BARLEY GRASS CONTROL: EVALUATION OF INITIAL AND SEQUENTIAL APPLICATIONS OF HERBICIDE MIXTURES

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Summary

Four trials to look at barley grass (*Hordeum murinum*) control were laid down in the South Island between October 1970 and September 1971. In two of the trials plots were split and resprayed in an attempt to establish an elimination programme. Paraquat-triazine mixtures were the most effective in reducing the barley grass population, even to the point of elimination after retreatment. Paraquat-carbetamide mixtures did not quite achieve the same level of control as paraquat-triazines but did show a good clover response and suitable mixtures may have sufficient selectivity for use in a pasture situation.

INTRODUCTION

CHEMICAL control of barley grass does not generally eliminate the problem and thus spraying becomes an annual chore. Often this failure to control is due to the critical timing required for application (Palmer and Williams, 1970).

Trials were established in order to evaluate chemical mixtures that would make the control technique less demanding and also to determine what programme would be necessary to eliminate barley grass for a longer term.

EXPERIMENTAL METHOD AND RESULTS

Details of the four trials are given in Table 1.

TABLE 1: TRIAL DETAILS

	A	B	C	D
Location	Broomfield N. Canterbury	Gimmerburn C. Otago	Gimmerburn C. Otago	Gimmerburn C. Otago
Soil type	Waipara Yellow-grey earth	Wetherburn/ Becks Brown- grey earth	Wetherburn/ Becks Brown- grey earth	Becks Brown- grey earth
Plot size	7½ m × 2½ m	7½ m × 2½ m	15 m × 2½ m	15 m × 2½ m
Replicates	4	4	4	4
Spray dates	19/10/70 24/4/71	11/9/70 26/4/71	26/4/71	14/9/71
Water Volume	340 l/ha	340 l/ha	400 l/ha	290 l/ha

TRIAL A

Site and application details are shown in Table 1.
Prior to spraying point analysis showed:

Barley grass (<i>Hordeum murinum</i> and <i>H. leporinum</i>)	....	37%
Ryegrass (<i>Lolium perenne</i>)	....	14%
Clover (<i>Trifolium</i> spp.)	....	8%
Storksbill (<i>Erodium</i> spp.)	....	26%

The time of spraying was six weeks before the green seed-head stage.
The trial area was fenced throughout the trial period.

Results of assessments are shown in Table 2. Visual assessments in this and subsequent tables represent the mean of estimates by at least two and, in some cases, three observers.

TABLE 2: TRIAL A ASSESSMENTS

Treatments (kg/ha)	25/11/70 % Control (visual)	30/12/70 Barley Grass Plants/Area (1)	27/1/71 Barley Grass Plants/Area (1, 2)	5/4/71 Barley Grass Plants/Unit Area (3)	RESPRAY	5/7/71 % Control (visual)	27/9/71 % Barley Grass Cover (visual)	4/11/71 Barley Grass Seed- heads/Unit Area	27/9/71 Area not Resprayed % Barley Grass DM
Untreated	0	29	1386	76		0	61	1272	58
paraquat 0.56/ simazine 0.84	68	9	30bc	18ab		53	1	0	29
paraquat 0.56/ simazine 1.68	75	8	6c	13b		63	Trace	0	22
paraquat 0.56/ terbuthylazine 0.84	63	12	37abc	8bcd		56	2	8	24
paraquat 0.56/ terbuthylazine 1.68	94	4	8c	4cd		84	0	0	8
paraquat 0.56/ haloxydine 0.56	67	18	87a	16b		60	31	141	13
paraquat 0.56/ haloxydine 1.12	89	5	14c	1d		79	6	22	21
paraquat 0.14/ carbetamide 2.24	78	3	59ab	9bc		55	1	3	19
carbetamide 2.24	52	5	187	40a		36	4	28	34

(1) Unit area = 0.8361 m².

(2) All treatments highly significantly lower than untreated and treatment 9 significantly higher than all others. Analysis of other 7 treatments (square root transformation) as shown.

(3) Untreated significantly higher than all others. Treatments 5 and 7 analysed separately then incorporated into table. Square root transformation use.

On 25/11/70 it was noted that, although barley grass was still present in all paraquat treatments, it was very stunted. The additive terbuthylazine was much more severe on subterranean clover (*Trifolium subterraneum*) than simazine.

At the end of December, most plants present in the control plots had seeded and dried. However, in plots treated with paraquat and additives those plants present dried before seeding.

