QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES
DIVISION OF PLANT INDUSTRY BULLETIN No. 701

SOME STUDIES INTO THE CHEMICAL CONTROL OF DAWSON GUM OR BLACKBUTT (EUCALYPTUS CAMBAGEANA)

Part I—Introduction and Stem Injection of Virgin Trees

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SUMMARY

In this paper, the first of a series on the chemical control of Dawson gum (*Eucalyptus cambageana* Maiden), four growth forms are defined and results of experimental work on one of these (virgin trees) are reported.

Stem injection using picloram-based chemicals was effective in killing virgin trees, using both basal and waist-high injections at 10 cm and 15 cm spacings. 2,4,5-T amine was less effective particularly when injections were made at waist height and using 15 cm spacings. Trees exceeding 150 cm in circumference at waist height were more difficult to kill than smaller trees.

Results of experimental work into the control of the other growth forms (sapling trees, multi-stemmed regrowth, sucker regrowth) will be reported in subsequent papers.

I. INTRODUCTION

Dawson gum or blackbutt (*Eucalyptus cambageana* Maiden) is commonly associated with brigalow (*Acacia harpophylla* F. Muell. ex Benth.) in an open forest community over a wide area of Queensland from Augathella and Taroom in the south to Charters Towers in the north. It also occurs to a much smaller extent as the dominant species in an open forest community with an understorey of bastard sandalwood (*Eremophila mitchellii* Benth.), wilga (*Geijera parviflora* Lindl.) and currant bush (*Carissa ovata* R. Br.). Dawson gum also occurs as an emergent in some dry closed forest (softwood scrub) communities. Communities in which Dawson gum plays an important role occupy more than 1 million hectares of country. They are mainly found on texture contrast soils with a shallow sandy or loamy A horizon. Gunn (1967) indicated that the depth of the A horizon is usually less than 37 cm.

Since mid 1950, the clearing of brigalow-Dawson gum communities has been undertaken as part of the large scale development of the brigalow country of Queensland. The usual method of clearing has been to pull the forest to the ground with a heavy chain or chain and cable dragged between two bulldozers (Johnson 1962, 1964). Because of the size of the large Dawson gum, many were left unpulled, particularly where low-powered bulldozers were used. Consequently the presence of large standing Dawson gum is a feature of cleared brigalow-Dawson gum country.

Following pulling, the trash is burnt and seed of introduced grasses is sown into the ash. Dawson gum regrowth on these burnt areas and also following the burning of natural communities has often led to a marked reduction in pasture productivity. Regrowth is of two types, seedling regrowth and regrowth from lignotubers. The former appears to be associated with standing trees which shed seed at the time of the initial burn or, if they survive the fire, in subsequent years. Seedlings usually develop into single-stemmed saplings. Regrowth from lignotubers occurs when established plants of Dawson gum are damaged by fire or mechanical operations such as pulling, particularly on areas where regrowth is already prevalent. Sprouting from the lignotubers results in bushy suckers which within a few years grow into multi-stemmed 'saplings'.

Because of great variation in growth form, related to the age and previous history of the individuals, no single method of control is suitable in all cases. The particular method selected is also influenced by the areal extent of the problem and the density of the individuals being treated. These studies were designed to obtain information on the chemical control of Dawson gum involving the treatment of individual plants.

To define the problem more precisely four growth forms were recognized—

(1) VIRGIN TREES. Trees greater than 60 cm in circumference at waist height.

(2) SAPLING TREES. Small single stemmed trees up to 60 cm in circumference at waist height. These trees would have been either seedlings whose growth had not been checked by fire or mechanical damage, or regrowth from lignotubers unchecked for a sufficient period to allow the leading shoot to suppress and eventually kill all other shoots.

(3) MULTI-STEMMED REGROWTH. Regrowth from lignotubers, following destruction of the above-ground parts by fire or mechanical means, which was old enough to have stems of approximately 15 mm diameter or more.

(4) SUCKER REGROWTH. Regrowth in its first season of growth from lignotubers following destruction of their above-ground parts.

Four methods of application were selected as being suitable for the control of some of these types of regrowth—

(1) TREE INJECTION. This involves placing small amounts of chemical into the sapwood of the tree by injecting it through the bark. This method is suitable for use on virgin and sapling trees but becomes an extremely difficult and time-consuming method for use on multi-stemmed regrowth. Because of the lower labour content involved, this method has largely replaced frill ringing and poisoning. For this reason, the latter method was not considered.

