White clover seed crop tolerance to diflufenican herbicide

M.P. Rolston and Bill Archie

AgResearch, PO Box 60, Lincoln, Canterbury, New Zealand

Abstract

A diflufenican based herbicide (Jaguar) was applied to the white clover (*Trifolium repens* L) cultivars Grasslands Demand and Grasslands Huia at rates from 25 to 75 g diflufenican/ha (1.0 to 3.0 litres Jaguar/ha). Phytotoxicity (chlorosis) occurred, and was observed at evaluations 23-28 days after treatment (DAT), and was also evident at 45 DAT for G. Huia. Growth suppression occurred in G. Huia and was evident 85 DAT. However this is thought to result from differences in plant size at treatment (G. Huia plants were smaller than G. Demand) rather than reflecting any difference in cultivar tolerance. There was no significant effect on white clover seed yield for any rates evaluated.

Additional key words: *Jaguar, seed yield,* Viola arvensis

Introduction

Until recently white clover (*Trifolium repens* L) growers have had few herbicide options for the control of broadleaf weeds, with 2,4-DB, 2,4-D and bentazone being the only herbicides commonly used. In 1995 flumatsalum (Preside) was registered for use in white clover. It controls many broadleaf weeds, but does not control field pansy (*Viola arvensis* Murr.). Diflufenican is a pre-and post emergence foliar absorbed herbicide that blocks photosynthesis. Diflufenican has good activity on field pansy, cleavers (*Gallium* spp.) and speedwell (*Veronica* spp.) (Cramp *et al.*, 1985; Haynes and Kirkwood, 1992). The recent release of diflufenican based herbicides for cereals (Cougar, a diflufenican + isoproturon mix) and ryegrass (Jaguar, a diflufenican + bromoxynil mix) for the control of field pansy and a range of broadleaf weeds, may give herbage seed growers new options for weed control. Jaguar has activity on a number of common weeds . These weeds can be grouped as those that contaminate seed lots after machine dressing, including chickweed (*Stelleria media* (L.) Vill.), scarlet pimpernel (*Anagallis arvensis* L.), hedge mustard (*Sisymbrium officinale* L.) Scop.), catchfly (*Silene gallica* L.), wireweed (*Polygonum aviculare* agg.) (Rowarth *et al.*, 1990), and competitve weeds such as speedwell, mouse-eared chickweed *(Cerastium glomeratum* Thuill.), parsley piet (*Aphanes* spp.), henbit (*Lamium amplexicaule* L.) and shepherd's purse (*Capsella bursa-pastoris* (L.) Med.). (P. Clifford, AgResearch Lincoln, pers. comm.). Previous trials had established that bromoxynil was safe to use on white clover (Rolston, 1987). The two trials reported in this paper were undertaken to determine the tolerance of white clover seed crops to the diflufenican based herbicide Jaguar applied at normal use rates (1.0 to 1.5 litres/ha) and double this rate (2.0 to 3.0 litres/ha).

Methods

Jaguar (diflufenican 25 g/litre + bromoxynil 250 g/litre as the octanate ester emulsifiable concentrate formulation) was applied to seedling white clover of two cultivars, Grasslands Demand and Grasslands Huia grown at two sites in Canterbury, to evaluate herbicide tolerance. Rates of herbicide were 1.0, 1.5, 2.0 and 3.0 litres/ha, applied at 220 litres water/ha, with a hand weeded control, and a nil treatment control. To ensure that crop herbicide tolerance effects were not confounded by weed competition, weeds were removed from all plots (except the nil treatment control) on the 7 November after the weed control evaluations were made. Plots were 2 m x 5 m, and treatments were replicated 4 times in a randomised block design.

At harvest the plots were sprayed with diquat (Reglone at 3 litres/ha) and Citowett non-ionic surfactant (1.5 litres/ha). The plots were harvested with a rotary lawn mower, cutting 2 passes (each 45 cm wide) by 5 m. Samples were air dried and stored in large multiwall paper sacks. Samples were threshed on a belt thresher, cleaned on an air-screen separator, and blown on a Dakatoa blower. Samples were then hand sorted to determine seed purity and seed yield which is expressed as 100% pure seed.

Site 1

Grasslands Huia white clover, at the property of Chris Heslop, Southbridge, mid Canterbury. The white clover was late autumn sown in 15 cm rows under an Italian ryegrass (*Lolium multiflorum* Lam.) cover crop. At the time of treatment the clover was at the three leaf stage, and had been recently grazed by sheep. Jaguar was applied on 14 August 1995. The ryegrass was sprayed with 60 g/ha haloxyfop (Gallant) on 15 September. Plots were evaluated on the 6 September (23 days after treatment [DAT]), 28 September (45 DAT), and 7 November (85 DAT). Plots were desiccated on 31 January 1996, and harvested on 5 February 1996.

Site 2

Grasslands Demand white clover at the property of Ray Maginness, Killinchy, mid Canterbury. The white clover was autumn sown in 45 cm rows and at the time of treatment was at the four leaf stage and had not been grazed. The field was very weedy with a wide range of species including field pansy, creeping speedwell (*Veronica filiformis* SM.), and shepherd's purse. Plots were evaluated on 6 September (28 DAT), 28 September (50 DAT), and 7 November (90 DAT). Plots were desiccated on 24 January 1996, and harvested on 29 January 1996.

