PROBLEMS ASSOCIATED WITH THE USE OF GLYPHOSATE AFTER WHEAT HARVEST

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Summary. Moisture conditions had a large effect on the performance of glyphosate. Volunteer wheat was controlled with 450 g/ha of glyphosate but awnless barnyard grass and liverseed grass were often poorly controlled at 900 g/ha. Watering awnless barnyard grass prior to spraying improved control, particularly larger plants. Control was reduced in barnyard and liverseed grass by improving soil moisture status 4 days after spraying. Increasing the rate of glyphosate reduced the rainfast period, but at marginal rates weed control was still diminished with simulated rain 22 hours after spraying.

INTRODUCTION

In northern New South Wales and southern Queensland the most common early fallow grass weeds are volunteer wheat, barnyard grass, *Echinochloa crus-galli*, awnless barnyard grass, *E. colonum* and liverseed grass *Urochloa panicoides*. Glyphosate is widely used in reduced tillage fallow management practices but with variable effectiveness. This can be attributed to the weed species and size (2), drought stress (1,6), rate of herbicide used (4,5), water volume and quality, temperature (6) and rainfall after application (3). Weeds often are not recognised as being under stress so increasing the herbicide rate or delaying spraying until conditions are more favourable are not considered.

A minimum rainfast period of 6 hours is suggested (Herbicide label) but it can be longer. In a weed survey in Nebraska (6), weed control was negatively correlated with rain on the day of spraying, as was rainfall 6 to 9 days after spraying. Rainfall 3 days prior to spraying improved weed control.

The relationship between times of rainfall and spraying glyphosate on fallow weeds, particularly stressed weeds, requires more information. The objective of the work reported in this paper was to evaluate the effects of various simulated rainfall events on the control of stressed fallow weeds.

METHODS

Two fields were selected at Tamworth where wheat had been harvested in December, 1989. Awnless barnyard grass was the dominant weed in experiment 1 and liverseed grass in experiment 2.

Experiment 1. Glyphosate was applied at nil, 225, 450, 675 and 900 g/ha in a spray volume of 84 L/ha on 11 January, 1990. The herbicide plots were 18x6 m and arranged in 4 randomised blocks. Each contained;
(a) 7 watering treatments, each consisting of 3x0.5 m^2 circular sub-plots. These were 6, 3 and 1 day before, and 1, 4, 7 and 11 days after spraying. A metal ring was used to prevent water escaping the treatment area and each watering time received 40 L which was equivalent to 80 mm of irrigation. The sub-plot areas were selected to include barnyard grass which were categorised into 3 growth stages.
(i) 5-10 cm, < 5 tillers, no seed heads
(ii) 10-20 cm, 6-15 tillers, 1-2 seed heads
(iii) > 20 cm, > 15 tillers, > 2 seed heads.
Volunteer wheat was 10-30 cm with most being 20-30 cm.

(b) 8 treatments of simulated rainfall, each with 3x0.5 m^2 sub-plots. These were 1 hour before and 1, 2, 4, 6, 8, 10 and 22 hours after spraying. A nozzle was used to apply 1 L in 30 sec which was equivalent to 2.5 mm of rain. There was no natural rainfall for 3 days after applying the simulated treatments.

Experiment 2. Glyphosate was applied at 450, 675 and 900 g/ha in a spray volume of 84 L/ha at 7 am, 11 am and 3 pm on 13 January and at 3 pm on the 14 January, 1990. Plots were 13x6 m in 3 randomised blocks. Watering treatments were applied as in experiment 1a at 3, 6, 10 and 13 days after spraying.

Visual evaluations were made for both experiments from 10 to 30 days after spraying. The number of live and dead plants were counted during the period 21 to 30 days after spraying, and the degree of control was rated from 1 to 7 (1 representing no control, 7 being total kill).

The weed control ratings were analysed for differences amongst treatments using a generalised linear model with gamma errors and an inverse link. The analysis of proportions of weeds controlled was also carried out by linear regression, using a model with binomial errors and a logit link.

RESULTS AND DISCUSSION

Wheat is very susceptible to glyphosate and rates of 675 and 900 g/ha gave near 100% control. At 450 g/ha there was fluctuation in the degree of control for the various stress treatments. Watering 6 days after spraying resulted in the poorest control. At 225 g/ha there was a large effect of the simulated rain treatments which was still present in the 22 hour treatment (Table 1).

Table 1. Effect of rainfast period on the control of volunteer wheat with glyphosate.

Watering times	glyphosate g/ha 225	450
(hr)	% control	
-1	32	99
1	14	93
2	11	88
4	50	91
6	59	95
8	16	97
10	48	89
22	39	98
>22	70	100

Control of awnless barnyard grass improved with increasing rates of glyphosate and was better on small than large weeds (Fig. 1). Watering prior to spraying gave better control than watering after spraying (Fig. 2). Stage (iii) plants needed to have water applied 3 to 6 days prior to spraying in order to obtain effective control even at 900 g/ha.

