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CHEMICAL CONTROL OF WOODY WEEDS IN WESTERN NEW SOUTH WALES -

B.M. ALCHIN, WESTERN LANDS COMMISSION, BOX 4351, G.P.O., SYDNEY, N.S.W. 2001.

1. The Problem of Woody Weeds

Woody weeds ("scrub regrowth") are the main cause of reduced productivity over large areas of western N.S.W.

There are many genera and species involved in the woody weed invasion. The main ones are hopbushes (*Dodonaea* spp., particularly *D. attenuata*) turpentine (*Eremophila sturtii*), budda (*E. mitchellii*) and cassias (*Cassia* spp. particularly *C. eremophila*).

2. Use of Chemicals

There has been very limited use of spray-applied chemicals because of the high labour cost, time involved, tediousness and inconvenience of the work, cost of the chemical and the requirements for transporting and using relatively large quantities of water.

The development of the point-application technique for applying chemicals prompted the Western Lands Commission, in co-operation with Du Pont (Australia) Ltd., to commence trials in mid-1978. (Alchin *et al*, 1979; Alchin, 1981).

3. The Point-Application of Chemicals

Point-application involves the placement of a relatively small quantity of chemical on the soil surface above the maximum density of active roots of the plant being treated. When rain falls the chemical moves downward through the soil profile forming a highly concentrated "core" of material. Plant roots that pass through this "core" absorb the chemical.

4. The Chemical

The chemical used in the trials was hexazinone, manufactured by Du Pont, and with various formulation bearing the trade name "Velpar".

4.1 Formulations

4.1.1 Liquid (Velpar L (R) - registered trade name).
The equipment for point-application of the liquid is a hand-operated soil injection applicator (Spotgun (R) - registered trade name). A calibrated dose of several millitres is applied to the drip-line of the plant. One to four or more points, spaced at equal distances apart around the drip-line, are treated.

A particular advantage of the soil injection technique is the large number of shrubs which can be treated per unit volume (or weight) of chemical.

Where clumps of shrubs have plants closer than 2 to 3 times their height, the chemical can be applied on a square grid pattern through the stand. This pattern of treatment means that several plants can absorb chemical from the one point and each plant can absorb chemical from several points.

4.1.2 Pellets. (Velpar Gridball Brushkiller (R) - registered trade name). These are hard elliptically-shaped pellets, weighing 1.0, 2.0 or 4.0 grammes and consisting of a clay matrix which carries the active ingredient. They are applied in the same pattern as for the liquid point application, i.e., equally spaced around the drip-line for individual plants or on a grid pattern for dense clumps.

4.2 Characteristics
Once absorbed into the plant, hexazinone is translocated to the leaf where it causes death by inhibiting photosynthesis. The plant often produces new leaf growth and a process of defoliation and refoliation may occur several times before the plant exhausts its regenerative reserves.

Its mode of action and the strong regenerative resilience of arid zone shrubs means that hexazinone is a slow acting chemical. Field trials have indicated it may take 3 to 18 months or more for a plant to die, mainly depending on rainfall.

Hexazinone is relatively resistant to degradation by ultra-violet light but can be digested and rendered inactive by mirco-organisms.

5. Factors Affecting Response

Trials have been carried out to determine the factors that affect response. The aim of the trials is to develop recommendations to obtain the maximum response at the least cost.

5.1 Comparison of Application Techniques

Soil injection on individual plants

The soil injection technique has been successful in most trials.

Pellet application on individual plants

This formulation was always the slowest to effect response, but has frequently produced higher percentage kills than any of the other application techniques - and often at lower rates of application per plant or per hectare. The reason for the relatively good response to pellet application is probably due to the chemical remaining intact until significant rain falls at which time there is a release of chemical and stimulation of both root absorption activity and plant growth. Also, the liquid formulation may be more subject to degradation and possibly up-take by non-target plants than the pellet.

Point-application on a grid-pattern - soil injection or pellet.

The rooting habits of arid zone shrubs appear conducive to high up-take under grid-pattern application.

