Response of Sugarbeet (*Beta vulgaris*) and Annual Weeds to Mefluidide*

E. E. SCHWEIZER AND Y. ESHEL

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Introduction

Mefluidide [*N*-[2,4-dimethyl-5-[[(trifluoromethyl) sulfonyl]amino]phenyl]acetamide] regulates the growth of plants by suppressing their height and inhibiting their seed formation or by killing them. It has effectively reduced the vegetative growth of bermudagrass [*Cynodon dactylon* (L.) Pers.] (5, 12), hemp sesbania [*Sesbania exaltata* (Raf.) Cory] (5, 6), and johnsongrass [*Sorghum halepense* (L.) Pers.] (5, 7). In these studies, height of the weeds was regulated because mefluidide suppressed the terminal and axillary buds for several weeks or killed them (5).

We became interested in mefluidide because of its potential in regulating growth of annual weeds in sugarbeets (*Beta vulgaris* L.) that escape cultivation and herbicidal treatments. Preplanting and postemergence herbicide treatments in the irrigated areas of the central High Plains and Intermountain West control 75 to 95% of the annual weeds in sugarbeets. However, even when only a few weeds escape, they compete and can reduce yields. For example, one kochia [*Kochia scoparia* (L.) Schrad.] plant per 7.6 m of row can reduce yield of roots by 8% (11), and

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one redroot pigweed (*Amaranthus retroflexus* L.) per 2.4 m of row can reduce yield by 16% (4). Because the availability of farm labor is declining and labor costs are increasing, the need to regulate growth of weed escapes is apparent. Therefore, greenhouse and field studies were initiated to determine the growth response of sugarbeets and several annual weeds to mefluidide. In addition, the translocation pattern of mefluidide or its metabolites was examined in sugarbeets and five annual weeds by radioassay.

Materials and Methods

Greenhouse experiments.

General. Seeds of sugarbeets and weeds were planted in plastic pots, 10 cm in diam, that had been filled with a 1:1:1 (v/v/v) mixture of clay loam, sand, and peat. All plants were grown in a greenhouse controlled for a 16-hr day at 27°C, and a 8-hr night at 16°C. Mixed fluorescent and incandescent light was provided throughout the photoperiod. Unless stated otherwise, mefluidide was mixed with water and applied in a spray chamber at a volume of 280 l/ha. Each experiment was arranged in a randomized complete block design with five or six replications. All data were expressed as a percentage of control and were subjected to analysis of variance.

Effects of mefluidide on weed growth and flowering. Seeds of seven weed species were planted at different times. After emergence, all seedlings were thinned to three plants per pot. The mean height (mm) and the number of leaves of each species at the time of treatment were: barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.] 308 and 3 to 4, common lambsquarters (*Chenopodium album* L.) 72 and 10, kochia 63 and 18, redroot pigweed 76 and 5, wild oat (*Avena fatua* L.) 192 and 3, wild mustard [*Brassica kaber* (DC.) L.C. Wheeler var. *pinnatifida* (Stokes) L.C. Wheeler] 69 and 5 to 6, and yellow foxtail [*Setaria lutescens* (Weigel) Hubb.] 305 and 5 to 6. Mefluidide was applied at 0.035, 0.07, 0.14, 0.28, 0.56, and 1.12 kg/ha. Plant heights were measured 7, 14, 21, and 28 days after treatment. After

28 days, the shoots of plants from four replications were excised at the soil level, oven-dried, and weighed. The fifth replication was kept for another 14 to 21 days to observe the effect of mefluidide on flowering.

Effects of mefluidide on sugarbeet growth. Seeds of sugarbeets 'Mono Hy A1' were planted on seven dates to establish plants at seven growth stages. The number of plants per pot for each growth stage was: four for cotyledon, three for two- and four-leaf, two for six-leaf, and one for eight-, ten-, and twelve-leaf. All growth stages were treated on the same day with mefluidide at rates of 0.34, 0.68, and 1.02 kg/ha. Plants were excised at the cotyledonary node 21 days (cotyledon and two-leaf stage), 28 days (four-, six-, and eight-leaf stage), and 35 days (ten- and twelve-leaf stage) after spraying. They were then oven-dried and weighed.

