CANADA THISTLE REGROWTH CONTROL

ONE YEAR AFTER HERBICIDE APPLICATION

IN WINTER WHEAT

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ABSTRACT

A field study was conducted to evaluate the effectiveness of several herbicides for long-term control of Canada thistle growing in winter wheat. Miscellaneous herbicides were applied at the five leaf stage of winter wheat in the presence of Canada thistle (30 plants per square meter). All herbicides gave effective control of Canada thistle topgrowth but did not increase yields compared to the weedy check. When Canada thistle control was evaluated one year after herbicide application, three of the nine treatments significantly reduced regrowth: 2,4-D amine at 840 g/ha, clopyralid + MCPA ester at 100 + 400 g/ha, and Clopyralid at 200 g/ha. These treatments reduced Canada thistle numbers by 58%, 67%, and 83% respectively. All herbicide treatments significantly reduced Canada thistle dry matter production one year after application as measured by shoot dry weight per square meter. Clopyralid at 100 g/ha in mixture with either 2,4-D or MCPA ester at 400 g/ha, and 2,4-D amine alone at 840 g/ha reduced dry weight of thistle shoots equally. Clopyralid at 200 g/ha was the most effective treatment tested; Canada thistle shoot dry weight per square meter was reduced by 93% one year following treatment.

INTRODUCTION

Canada thistle is the worst perennial weed problem in western Canada (Friesen, 1968). Calculations by Hunter and Smith

(1972) from a survey by Alex (1966) indicated that nearly 9 million hectares of cultivated land in the prairie provinces were infested with this weed. Canada thistle is also highly competitive in cereal crops (Cameron, 1938; Hodgson, 1968; Kirkland, 1977). Compared with a wild oat plant in barley, a Canada thistle shoot may be 3.4 times as competitive as wild oats (O'Sullivan et al, 1982). One report, however, suggests that Canada thistle may cause less serious cereal crop losses that are generally reported (Peschken, 1980).

The success of Canada thistle is due mainly to vegetative production of aerial shoots from buds produced on roots (Moore, 1975). Established Canada thistle stands are characterized by an extensive system of branching horizontal roots from which new shoots develop. Thus, to effectively control this weed with herbicides, it is generally assumed that herbicides must translocate to roots in sufficient quantities to be toxic (Moore, 1975, Devine and Vanden Born, 1985). Chemicals such as phenoxies and benzoics suppress topgrowth, but generally fail to kill the root buds unless applications are repeated (Carson and Bandeen, 1975). Topgrowth control of Canada thistle is beneficial to the extent that it reduces crop competition from the weed, and also prevents spread of the weed by preventing seed production. However, it would be more desirable if a high degree of regrowth control could be obtained with a single in crop spraying operation. Canada thistle is a particularly serious problem in cereal crops grown in western Canada since there are no herbicides currently registered in Canada which provide effective selective control of both shoots and roots of Canada thistle in

these crops (O'Sullivan et al, 1982). There is a need, therefore, to develop herbicides that are not only more effective on Canada thistle, but also safe to apply on cereals.

The compound clopyralid is a selective postemergence herbicide that is being developed in Canada for control of broadleaf weeds, including Canada thistle, in cereal crops. Clopyralid, as yet unregistered for use in cereals, is chemically similar to picloram although less persistent (Haagsma, 1975). Mixtures of clopyralid with phenoxy herbicides are currently being developed for control of phenoxy-tolerant weeds such as Canada thistle in cereal crops.

The purpose of this study was to compare clopyralid and clopyralid-phenoxy mixtures with currently recommended herbicide treatments for control of Canada thistle in winter wheat. These kind of data are needed to determine whether effective control of Canada thistle can be achieved with a single herbicide application in winter wheat.

MATERIALS AND METHODS

A field study to determine the long-term efficacy of miscellaneous herbicides on Canada thistle growing in winter wheat was initiated in fall 1983. The study was located at Clair, 200 km east of Saskatoon, on a loam soil naturally infested with Canada thistle. Norstar winter wheat was seeded on September 14, 1983 at a rate of 100 kg/ha in 20 cm rows. 56 kg/ha of 11-51-0 fertilizer was applied with the seed and 224 kg/ha of 34-0-0 was broadcast in the spring when the crop

commenced growth. The design of the experiment was randomized complete block with four replications. Herbicide treatments are listed in table 1 and all rates were active ingredient per hectare. Plot size was 2.5m by 7.0m and the same plots were used throughout the experiment.

