THE USE OF A MIXTURE OF TERBUTHYLAZINE AND TERBUTHYLATON FOR CONTROL OF GRASS IN *PINUS RADIATA* PLANTATIONS

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Summary

A mixture of terbuthylazine and terbuthylaton was evaluated in the Kinleith forests over the period 1971 to 1974. Various rates and combinations with other chemicals were used to test tolerance of radiata pine (*Pinus radiata* D. Don) and control of grass weeds. Results from a number of trials are presented and discussed.

INTRODUCTION

A major factor in the survival and growth of newly planted radiata pine is weed competition, which may be severe in the case of grass weeds. Control of grass in plantations has been briefly described (Bowers, 1971). In 1971 a proprietary mixture containing 25% terbuthylazine plus 25% terbuthylaton as a wettable powder became available. For the sake of brevity this will be referred to in this paper by its code number 'A3587'. This material was tested against N.Z. Forest Products Limited standard grass control mixture, which in 1971 was 2 kg/ha amitrole-T and 4 kg/ha atrazine.

EXPERIMENTAL

All treatments were applied to 1/0 radiata pine recently planted in pasture. Plots were 10 m x 2 m. Details of the main trials are given below:

Trial No.	*Treatment Date*	*Replications*	*Trees per Plot*
266	18.8.71	2	10
324	18.9.72	3	20
336	24.9.73	3	20

All applications were made at a volume of 330 litres/ha with surfactant added at 0.1%. The main weed species in all trials were ryegrass (*Lolium perenne*), Yorkshire fog (*Holcus lanatus*), cocksfoot (*Dactylis glomerata*), sweet vernal (*Anthoxanthum odoratum*) and white clover (*Trifolium repens*), from 10 cm to 20 cm in height. In addition an aerial application was made on 2.10.72 to 2 ha of recently planted radiata pine in pasture, under operational conditions.

RESULTS and DISCUSSION

In trials 266 and 324, tree heights were measured after the first growing season, and heights, diameters and green weights after the second growing season. Green weights are given down to ground level only. In the trials 336 tree heights and diameters were measured after the first growing season. Results from the trials are given in Tables 1 to 5.

TABLE 1: MEAN TREE MEASUREMENTS

Treatment (kg/ha)	1 Year Height (cm)	1 Year Diam (cm)	2 Years Height (cm)	2 Years Diam (cm)	Green weight (kg)	Survival %
1971 TRIAL:						
'A3587' 10	86.6	—	202	5.0	4.9	100
'A3587' 5 + amitrole-T 2	77.4	—	188	4.2	3.9	100
'A3587' 10 + amitrole-T 2	84.8	—	215	5.1	5.8	100
atrazine 4 + amitrole-T 2	58.4	—	137	2.8	1.5	95
untreated control	45.2	—	118	2.3	1.0	77
1972 TRIAL:						
'A3587' 10	86.6	—	234	5.3	6.8	90+
'A3587' 4 + amitrole-T 1	81.0	—	215	4.8	5.7	90+
'A3587' 5 + amitrole-T 1	81.8	—	228	5.0	6.0	90+
'A3587' 10+ amitrole-T 1	76.1	—	213	4.6	4.9	90+
'A3587' 4 + amitrole-T 2	74.9	—	204	4.4	4.6	90+
'A3587' 5 + amitrole-T 2	71.9	—	195	4.5	5.0	90+
'A3587' 10+ amitrole-T 2	74.0	—	219	4.9	6.0	90+
atrazine 4 + amitrole-T 2	67.8	—	209	4.5	4.8	90+
untreated control	49.6	—	150	3.0	1.9	63
1973 TRIAL:						
'A3587' 10	91.3	1.8				
'A3587' 20	96.0	1.9				
'A3587' 5 + amitrole-T 1	92.8	1.8				
atrazine 4 + amitrole-T 2	87.1	1.6				
atrazine 5 + amitrole-T 1	94.9	1.9				
untreated control	61.1	0.9				

TABLE 2: COMPARISON OF TIMES OF TREATMENT — MEAN TREE MEASUREMENTS FROM 1973 TRIAL

Treatment (kg/ha)	Treatment Date	Height at 1 year (cm)	Diameter at 1 year (cm)
'A3587' 5 + amitrole-T 1	24.9.73	92.8	1.8
'A3587' 5 + amitrole-T 1	25.10.73	85.1	1.5
'A3587' 5 + amitrole-T 1	27.11.73	72.0	1.2
untreated control	—	61.1	0.9

TABLE 3: COMPARISON OF RATES AND FORMULATIONS OF AMITROLE — MEAN TREE MEASUREMENTS

Treatment (kg/ha)	1 Year Height (cm)	1 Year Diameter (cm)	2 Years Height (cm)	2 Years Diameter (cm)	Green Weight (kg)
1972 TRIAL:					
'A3587' 5 + amitrole-T 1	81.8	—	228	5.0	6.0
'A3587' 5 + amitrole-T 2	71.9	—	195	4.5	5.0
'A3587' 5 + amitrole SP 1	79.9	—	211	4.9	5.4
'A3587' 5 + amitrole SP 2	80.4	—	219	5.0	5.8
'A3587' 5 + amitrole SP 3	68.4	—	187	4.2	4.1
1973 TRIAL:					
'A3587' 5 + amitrole-T 1	92.8	1.8	—	—	—
'A3587' 5 + amitrole SP 1	90.3	1.7	—	—	—

Mean visual ratings for grass control are presented in Table 4. Assessments were made on a 1 to 10 scale (1 = no effect, 10 = full control). Ratings were based on control of grasses only, and take no account of other weeds, mainly sheep's sorrel *(Rumex acetosella)*.

