EVALUATION OF AN AUTOMATIC HERBICIDE DISPENSER FOR ROTARY WEED WIPERS

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SUMMARY

In using rotary carpet weed wipers, an automatic herbicide dispenser which electronically maintained the carpet at a predetermined level of wetness without spillage of herbicide, was compared with conventional manual operation. With four of the five farmers who tested the system, less glyphosate was applied to Californian thistle (*Cirsium arvense*) by the automatic dispenser than by manual operation, with no evidence of reduced herbicide efficacy. Perceived advantages over manual operation were reduced herbicide wastage and pasture damage, and improved safety in being able to concentrate solely on driving. In a survey, 73% of farmers who saw a dispenser in operation were in favour of fitting the device to their weed wipers.

Keywords: rotary weed wiper, automatic liquid dispenser, Californian thistle, *Cirsium arvense*, wetness sensing.

INTRODUCTION

Rotary weed wipers are currently proving popular with farmers for control of weeds in pasture. Bisset Engineering, the major manufacturer of rotary weed wipers in New Zealand, has projected sales of 1000 per year, mostly for export (D. Bisset, pers comm.). Consisting of a spray boom fixed above a 150 mm dia rotating carpet roller, which is suspended above the pasture/crop between two wheels (Ballantyne 1989), the rotary weed wiper provides a practical method of applying translocating herbicides onto taller-than crop target weeds (Martin *et al.* 1990).

Two main problems have been recognised in the current models of rotary wipers. Manual dispensing of the herbicide onto the carpet by a farmer-operated pump, causes difficulties in being able to judge how much herbicide solution needs to be applied onto the carpet during operation. Farmers complain of pasture damage through excessive application of herbicide, or of poor control of target weeds due to under-application. The other problem occurs when the operator is distracted by looking behind to check on the wetness of the roller and level of solution in the tank, introducing a safety hazard. Consequently, there are obvious benefits from automatic application of the herbicide solution onto the carpet regulated by the number of weeds coming into contact with it, and to alert the operator when the herbicide tank becomes low.

Schepers and Burnside (1987) described an electronic moisture sensor for maintaining herbicide solution on a roller applicator, but their controller circuit operated only one solenoid from one sensor, without monitoring the evenness of carpet wetness over the whole carpet. A similar device has been designed for a blade weed wiper (Muir-Wilson 1986). These designs were improved by incorporating a gang of sensors which measured changes in wetness on independent sections of the carpet to control a pump and feed valves, thereby maintaining the carpet at a predetermined wetness (van Toor and Brewster 1993). In addition to the Schepers and Burnside (1987) model, the circuit accommodated a motion sensor and a pump timer to prevent liquid dispensing onto the fabric when the wiper was stationary, or when the pump had been operating for a greater period than normal.

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These features were incorporated into a device referred to as 'Autowipe' (van Toor and Brewster in prep.). This device contained a frame supporting wetness sensors, feed valves, motion sensor and electronic controller, which clamped readily onto existing rotary weed wipers to circumvent manual operation of the pump.

This paper reports on results of a field comparison between manual and automated dispensing of glyphosate for control of Californian thistle (*Cirsium arvense*) in pasture, using the 'Autowipe' prototype attached to a rotary weed wiper. Glyphosate was chosen for the evaluation because of its effectiveness in reducing Californian thistle populations using rotary weed wipers (Martin *et al.* 1990). The perceptions of automatic dispensing by the trial participants, and results of a survey which canvassed farmers' views on whether they wanted an automatic dispenser, are also presented.

METHODS

A comparison of the effectiveness of dispensing herbicide automatically and manually was made on five farms in Otago on Californian thistle. However, no post treatment results were available for one site where the trial was destroyed by flooding. All farmer/participants had experience in using a commercially available rotary weed wiper. The automatic dispenser was fitted to a 'Dinkum' commercial weed wiper (Ballantyne 1989), and set to maintain the carpet at a similar wetness to that of normal operation, ie. when the carpet starts dripping 30 seconds after the roller becomes stationary. At each site, glyphosate (Roundup) diluted to 1:20 with water, was applied to Californian thistles in plots 10 x 50 m in four randomised blocks of either automatic or manual dispensing. Applications were made on 16-19 March 1993 when the thistles had set seed and were in the down stage.