Uptake and translocation of ^{14}C mefluidide. Sugarbeet 'Mono Hy A1' and five weed species were thinned to one seedling per pot after emergence. The mean height (mm) and number of leaves treated with ^{14}C-mefluidide for each species were: barnyardgrass 209 and 5, common lambsquarters 102 and 6, redroot pigweed 86 and 4, sugarbeets 97 and 3, wild mustard 118 and 3, and wild oat 166 and 3.

The diethanolamine salt of mefluidide was uniformly labeled in the ring (sp. act. 41.34 µCi/mg), and its purity was 99.4%. The radiolabeled herbicide was diluted with water that contained 0.25% (v/v) of X-77* surfactant to give a final concentration of 670 µg/ml. A total of 15 µl (0.5 µCi) of the stock solution was applied to each plant. The 15 µl were placed on the upper surface of the

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first three to six true leaves, depending on plant species, and were spread uniformly with a brush. The dosage of mefluidide applied per plant was about 0.25 kg/ha and equal to a spray volume of 400 l/ha. Each treatment was replicated three times, and the pots were arranged in a randomized complete block design.

The distribution of the radiolabeled herbicide or its metabolites in the different plant parts was determined 5, 15, and 25 days after treatment. At each sampling date, the plants were harvested and separated into the parts listed in Table 3. Any herbicide that remained on the treated leaf surface was removed by rinsing with 50 ml of 50% ethanol. The plant parts were weighed and combusted in a biological oxidizer, and the carbon dioxide that was produced was trapped in 2-aminoethanol:ethoxyethanol (30:70, v/v) solution. A portion of this solution was diluted with a scintillation fluid before it was radioassayed by liquid scintillation. The scintillation fluid consisted of 0.5 g of 1,4-*bis*2-(4-methyl-5-phenyloxazolyl)-benzene (dimethyl-POPOP) and 5.0 g of 2,5-diphenyloxazole (PPO) in 1 l of toluene. The samples radioassayed 10 to 30 min, depending on the level of radioactivity.

Field experiments. Two different experiments were conducted for 1 yr each at Fort Collins. Sugarbeet 'Mono Hy D2' seed were planted in April in four-row plots that were 12 m long. The soil was a sandy clay loam with a pH of 7.7 and an organic matter content of 2 to 2.5%. The sugarbeets were grown in rows 55 cm apart and were furrow-irrigated. All cultural practices were typical of those used for commercial sugarbeet production in Colorado. During the middle of October, roots were harvested from the inner two rows of each plot, washed, weighed, and analyzed for sucrose content.

In 1975, sugarbeet seedlings were sprayed at the four-, eight-, and twelve-leaf stages with 0.34, 0.68, and 1.02 kg/ha of mefluidide. The herbicide was sprayed in water

at 280 l/ha. A split-plot design with four replications was used in which stages of growth were main plots and mefluidide rates were subplots.

In 1976, 3.4 kg/ha of cycloate (*S*-ethyl *N*-ethylthiocyclohexanecarbamate) was preplant incorporated. When sugarbeets had four fully-expanded true leaves, desmedipham [ethyl *m*-hydroxycarbanilate carbanilate (ester)] and phenmedipham (methyl *m*-hydroxycarbanilate *m*-methylcarbanilate) was applied as a mixture, each at 0.56 kg/ha, to control annual weeds that had escaped the cycloate treatment. This sequential herbicide treatment controlled all of the grass weeds, but about 20% of the common lambsquarters, kochia, and redroot pigweed were not killed.

