# EFFECT OF ETHOFUMESATE ON BARLEY GRASS AND OTHER PASTURE SPECIES

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*Summary*

Trials carried out in a wide range of localities showed ethofumesate at rates from 1.5 kg/ha in Southland to 3 kg/ha in Waikato, applied in June and July to have provided equivalent barley grass (*Hordeum* spp.) control to a mixture of 2,2-DPA and TCA. Ryegrass (*Lolium* spp.) demonstrated a high degree of tolerance to ethofumesate, whereas bromus mollis (*Bromus mollis*) and sweet vernal (*Anthoxanthum odoratum*) were variably susceptible in the North Island trials and bromus mollis very susceptible in a Southland trial. In all trials ethofumesate at 1 to 4 kg/ha was severe on white clover (*Trifolium repens*) and also on subterranean clover (*T. subterraneum*) and spotted bur medick (*Medicago arabica*) in the Hastings trial. White clover established successfully when oversown into ethofumesate treated plots, three months after treatment.

## INTRODUCTION

Previous work on the use of ethofumesate for barley grass (*Hordeum* spp.) control in New Zealand (Hartley 1972; Allen, Hartley, Meeklah 1974; Minter 1974) described the results of trials in the Waikato, Canterbury and Coastal Otago districts and showed rate requirements in relation to time of application for these regions and longer term effects of treatment on a number of pasture species.

The trials reported in this paper detail results from further regional evaluation of rates and time of application of ethofumesate in relation to barley grass control together with measurements of its effects on some other pasture species. Some of the trials included the oversowing of white clover (*Trifolium repens*) seed at intervals following ethofumesate treatment to establish the duration of residual toxicity of the herbicide.

## METHOD

The trials were located in Waikato, Hawkes Bay, Manawatu, Rangitikei, North Canterbury, North Otago and Southland, all being situated on sheep and cattle grazed pastures.

Ethofumesate at rates of 1 to 4 kg/ha was applied at intervals over the period of June to early September and a mixture of 2,2-DPA 11% and TCA 63% included as a standard treatment at the recommended rates for each district.

Four replicates, using 20 to 30 $m^2$ plots were boom sprayed using rates from 250 to 400 litres/ha through a modified Oxford precision sprayer. The pasture averaged 3 to 5 cm in height for the June and July applications and 5 to 7 cm for the August and September applications. Where thistles (*Cirsium* spp., *Carduus* spp.) represented a possible source of competition following treatment for barley grass control a phenoxybutyric herbicide was applied for their control.

Where quantitative measurements were made, herbage samples were collected for dissection and pasture cuts made for dry matter production, following which the trials were grazed, trimmed and closed. Seed head counts of barley grass were made on sites where the barley grass population was sparse and a percentage ground cover or percentage control estimate made where populations were dense, these assessments being made at the seed head stage.

On some trials white clover seed was oversown across the plots at intervals following treatment, half of each strip having been pre sprayed with paraquat to remove competition. Visual assessments were made of the success of establishment.

## RESULTS

### *Barley Grass Control*

Results in Table 1 show ethofumesate to have controlled barley grass in a wide range of locations, with late June and late July applications giving similar control with both times markedly superior to the late August — early September applications. Whilst not reaching statistical significance, the optimum rate of ethofumesate when applied in the late June to late July period, appeared to be .4 kg/ha in Waikato, 2 to 3 kg/ha in Hastings, Waipukurau, Manawatu and Rangitikei, 2 kg/ha in North Canterbury and North Otago and 1.5 kg/ha in Southland trials. Within the recommended times of application the mixture of 2,2-DPA and TCA provided similar barley grass control to ethofumesate 2 kg/ha except in the Waikato trials where ethofumesate 3 kg/ha was required to provide comparable results to the 2,2-DPA and TCA mixture.

### *Effect on Other Pasture Species*

Ryegrass (*Lolium* spp.) demonstrated a high degree of tolerance to all rates of ethofumesate as shown in Table 2. On the Waikato, North Canterbury and Southland trials where there was a high percentage of barley grass at the time of treatment, ryegrass production following treatment was highly significantly greater on the ethofumesate treatments than on untreated. However, there was an indication on the Waikato and Rangitikei trials of a slight initial suppression in ryegrass production where rates of ethofumesate exceeded 1.0 kg/ha. The 2,2-DPA and TCA mixture markedly suppressed ryegrass production compared to ethofumesate treatments, there being a highly significant difference on some sites.

