

Spraying Woody Weeds

DECEMBER 2007

SMARTtrain Chemical Notes 2

Prepared by Mark Scott and Tony Cook

Introduction

Being adequately trained in the techniques of woody weed spraying is critical to successful control of these plants. Spraying woody weeds is a more complex task than first appears. In woody weed spraying, the target plant should not be viewed in two dimensions, as you are not spraying an area. The target plant should be seen in three dimensions, as you are spraying a solid object.

Tests on 15 spray operators showed a 300 to 400% difference in volumes applied to treat the same bush (McMillan, M G, 1987, 'Operator variability in the Application of Herbicides to Woody Shrubs', Proceedings of the Eighth Australian Weeds Conference, Sydney). In this controlled study, all the applicators followed the same label and operated the same equipment. The large discrepancies in spray volumes were responsible for ineffective spray jobs due to under-spraying and a waste of herbicide due to over-spraying.

The most common error in woody weed spraying is that larger bushes are under-sprayed due to their extensive surface area, big canopy volume and massive amount of plant biomass (centre of bush) protected by outer layers of foliage.

Woody weed spraying follows the same principles as dosing animals with veterinary medicines. Just as the larger the animal, the larger the dose; so the larger the woody weed, the larger the volume of spray. Quite often larger bushes are under-sprayed because applicators see that the outer foliage appears wet and decide that the plant is sufficiently sprayed. No consideration is given to the inner biomass of the weed. Experienced applicators ensure these larger plants get sufficient wetting of the inner canopy leaves and stems.



Spray failure on bitou bush (Tony Cook)

This training note is intended to rectify common errors in woody weed spraying. After following the instructions in this guide and practising on a range of woody weeds, applicators should be able to spray woody weeds without the need to measure bushes and refer to spray tables.



Bitou bush infestation (Royce Holtkamp)



High volume spraying equipment

Spraying large woody weeds requires hand guns capable of delivering relatively high pressures. High pressures are necessary to penetrate dense foliage and cover tall bushes. Hand guns capable of 5 to 15 bar are used for this kind of high volume spraying.

The pumps for these sprayers may have their own electric or petrol motors, or may be PTO driven. The hand guns may be attachments to booms on tractor 3PLs (three point linkages) or ATVs, or may be a dedicated unit on an ATV with its own small diaphragm pump used exclusively for spot spraying or a larger, tray mounted ute model with a petrol motor.

All pumps should have a pressure gauge and a regulator to alter the pressure.

Adjustable hollow cone nozzles are popular. The tips can either give a straight stream or a cone pattern. The tips are also available in a range of sizes to deliver finer and coarser droplets. Choice of tip will be determined by the sorts of weeds being sprayed and the herbicide(s) being applied. In a straight stream, they will throw 15 m which is helpful for covering tall or wide bushes. Tips delivering finer droplets will deliver 2.4 litres



Three point linkage spot sprayer (Nathan Cutter & Silvan)

(per minute) at 14 bar in a cone pattern, while tips delivering coarser droplets can deliver over 22 litres (per minute) at 14 bar in a cone pattern.

Instead of different tips, other hand guns come with a range of orifice discs. These are more versatile, as a change of orifice can deliver either a finer spray or a coarser spray.



ATV spot sprayer (Nathan Cutter & Silvan)

Spraying from ute pack (Jane West – DET Centre for Learning Innovation)



Spray packs with electric diaphragm pumps (Nathan Cutter & Silvan)



Handguns (Nathan Cutter & Silvan)

Adjusting the nozzle towards a straight stream gives good penetration to wet stems and canes. Then the nozzle can be adjusted back toward the cone pattern to wet the foliage.



Table 1: Hollow cone orifice discs @ 14 bar

Orifice number	Performance	Wide angle cone spray	Straight stream spray
D2	Capacity L/min	2.4	2.5
	Max vert throw m	NA	7
	Max horiz throw m	3	10.4
D4	Capacity L/min	5	5
	Max vert throw m	NA	8.5
	Max horiz throw m	3.2	11.3
D6	Capacity L/min	10.3	11.1
	Max vert throw m	NA	10.5
	Max horiz throw m	3.2	14
D8	Capacity L/min	16.8	18.3
	Max vert throw m	NA	11.6
	Max horiz throw m	3.2	14.3
D10	Capacity L/min	22.1	27.1
	Max vert throw m	NA	12.2
	Max horiz throw m	3.4	15.2

Source: TeeJet

Calibration

Prior to spraying, select a bush to spray and decide what shape the weed can be categorised as (either dome or cylindrical - see next section). Spray that bush normally to achieve good coverage to the point of run off. Time how long it took you to spray. If you changed the nozzle setting, e.g. from spraying stems to foliage, time each operation separately and mark where you rotated the nozzle to for the different settings. Repeat what you did into a bucket for the same time(s) at the same nozzle setting(s) and at

the same pressure. Measure the spray volume and compare this with the recommended spray or water rate (using the appropriate table for the correct bush shape). Installing a flow meter on the high pressure hose next to the hand gun will make calibration easier. (See next section.)