On June 22, the tops of weeds that exceeded the sugarbeet canopy in a series of plots were clipped manually. The heights of sugarbeets were 5 cm; of redroot pigweed, 8 cm or less; and of common lambsquarters and kochia, 9 cm or less. On June 30, weeds were clipped in another series of plots and in some of the same plots where they were clipped previously. The height of the latter weeds was then 6 to 7 cm. The height of sugarbeets on June 30 was 6 cm, and the plants had 14 to 16 true leaves. The heights of untopped redroot pigweed were 7 to 9 cm and of common lambsquarters and kochia, 9 to 13 cm. After the weeds were clipped on June 30, mefluidide was formulated in water with 0.5% (v/v) of X-77 and was applied at 280 l/ha as a topical spray at 0.68 kg/ha to weed-free sugarbeets and to plots with weeds that had been clipped once or twice. The ambient air temperature was 24°C.

Results

Greenhouse experiments:

Effects of mefluidide on weed growth and flowering. The degree of height suppression induced by mefluidide varied among the seven annual weeds, depending on the period of time lapsed after treatment and on herbicide rate (Figure 1 and Table 1). At 0.28 kg/ha or higher, growth

of all treated plants decreased each week, except yellow foxtail, which began to recover between the third and fourth week at rates less than 1.12 kg/ha. The weekly response of wild mustard and yellow foxtail is compared in Figure 1.

At 28 days the height of redroot pigweed and wild mustard was suppressed 66 and 84%, respectively, at the 1.12 kg/ha rate (Table 1). The other weeds were suppressed

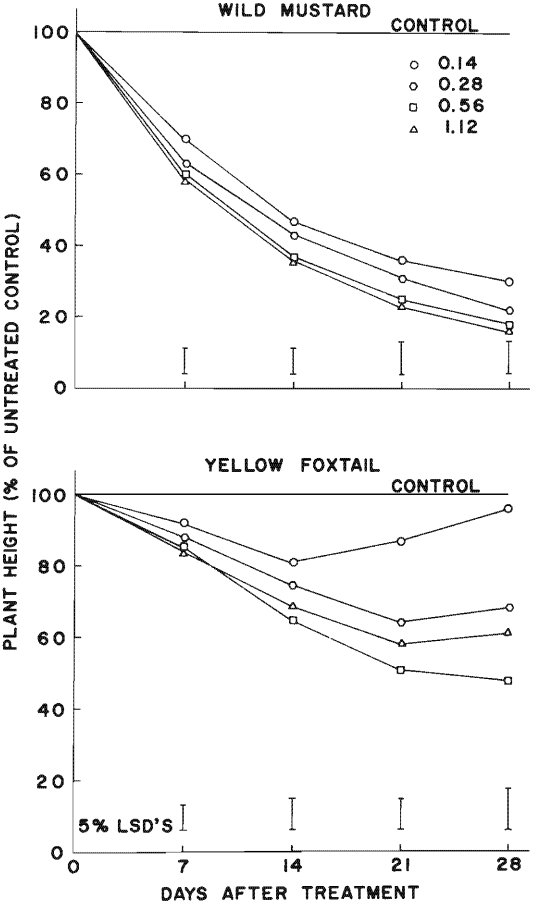

Figure 1. Response of wild mustard and yellow foxtail to postemergence applications of mefluidide. Legend: Mefluidide treatments at (○) 0.140, (⬡) 0.280, (△) 0.560, and (□) 1.120 kg/ha.

Table 1. Effect of six rates of mefluidide on the height of annual weeds 14 and 28 days after postemergence treatment (data expressed as a percentage of untreated control).[a]

Mefluidide (kg/ha)	Barnyard-grass (%)	Wild oat (%)	Yellow foxtail (%)	Common lambsquarters (%)	Kochia (%)	Redroot pigweed (%)	Wild mustard (%)
	14 days						
0.000	100a	100a	100a	100a	100a	100a	100a
0.035	98a	102ab	99a	97a	90b	94a	56b
0.070	100a	103ab	92a	100a	87b	77b	53bc
0.140	99a	96b	81b	93a	84bc	78b	47cd
0.280	92a	84c	75bc	85b	80c	65c	43de
0.560	80b	77d	69bc	76c	73d	60cd	37e
1.120	76b	71e	65d	71c	67e	54d	36e
	28 days						
0.000	100a	100a	100a	100a	100a	100a	100a
0.035	107a	89b	99a	98a	83b	107a	31bc
0.070	102a	88b	99a	104a	76bc	75b	34b
0.140	100a	78c	96a	95a	71c	75b	30bc
0.280	88b	64d	68b	78b	61d	55c	22cd
0.560	56c	58d	61b	63c	56d	48cd	18d
1.120	48c	49e	48c	52d	46e	34d	16d

[a]Means followed by the same letter within each column and within each measurement subgroup did not differ significantly at the 5% level of probability, as determined by Duncan's multiple range test.