Herbicides were applied with a hand-held plot sprayer operated to deliver 108 l/ha of spray solution at 290 kPa pressure. All treatments were applied on June 11, 1984 to winter wheat at the five leaf stage (35 cm tall) and Canada thistle in the vegetative stage (20 cm tall). Canada thistle shoots were counted in 0.5 square meter quadrats on August 9, 1984 and plots were harvested with a combine to obtain winter wheat yield data in 1984. Plots were not recropped, but Canada thistle regrowth was measured in summer of 1985. Number and dry weight of Canada thistle shoots per square meter were measured June 27, 1985. Data obtained were subjected to analysis of variance and Duncan's Multiple Range Test at the 5% level where applicable.

RESULTS AND DISCUSSION

The Canada thistle infestation was significantly reduced in all herbicide treated plots in the first year (Table 1). However, some treatments were significantly more effective at reducing thistle numbers than others. Bromoxynil + MCPA ester provided the lowest level of control, and clopyralid the highest. Other herbicides gave control levels between these two extremes; the mixtures of phenoxy herbicides with dicamba or clopyralid generally resulted in slightly greater control of topgrowth than phenoxies alone. Yield of winter wheat, however, was not

affected by herbicide treatment. Although the reason for the herbicides' failure to increase yields is not known, thistles may have exerted most of their competitive effects before control was achieved, or roots may have continued to compete despite the apparent high level of topkill following herbicide application.

Table 1. Effects of spring applied herbicides on winter wheat yield and Canada thistle numbers in the year of application.

Treatment	Rate (g/ha)	Winter Wheat Yield* (g/m^2)	Canada Thistle Number[a] ($\#/m^2$)
Weedy check	---	355	31 a
2,4-D amine	840	326	13.5bc
2,4-D ester	840	351	8 cd
MCPA ester	840	343	13 b-d
Dicamba+MCPA salt	100+400	321	11.5cd
Dicamba+2,4-D amine	100+400	356	7.5cd
Bromoxynil+MCPA ester	280+280	338	21.5b
Clopyralid	200	338	4 d
Clopyralid+2,4-D ester	100+400	337	7 cd
Clopyralid+MCPA ester	100+400	362	10 cd

*Overall F-test for difference in winter wheat yield was not significant at the 5% level.

[a]Values followed in columns by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

One year after treatment, most herbicides did not reduce the weed infestation significantly; however, significant improvement in control was obtained with three treatments (Table 2). 2,4-D amine at 0.84 kg/ha, clopyralid + MCPA ester at 100 + 400 g/ha, and clopyralid at 200 g/ha, respectively, reduced Canada thistle shoot numbers by 58%, 67%, and 83%. Shoot counts alone do not fully describe the effects of the treatments on

Canada thistle because even though shoot numbers did not always decline significantly, there was always a significant decline in the dry weight of shoots per square meter on the treated plots. Among the herbicides tested, clopyralid at 200 g/ha was the most effective at reducing dry weight of Canada thistle per square meter.

Table 2. Effects of spring applied herbicides on Canada thistle shoot number and dry weight one year after application in winter wheat.

Treatment	Rate (g/ha)	Canada Thistle Shoot Counts* (#/m^2)	Canada Thistle Shoot Dry Weight (g/m^2)
Weedy check	---	42 a	148a
2,4-D amine	840	17.5bc	47d
2,4-D ester	840	33.5ab	102b
MCPA ester	840	28 ab	80c
Dicamba+MCPA salt	100+400	28.5ab	116b
Dicamba+2,4-D amine	100+400	30.3ab	109b
Bromoxynil+MCPA ester	280+280	26.8ab	76c
Clopyralid	200	7.3c	11e
Clopyralid+2,4-D ester	100+400	24 a-c	43d
Clopyralid+MCPA ester	100+400	13.8bc	36d

*Values followed in columns by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

In summary, single applications of recommended selective herbicide treatments generally did not control Canada thistle one year after treatment in this study. Phenoxy herbicides either alone or in mixtures with dicamba or bromoxynil failed to significantly reduce Canada thistle shoot numbers, with the exception of the amine formulation of 2,4-D. However, similar applications with clopyralid and clopyralid-phenoxy mixtures, at

anticipated use rates in cereals, provided a measure of control in some cases one year after treatment. Clopyralid alone and in mixture with MCPA, but not with 2,4-D, resulted in a significant decline in thistle shoot numbers. The level of control obtained with clopyralid alone and in mixture with MCPA was equal to that obtained with 2,4-D amine. In addition, all herbicide treatments did not injure winter wheat. These results indicate that single applications of clopyralid alone and in mixture with MCPA may improve long-term control of Canada thistle in winter wheat obtained with similar applications of most recommended treatments.

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