(2) BASAL BARK SPRAYING. This involves the spraying of the lower trunk of the plant up to 55 cm from the ground and is suitable as a method for controlling young sapling trees and multi-stemmed regrowth.

(3) Cut Stump Application. This involves chopping down the above-ground growth close to ground level and swabbing or spraying the cut stump. This is also a suitable method of application for the control of young sapling trees and multi-stemmed regrowth.

(4) Foliage Application. This involves spraying or misting the foliage of the plant and is suitable as a method of control only when regrowth is less than 1·5 m high. Larger plants require a considerable quantity of spray solution and application is difficult and very time consuming.

This paper is concerned with the use of tree injection for destroying virgin trees. Subsequent papers will deal with the control of other forms of Dawson gum.

II. MATERIALS AND METHODS

Experimental area

The trial was undertaken on the Brigalow Research Station, 32 km north-west of Theodore. The trial area (Figure 1) was originally part of a brigalow-Dawson gum-wilga forest which was pulled in September 1963. Two adjoining ridges, where large numbers of Dawson gum had been left standing, were selected. The area was burnt in December 1963 and many of the Dawson gum were damaged, leaving areas of scar tissue round the base. Only relatively undamaged trees were treated. The soil is a loamy duplex soil with a dark brown sandy loam 15 to 20 cm thick on a hard very dark greyish brown B horizon (Northcote Db 1.43).

Chemicals

Three chemicals were used, each at one concentration and one rate of application.

(1) Picloram plus 2,4-D amine ('Tordon 50D'), containing 5% a.e. of picloram and 20% a.e. of 2,4-D, both present as tri-isoproplyamine salts. Application rate was 2 ml per cut of a 1 plus 4 mixture in water, equivalent to 1% picloram plus 4% 2,4-D.

(2) Picloram plus 2,4,5-T amine ('Tordon 105'), containing 5% a.e. of picloram and 20% a.e. of 2,4,5-T, both present as tri-ethylamine salts. Application rate was 2 ml per cut of a 1 plus 4 mixture in water, equivalent to 1% plus 4% 2,4,5-T.

(3) 2,4,5-T amine ('Farmco T.A. 20'), containing 20% a.e. of 2,4,5-T as the dimethylamine salt. Application rate was 2 ml per cut of a 1 plus 1 mixture in water equivalent to 10% 2,4,5-T.

Method of application

Tree injection was used with variations in the positioning and spacing of cuts.

Application was made at waist height (1 m above ground level) and at the base (7·5 to 15 cm above ground level). Because of incipient buttressing at the base, the circumference of older trees increases greatly in the lowest 25 cm of the trunk and the basal height selected was felt to be the most convenient and economical. Tree injections are usually made with an injection gun and built-in dispenser or with a light axe and hand vaccinator. The tree injector is suitable only for basal application, whereas the axe is most acceptable when used at waist height. A commercial tree injector (J.K.L. gun) was used for basal applications and an axe and vaccinator for waist-high applications. In both cases, injections were made at 10 cm and 15 cm spacings, the distance being measured between centres of adjoining cuts.