TABLE 4: GRASS CONTROL

Treatment (kg/ha)	*Mean visual 5 months*	*Ratings 7 months*
1971 TRIAL:		
'A3587' 5 + amitrole-T 2	9.0	—
'A3587' 10 + amitrole-T 2	10.0	—
'A3587' 10	8.0	—
atrazine 4 + amitrole-T 2	5.0	—
1972 TRIAL:		
'A3587' 5 + amitrole-T 1	9.3	—
'A3587' 10 + amitrole-T 1	9.8	—
'A3587' 10	9.0	—
atrazine 4 + amitrole-T 2	8.5	—
1973 TRIAL:		
'A3587' 5 + amitrole-T 1	8.7	8.7
'A3587' 10	7.3	7.7
'A3587' 20	9.7	9.7
atrazine 4 + amitrole-T 2	8.7	8.7
atrazine 5 + amitrole-T 1	9.0	8.3
'A3587' 5 + amitrole-T 1 (October)	6.3 (4 months)	5.7 (6 months)
'A3587' 5 + amitrole-T 1 (November)	5.3 (3 months)	4.0 (5 months)

In all treatments control of grass was satisfactory, except in the atrazine/amitrole-T treatment in the 1971 trial, where excessive rain in the two months following application was thought to have leached out the atrazine. Yorkshire fog, ryegrass and sweet vernal were fully controlled, but cocksfoot was only partially controlled. Cocksfoot accounted for the poorer results in the 1973 trial, particularly in the October and November treatments. White clover was fully controlled. Flat weeds, mainly sheep's sorrel, appeared four to six months after treatment, and grasses and white clover re-established during the winter following treatment.

During the late summer and autumn following successful grass control, nodding thistle *(Carduus nutans)* and Scotch thistle *(Cirsium vulgare)* germinate, and may present serious competition during the second year. This often necessitates a separate release operation. In the 1972 trials nodding thistle was a serious weed in buffer strips and surrounds, and although occurring in the atrazine treatments, was observed to be minimal in the plots treated with low rates of 'A3587', and absent in plots treated with heavy rates of 'A3587'.

Counts were made in the 1973 trial to compare similar rates of atrazine and 'A3587' for control of nodding thistle. The results are given in Table 5.

TABLE 5: CONTROL OF NODDING THISTLE

Treatment (kg/ha)	*Occurrence of nodding thistle after 8 months (plants/ha)*
'A3587' 5 + amitrole-T 1	< 2,500
atrazine 4 + amitrole-T 2	>15,000
atrazine 5 + amitrole-T 1	>15,000

Tree Growth:

The growth of trees treated with 'A3587' in combination with amitrole-T was as good as that of trees treated with atrazine and amitrole-T,

and may under conditions of heavy rainfall be better. The growth of trees treated with 20 kg/ha of 'A3587' in the 1973 trial was greater, probably due to better weed control. Treatments in combination with 2 kg/ha of amitrole-T gave poorer growth than with 1 kg/ha of amitrole-T, with both 'A3587' and atrazine. At high rates (10 kg/ha or over) 'A3587' alone gave good growth.

Tree tolerance:

Amitrole-T at 2kg/ha produced chlorosis for up to seven months, and resulted in reduced growth. At 1 kg/ha chlorosis was less severe and lasted for only two to four months. 'A3587' alone produced no chlorosis. All treatments with 'A3587' resulted in the trees becoming a darker green, particularly at the heavy rates.

Weed Control:

1. Control of grass was good, and generally lasted for the whole of the growing season. Cocksfoot was only partially controlled, large plants tended to recover by late summer or autumn, but small plants were killed.
2. Germination of nodding thistle and Scotch thistle was controlled by 'A3587' but not by atrazine. This obviated a separate spraying operation in the winter or spring following planting.

   Based on trial work a treatment of 1 kg/ha amitrole-T + 5 kg/ha 'A3587' is thought to be optimum for aerial operations.

CONCLUSIONS

1. A mixture of terbuthylazine and terbuthylaton gave effective control of grass in radiata pine plantations and compared favourably with atrazine in combination with amitrole-T in both weed control and tree growth.
2. Radiata pine showed good tolerance to the mixture at rates up to at least 20 kg/ha.
3. The mixture of terbuthylazine and terbuthylaton controlled the germination of nodding thistle and Scotch thistle for up to 12 months.

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REFERENCES

Bowers, A., 1971. Aerial release in young pine plantations. *Proc. 24th N.Z. Weed and Pest Control Conf.*: 21-3.