The effect of ethofumesate on bromus mollis (*Bromus mollis*) and sweet vernal (*Anthoxanthum odoratum*) was variable, both within and between sites. At the August cut on the Hastings trial, ethofumesate 2 to 3 kg/ha caused a highly significant reduction in sweet vernal and bromus mollis production in the June application but the bromus mollis production on the ethofumesate treatments on the July application was similar to untreated. At the October cut, however, the only ethofumesate treatment to have significantly reduced the other grass's (bromus mollis and sweet vernal) component of the pasture was the 3 kg/ha rate applied in July. At both cuts on the June and July applications the 2,2-DPA and TCA mixture significantly reduced bromus mollis and sweet vernal compared to untreated. On the Rangitikei site neither the ethofumesate nor 2,2-DPA/TCA treatments significantly reduced the 'other grass' component of the pasture. On the Southland trials ethofumesate 1.5 kg/ha and above in June and 2 kg/ha and above in July, along with 2,2-DPA and TCA mixture at both times totally removed bromus mollis.

White clover was virtually completely suppressed by all rates of ethofumesate on all sites, as also was subterranean clover (*T. subterraneum*) and spotted bur medick (*Medicago arabica*) on the Hastings trial. The action on clovers was slow, taking up to three months to cause extensive necrosis of all plants. White clover was successfully established by over-

TABLE 1: PERCENTAGE BARLEY GRASS CONTROL — THE EFFECT OF LOCALITY, TIME OF APPLICATION AND RATE OF ETHOFUMESATE

| *Time of Application* | *Treatment* | *Waikato* | *Hastings* | *Waipukurau* | *Manawatu* | *Rangitikei* | *North Canterbury* | *North Otago* | *Southland* |
|---|---|---|---|---|---|---|---|---|---|
| Late June 1974 | untreated | 0 eD | 0 cC | 0 cB | 0 bB | 0 b | — | 0 bB | 0 |
| | ethofumesate 1.0 | 63 dC | 71 bB | 78 abA | 64 aA | 68 b | — | 25 bB | 80 |
| | ethofumesate 1.5 | — | 75 bAB | 81 abA | 85 aA | 95 a | — | 90 aA | 100 |
| | ethofumesate 2.0 | 77 cB | 89 abAB | 89 abA | 93 aA | 96 a | — | 95 aA | 100 |
| | ethofumesate 2.5 | — | — | — | — | — | — | 95 aA | 100 |
| | ethofumesate 3.0 | 89 bA | 89 abAB | 98 aA | 99 aA | 97 a | — | — | — |
| | ethofumesate 4.0 | 99 aA | — | 98 aA | 99 aA | — | — | — | — |
| | TCA/2,2-DPA | 90 bA | 99 aA | 65 bA | 78 aA | 100 a | — | 98 aA | 95 |
| Late July 1974 | untreated | — | 0 cB | 0 bB | 0 bB | 0 bB | 0 cB | 0 cB | 0 |
| | ethofumesate 1.0 | — | 72 bA | 5 baAB | 58 bB | 0 bB | 71 bA | 15 cB | 50 |
| | ethofumesate 1.5 | — | 87 abA | 73 aA | 93 aA | 71 aA | 89 abA | 55 bA | 80 |
| | ethofumesate 2.0 | — | 92 abA | 80 aA | 98 aA | 99 aA | 99 aA | 80 abA | 100 |
| | ethofumesate 2.5 | — | — | — | — | — | — | 85 aA | 100 |
| | ethofumesate 3.0 | — | 98 aA | 87 aA | 99 aA | 100 aA | — | — | — |
| | ethofumesate 4.0 | — | — | 87 aA | 99 aA | — | — | — | — |
| | TCA/2,2-DPA | — | 87 abA | 91 aA | 97 aA | 100 aA | 88 abA | 85 aA | 95 |
| Late August Early Sept 1974 | untreated | 0 cC | 0 a | 0 b | 0 c | 0 bB | — | — | 0 |
| | ethofumesate 1.0 | 35 bB | 0 a | 36 ab | 0 c | 73 aA | — | — | 85 |
| | ethofumesate 1.5 | — | 21 a | 42 ab | 0 c | 93 aA | — | — | 85 |
| | ethofumesate 2.0 | 50 bB | 15 a | 42 ab | 68 ab | 72 aA | — | — | 90 |
| | ethofumesate 2.5 | — | — | — | — | — | — | — | 95 |
| | ethofumesate 3.0 | 74 aA | 76 a | 81 a | 80 ab | 99 aA | — | — | — |
| | ethofumesate 4.0 | 81 aA | — | 90 a | 90 a | — | — | — | — |
| | TCA/2,2-DPA | 71 aA | 73 a | 20 ab | 33 bc | 100 aA | — | — | 100 |

