

## SCREENING RED CLOVER CULTIVARS FOR TOLERANCE TO 2,4-D

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### SUMMARY

A large number of red clover (*Trifolium pratense*) lines was screened for tolerance to the herbicide 2,4-D amine. Selections were made from eight promising lines including four New Zealand cultivars and these plants were cross pollinated. The harvested seed was used in glasshouse and field trials. Differences between lines were apparent and the tetraploid red clovers G22 (NZ) and 'Grasslands Pawera' (NZ) were more susceptible to herbicide damage than the other lines (all diploid). There were encouraging differences in tolerance between the selected crosses and the unselected control material.

### INTRODUCTION

In recent years there have been several successful attempts to increase the herbicide tolerance of grass and clover cultivars. The main benefit sought in overseas work is the use of a low cost herbicide where damage to one of the cultivars would normally preclude the use of that herbicide. Faulkner (1976) tested a line of perennial ryegrass (*Lolium perenne*) which showed resistance to paraquat and this has since been certified as the cultivar 'Stormont Causeway'. He also published (Faulkner 1978) results of trials testing a dalapon resistant perennial ryegrass while Devine *et al* (1975) bred a line of birdsfoot trefoil (*Lotus corniculatus*) which showed resistance to 2,4-D. Herbicide tolerance in red clover would reduce damage in operations such as thistle control in pastures. Tolerance would also enable control of contaminants in seed crops of the same species germinating from buried seed.

The method used in these trials was to apply high rates of 2,4-D to a wide range of cultivars and select from surviving plants. All trial work was carried out at Grasslands Division, Palmerston North.

### METHOD

#### Preliminary trials

2,4-D amine (Weedar 77 40%) was applied twice to 480 lines of red clover as part of a large evaluation trial (Claydon and Rumball 1982). Seventeen lines were selected as having potential tolerance, and from these 11 lines were selected after further 2,4-D applications in a glasshouse box trial.

Plot testing of these 11 lines including four NZ cultivars, all sown in rows, was carried out in a field trial replicated four times. Rates and time intervals are shown in Table 1. Each plot received a single application. Scores were made for plant damage and density of the row approximately a month after each spray application. The results were analysed using pre-treatment growth and density measurements as a covariate.

The best surviving plants from eight lines were removed for cross pollinating during the summer of 1981-82. Each line was crossed separately in isolation cages using long-tongued bumble bees.

#### Selection trials

The harvested seed was sown in boxes for further spray treatment and selection. Six weeks after sowing 2,4-D was applied at 1 and 2 kg ai/ha. Levels of damage were noted at weekly intervals for five weeks.

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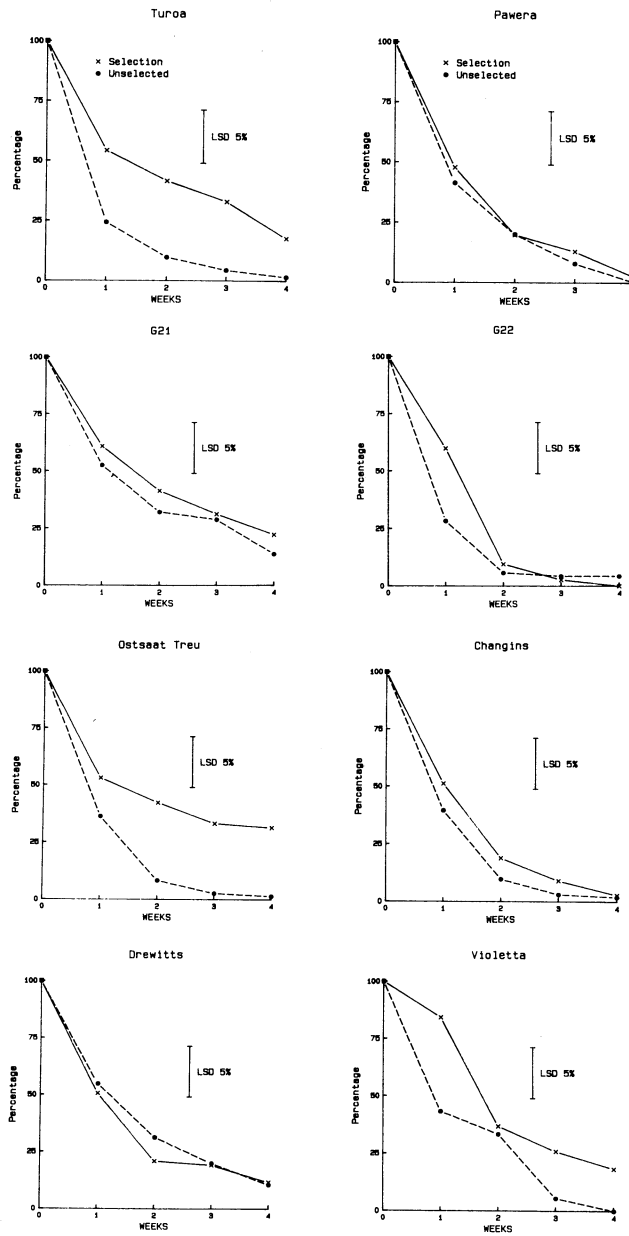