Hand gun with flow meter (Tony Cook)

If you are spraying too much or too little, you will need to replace the orifice disc or spray tip, depending on your set-up. Alter the pressure only slightly for fine tuning. Big increases/decreases in pressure only have a small effect on flow rates. (See chapter on nozzles in SMARTtrain AQF3 Resource Folder.) Big changes in pressure can affect the efficacy of the herbicide, for example increasing the pressure produces smaller droplets which are more drift prone.

If the label specifies a spray tip or orifice plate, then the adjustment to achieve the correct volume may have to be made by either spraying faster (to reduce) or slower (to increase). If a range of tip sizes and pressures is given, then going up or down a tip size may work. If not, you will either have to speed up or slow down. For example, Starane specifies a 6-8 tip at 7-15 bar, as do Garlon and Grazon, whereas glyphosate specifies a D6 tip at 4-7 bar, and metsulfuron-methyl links tips to bush height at 5.5-7.5 bar (4/5 tip < 1 m, 5/6 tip 1-2 m, 7/8 tip 2-3 m or large diameter).

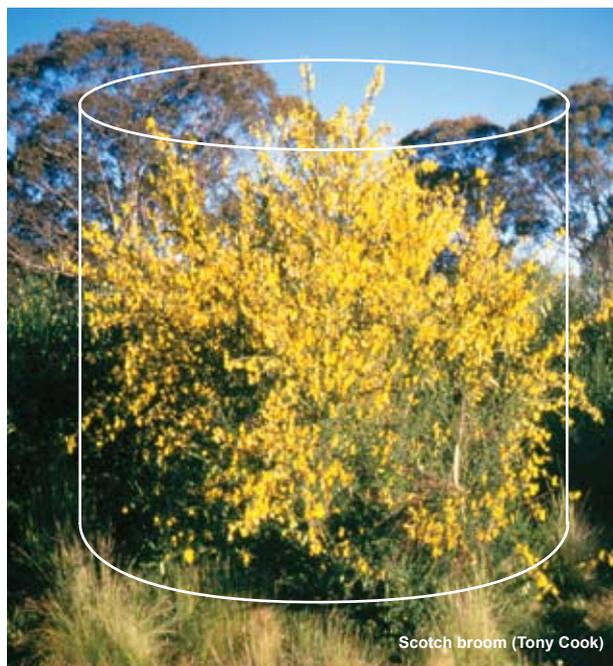
Once the adjustment is made, repeat the procedure on another bush to check you have got it right.

Spray rates

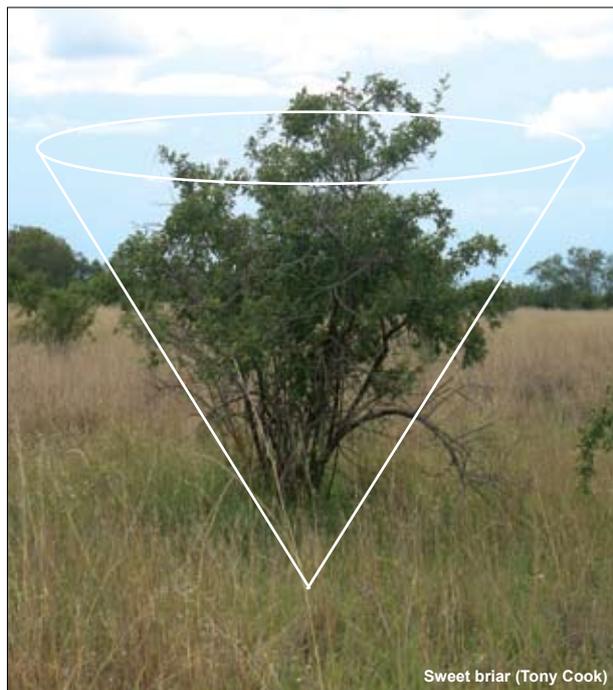
Herbicide labels will give a mixing rate, e.g. 500 mL/100 L water, but not always a spray or water rate. Even when a spray rate is given, e.g. 1500-4000 L/ha, the rate is not particularly helpful. The reason for this is that you are not spraying a flat surface. Woody weeds have to be well wet, and with some weeds the stem or canes may also have to be wet, e.g. blackberries. Where the nature of the weed and the mode of action of the herbicide requires wetting of stems and canes, the volume needed to achieve good coverage will be about 50% more than if only the foliage had to be wetted. To find out what to wet, READ THE LABEL.

To achieve good coverage, and to make sense of a rate range in hectares, it is better to think of spraying the volume enclosed by the canopy rather than the area of the canopy.

Shrubs like sweet briar and African boxthorn have canopies shaped like cylinders or inverted cones.



