# THE USE OF 3,6-DICHLOROPICOLINIC ACID MIXTURES FOR BROADLEAF WEED CONTROL IN CEREAL CROPS

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*Summary*

In mixture with MCPA/bromoxynil, MCPA/dichlorprop or bromoxynil/dichlorprop 3,6-dichloropicolinic acid, at 80-100 g/ha was compared with dicamba at 70-150 g/ha in similar commercial formulations in replicated research trials and half paddock field assessment trials during the 1977-78 and 1978-79 seasons. 3,6-dichloropicolinic acid mixtures gave a high level of control of a wide range of weeds and appeared to offer a greater margin of crop safety than standard dicamba mixtures under the same treatment conditions.

## INTRODUCTION

Specific activity has been shown by 3,6-dichloropicolinic acid (3,6-DPA) on several phenoxy-tolerant weeds in cereals, particularly compositae and leguminosae (Haagsma 1975; Naish 1975) with excellent crop tolerance. Combinations with MCPA, dichlorprop and mecoprop have been extensively evaluated in Europe resulting in commercial development of 3,6-DPA mixtures in Great Britain.

This paper reports the evaluation of 3,6-DPA acid as a possible alternative for dicamba in mixture with other selective broadleaf herbicides.

## METHOD

### Research trials

Seven North Island and thirteen South Island research trials were laid down during 1977 and 1978 on wheat, barley and oats. Weed control trials contained 2-4 replicates and tolerance trials 4-5 replicates. Treatments were applied with a precision sprayer using 730-231 or 8003 nozzles at 200 kPa applying 200-300 litres/ha to 5x2 or 5x4 m plots of randomised block design. Weed control was visually assessed using a 0-10 scale by rating overall weed control and control of individual species.

Harvesting was carried out with either a stripper harvester followed by threshing or with a small plot combine harvester. Four rates of treatments 1, 2 and 3 (Table 2) were applied in the seven tolerance trials but Table 2 shows only the most promising rate of each.

### Field assessment trials

Thirteen half paddock trials comparing 3,6-DPA mixtures and proprietary formulations containing dicamba at recommended label rates, were applied by contractor or farmer equipment in the South Island during the 1978 season. All trials except No.9 (Table 3) were on weedy paddocks which would normally have been treated for weed control. Trial

9 had relatively few weeds and these were not regarded as competitive with the crop. Yields were assessed either by sampling 10 random $m^2$ samples/plot (Table 3, trials 1-9) or by using the co-operators harvester to head an equal area from each treatment 100-130 m long by 3.6 - 7.2 m wide (Table 3, trials 10-13).

## RESULTS

### Weed control

Of the three 3,6-DPA formulations tested the one containing bromoxynil and MCPA gave best overall weed control, especially of wireweed *(Polygonum aviculare)* and willow weed *(Polygonum persicaria)*.

Table 1 compares weed control with the 3,6-DPA/MCPA/bromoxynil formulation with two commercially recommended mixtures containing dicamba (Treatments 4 and 5). The 3,6-DPA formulation shows generally similar weed control to these standards with better activity on fumitory *(Fumaria officinalis)*, Californian thistle *(Cirsium arvense)* and stinking mayweed *(Anthemis cotula)*. The more susceptible weeds, black nightshade *(Solanum nigrum)*, fathen *(Chenopdium album* agg*)* and tares *(Vicia sativa)* were satisfactorily controlled with all treatments.

**Table 1. Research trial results: Weed control.**

| Weed species | Treatment* | Number of trials | Mean % control at 3-5 weeks | Range |
|---|---|---|---|---|
| willow weed + wire weed | 1 | 8 | 81 | 58 – 100 |
| | 4 | 8 | 82 | 55 – 100 |
| | 5 | 7 | 71 | 48 – 80 |
| spurrey | 1 | 3 | 51 | 30 – 67 |
| | 4 | 3 | 46 | 18 – 63 |
| | 5 | 3 | 52 | 32 – 70 |
| Californian thistle | 1 | 3 | 93 | 90 – 100 |
| | 4 | 3 | 88 | 75 – 100 |
| | 5 | 3 | 75 | 70 – 83 |
| broad leaved dock | 1 | 2 | 87 | 83 – 90 |
| | 4 | 2 | 94 | 93 – 95 |
| | 5 | 1 | 83 | 83 |
| fumitory | 1 | 2 | 78 | 76 – 90 |
| | 4 | 2 | 73 | 66 – 80 |
| | 5 | 1 | 40 | 40 |
| redroot | 1 | 2 | 97 | 95 – 100 |
| | 4 | 2 | 100 | 100 |
| stinking mayweed | 1 | 1 | 53 | |
| | 4 | 1 | 37 | |
| | 5 | 1 | 30 | |

* Treatment No. and rate as used in Table 2.
1 = 3,6-DPA/MCPA/bromoxynil 0.09/0.9/0.3 kg/ha
4 = dicamba/MCPA/bromoxynil 0.1/1.0/0.4 kg/ha
5 = dicamba/MCPA/dichlorprop 0.07/0.44/2.0 kg/ha