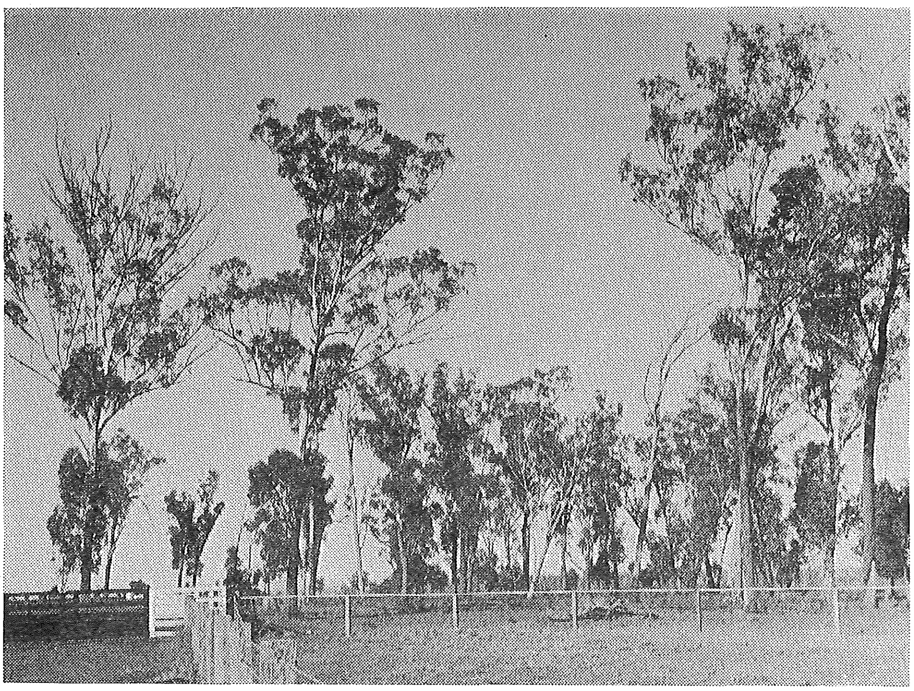

Figure 1. Experimental area showing virgin Dawson gum trees.

Time of application

Treatments were applied on 29 February 1968. The aim was to treat the trees when they were actively growing. Average rainfall had been received for the 3 months before treatment and rainfall was above average in the 3 months after treatment.

Experimental design

A three-factor factorial (chemical x spacing x height) in a randomized block design was used, the two blocks being located on adjoining hills. At the time of treatment, all trees were tagged and the circumference at waist height and at the base was measured. The position of the injection cuts was marked on the bark before treatment.

Ten trees were selected at random within each block for each treatment. Because the size of the tree may have had an influence on the result, an attempt was made to include the whole range of size classes available in similar proportions within each treatment. This meant that, when tagging the final few trees in each treatment, trees were selected from specific size classes so that the approximate population mean was approached. Trees, with cuts made at both spacings and both heights but without the application of chemicals, were used as controls.

Two interim counts were made 6 months and 12 months after treatment and a final assessment was undertaken on 23 September 1969, 19 months after treatment. Dead and alive trees were recorded and the percentage defoliation was recorded on all live trees using the six class intervals (0 to 5, 5 to 25, 25 to 50, 50 to 75, 75 to 95, 95 to 100%). Results were analysed using transformed and untransformed data. A square root transformation was applied to density data and an inverse sine transformation to percentage defoliation data.

TABLE 1

KILL OF DAWSON GUM 18 MONTHS AFTER VARIOUS TREATMENTS

Chemical	Position	Spacing	Trees killed out of 10 Equivalent Mean (Transformed Value)	Maximum Defoliation Equivalent Mean (Transformed Value)*
Picloram + 2,4,5-T amine ..	Waist ..	10 cm	10·0 (3·162)	100·0 (1·571)
		15 cm	7·9 (2·806)	95·4 (1·355)
	Base	10 cm	7·5 (2·725)	90·1 (1·250)
		15 cm	7·5 (2·725)	88·8 (1·229)
Picloram + 2,4-D amine ..	Waist ..	10 cm	6·7 (2·581)	91·6 (1·277)
		15 cm	6·0 (2·449)	72·0 (1·013)
	Base	10 cm	7·9 (2·806)	93·2 (1·308)
		15 cm	6·0 (2·441)	79·0 (1·095)
2,4,5-T amine	Waist ..	10 cm	4·0 (2·000)	50·1 (0·787)
		15 cm	2·0 (1·414)	44·5 (0·731)
	Base	10 cm	6·9 (2·618)	81·8 (1·130)
		15 cm	5·4 (2·323)	76·6 (1·065)
Control	Waist ..	10 cm	0·0	1·3
		15 cm	0·0	1·0
	Base	10 cm	0·0	1·4
		15 cm	0·0	1·3
Difference Necessary for significance 5%	..	..	(0·946)	(0·579)
1%	..	..	(1·336)	(0·817)

* Percentage data.

III. RESULTS

Results are given in Tables 1 and 2.

Although counts were made 6, 12 and 18 months after treatment, more than 90% of the trees which eventually died were without green leaves at the first count.

