A SUGGESTED PROTOCOL FOR WOODY SHRUB SPOT SPRAYING EXPERIMENTS

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Summary. In many woody shrub experiments, application rates are not recorded in reproducible quantitative terms and it is rare for predetermined application rates to be applied. This paper demonstrates by example the value of an experimental protocal which includes accurate recording of bush size and application volumes, ranking of bush sizes as a basis for selecting treatment replicates and application of pre-determined application rates.

INTRODUCTION

In reports of woody shrub spot spraying experiments, it is unusual for predetermined application rates to be applied (1,2,3,5,6,7,8) and application rates are often inadequately recorded. Usually a description of application technique and the herbicide concentration are reported but the size of the experimental unit and/or the spray volume are omitted (1,2,3,6).

It was shown previously (4) that there is wide variation in application rates between spray operators using hand held spot spray equipment even though operators were endeavouring to apply herbicide according to label directions.

Failure to adequately record and report application rates greatly reduces the value of spot treatment experiments because the treatment cannot be repeated by other workers or even by the same worker, with any degree of confidence. There is also an undefined relationship between experimental application rates and commercial practice which introduces vagueries into interpretation.

My objectives in this paper are to illustrate by example the need for accurate recording and reporting of application rates in reproducible quantitative terms and the advantages of applying pre-determined application rates in spot treatment experiments. Results are drawn from several experiments and methods are described only in sufficient detail to illustrate the aims of the paper.

METHODS

The experiments described were conducted on blackberry, (*Rubus fruticosus* spp. Agg.), in the northern tablelands of N.S.W. Similar examples could be drawn from experiments on a range of other shrub species. Unless otherwise stated, the reported assessments were undertaken 11-13 months after treatment. Control is reported according to the EWRC 1-9 ranking system.

Three basic protocols were used to establish the experiments from which examples are drawn for this paper:

(i) Bushes were selected completely at random and herbicide was applied at a prescribed concentration to give a subjective level of coverage (eg. point of run off). Bush height, bush circumference and spray volume were recorded.

(ii) Bush height and circumference were measured and bushes were ranked into size classes according to bush volume. Single bush replicates were randomly selected in equal numbers from each size class. Herbicide was applied at a prescribed concentration to give a subjective level of coverage.

(iii) As for (ii) except that herbicide was applied at a prescribed rate per cubic metre of bush volume or per hectare with the concentration and coverage varying accordingly.

High volume application. Herbicides were applied using Spraying Systems Gunjet 43 fitted with an appropriate spraying systems 'D' series cone nozzle. Spray volume was measure by difference in calibrated 50L bottle or using a water flow meter accurate to $\pm 1.0\%$ with a limit of reading of 0.5 L.

Two basic approaches to high volume application were adopted:

(a) to thoroughly cover all foliage but not canes and avoid run off as far as possible. This method employed a D4 to D6 nozzle and operating pressures of 500-700 kPa.

(b) to thoroughly cover leaves and canes. Bushes were usually dripping freely after treatment. Operating pressures were 1000 -2000 kPa and D7 or D8 nozzles were used.

Low volume application. An Ag-murf® Gas Gun was fitted with an 8003E Teejet® nozzle tip and operated at 250 kPa pressure. Spray volume was measured by calibrating the discharge volume of the gun and counting the number of shots and portions of shots applied.

RESULTS

Method (i). In an experiment at Maybole near Glen Innes, the aim was to compare a range of application methods and herbicides (table 1). Triclopyr (480 g/L) was applied by two different high volume techniques. The application rate per square metre of bush surface for method (b) was double that for method (a) but the application rates per cubic metre of bush volume almost identical due to the difference in average bush volume between the treatments. It is evident that a failure to control bush size has confounded the treatments.

Table 1. Effect of .21% triclopyr (480 g/L) on blackberry.