Scotch broom (Tony Cook)



Sweet briar (Tony Cook)

Table 2: Woody weeds with canopies like cylinders or inverted cones

Volume of spray per bush in mL (multiply by bush height: in metres)				
Bush diameter (metres)	Spray rate on label			
	1500 L/ha	2000 L/ha	3000 L/ha	4000 L/ha
0.6	40	60	80	110
0.8	80	100	150	200
1	120	160	240	310
1.2	170	230	340	450
1.4	230	310	460	620
1.6	300	400	600	800
1.8	380	510	760	1000
2	470	630	940	1300
2.2	570	760	1100	1500
2.4	680	910	1400	1800
2.6	800	1100	1600	2100
2.8	920	1200	1900	2500
3	1100	1400	2100	2800
3.5	1400	1900	2900	3900
4	1900	2500	3800	5000
4.5	2400	3200	4800	6400
5	3000	3900	5900	7900
5.5	3600	4800	7100	9500
6	4200	5700	8500	1130
6.5	5000	6600	1000	1330
7	5800	7700	1160	1540
7.5	6600	8800	1330	1770
8	7500	1010	1510	2010
8.5	8500	1140	1700	2270
9	9500	1270	1910	2550

Source: Max McMillan

To work out the spray volume per bush, estimate the diameter and height of the bush. Look up the label to find the spray rate. Garlon should be applied between 3000-4000 L/ha. Say the diameter of the bush is 2 m. From the table above, a 2 m diameter bush sprayed with a product recommending 3000-4000 L/ha would be 940-1300 mL, depending on the density of the canopy. If the bush were 3 m high, we need to multiply the area rate by 3. This would give a range of 2820-3900 mL per bush.

If the bush were only 0.5 m high, we would multiply the area rate by 0.5. This would give a spray range of 470-650 mL per bush.

Other weeds, like blackberry, bitou bush and lantana are more dome shaped.



Bitou (Cathy Mardell - DECC)



Blackberry (Tony Cook)

The volume of the canopy is a function of the area or bush diameter multiplied by the height.

Table 3: Woody weeds with canopies like domes

Volume of spray per bush in L based on 3000-4000 L/ha			
Bush diameter (metres)	Bush height (metres)		
	1.5	2	2.5
4	7	10.5	15
4.5	8.6	13.6	17.6
5	10.4	14.9	20.6
5.5	12.3	17.6	23.8
6	14.4	20.4	27.3
6.5	16.8	23.5	31.1
7	19.3	26.8	35.3

Source: Max McMillan

Dome shaped weeds like blackberry, lantana and bitou bush tend to grow in groups with a sprawling shape. They require high volumes to wet. To use the table above, estimate the diameter and height of the bush, and look up the required spray rate. For example, a bush 5 m in diameter and 2 m high would need 14.9 L of spray.

Low volume spraying equipment

Low volume spraying is mainly done with knapsacks that are pressurised manually. Some labels, like Starane, recommend the same settings as hand guns. This is not realistic, as unpowered knapsacks are not capable of delivering either the same pressures or volumes as powered hand guns. Low volume spraying is suited to smaller and less dense infestations of woody weeds because large woody weeds require good wetting of the inner canopy, a task that knapsack sprayers are not designed for.



Cut-away of knapsack (Nathan Cutter & Hardi)

When spraying woody weeds with a knapsack, ensure they are lightly and evenly sprayed so that foliage appears to have received a moderate misting. Wetting to the point of run-off when knapsack spraying (low volume) is excessive and defeats the purpose of low volume spraying, viz to apply less.

For lower volumes, the concentration of active ingredient has to be increased to maintain efficacy. As a rule of thumb, low volume spraying requires one tenth the water rate and 10 times the concentration of product compared to high volume spraying. In other words, the concentration of active ingredient should be increased to compensate for the reduced wetting of the weeds. For example, if the high volume rate for Garlon was 40 mL/10 L (or 400mL/100L water), then the low volume rate would be 400 mL/10 L. This concentrated rate would be suitable for low volume seedling eucalyptus control.

See SMARTtrain AQF3 or AQF4 references for calibration of knapsack sprayers.



Croplands knapsack (Nathan Cutter & Croplands)

Formulations exercise

You are using Grazon Extra to spray blackberry bushes.
The bush you are going to spray is 1.5 m high and 7 m across.
You are using a high volume hand gun.

1. What is the label rate of Grazon Extra to apply? _____mL/100L water
2. What is the recommended spray volume for blackberries? _____L/ha.
3. To achieve this spray volume:
 - a) What number spray tip should you use? _____
 - b) What pressure should you use? _____kPa
4. What volume of spray should you apply to the bush 1.5 m high and 7 m wide (refer to Table 3 using the answer from question 2)? _____L

© State of New South Wales through NSW Department of Primary Industries 2007. You may copy, distribute and otherwise freely deal with this publication for any purpose, provided that you attribute NSW Department of Primary Industries as the owner.

Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (September 2007). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

ALWAYS READ THE LABEL

Users of agricultural (or veterinary) chemical products must always read the label and any Permit before using the product, and strictly comply with the directions on the label and the conditions of any Permit. Users are not absolved from compliance with the directions on the label or the conditions of the permit by reason of any statement made or not made in this publication. Job number 8419



NSW DEPARTMENT OF PRIMARY INDUSTRIES