48 to 54%. The dry weights of all weeds (data not presented), except wild mustard, were reduced by a greater percentage than were their heights. For wild mustard, these percentages were nearly equal.

Twenty-eight days after treatment, mefluidide had altered the morphological appearance of most treated plants. At 0.56 and 1.12 kg/ha rates the apical buds were deformed or appeared dead and secondary branching or tillering had occurred. Depending on rate, flowering and pollination also were delayed. In the two species in which seed production was observed, it was decreased. The number of wild oat seed per plant 38 days after treatment was reduced 30, 66, and 77% at rates of 0.28, 0.56, and 1.12 kg/ha, respectively. The number of yellow foxtail seed heads per plant 49 days after treatment was reduced 62, 69, and 94% at the same rates.

Effects of mefluidide on sugarbeet growth. Suppression of foliar growth in sugarbeets was associated with stage of growth at time of application (Table 2). Sugarbeet seedlings sprayed at the cotyledonary stage were injured the most. At this stage mefluidide appeared to kill the apical buds, and true leaves failed to develop within 21 days after treatment. Sugarbeets sprayed at the two-leaf stage had only two true leaves 21 days after treatment, which compared to five to seven normal true leaves on the untreated plants. Plants treated at the four-, six-, and eight-leaf stages had 50 to 60% fewer true leaves 28 days after treatment than did the untreated plants; the leaf margins on most treated leaves were desiccated. Plants treated at the ten- and twelve-leaf stage had 40% fewer true leaves 35 days after treatment than did the untreated plants. At the latter two growth stages, regrowth of new leaves had begun on most plants treated with 0.34 and 0.68 kg/ha of mefluidide.

Table 2. Percentage reduction in the dry weight of sugarbeet tops after postemergence application of three rates of mefluidide to sugarbeets at seven growth stages.[a]

Mefluidide (kg/ha)	Leaf stage						
	Coty. (%)	2 (%)	4 (%)	6 (%)	8 (%)	10 (%)	12 (%)
0.00	0a	0a	0a	0a	0a	0a	0a
0.34	84b	58b	36b	36b	27b	29b	36b
0.68	85b	63b	49b	41b	37b	37bc	44b
1.02	83b	68b	50b	45b	32b	44c	40b

[a]Means followed by the same letter within each growth stage did not differ significantly at the 5% level of probability, as determined by Duncan's multiple range test.

Uptake and translocation of ^{14}C-mefluidide. Within the first 15 days after treatment, the treated leaves of wild mustard retained the least mefluidide, and the treated leaves of common lambsquarters, the most (Table 3). After 25 days treated leaves of wild oat retained the most mefluidide.

Within 25 days of treatment the distribution of mefluidide or its metabolites in different organs of six plant species indicated that translocation was mostly acropetal (Table 3). However, the six species showed marked differences in rate of distribution of radioactivity. Of the recovered radioactivity 77% was detected to move acropetally in wild mustard; 51%, in redroot pigweed and sugarbeets; and less than 25%, in common lambsquarters, barnyardgrass, and wild oat.

At 25 days the highest concentration of translocated mefluidide or its metabolites was present in the apex of wild mustard (Table 3). On a fresh-weight basis the apices of redroot pigweed and common lambsquarters contained 75 and 96% less radioactivity, respectively, than did wild mustard. The lowest concentrations were found in lateral branches, stems, and roots of the dicotyledonous species. In the monocotyledonous species, the highest concentrations remained in the treated leaves.