It has been found that where the distance between shrubs is less than 2 to 3 times their height it is more efficient to use grid pattern rather than individual plant treatment.

Consideration is being given to achieving less than 100% death with grid pattern application and treating the remaining plants on an individual basis. This may be more economical in amount of chemical required than endeavouring to attain a 100% kill with grid pattern treatment alone.

5.2 Application rate

The effective application rate for either the soil injection or pellet application depends on the plant species, soil type, seasonal conditions (particularly rainfall) as they affect movement and absorption of the chemical, as well as plant growth and plant size. Plant size involves the existing biomass of leaves as well as the regenerative reserves in the root and stem portions. The amount of chemical applied must allow for sufficient up-take (presumably there would be some loss of chemical between application and absorption) to effect defoliation of all the existing leaves as well as any leaves the plant is able to produce in refoliation.

5.3 Timing of application

The chemical hexazinone is most effective when the plants are growing actively. Active growth usually occurs when soil moisture is available and temperatures are moderate to high. Spring to early summer appears to be the optimum time for application.

5.4 Placement of application in relation to shrub dimensions

Optimum placement of application in relation to distance out from the butt of the shrub is critical in terms of achieving maximum absorption of the chemical. For most situations it appears that application at the drip-line is adequate.

5.5 Number of points of application

Results to date indicate that increasing the number of points of application for the one application rate with soil injection increases the response. This would be related to the greater probability of roots intercepting the chemical with increasing number of points of application.

5.6 Dilution of liquid

Trials involving dilution of the liquid with the soil injection technique have indicated an increased response to increasing dilution. Dilution allows an increase in the volume of liquid applied per injection. This results in greater penetration of the

chemical into the top of the soil profile and thus enhances its movement towards the plant roots.

5.7 On or below soil surface application for soil injection.

Nozzle attachments on the soil injector can be exchanged so that the liquid is applied to either the top of the soil surface or at any depth up to several centimetres below the soil surface. The below-surface application was developed mainly for sloping areas to prevent overland flow of the liquid. Trials were carried out to compare on-surface soil and below-soil surface application on level areas on the basis that below-surface application may lessen any loss of chemical from disturbance or break-down. However, results to date have not indicated any significant difference between the treatments.

5.8 Placement on bare soil, litter or pasture plants.

It was considered that point-application of chemicals would be affected by placement on bare soil, litter or pasture plants. Unexpectedly, trials to date have not indicated any significant difference between the three placements.

5.9 Soil type

Hexazinone is slightly adsorbed by clay particles and organic matter. However, its high solubility means that it is transported rapidly through soils of high sand content. The effect of soil type and characteristics is currently being studied.

5.10 Pasture growth

Trials have shown that each point of application affects pasture growth within a circular shape of 30 to 50 cm diameter around the point, depending on the rooting dimensions of the adjacent pasture plants. For a closely spaced grid of 1.4m square, there was a 50 cm diameter influence around each point, approximately 10% of the total area being affected.

Trials have indicated that any plant that germinates or has roots that grow into the concentration of chemical within 12 months of application would normally die. After about 12 months, depending

mainly on rainfall, the chemical has been leached below the root zone of most pasture species as well as being reduced through degradation. The first pasture plants to recolonise the bare areas are medics (because of the symbiotic bacteria being able to degrade the chemical). Grasses, herbage and pasture shrubs follow the medics.

5.11 Residual and break-down characteristics

The residual and break-down characteristics of hexazinone are important in relation to the length of time the chemical remains active and available for absorption by both target and non-target species.

Results to date indicate that the chemical will remain available, awaiting movement by rainfall and absorption by the plant for several months to 2 years and possibly longer.

It has been noted in some trials that, as well as the initial target plant, shrubs which have germinated near the treated point several months after application have also died.

6. Application Rates and Costs

It will be some time before optimum application rates can be recommended for each species in every situation. However, sufficient data has been collected to provide a guideline. The following table provides a basis for probable general recommended application rates on individual plants.