Following a temporary break in the drought, counts were made at the end of January after germination had occurred.

A further count was made in early April after the drought had finally broken. Plants that survived were well established and were set for seeding and at this stage plots were split for retreatment, with the same chemicals and rates, on 24/4/71, six months after the first spray.

Observation of the parts of the plots not retreated continued and cuts were taken for dry matter analysis; the figures for the barley grass are shown in the last column of Table 2.

The retreated areas had very little barley grass, as a result of paraquat application, until germination occurred, and this was assessed in July. By the end of September some of the better treatments were almost clear of barley grass and this was confirmed by a seed-head count in November. In September the assessment showed that plant population included the following:

							Storksbill %	Clover %
Control	....	....	....	....	....	....	14	8
paraquat 0.14/carbetamide 2.24				....	....	....	6	84
carbetamide 2.24	....	....	....	....	....	....	44	46

At the end of September, short-rotation ryegrass was direct drilled with a Duncan 730 Multi-seeder into all plots. The ryegrass established in all treatments where bare ground was present and did not appear to suffer chemical damage.

The trial was finally concluded in February 1972 when the paddock was cultivated and at this stage there was no barley grass on the paraquat/simazine plots or on those of paraquat/terbuthylazine at the higher rate.

TRIAL B

Site and application details are shown in Table 1.

At the time of spraying, point analysis gave a population which included 54% barley grass (*H. murinum* and *H. glaucum*) and up to 14% lucerne (*Medicago sativa*).

The trial was alternately fenced and grazed to control lucerne growth. Visual assessments, counts, and cuts for dry matter were made and figures from these are in Table 3.

During the first season of the trial there was continual germination which resulted in a mass of barley grass on untreated areas.

As in Trial A, plots were split in the autumn and retreated on April 26, 1971, seven-and-a-half months after the initial treatment. Observations then continued on both parts of the plots as indicated in Table 3.

The autumn treatments greatly reduced the barley grass population and by the end of July most treatments were free of barley grass. In only the terbuthylazine alone treatment was the weed noted.

By April 1972, areas which had been sprayed twice with paraquat/simazine and 2,2-DPA/atrazine were still free of barley grass.

TABLE 3: TRIAL B ASSESSMENTS

<i>Treatment</i> (kg/ha)	8/10/70 % Control (visual)	12/12/70 Barley Grass Seed- heads/Unit Area	2/4/71 % Cover Barley Grass (visual)	26/4/71 % Control (visual)	RESPRAY	28/7/71 Point Analysis % Barley Grass	30/11/71 % Barley Grass DM	4/4/72 % Barley Grass (visual)	28/7/71 Point Analysis % Barley Grass	30/11/71 % Barley Grass DM	4/4/72 % Barley Grass (visual)
Untreated	0	120	45	1		72	61	60	74	70	63
paraquat 0.56	65	30	4	46		0	3	1	41	51	29
paraquat 0.28/ karbutilate 0.56	63	35	4	59		0	1	2	36	57	39
paraquat 0.56/ simazine 0.84	75	0	3	62		0	0	0	26	40	21
paraquat 0.56/ simazine 1.68	85	0	2	72		0	0	0	19	32	25
paraquat 0.56/ terbuthylazine 0.84	64	6	2	54		0	0	2	31	34	29
terbuthylazine 1.68	10	26	43	17		13	6	6	53	35	34
2.2-DPA 1.68/ atrazine 0.9	46	17	4	49		0	0	0	33	45	38
sprayed only once											

TRIAL C

Site and application details are shown in Table 1.

The trial was adjacent to Trial B and involved autumn treatment. Results are given in Table 4.

TABLE 4: TRIAL C VISUAL ASSESSMENTS

<i>Treatment</i> (kg/ha)	1/12/71 % Barley Grass Control	4/4/72 % Barley Grass Cover
Untreated	0	83
paraquat 0.56	28	61
paraquat 0.56/simazine 0.84	83	4
paraquat 0.56/simazine 1.68	97	7
paraquat 0.56/terbuthylazine 0.84	86	3
paraquat 0.56/terbuthylazine 1.68	95	3
2.2-DPA 1.68/atrazine 0.9	81	8
karbutilate 2.24	58	16

The paraquat in the mixtures dessicated barley grass plants present and plots remained clear through to spring. The karbutilate and 2,2-DPA/atrazine acted more slowly and plots did not become entirely barley grass free. By December the effects of the paraquat and the karbutilate had diminished and the barley grass population was increasing whilst the triazine mixtures were maintaining control.

