SUGAR BEET INJURY WITH EARLY AND LATE DAY APPLICATIONS OF MICRO-RATE HERBICIDE PROGRAMS

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ABSTRACT

Conventional rates of sugar beet herbicides that include Betamix are generally applied in late afternoon, once temperatures start to decrease, so as to reduce the risk of sugar beet injury. Micro-rate applications contain lower amounts of Betamix and are considered safer than conventional rates for the sugar beet crop. In Alberta, postemergence Betamix applications are often applied in the presence of a preemergence herbicide. Our objective was to assess sugar beet injury and yield with early and late day applications of conventional rate and micro-rate sugar beet herbicides in the absence or presence of a preemergence herbicide. Field experiments were conducted in 1999, 2000 and 2001 under weed-free conditions. Early day treatments were applied before 10:30 a.m., while late day treatments were applied after 4:30 p.m. In each of the three study years, visual sugar beet injury ratings were within commercially acceptable limits. Sugar beet injury ratings were similar for conventional and micro-rate treatments in 1999 and 2000, and higher for conventional treatments in 2001. The presence of a preemergence herbicide generally resulted in increased visual sugar beet injury from subsequent postemergence herbicide applications. Extractable sugar per acre did not differ among herbicide treatments in any of the three study years, with one exception; in 2001, the early day conventional herbicide treatment applied in the presence of a preemergence herbicide yielded less extractable sugar per acre than other herbicide treatments.

INTRODUCTION

Conventional rates of sugar beet herbicides such as Betamix (desmedipham & phenmedipham) are applied later in the day to avoid excessive crop injury. Sugar beet producers first implemented reduced rates of herbicides, commonly known as micro-rates, in the late 1990's. Based on U.S. data, micro-rates appeared to cause minimal crop damage irrespective of the time of day when the herbicide applications were made. These observations were based on postemergence applications of sugar beet herbicides, but no information on the effect of preemergence herbicides was available. In Alberta, Canada, preemergence herbicides such as ethofumesate and pyrazon are typically applied to sugar beet fields. The objective of this project was to evaluate sugar beet injury and yield reduction with morning and late day postemergence micro-rates applied in the absence or presence of preemergence herbicides.

MATERIALS AND METHODS

A randomized complete block design field experiment was initiated in 1999 and repeated in 2000 and 2001. Herbicide treatments (Table 1) were applied in the morning (between 0800 and 1030 hours) or late day (1600 to 2130 hours). Herbicide rates were adjusted for the row width to which they were applied; preemergence herbicides and the conventional herbicide program were applied to 17.8 cm of each 56-cm row, and the micro-rate herbicide program was applied to 23 cm of each 56-cm row. All plots were hand-weeded to eliminate weed competition effects.

Plots were seeded on May 7, 1999, May 3, 2000 and May 9, 2001. Herbicide application dates are indicated in Table 2. Daytime high temperatures were recorded on each application date. Sugar beet injury ratings were assessed following the completion of herbicide applications. Herbicide injury was assigned a value as follows: 0% = no effect, 2% = slight effect, 5%, 7% and 10% = definite effect, and >10% = commercially unacceptable. Plots were harvested and sugar content and root yield was determined. Harvest dates were September 29, 1999, September 15, 2000 and September 25, 2001.

RESULTS

All sugar beet injury ratings were considered to be commercially acceptable (£10%) (Table 3). In 1999 and 2000, the morning-applied micro-rate herbicide program applied in the presence of a preemergence herbicide resulted in the greatest sugar beet injury. In 2001, the conventional herbicide program was rated as most injurious.

Table 1. Herbicide treatment descriptions for experiments conducted in 1999 to 2001

Treatment designation	Preemergence herbicide [a]	Postemergence program [b]	Application time of day
Control	-	Weed free control	-
Conv + pre (AM)	Yes	Conventional	Morning
Micro (AM)	No	Micro-rate	Morning
Micro + pre (AM)	Yes	Micro-rate	Morning
Micro (PM)	No	Micro-rate	Late day
Micro + pre (PM)	Yes	Micro-rate	Late day

[a] *Preemergence herbicides and rates (kg ai ha^{-1}) 1999: ethofumesate (etho) 3.0; 2000: etho 1.5 + pyrazon 1.5; 2001: etho 1.5 + pyrazon 2.04*

[b] *Postemergence herbicides and rates (kg ai ha^{-1}) Conventional: 1999/2000: desmedipham & phenmedipham (des & phen) 0.105 & 0.105, etho 0.21, triflusulfuron-methyl (triflu) 0.0175, clopyralid (clo) 0.028; 2001: 1st application: same as 1999/2000, 2nd and 3rd applications: des & phen increased by 28%; Micro-rate: 1999/2000 des & phen 0.0225 & 0.0225, etho 0.045, triflu 0.0045, clo 0.030, Merge surfactant 1%; 2001: 1st application: same as 1999/2000, 2nd to 4th applications: all herbicides increased by 22%*

Table 2. Postemergence herbicide program application dates and daytime temperatures

Year	Application date and daytime high temperatures (°C)			
1999	May 25*29*	May 31*23*	June 5*23*	
2000	May 21*24*	May 26*24*	June 2*23*	
2001	May 28*27*	June 7*24*	June 14*26*	June 21[a]*31*

[a] *Micro-rate herbicide treatments only*

Late day applications of micro-rate programs generally resulted in less injury than morning applications. The presence of a preemergence herbicide resulted in greater injury from morning micro-rate applications, but did not affect sugar beet injury from late day micro-rate applications.

Extractable sugar per hectare was not affected by any herbicide applications in 1999 and 2000 (Table 4).

In 2001, all herbicide programs caused significant extractable sugar loss compared with the control treatment. The conventional herbicide program yielded significantly lower than all other herbicide treatments, with the exception of the morning-applied micro-rate herbicide program applied in the presence of a preemergence herbicide.

Table 3. Sugar beet injury (%) determined after application of herbicide programs

Treatment	1999	2000	2001
	June 10	June 12	June 28
Control	0.0	0.0	0.0
Conv + pre (AM)	6.5	6.8	9.7
Micro (AM)	7.7	6.0	7.2
Micro + pre (AM)	8.8	7.2	8.5
Micro (PM)	6.3	6.0	5.7
Micro + pre (PM)	7.0	5.7	5.3
LSD (0.05)	1.0	1.1	1.6

Table 4. Extractable sugar yield (kg ha^{-1})

Treatment	1999	2000	2001
Control	7 608	9 610	10 712
Conv + pre (AM)	7 205	9 449	9 313
Micro (AM)	7 331	9 140	9 904
Micro + pre (AM)	7 131	9 528	9 812
Micro (PM)	7 470	9 340	10 020
Micro + pre (PM)	7 223	9 412	10 057
LSD (0.05)	NS	NS	531

CONCLUSIONS

Micro-rate herbicide programs can be safely applied in the morning in the presence of a preemergence herbicide. However, sugar beet injury may be slightly increased compared to late day applications.

Conventional herbicide programs applied in the morning in the presence of a preemergence herbicide can cause significant sugar yield loss compared to micro-rate herbicide programs. Conventional and micro-rate herbicide programs can cause sugar yield loss relative to a herbicide-free program.