**Table 2. Research trial results: grain yield in tonnes/ha.**

| Trial No. Treatment | kg/ha | 1 Wheat | 2 Oats | 3 Wheat | 4 Barley | 5 Barley | 6 Barley | 7 Wheat | Mean |
|---|---|---|---|---|---|---|---|---|---|
| 1. 3,6-DPA/MCPA/bromoxynil | 0.09/0.9/0.3 | 1.60 a | 2.07 aA | 0.50 aA | 2..46 a | 3.30 | 1.94 | 2.15 | 2.00 |
| 2. 3,6-DPA/MCPA/dichlorprop | 0.1/0.48/2.0 | 1.33 ab | 1.95* ab AB | 0.32 cdAB | 2.71 a | 3.31 | 2.09 | 1.99 | 1.96 |
| 3. 3,6-DPA/dichlorprop/bromoxynil | 0.08/1.6/0.2 | 1.15 ab | 2.08* aA | 0.26 cdB | 2.44 a | 3.06 | 1.99 | 2.10 | 1.87 |
| 4. dicamba/MCPA/bromoxynil | 0.08/0.75/0.3 | | | 0.41 abcAB | | | 2.20 | 2.09 | 1.96 |
| | 0.1/1.0/0.4 | 0.93 b | 2.12 aA | | 2.61 a | 3.35 | | | |
| 5. dicamba/MCPA/dichlorprop | 0.07/0.44/2.0 | 1.01 b | 1.70 bB | 0.21 dB | 2.41 ab | 3.37 | 2.15 | 2.10 | 1.85 |
| 6. untreated weedy | | 1.16 ab | | | 1.97 b | | | | |
| weed free | | | 2.10 aA | 0.49 abA | | 3.61 | 2.03 | 2.36 | 1.96 |
| | | | | | | N.S. | N.S. | N.S. | N.S. |
| | CV% | 30.8 | 10.7 | 26.2 | 14.5 | 15.2 | 13.9 | 13.8 | 9 |

*Double rate applied

**Crop yield**
**Research Trials** (Table 2)

The dicamba/MCPA/dichlorprop mixture gave the lowest in three trials. The only other yield differences occurred in Trial 3, where drought stress caused poor crop yield and the three treatments containing dichlorprop caused significant yield suppression.

The 3,6-DPA/MCPA/bromoxynil mixture gave the highest mean yield and was significantly better than all other treatments except weed free untreated in at least one of the trials.

**Field assessment trials (Table 3)**

The 3,6-DPA mixture treatments gave a highly significant mean increase of 12.4% ($p<0.01$) over the treatments with which they were compared. The yield increase was significant in all trials where the dicamba/MCPA/dichlorprop mixture was compared and in two out of four cases where the dicamba/MCPA/bromoxynil mixture was compared. The increase was not significant or not analysed where the dicamba/MCPA mixture was compared.

**Table 3. Field assessment trial results: yield in tonnes/ha.**

| Trial No. | Crop[8] | Dicamba Mixtures | 3,6-DPA Mixtures | % Yield Increase | Significance (t-test) | |
|---|---|---|---|---|---|---|
| 1 | B | 4.38[5] | 4.92[1] | 12.3 | t = 3.19 | p<0.01 |
| 2 | W | 4.15[5] | 4.45[2] | 7.2 | t = 1.82 | NS |
| 3 | W | 5.09[5] | 5.58[2] | 9.6 | t = 2.15 | p<0.05 |
| 4 | W | 2.81[5] | 3.88[3] | 38.1 | t = 7.40 | p<0.01 |
| 5 | B | 2.96[4] | 3.00[1] | 1.4 | t = 0.13 | NS |
| 6 | W | 3.62[4] | 4.67[1] | 29.0 | t = 4.08 | p<0.01 |
| 7 | W | 3.20[4] | 3.85[2] | 20.0 | t = 4.18 | p<0.01 |
| 8 | W | 4.48[4] | 4.72[2] | 5.4 | t = 1.34 | NS |
| 9 | B | 4.25[7] | 4.64[1] | 9.2 | t = 1.67 | NS |
| 10 | B | 4.00[7] | 4.19[1] | 4.8 | | |
| 11 | B | 3.75[7] | 4.53[1] | 20.8 | | |
| 12 | B | 4.77[7] | 4.91[1] | 2.9 | | |
| 13 | B | 3.76[4] | 4.31[1] | 14.6 | | |
| Mean = | | 3.94 | 4.43 | 12.4 | | |

CV% 5.3
LSD (P = 0.01) 0.31

[1 2 3 4 5] treatment numbers as used in Table 2.

[7] dicamba/MCPA (0.15/0.90 kg/ha) [8] B = barley : W = wheat

In the barley trials the mean screenings from the 3,6-DPA mixture treatments were 20% against 27.5% for the comparative treatments. Wheat screenings were only 1% different and bushel weights for both crops were similar.

## DISCUSSION

**Weed control**

In the range of 80-100 g/ha 3,6-DPA used in mixture with other selective herbicides has given similar results to those obtained in Great Britain. (Brown and Uprichard 1976; Gilchrist and Page 1976; Mayes *et al* 1976). Less effective control of stinking mayweed than would be expected from the British work is probably due to the advanced stage (more than 12 true leaves) at treatment. Variable control of spurrey is consistent with the British results.

**Crop tolerance**

Dicamba is widely quoted by researchers as causing yield suppression in cereals under some conditions, particularly in barley (Allen 1966, 1968; Lallukka 1977), reasons for which have been discussed by Friesen *et al* (1964).

This data shows a trend that dicamba, particularly in combination with dichlorprop causes yield suppression under some circumstances.

It should be noted however that details regarding the crop at the time of application are not included, and most authors suggest specific situations under which suppression occurs. Without specifically designed trials only a general trend can be inferred. In the presence of weed competition, dicamba mixtures with and without dichlorprop normally give yield increases over untreated. The continued commercial use of these standards indicates that farmers have appreciated this, particularly where difficult-to-control broadleaf weeds sensitive to dicamba and dichlorprop have been present.

## CONCLUSION

Mixtures of 3,6-DPA with other selective broadleaf herbicides, particularly MCPA/bromoxynil, gave high levels of control of a wide range of weeds in cereal crops. These mixtures appear to offer greater margin of crop safety than standard dicamba mixtures under the same treatment conditions.

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