TINE WEEDING EFFECTS ON CEREAL CROPS WITH FEW WEEDS

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Despite possible damage to soil structure, and extra energy use, mechanical weed control in cereal crops is a commonly used alternative to herbicides. However, mechanical weed control experiments in New Zealand have shown that despite tine weeding reducing the number of weeds, crop yield is not incresed (Stiefel and Popay 1990; Popay *et al* 1992). Weeds may be too few to affect crop yields, or the weeds left after weeding still damage the crop, or weeding itself reduces crop yields. Two experiments were conducted to measure the effects of the tine weeder on crops grown with few weeds.

One experiment with wheat in 1990-1991, and a second with barley in 1991-1992, were carried out at Flock House Agricultural Centre, on Manawatu silt loam soil. In both experiments, main plots (60 m x 5 m) were either treated post-emergence with chlorsulfuron at 15 g/ha + bromoxynil at 200 g/ha (Glean plus Bromoxynil 40 Twin Pack Herbicide) or sterilised with dazomet (Basamid Granular) at 495 kg/ha. Sub-plots (15 m x 5 m) were 1. no tine weeding; 2. tine weeded once at Zadoks growth stage 13 to 16 (Zadoks *et al* 1974); 3. tine weeded once at Zadoks 32; 4. tine weeded twice as in 2 and 3.

In the first experiment, no fertiliser was applied. Dazomet was applied on 18 September 1990, and plots were rotary hoed, and rolled. On 9 October the area was re-cultivated and drilled with wheat (cv. Otane) on 11 October. Establishment was poor in the sterilised plots, which were re-drilled on 23 October. In the herbicide-treated plots, early tine weeding was carried out on 6 November at Zadoks 14, and herbicide applied on 7 November. On 14 November the second tine weeding was carried out at Zadoks 32 when wheat height was 45-55 cm. In the sterilised plots, the first tine weeding was on 4 December and the second on 14 December. An area, 15 m x 1.25 m, was harvested from each plot on 26 February 1991, using a small plot harvester. This harvested strip included one tractor tyre track from the tine weeding.

In the second experiment treatments were similar, except that in the herbicide-treated sub-plots the tractor was run through the plots with the tine weeder raised. Dazomet was applied on 2 October 1991, and the plots rotary hoed and rolled. These plots were re-cultivated immediately before barley (cv. Fleet) was drilled on 5 November. Diammonium phosphate fertiliser was applied at drilling. Early tine weeding was on 4 December at Zadoks 16, and late weeding on 7 January at Zadoks 32. Barley plant populations were assessed in each plot on 20 November, 16 December and 16 January. An area of 15 m x 3.2 m was harvested from each plot on 2 March, after heavy rain had caused lodging of 95% of the crop. The harvested strip included both tyre tracks from the tractor or tine weeder passes.

In the first experiment, wheat yields following herbicide application were often higher than after sterilisation (Table 1), probably because of the later second sowing. In the herbicide treated plots, plots without tine weeding gave the highest yields, but these were only significantly higher than those given a single early pass of the tine weeder. In the sterilised plots, the treatments, including a later tine weeding, gave yields significantly lower than the treatment without tine weeding or with one late pass of the tine weeder.

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TABLE 1: Wheat grain yields (kg/ha) from different tine weeding regimes in 1990-91 trial.

	One pass at Z 13-14[1]	One pass at Z 32	Two passes at Z 13-14 and at Z 32	No tine weeding
Herbicide	6770 bc[2]	7039 ab	7030 ab	7357 a
Sterilised	6640 c	5979 d	6036 d	6518 c

[1] Zadoks growth stage
[2] Numbers followed by the same letter are not significantly different (5% level).

In the second trial (Table 2), the sterilised, unweeded treatment had significantly lower yields than most other treatments.

TABLE 2: Barley yields (kg/ha) from different tine weeding regimes in 1991-92 trial.

	One pass at Z 16	One pass at Z 32	Two passes, at Z 13-14 and at Z 32	No tine weeding
Herbicide	5952 a[1]	5847 a	6162 a	6328 a
Sterilised	5752 ab	6273 a	6278 a	5140 b

[1] Numbers followed by the same letter are not significantly different (5% level).

Tine weeding had no significant effect on barley plant numbers. In the soil sterilised plots, scrambling fumitory (*Fumaria muralis*) and black nightshade (*Solanum nigrum*) emerged at 74 and 12 plants/m^2 respectively. A single early pass of the tine weeder reduced numbers of both weeds by about 30%. A single late pass reduced fumitory numbers by 62% and black nightshade numbers by 23%. Two passes reduced numbers of both weeds by over 60%.

In the wheat trial, where weeds were few, yields from sub-plots with no tine weeding were greatest, and in both herbicide-treated and sterilised plots some of the tine-weeded plots gave significantly lower yields. The results suggest that tine weeding can reduce crop yields. Results of the barley trial may have been affected by crop lodging, but there was no evidence that tine weeding, or the passage of tractor tyres, had any effect on yields.

These results suggest that in wheat, tine weeding can sometimes reduce the yields of weed-free crops. Thus the inability of the tine weeder to increase yields from weedy crops might be because reduction in yields due to tine weeder damage is as great as that caused by the weeds. In barley, a more competitive crop than wheat, tine weeding did not affect yields in low-weed conditions. The specific weeds found in this experiment may have had little effect on barley yields, resulting in ineffectual tine weeding.

REFERENCES

Popay, A. I., Daly, M., Knight, T., Stiefel, W. and White, S., 1992. Weed control in "organic" arable crops in New Zealand. *First International Weed Control Congress:* (in press).

Stiefel, W. and Popay, A.I., 1990. Weed control in organic arable crops. *Proc. 43rd N.Z. Weed and Pest Control Conf.:* 138-141.

Zadoks, J.C., Chang, T.T. and Konzak, C.F., 1974. A decimal code for the growth stages of cereals. *Weed Research 14:* 415-421.