Results and Discussion

Chlorosis

Typical diflufenican induced chlorosis (with leaves becoming pale yellow) was observed in white clover at the first evaluation (23-28 DAT), with 10-21% of leaves showing chlorotic symptoms (Table 1).

At the second evaluation there was no chlorosis evident on the G. Demand clover, but chlorosis was evident on the Huia clover 45 DAT (Table 1).

Growth Suppression

Jaguar did not cause any growth suppression in the G. Demand white clover. The G. Huia white clover showed visual growth suppression following Jaguar treatment for at least 85 DAT after treatment (Table 2). This growth suppression is thought to result from the less mature growth stage of the G. Huia at the time of late winter herbicide application, rather than reflect a cultivar sensitivity to the herbicide. The G. Huia had three leaves (compared to four leaves for G. Demand), and was visually smaller having developed during the winter under a cover crop and with grazing, while the G. Demand had not been grazed. A subsequent trial (not reported here) where G. Demand and G. Huia were sown side by side under the same management supports the hypothesis that there is no difference in Jaguar herbicide tolerance between these two cultivars. There was no deleterious effects on seed yield of white clover at this site because of the suppression (Table 3).

In many cases a major problem limiting seed yield in white clover is excessive vegetative growth (Clifford, 1985), and only on light soils without irrigation in drier than average years could reductions in vegetative growth translate to a reduction in seed yield.

In other unreported trials (P. Clifford, AgResearch, Lincoln, pers. comm.), autumn application of diflufenican based herbicide (Jaguar) caused severe growth suppression on winter dormant types, especially the small leaved white clover cultivar S184, although this did not affect seed yield.

Seed yield

There was no significant effect of Jaguar on seed yield (Table 3). In particular the G. Huia, which showed visible growth reduction for more than 85 days after treatment, showed no seed yield effects, despite this reduction in growth. In these trials white clover was

Table 1. Percent of white clover leaves with chlorosis.

Treatment (Jaguar L/ha)	G. Demand 28 DAT[1]	G. Huia 23 DAT	Combined Data (23-28 DAT)	Huia 45 DAT
Control	1	0	0.5	0
Hand weeded control	1	0	0.5	0
1.0 L/ha	10	10	10	6
1.5 L/ha	14	14	14.5	7.5
2.0 L/ha	15	12	13.5	11
3.0 L/ha	21	20	20.5	14
$LSD_{(0.05)}$[2]	6.5	6.0	3.8	4.2

[1] Days after treatment

[2] Applies to treatments 3-6 only

Table 2. Percent growth suppression (visual evaluation) in G. Huia white clover growth after diflufenican (Jaguar) treatment.

Treatment (Jaguar L/ha)	Growth suppression (%) 45 DAT	85 DAT
Control	0	0
Hand weeded control	0	0
1.0 L/ha	4	16
1.5 L/ha	9	23
2.0 L/ha	13	24
3.0 L/ha	24	25
$LSD_{(0.05)}$	6.6	8.9

Table 3. Seed yield (kg/ha pure seed) of white clover treated with Jaguar.

Treatment (Jaguar L/ha)	Grasslands Demand	Grasslands Huia	Combined Data
Control	440	500	470
Hand weeded control	490	460	480
1.0 L/ha	480	500	490
1.5 L/ha	450	510	480
2.0 L/ha	450	490	470
3.0 L/ha	450	540	490
$LSD_{(0.05)}$	97	90	62
treatment v control	ns	ns	ns
treatment v weeded control	ns	ns	ns

Table 4. Weed control[1] (%) from Jaguar treatments.

Treatment (Jaguar L/ha)	Huia 85 DAT	Demand 90 DAT
Control	0	0
Hand weeded control	100	90
1.0 L/ha	88	53
1.5 L/ha	89	74
2.0 L/ha	90	78
3.0 L/ha	93	84
$LSD_{(0.05)}$	4.6	4.5

[1] Percent weed control by visual evaluation with two independent evaluators.

tolerant to 3.0 litres/ha of Jaguar (75 g diflufenican/ha), which is double the normal expected use rate of the herbicide.

Weed Control

The level of weed control was reasonable (Table 4). In the G. Demand field which was very weedy, the application of Jaguar provided sufficient weed control to allow inter-row band spraying to take place, with weeds checked sufficiently for rows to become defined. Without Jaguar, inter-row spraying would have been impossible, and the field then would have failed to meet seed certification field inspection requirements because of the difficulty of inspecting for volunteer clovers in a weedy field. Some of the weed problems in this field represented weeds that had already exceeded the recommended growth stage at treatment, especially hawksbeard (*Crepis capillaris* (L.) Wallr.) (up to two leaf stage), and shepherd's purse, and field madder (*Sherardia arvensis* L.), two species that are poorly controlled by Jaguar.

The weed control in the Huia field was good (Table 4), and the only problem weed occurring was field madder.

Conclusion

White clover seed crops showed good seed yield tolerance to diflufenican at rates from 25 to 75 g/ha (applied as Jaguar herbicide at 1.0 to 3.0 litres/ha). The higher rates used represent twice the recommended rate for the control of weeds. Clover growth suppression can occur, but is thought to be due to the clover growth stage at treatment time, rather than reflecting a difference in cultivar tolerance. Jaguar was an effective herbicide for the control of field pansy and a range of common broadleaf weeds, except field madder. This new herbicide will be an important mangement tool for the production of high quality (low weed seed content) white clover seed lots.

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