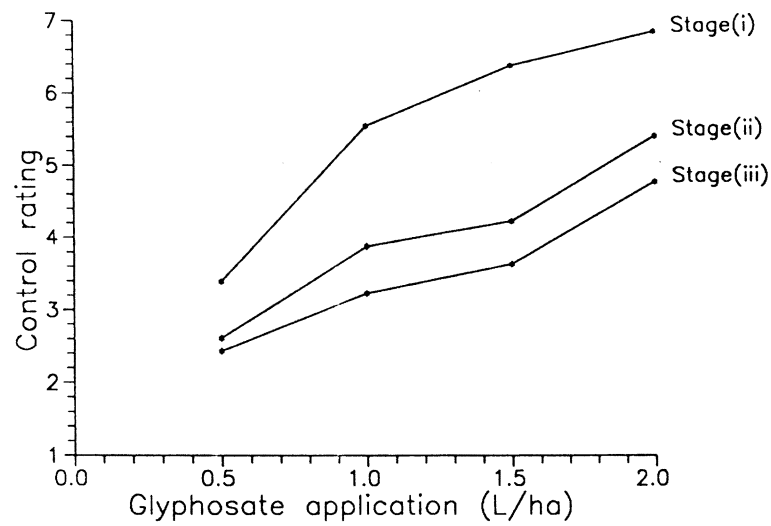

Figure 1. Efffect of glyphosate dosage and stage of development of awnless barnyard grass on control.

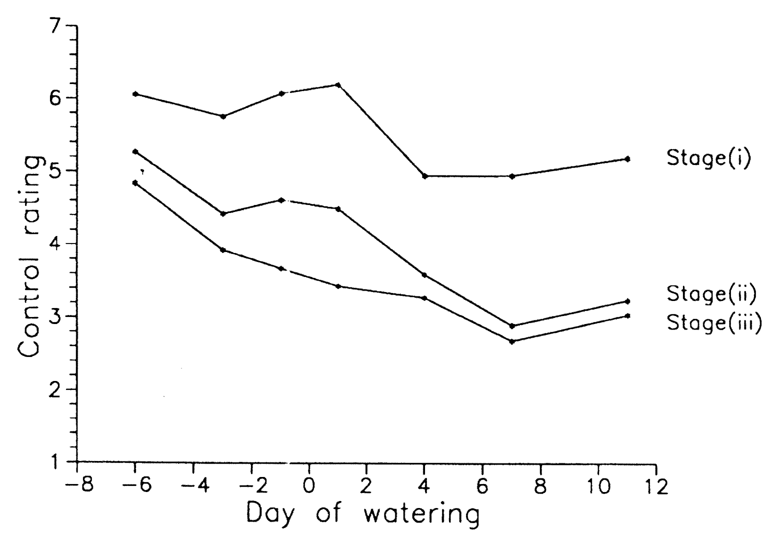

Figure 2. Effect of time of watering and stage of development of awnless barnyard grass on control by 450 g/ha glyphosate.

Applying 2.5 mm of simulated rain within 22 hours after glyphosate at 225 g/ha was applied reduced the control of awnless barnyard grass in stage (i). Using 900 g/ha reduced the rainfast period to 4 hours for stage (i) weeds but at least 22 hours were required for stage (ii) weeds.

In experiment 2 very poor control of liverseed grass was obtained with glyphosate at 450 g/ha. At 625 g/ha, poor control resulted from the 3 application times on the 13 Jan. All 900 g/ha treatments applied on the 13 Jan. were also poor. There was a substantial improvement in control in the 625 and 900 g/ha treatments applied on the 14 Jan. even though the result would still be commercially inadequate. The data did however, demonstrate how control was dramatically reduced with an improvement in soil moisture conditions 6 to 13 days after spraying (Fig. 3). The stage of weed effect was variable and in many sub-plots control of small weeds was poorer than larger weeds.

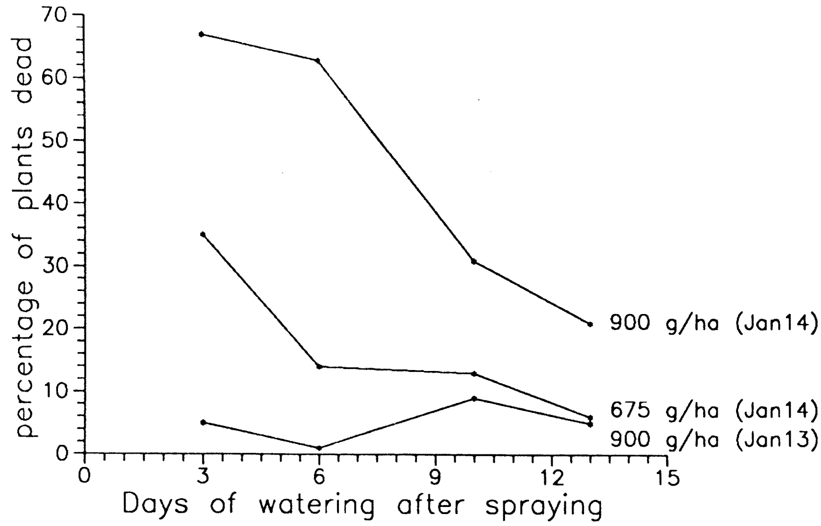

Figure 3. Influence of post-spraying watering and application time on control of liverseed grass with glyphosate.

The difference in control between the 13 and 14 Jan. applications is the result of a 2 mm shower of rain at 4.30 pm on the 13 Jan. We do not consider that washing the herbicide from the weeds is the reason. If this was so then the 7 am treatments should be better than the 11 am treatments which should in turn be better than the 3 pm treatments. A 2 mm shower did not improve soil moisture but it may have had a subtle effect on the moisture status of the weeds. It is difficult to imagine that this could have persisted for almost 24 hours. A more plausible explanation is that there was sufficient rain to reduce dust on the leaves of the weeds. Herbicide performance is influenced by dust and this may be a greater problem on weeds with pubescent leaves such as occurs with liverseed grass. It is worthy of further investigation.

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