In early April all plots had at least a small percentage of the weed.

TRIAL D

Site and application details are shown in Table 1. An error at the time of application resulted in twice the planned amount of carbetamide being applied.

TABLE 5: TRIAL D ASSESSMENTS

Treatment (kg/ha)	kg DM/ha	
	Lucerne	Barley Grass
Untreated	2211	1147
paraquat 0.6/simazine 0.75	3610	0
paraquat 0.6/simazine 1.5	3396	0
carbetamide 7.0	2942	0
paraquat 0.3/carbetamide 7.0	3463	0
pronamide 0.5	2256	389
pronamide 1.0	3228	74
pronamide 1.0/atrazine 1.2	3049	8
terbacil 0.8	2769	297
2,2-DPA 1.5/atrazine 0.8	3152	25
paraquat 0.6/atrazine 0.8	3781	0

Cuts for dry matter were taken on 1/12/71 and the figures for barley grass and lucerne are shown in Table 5. At the time of cutting, only grasses were actively growing in the lucerne but earlier shepherd's purse (*Capsella bursa-pastoris*) and storksbill had been very active in some plots. For this reason lucerne yields from some treatments are lower than others.

At the beginning of April germination of barley grass was just evident.

DISCUSSION

From the work reviewed, it can be seen that none of the treatments employed completely eliminated barley grass with only one application, although populations were greatly reduced for a period of at least six months. By adopting a programme that involves spraying in spring and autumn, it should be possible to achieve barley grass free areas for over a year with some of the treatments. If this is so, then, considering the work of Rumball (1971), the problem should be overcome in most instances, for if no seed is set during the twelve months period, there should be no viable seed present, unless introduced by stock.

Of the additives to paraquat, the triazines appear to be most satisfactory for barley grass control itself. There seems to be little advantage in increasing the triazine rates above 0.8 kg/ha for although recovery was

reduced barley grass was still not eliminated with one application, whereas it was with two applications of the 0.8 kg rate.

Haloxydine did not perform as well as earlier work indicated (Palmer and Williams, 1970) and karbutilate moves away from the soil surface too quickly to be useful for barley grass control.

When viewed solely as a method for controlling barley grass at these times, carbetamide on its own or as an additive to paraquat at the rates shown is not as effective as the paraquat/triazine mixtures. However, other factors to be discussed may indicate very useful properties for the mixture.

2,2-DPA/atrazine, being slower acting, may allow seed-head development when applied at the times of these trials. This could lead to reinfestation.

It may be noted in Trial B that paraquat alone gave acceptable results but in practice this is not always the case as timing and germination conditions can be critical.

In practice, there are several different barley grass situations and results must be considered in this context.

(a) FENCE LINES AND WASTE AREAS

Both trials involving two applications demonstrated the feasibility of eliminating a barley grass problem using a mixture of paraquat and simazine applied before plants have a chance to shed any seed.

(b) PASTURE

In Trial A, all treatments except the two including carbetamide resulted in the elimination of clovers and ryegrass, giving bare ground, except for any lucerne present.

Carbetamide alone at 2.24 kg/ha in spring and autumn did not control barley grass to an acceptable level. The addition of a low rate of paraquat greatly improved the barley grass control even with just one application. Following the autumn application, the advantage of the paraquat was very obvious, not only in the improved control of barley grass but also in the greatly reduced storksbill content and the consequent increase in clover.

As a pasture treatment, this is not yet satisfactory but it may be that, with the correct ratios of the two chemicals, barley grass could be controlled whilst leaving a satisfactory sward, particularly if allied to correct grazing management.

(c) LUCERNE

Paraquat/simazine mixtures are already widely used for weed control in lucerne. On the basis of these results, barley grass should present no problem where regular treatment is maintained.

In Trial D, paraquat/triazine mixtures and carbetamide (at luxury rate) cleared barley grass by the first cut in December. Pronamide, when applied at this time, terbacil or 2,2-DPA plus atrazine did not give full control. Pronamide, carbetamide and to some extent terbacil and 2,2-DPA plus atrazine failed to control some of the flatweed species.

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REFERENCES

- Palmer, P. C.; Williams, P. P., 1970. An evaluation of additives to paraquat for the control of barley grass. *Proc. 23rd N.Z. Weed & Pest Control Conf.*: 103.
- Rumball, P. J., 1971. Longevity of barley grass seed. *Proc. 24th N.Z. Weed & Pest Control Conf.*: 80.