TABLE 2: THE EFFECT OF ETHOFUMESATE ON SOME OTHER PASTURE SPECIES — KG DRY WEIGHT/HECTARE

| *Location* | *Date of treatment* | *Date of assessment* | *Species* | *Untreated* | *ethofumesate 1.0 kg/ha* | *ethofumesate 1.5 kg/ha* | *ethofumesate 2.0 kg/ha* | *ethofumesate 3.0 kg/ha* | *2,2-DPA/TCA* |
|---|---|---|---|---|---|---|---|---|---|
| Waikato | 26.6.74 | 20. 8.74 | ryegrass | 867 aAB | 1023 aA | — | 783 aAB | 673 abAB | 204 bB |
| | | 18. 9.74 | ryegrass | 553 bB | 1406 aA | — | 1318 aA | 1454 aA | 743 baB |
| Hastings | 24.6.74 | 21. 8.74 | ryegrass | 491 aAB | 491 aAB | 412 abAB | 430 abAB | 574 aA | 231 bB |
| | | | bromus mollis | 337 aA | 201 abAB | 175 bcAB | 113 bcdAB | 33 cdB | 0 dB |
| | | | sweet vernal | 114 aA | 74 abAB | 46 bAB | 16 bB | 0 bB | 0 bB |
| | 30.7.74 | | ryegrass | 337 a | 316 a | 268 a | 317 a | 303 a | 178 a |
| | | | bromus mollis | 115 a | 62 ab | 55 ab | 60 ab | 56 ab | 41 b |
| | 24.6.74 | 1.10.74 | ryegrass | 211 bB | 314 bB | 688 aA | 690 aA | 752 aA | 739 aA |
| | | | other grasses | 237 abcAB | 439 aA | 288 abcAB | 362 abAB | 118 bcAB | 0 cB |
| | 30.7.74 | | ryegrass | 176 cB | 363 abcAB | 293 bcAB | 391 abcAB | 605 aA | 433 abAB |
| | | | other grasses | 213 aAB | 140 abAB | 257 aA | 126 abAB | 49 bB | 74 bAB |
| Rangitikei | 19.6.74 | 16. 9.74 | ryegrass | 241 ab | 392 a | 325 ab | 329 ab | 263 ab | 166 b |
| | 29.7.74 | | ryegrass | 223 ab | 384 a | 241 ab | 222 ab | 283 ab | 96 b |
| | 19.6.74 | 5.11.74 | ryegrass | 536 b | 899 ab | 649 ab | 541 b | 1305 a | 608 b |
| | | | other grasses | 798 ab | 720 ab | 1092 a | 1086 a | 394 b | 327 b |
| | | | white clover | 360 aA | 0 bB | 0 bB | 0 bB | 0 bB | 138 aA |
| | 29.7.74 | 5.11.74 | ryegrass | 431 a | 758 a | 567 a | 554 a | 678 a | 411 a |
| | | | other grasses | 1058 a | 1046 a | 1365 a | 1348 a | 1055 a | 858 a |
| | | | white clover | 109 aA | 0 bB | 0 bB | 0 bB | 0 bB | 173 aA |
| Nth Canterbury | 31.7.74 | 12.11.74 | ryegrass | 541 cB | 2419 bA | 2875 abA | 3584 aA | — | 3216 abA |
| Southland | 27.6.74 | 17.12.74 | ryegrass | 847 eE | 6646 bB | 5772 cC | 8053 aA | 7061 bB* | 2350 dD |
| | | | bromus mollis | 2772 | 357 | 0 | 0 | 0 | 0 |
| | | | white clover | 868 | 0 | 0 | 0 | 0 | 2350 |
| | 25.7.74 | 17.12.74 | ryegrass | 847 dD | 5085 cC | 5223 cC | 6504 bB | 8260 aA* | 788 dD |
| | | | bromus mollis | 2772 | 919 | 615 | 0 | 0 | 0 |
| | | | white clover | 868 | 0 | 0 | 0 | 0 | 3417 |

* ethofumesate 2.5 kg/ha. In Waikato ethofumesate tested at 4.0 kg/ha; results same as for 3.0 kg/ha.

sowing three months after treatment on sites in the Waikato, Hastings, Rangitikei and North Otago, on plots treated with ethofumesate at rates up to 4 kg/ha. On most of the sites a natural re-establishment of clovers on the ethofumesate treated plots was observed to have occurred in the autumn following treatment.

## DISCUSSION

It should be noted that whilst the trials show June and July as the optimum time of application for ethofumesate, other workers (Allen *et al.* 1974) have achieved an equivalent level of barley grass control from May applications, a time not tested in this series of trials. The optimum rate of ethofumesate required for barley grass control decreased from North to South.

Whilst the results show June application of ethofumesate to have provided a more consistent reduction of bromus mollis and sweet vernal compared with the July application, the earlier application time of May should not be ignored when considering work on the control of these species.

Where it is considered necessary to oversow white clover following ethofumesate treatment, three months has been shown to be an adequate waiting period to ensure successful establishment; however natural re-establishment of clover species in the Autumn following treatment should render oversowing an unnecessary operation in many situations.

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