Fig. 1: Percentage of red clover plants surviving after application of 2,4-D at 12 kg ai/ha.

A field trial was laid down on 9.11.82 to compare selected with unselected control seed. As establishment of the clovers was variable two micro plots of 0.1m<sup>2</sup> were hand thinned to equal numbers in plots before spraying with 2,4-D at 12 kg ai/ha on 2.2.83. Surviving plants were counted on 22.2.83, 1.3.83, 8.3.83 and 15.3.83, and counts converted to percentage of original plants present for analysis and presentation. Cultivar growth stage was variable at spraying so only plant age has been presented.

### RESULTS

In the first field trial Changins, Drewitts and Otsaat Treu displayed most tolerance over four application times. However, damage was significant (Table 1). G21 was reduced after the third application and all four lines scored well in density.

**TABLE 1: Growth score (max. = 6, min. = 0) of New Zealand and overseas red clover cultivars in field trial one month after spraying with 2,4-D.**

Plant age (in weeks) at spraying	6	8	12	16
Rates (kg ai/ha)	6.8	11.3	11.3	15.8
Pawera	2.7	3.4	3.0	2.6
Turoa	2.1	1.9	2.5	2.8
G21	3.7	3.6	3.7	3.4
G22	2.5	3.1	2.9	2.9
Bara	2.5	3.1	2.5	2.8
Changins	3.9	4.1	4.7	3.7
Drewitts	4.1	4.3	4.5	3.6
Vesta	3.3	3.4	2.9	3.0
Otsaat Treu	3.2	3.7	4.4	3.9
Violetta	2.9	3.0	3.5	3.2
Otofte	2.6	3.1	2.6	2.9
LSD 5%	0.95	0.73	0.73	0.54

### Selection trials

Both Turoa and G22 selections were significantly more tolerant than the unselected control lines when tested in boxes whereas the Pawera and G21 selections were only slightly tolerant. In the field trial live plant percentage of Turoa, G22, Changins, Otsaat Treu and Violetta increased after selection, but Drewitts decreased (Fig. 1). There was a significant difference with time, the mean percentage of all live plants declining from 49% to 8% over the evaluation period.

### DISCUSSION

The large difference in tolerance between G21 (diploid) and G22 (tetraploid) lines with similar agronomic characteristics (Claydon and Rumball 1982) shows advantage to the diploid. This is also illustrated with 'Grasslands Pawera' (tetraploid) and 'Grasslands Turoa' (diploid) selection results in the final trial. With Pawera the ploidy factor may limit the possibility of its continued place in this particular plant breeding programme.

Of the four New Zealand cultivar selections, greatest gain was made with Turoa. The Grasslands pipeline cultivar G21 (diploid) shows considerable promise with its natural tolerance and warrants further selection. However, the other pipeline cultivar, G22 (tetraploid) showed little tolerance and it is doubtful if further work is warranted. The agronomic characteristics of the overseas lines (Claydon and Rumball 1982) are such that only Changins (Switzerland) is suitable for further selection although Drewitts demonstrated high natural tolerance and significant improvement was made with Otsaat Treu.

The selection differences overall were encouraging and further work is under way to establish if these differences still exist in a normal sward at recommended rates for weed control. Progress from only one generation has been substantial and recurrent selection should achieve greater progress.

#### ACKNOWLEDGEMENTS

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