Table 3. Distribution of ^{14}C-mefluidide or its metabolites in different organs of six plant species following foliar application.

Plant organ	Days after treatments: 5 (% of recovered ^{14}C)	15 (% of recovered ^{14}C)	25 (% of recovered ^{14}C)	5 (µg/g fresh wt of tissue)	15 (µg/g fresh wt of tissue)	25 (µg/g fresh wt of tissue)
			Barnyardgrass			
treated leaves	81.2	58.3	50.9	6.77	2.85	2.01
new leaves	5.5	7.2	10.7	3.20	0.66	0.59
tillers	1.6	11.8	10.7	8.11	1.70	0.48
main shoot	8.4	17.1	22.4	0.36	0.17	0.15
roots	3.3	5.6	5.2	0.14	0.07	0.08
			Common lambsquarters			
treated leaves	94.0	85.1	63.8	13.72	10.66	9.72
new leaves	-	6.4	22.4	-	1.42	0.84
apex	3.0	0.4	2.1	3.11	0.11	0.41
lateral branches	-	3.9	2.0	-	0.24	0.37
stem + cotyledons	2.7	3.8	8.2	2.35	0.63	0.31
roots	0.4	0.4	1.5	1.26	2.01	0.23
			Redroot pigweed			
treated leaves	66.7	53.6	39.8	12.70	4.75	2.85
new leaves	8.5	25.7	42.4	3.12	1.96	2.04
apex	20.4	13.2	9.0	5.84	5.06	2.39
lateral branches	-	3.0	3.6	-	1.20	0.58
stem + cotyledons	3.1	3.1	3.2	1.78	0.35	0.21
roots	1.3	1.4	2.0	0.33	0.26	0.11
			Sugarbeet			
treated leaves	69.7	59.0	39.6	3.42	2.21	1.47
new leaves	21.4	30.7	51.5	3.49	2.25	0.79
cotyledons	2.1	1.3	1.5	0.53	0.65	0.37
stem	5.8	6.2	3.2	3.30	0.93	0.46
roots	1.0	3.0	4.1	0.45	0.25	0.18

Plant organ	Days after treatments: 5	15	25		5	15	25
	(% of recovered ^{14}C)				(µg/g fresh wt of tissue)		
				Wild mustard			
treated leaves	28.4	19.2	12.0		1.27	0.84	0.32
new leaves	25.4	40.8	35.1		3.68	3.65	2.50
apex	29.8	24.6	42.6		19.85	11.73	9.40
lateral branches	-	3.9	1.8		-	0.59	0.13
stem + cotyledons	12.5	6.8	4.3		3.99	1.17	0.29
roots	3.9	4.7	4.2		0.87	0.18	0.30
				Wild oat			
treated leaves	87.6	75.0	68.1		10.13	9.81	5.81
new leaves	-	3.0	2.3		-	0.72	0.51
tillers	-	10.3	13.9		-	3.61	3.80
main shoot	10.4	8.6	12.7		0.54	0.49	0.43
roots	2.4	3.1	3.0		0.15	0.17	0.28

Field experiments. Sugarbeet tolerance was associated with herbicide rate and stage of plant growth at treatment. The higher the herbicide rate, the greater the suppression in foliar growth. Foliar growth was suppressed most when plants were treated at the eight-leaf stage and least when treated at the four-leaf stage (data not shown). At the four-leaf stage recovery was complete within 4 to 5 weeks after treatment. At the eight-leaf stage recovery continued each week at all rates except the two highest, where growth was still suppressed significantly 7 weeks after treatment. At the twelve-leaf stage, growth was also suppressed by the two highest rates. In contrast to plants at the eight-leaf stage, plants at the twelve-leaf stage were suppressed considerably less initially, but recovery was not apparent even 6 weeks (mid-August) after treatment.

Table 4. Effect of mefluidide on the quality and yield of sugarbeets when treated as seedlings at three growth stages in the field.