Method	Volume of spraymix (L/m^2)	(L/m^3)	(L/ha)	Applic. rate (mL prod/m^3)	Control score (1-9)	Bush Volume (m^3)
(a)D5,414 kPa	.42	.98	4,400	2.1	2.6	13
(b)D8, 2000kPa	.84	.94	13,100	2.0	1.7 (n.s)	52

Method (ii). An experiment was conducted at Niangala, east of Tamworth to compare herbicides, rates and application techniques. Only the high volume application of glyphosate (360 g/L) will be considered here. Herbicide was applied at two concentrations to eight single bush replicates by high volume method (a) using a D5 nozzle operating at 500 kPa pressure. Results are presented in Table 2.

Table 2. Blackberry control with glyphosate applied by high volume handgun.

Concentration (% v/v)	Control score (1-9)	Average application rates (product) (mL/m^2)*	(mL/m^3)	(L/ha)
1.3	3.8	2.0	3.7	34.2
0.65	4.8	1.2	1.6	17.2

In this experiment, the differences in concentration translated quite faithfully into differences in application rate due to selection of similar bush sizes for each treatment. There is a mathematical problem in averaging derived application rates and the averages are approximate, but at least provide a guide for comparative costing. Apart from this difficulty, method (ii) works well if application method is the same for each treatment.

Table 3 shows the results of an experiment where the "commercial practice" for two different application methods of Grazon® (triclopyr 150 g/l+picloram 50 g/l) were compared. Although having some practical interest, the comparison is scientifically invalid because of a vast difference in application rates between the methods. Unless pre-determined rates are applied, it is highly unlikely that application rates from different methods of application will coincide.

Table 3. Blackberry control with Grazon® applied by two methods.

Application Method	Herbicide Concentration (%v/v)	Average Bush Volume (m^3)	Application Rate (mL/m^3)	Control Score (1-9)
High volume (a)	0.7	39	5.8	4.5
Gas gun	6.6	40	1.3	7.5

Method (iii). Table 4 shows results from an experiment conducted on the following day and at the same site as the experiment reported in table 2. All treatments were applied with the Gas Gun. Glyphosate 360 g/l was mixed at a concentration of 10% v/v and applied to three single bush replicates in each of three size classes. Rates were determined in relation to bush volume.

Table 4. Blackberry control with glyphosate applied at four rates by low volume gas gun.

Application Rate (Product)		Control Score
mL/m^3	L/ha(average)	(1-9)
3.0	31.7	3.2
1.5	14.9	5.5
0.75	7.7	6.9
0.375	4.3	7.9

Method (iii). Produces a good rate response curve and minimises the averaging problems of uncontrolled rates. In figure 1, the rate response curve from table 4 is plotted as a solid line. The average points from table 2 and the individual points making up these averages have been plotted on the same figure. The individual points show a better fit than the derived averages. Graphical presentation of individual data points can salvage information from otherwise useless data. An example is shown in figure 2 where results from three experiments are plotted on the same graph. All experiments were carried out under method (i) or (ii).