6.1 Individual Plants

Table 1. Tentative estimates of rates and costs for application of "Velpar" to individual shrubs, saplings or suckers.

SITE	RATES AND COST PER PLANT			
	Active Ingredient* (grammes)	Volume** Liquid (m^l)	No. of Pellets$^{\phi}$	Cost of Chemical$^{\phi\phi}$
Shrubs, Suckers, Saplings Less than 1 metre high	0.5	2	1	4 cents
1 to 2 metres high	1.0	4	3	8 cents
Greater than 2 metres high	2.0	8	5	16 cents.

* Effective results have been obtained with less ingredient but the figures shown are the anticipated optimum amounts to effect death of the plant under most conditions.

** Applied through the "Spotgun".

ϕ Based on the 4.0 gramme pellet - the number shown contains the quantity of active ingredient closest to that indicated in the first column. There is no commercial price available for the pellets yet.

ϕϕ Based on price of $20.00 per litre for liquid (retail price varies from about $15 to $20 per litre).

The application rate for suckers may need to be higher than indicated, depending on how much regenerative reserve is present in the plant, particularly in the underground portions.

7. The Potential role of Chemical Control.

7.1 Treatment of encroaching scrub areas

Point-application of chemicals has the potential to provide significant economic control in encroaching scrub areas. The following table presents the estimated time and cost involved for treating stands of scrub regrowth at various densities:

Table 3. Tentative times and costs involved in treating stands of different density.

DENSITY (Plants /ha)	AVERAGE SPACING (Metres)	COST OF LIQUID ($/ha)	TIME INVOLVED (min/ha)	COST OF LABOUR ($/ha)	VEHICLE COST ($/ha)	TOTAL COST ($/ha)	TOTAL TRANSPORT COST ($/ha)
114	10	$9.12	25	$2.08	$0.06	$11.30	Motorbike at 5 k.p.h.
28	20	$2.24	5	$0.40	$0.03	$ 2.70	Motorbike at 10 k.p.h.
5	50	$0.40	1	$0.08	$0.01	$ 0.50	Motorbike at 15 k.p.h.
1	100	$0.08	0.5	$0.04	$0.01	$ 0.10	Motorbike at 20 k.p.h.

Notes

Cost of chemical - based on $20.00 litre (the assumption is that the shrubs are 1 to 2 metres high and application rates are as in Table 1.

Time involved - based on taking 5 seconds to treat each plant and travelling time on motorbike between plants at speed noted.
Cost of labour - based on $5.00/hour.
Vehicle cost - based on $0.05/kilometre (a 4-wheel drive vehicle could be used but this would increase costs).
Total cost - figures rounded to nearest 10 cents.

Assuming a typical area of scrub encroachment to have 1 to 2 metre high shrubs at 20 metres apart, this would cost approximately $3/hectare ($1.00/acre).

The cost of chemical treatment increases at an accelerating rate with increasing plant size and stand density. The cost of treatment is significantly reduced on (a) a per hectare basis if encroaching regrowth is treated as early as possible and (b) an individual plant basis if the plants are treated when they are as small as possible.

7.1.1 Practical aspects

Treatment pattern

Maintaining a check on individual plants and areas already treated to ensure efficiency of travel can be facilitated by the use of a dye in the liquid (which remains visible for up to 2 months without rain) and simple markers tied to shrubs.

Use of soil injector

Observations indicate that best results are obtained by having the soil injector at an angle (a) as close to vertical and (b) as close to the soil, as possible.

7.1.2 Integrated control programme

It is proposed that an integrated control programme involving fire and chemical would greatly reduce the problem of scrub regrowth. CSIRO research has indicated that burning to control scrub is most effective in the autumn. A programme involving an autumn burn followed by chemical treatment in the spring appears a feasible proposition. (Trials are being carried out on comparative burnt and unburnt areas). It is presumed that shrubs that survive the fire will have largely exhausted their reserves for regeneration by spring and the chemical treatment may not require a very high application rate to effect death.

It has also been proposed that, where areas are suitable, chemical application to control scrub could be feasible following intensive goat grazing.

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