Californian thistle shoots were counted along a 51 m x 1 m wide fixed diagonal transect in each plot prior to each treatment and again during 26 January - 3 February 1994. The quantity of herbicide solution used by the two dispensing methods was determined by calculating the difference in the amount of solution in the reservoir before and after treatment at each site. The amount of herbicide used was divided by the area covered in the trial to calculate the application rate/area, and by the number of Californian thistle stems to calculate the dose/plant. Analysis of variance was performed on untransformed and $\log_e$ transformed thistle densities, and on calculations of rate and dose applied. Immediately after the farmer/participants had completed the application of the herbicide by both methods, they were asked prepared questions about manual and automatic operation of the rotary weed wiper.

A prototype model of the automatic dispenser was also fitted to a Bisset 'Rotowiper' and displayed under operation conditions at 1993 Mystery Creek Field Days in Hamilton, New Zealand. One hundred farmers who owned or intended to purchase a rotary weed wiper were given a descriptive demonstration of the automatic dispenser in use, and were questioned as to whether they would want an automatic dispenser fitted to their machine.

RESULTS AND DISCUSSION

Field evaluation

Californian thistle densities prior to treatment application in sites 1-5 were 7.6, 10.5, 9.2, 13.4 and 10.5/m² (SEM = 1.54, 0.79, 0.64, 0.77 and 0.80), respectively, and were uniform between allocation of treatments. The amount of herbicide mixture dispensed per unit area by the automatic dispenser divided by that from manual-operation ranged from 0.38-1.33, averaging 0.78 (SEM = 0.17) over the five sites (Table 1). There was no difference in the amount of solution applied by the automatic dispenser compared with manual dispensing, either measured per unit area (rate) or by the amount of herbicide solution applied per stem (dose). There was no evidence of a difference between sites or overall thistle densities counted in the following summer between automatic and manual dispensing, either analysed on untransformed (Table 1) or $\log_e$ transformed data.

TABLE 1: Rate and dose of glyphosate solution applied by automatic and manual application, and its effect on Californian thistle stem density 11 months following treatment.

Site	Treatment	Rate applied (ml/m ²)	Dose applied (ml/stem)	Summer 1994 thistle density (No./m ²)
1	Auto	2.5	0.26	6.3
	Manual	3.3	0.58	2.9
2	Auto	2.6	0.25	16.8
	Manual	5.2	0.48	15.5
3	Auto	9.7	1.07	8.8
	Manual	7.3	0.78	9.7
4	Auto	3.9	0.29	17.8
	Manual	4.1	0.31	17.8
5	Auto	1.7	0.16	na
	Manual	4.3	0.40	na
	SED _(df=12)	-	-	2.24
	Site x treatment interaction			ns
Mean Auto		4.1	0.41	12.4
Manual		4.9	0.51	11.5
	SED _(df=12)	0.93	0.110	1.05

na = not available

Farmers perceptions

The farmer/participants commented that they thought the automated system would reduce guess-work in knowing how much herbicide solution was required, ensure consistent application of herbicide, reduce operator fatigue, reduce wastage and pasture damage, and improve safety in being able to concentrate solely on where they were driving. Potential malfunction, resulting in repair costs and time delays, was their main reservation. They considered the estimated retail price of \$900 for an automatic dispenser to be acceptable.

Farmers surveyed at the Mystery Creek field days who either owned (25) or intended to purchase (75) a rotary weed wiper, had either dairy (40), sheep/beef (37), sheep (12) or cropping (1) farms, or were agricultural contractors (5), and were mainly from the North Island (96) of New Zealand. Seventy three percent of these farmers said they wanted an automatic herbicide dispenser fitted to their existing wiper or a new purchase.

CONCLUSIONS

Automatic dispensing of herbicide solutions in the use of rotary weed wipers has advantages over manual application of consistent application of the herbicide, improved operator safety, and a potential to reduce the consumption of herbicide, with no reduction in efficacy evident under the conditions operating in these trials. There appears to be demand for automatic herbicide dispensers to be fitted to rotary weed wipers.

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REFERENCES

- Ballantyne, M.J., 1989. Apparatus and method for applying liquid chemicals to plants. New Zealand Patent No. 231420.
- Martin, P., Fullerton, D.K. and James, T.K., 1990. Weed trials using a rotary weed wiper. *Proc 43rd N.Z. Weed and Pest Control Conf.*: 262-265.
- Muir-Wilson P., 1986. Herbicide applicator: supply controlled through sensor associated with wiper blade. Patent No. A and NZ201600.
- Schepers, J.S. and Burnside, O.C., 1987. Electronic moisture sensor for maintaining herbicide solution on a roller applicator. *Weed Sci.* 27: 559-561.
- van Toor, R.F. and Brewster D.S., 1993. Liquid dispenser for weed wiper fabric rollers. Provisional New Zealand Patent No. 247886.