Treatments involving picloram plus 2,4,5-T amine were significantly better ($P < 0{\cdot}01$) than those in which 2,4,5-T amine alone was used. Picloram plus 2,4-5-D amine was intermediate in effectiveness, being significantly better than 2,4,5-T amine ($P < 0{\cdot}05$). Where either of the picloram mixtures was used, the height and method of treatment had little effect on the results. But with the 2,4,5-T amine, kills in trees injected at the base were markedly better than kills in trees treated by waist-high injection. With basal treatment, the 2,4,5-T amine was only slightly inferior to the picloram treatments.

TABLE 2

MAIN EFFECTS FROM FACTORIAL ANALYSIS USING KILL DATA

Chemicals		Spacing		Position	
Treatments	Equivalent Means (Transformed Means)	Treatments	Equivalent Means (Transformed Means)	Treatments	Equivalent Means (Transformed Means)
Picloram + 2,4,5-T amine	8·25 (2·854)	10 cm	7·25 (2·649)	Waist ..	6·17 (2·402)
Picloram + 2,4-D amine	6·75 (2·569)				
2,4,5-T amine	4·62 (2·089)	15 cm	5·83 (2·360)	Base ..	6·92 (2·609)
Differences necessary 5%	(0·473)	..	(0·386)	..	(0·386)
for significance 1%	(0·668)	..	(0·545)	..	(0·545)

Spacing cuts 10 cm apart gave better results than 15 cm spacing with all chemicals but the differences were not significant. The difference was greatest with 2,4,5-T alone and least where picloram plus 2,4,5-T amine was used.

The size of the treated trees influenced the result. With trees under 150 cm in circumference at waist height, the average kill obtained following waist-high treatments with picloram based chemical was 87% compared with 48% for larger trees. With basal treatments 77% of the smaller trees were killed compared with 61% for the larger trees. There were too few data from the large trees to determine whether the effect was different for different chemicals.

Over the whole population, the proportional relationship between the circumference of the trees at waist height and at the base (·84 ± ·06) was fairly constant and at the same spacing approximately 19% more cuts were required for basal treatment.

Because treated trees were selected at random and only a small proportion of the available trees was treated, no estimate was made of increased plant productivity.

IV. DISCUSSION

This trial was carried out in a summer of average rainfall and results are strictly applicable only under these conditions. Subsequent papers in this series will discuss the influence of time of treatment.

Movement of chemical from the site of treatment has been a problem in the control of eucalypts (Young 1966). As eucalypts are able to regenerate from buds at or near ground level, chemical treatments with 2,4,5-T have been most effective when the chemical is applied as close to this area as possible. Both by increasing the distance between injection cuts and by increasing the height of treatment, the ability of a chemical to move from the point of injection into the lignotuber is tested. It appears that the picloram treatments resulted in greater lateral and vertical movement than the 2,4,5-T amine treatments or, with equal movement, that picloram was more effective at relatively lower concentrations. The more the method of treatment relied on movement, the relatively less effective were the treatments with 2,4,5-T amine. Picloram plus 2,4,5-T was more effective than picloram plus 2,4-D. On woody plants, 2,4,5-T is usually more phytotoxic than 2,4-D and this alone could account for the increased effectiveness of the picloram plus 2,4,5-T mixture.

The height of treatment is dictated by the equipment used. It was found more difficult to dispense accurately a measured dose with the particular injector used than with the vaccinator. As there was little difference in effectiveness using picloram plus 2,4,5-T when injected at the base or the waist and as more cuts and more chemical are used with the same spacing if injections are made at the base, it is considered that waist-high treatment is preferable.

Because the size of an individual tree is correlated with the square of the circumference of the trunk, the decrease in effectiveness with increase in circumference is probably a result of insufficient chemical being injected. This indicated that closer spacings or higher concentrations or larger dose rates are necessary when the circumference of the trunk at waist height exceeds 150 cm.

The most effective treatment, picloram plus 2,4,5-T injected at waist height using 10 cm spacings, killed all trees treated regardless of size.

V. ACKNOWLEDGEMENTS

We wish to thank Mr. N. D. Young, Dow Chemical Co., for his assistance in planning this trial and the Dow Chemical Co. for supplying chemicals. Acknowledgement is also made of Miss E. Goward, Special Biometrician, who carried out the statistical analysis.

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(Received for publication 5 September 1974)

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