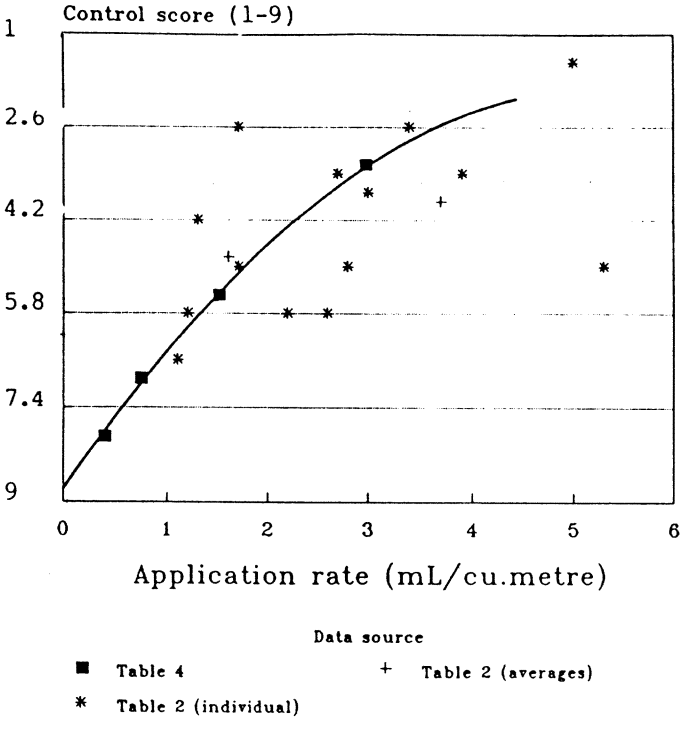

Fig. 1. Effect of rate of glyphosate (360g/L) on blackberry control.

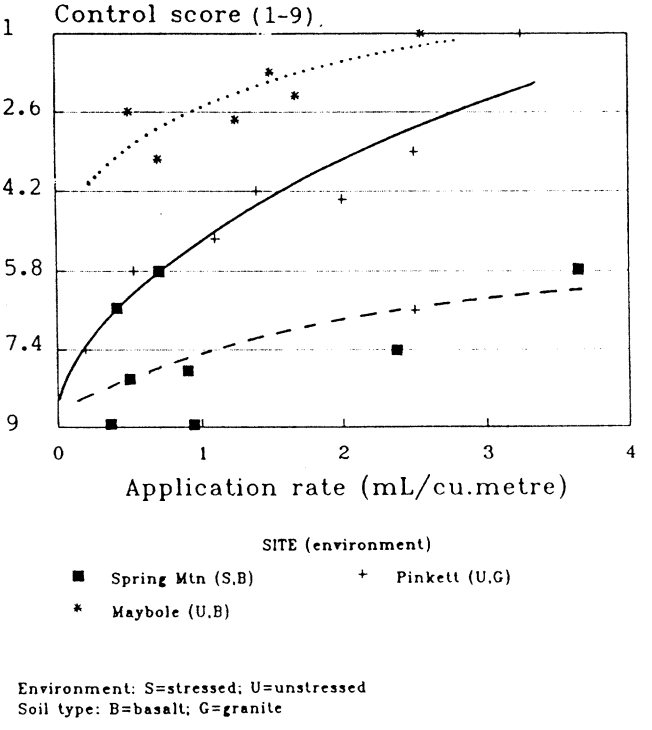

Fig. 2. Blackberry control by 480 g/L triclopyr at three sites on the N.S.W. Northern Tablelands.

The data from which table 4 was derived can be rearranged as in table 5. Herbicide was applied on the basis of bush volume, there is a clear interaction between rate per hectare and rate per m^3 of bush volume. This illustrates the need to be specific about the units of measure for application rate and further demonstrates the potential problems in interpretation of data from experiments where application rates are not recorded or controlled.

Table 5. Effect of bush size on blackberry control with glyphosate (360 g/L).

Bush volume* (m^3)	Application Rate of Product L/ha	mL/m^2	mL/m^3	Control Score (1-9) 9 MAT	11MAT
10.2	11.2	0.73	1.41	5.1	6.0
24.8	15.7	1.03	1.41	5.1	5.9
42.9	17.1	1.19	1.41	5.3	5.8
* (mean 12 bushes)				sed = .30	sed = .30

The experimental protocol suggested in method (iii) simply regards each bush as a small plot to which a prescribed amount and rate of herbicide is applied. This adds precision to results and enables valid comparisons to be made between different experiments and among diverse treatments within the same experiments. It enables accurate costing of treatments and increases the confidence with which results can be extended to commercial use patterns. The suggested protocol has a cost in installation time, but this cost is small in comparison to the increased precision, ease of analysis, increased confidence in results.

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