Treatments	Sucrose yield components: Sucrose[a] (%)	Purity[a] (%)	Roots[b] (tons/ha)	Recoverable sucrose[b] (kg/ha)
Stage of growth				
4-leaf	18.8a	94.1a	50.9	8440
8-leaf	18.8a	93.9a	43.5	7200
12-leaf	19.1a	94.4a	49.5	8390
Mefluidide rate (kg/ha)				
0.00	19.2a	94.5a	49.5	8470
0.34	18.9ab	94.1ab	48.9	8180
0.68	18.7b	94.1ab	47.7	7850
1.02	18.8b	93.9b	45.7	7540

[a]Means followed by the same letter within each column and within each treatment subgroup did not differ significantly at the 5% level of probability, as determined by Duncan's multiple range test.

[b]Statistical differences between means not indicated because the interaction between stage of growth and mefluidide rates was significant (see Figure 2 for recoverable sucrose interaction).

Table 4 shows the influence of stage of growth at treatment and mefluidide rate on the quality and yield of sugarbeet roots. The sucrose yield components, percentage sucrose and percentage purity, were not significantly different when averaged over stages of growth. However, when these parameters were averaged over mefluidide rate, percentage sucrose was reduced significantly at the 0.68 and 1.02 kg/ha rates and percentage purity at the 1.02 kg/ha rate.

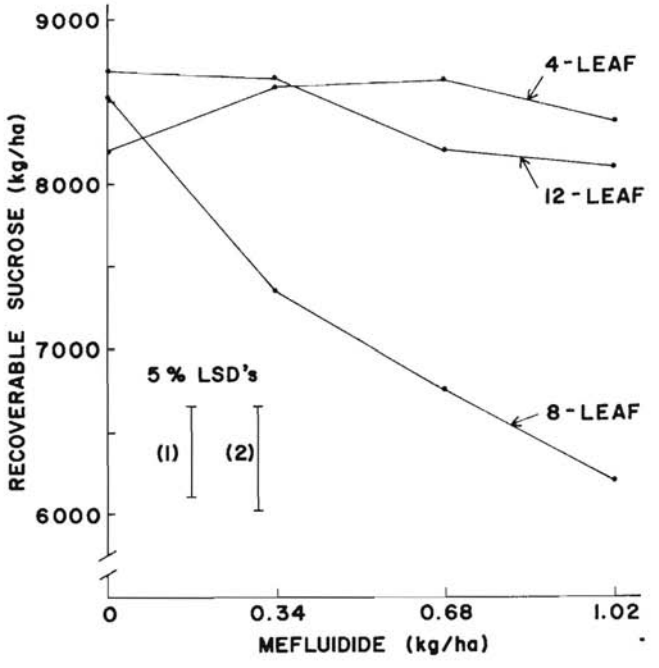

Figure 2. Effect of mefluidide on the mean yield of recoverable sucrose when sugarbeets were treated at three growth stages. LSD (1) compares rates at the same growth stage. LSD (2) compares means for different growth stages at the same mefluidide rate or compares means for different mefluidide rates at different growth stages.

The interaction between stage of growth and mefluidide rates was significant for root yield and recoverable sucrose. The recoverable sucrose data are shown in Figure 2. These interactions resulted because sugarbeets treated at the eight-leaf stage were injured more than those treated at the four- and twelve-leaf stages. Only at the eight-leaf stage were root yield and recoverable sucrose decreased significantly as the rate of mefluidide increased.

Clipping weeds once or twice in June slowed their growth temporarily, but by September the growth of these weeds was similar to that observed in the weedy check plots (Table 5). Weed control was best where mefluidide was applied to weeds that were clipped once or twice in June. The latter treatment, in which growth of weeds was stopped twice by clipping and then again by mefluidide, had the highest weed control rating, 85%.

Neither clipping the weeds nor mefluidide significantly affected the sucrose content of roots (Table 5). Mefluidide applied to weed-free sugarbeets reduced root yield 5.7% and sucrose yields 7.3%. Although weed competition in all plots significantly reduce root and sucrose yields below those in the weed-free check plots, plots that had weed growth checked twice by clipping and again by mefluidide produced significantly higher root and sucrose yields than did the weedy check plots.

