of seed viability made (Table 2).

TABLE 2: EFFECT OF PARAQUAT AND MIXTURES ON BARLEY GRASS SEED VIABILITY

<i>Treatment (lb)</i>	% Germination	
	10 days	20 days
Control	68	71
paraquat 0.5	12	17
paraquat 0.5/NIA 11092 1.0	9	8
paraquat 0.5/diuron 1.0	3	6
paraquat 0.5/atrazine 1.0	3	3
paraquat 1.0	0	0

The effect of paraquat at 1 lb on reducing seed viability was confirmed. At paraquat 0.5 lb, germination was reduced to 17%. Atrazine, diuron and NIA 11092 at 1 lb added to paraquat 0.5 lb, further reduced germination to 3, 6 and 8%, respectively.

CLOVER TOLERANCE

Table 3 shows clover tolerance of the mixtures which have the highest percentage barley grass control at the vegetative stage in the Hawke's Bay trial, compared with paraquat alone.

TABLE 3: CLOVER TOLERANCE

(Cover 5 months after treatment)

<i>Treatment (lb)</i>	% Clover Cover
paraquat 0.5	10
paraquat 1.0	15
paraquat 0.5/prometon 2.0	10
paraquat 0.5/diuron 2.0	0
paraquat 0.5/PP493 0.5	5
paraquat 0.5/PP493 1.0	0
paraquat 0.5/simazine 1.0	10
paraquat 0.5/simazine 2.0	10
Control	5

Simazine 1 and 2 lb and prometon 2 lb have given a good level of clover tolerance, whilst diuron 2 lb and PP493 0.5 and 1 lb have been more severe, reversing the characteristic paraquat effect on clover.

In the Waikato green seed-head trial there was the opportunity to assess clover tolerance of further additives. Of diuron, atrazine and NIA 11092, only the latter produced acceptable clover tolerance.

DISCUSSION OF RESULTS

The parameters by which additives to paraquat should be measured for control of barley grass are:

- (1) Vegetative stage activity.
- (2) Residual activity.
- (3) Seed viability reduction.
- (4) Clover tolerance.

In the trials described, simazine most closely approached the ideal. Added to paraquat, simazine at 1 to 2 lb showed vegetative stage activity, up to six months' residual activity, and acceptable clover tolerance. Paraquat at 0.5 lb reduced barley grass germination, the addition of the other triazine, atrazine, further reduced seed viability, but only at paraquat 1 lb was germination nil. Of the newer chemicals, NIA 11092 and PP493 warrant further testing.

REFERENCES

- Meeklah, F. A., 1964: *Proc. 17th N.Z. Weed & Pest Control Conf.*: 28.
Thompson, F. B., 1964: *Proc. 17th N.Z. Weed & Pest Control Conf.*: 37.