Discussion

In our greenhouse studies we showed that mefluidide can effectively regulate growth of several troublesome annual weeds in sugarbeets. Of the four broadleaf weeds treated with mefluidide, wild mustard was the most susceptible, redroot pigweed was intermediate, and common lambsquarters and kochia were least susceptible. The susceptibility of the three grass species was similar to that of common lambsquarters and kochia. Susceptibility appears to be associated with the amount of mefluidide that was translocated acropetally from the treated leaves to the

Table 5. Comparison of weed clipping regimes and one application of mefluidide at 0.68 kg/ha on weed control, sucrose content of sugarbeet roots, and root and sucrose yields.

Weed topping and mefluidide regimes	Weed control rating (%)	Sucrose (%)	Root yield (tons/ha)	Sucrose yield (kg/ha)
weed-free check	--	17.2	54.8	9430
weed-free check plus mefluidide	--	16.9	51.7	8740
weedy check	33	17.1	30.2	5160
clipped once (June 22)	27	17.1	26.0	4480
clipped once (June 30)	42	17.4	34.3	5960
clipped once (June 22) plus mefluidide	62	17.0	32.8	5560
clipped twice (June 22 and June 30)	42	17.3	34.2	5890
clipped twice (June 22 and June 30) plus mefluidide	85	17.1	41.1	7020
LSD (0.05)	18	0.4	10.6	1860

meristematic regions. McWhorter and Wills (9) have reported that the adjuvant, nonoxynol, increased the absorption and translocation of mefluidide in common cocklebur (*Xanthium pensylvanicum* Wallr.), johnsongrass, and soybeans [*Glycine max* (L.) Merr.]. Therefore, the addition of an appropriate adjuvant to the spray mixture may enhance the effect of mefluidide on those annual weeds present in sugarbeets that are more difficult to control.

Based on our greenhouse studies, we expected mefluidide to injure younger sugarbeet plants more than older ones. However, in the field study sugarbeets treated at the eight-leaf stage were injured the most, and least when treated at the four-leaf stage. Environmental conditions at the time of application and for the next few days may have minimized the injury observed on sugarbeets treated at the four-leaf stage. The average maximum ambient temperatures for the 3-day period following application at the four-, eight-, and twelve-leaf stages were 18, 27, and 29°C, respectively. The average minimum ambient temperatures for this period were 4, 10, and 10°C, respectively. At a constant level of 40 or 100% relative humidity, McWhorter and Wills (9) have shown that an increase in air temperature from 22 to 32°C resulted in a two- to three-fold increase in absorption and a four- to eight-fold increase in translocation of labelled mefluidide in soybeans following application to the second trifoliolate.

Under field conditions mefluidide complemented weed clipping in minimizing competition of weed escapes, but sucrose yield was still reduced 26% (Table 5). Although sugarbeet tolerance increased with age, over-the-top sprays of mefluidide injured sugarbeets. To minimize sugarbeet injury, mefluidide might be applied through a recirculating sprayer to control tall weeds in the same manner as glyphosate [*N*-(phosphonomethyl)glycine] is (8). Mefluidide also might be used to regulate or retard the foliar growth of sugarbeets in the fall to ensure that root quality is not reduced by regrowth.

Sugarbeets are considered mature when the sugar content of their roots reaches its maximum. External factors that influence this process include the levels of nitrogen and moisture in soils. Nitrogen deficiency, moisture stress, and cool nights slow root and top growth, thus enhancing the accumulation of sucrose in roots rather than its consumption for plant growth. Hail (1), killing frost (2), or rain (10) immediately preceding harvest can markedly lower sucrose content in roots if subsequent temperatures are high enough to promote new foliar growth at the expense of sugar reserves in roots. Our results, as well as others (3, 9), show that mefluidide is absorbed and translocated rapidly to active meristematic regions. Therefore, mefluidide might be used in the fall to prevent the growth of new foliage in sugarbeet crown when edaphic and environmental conditions might promote regrowth.

Summary

In greenhouse studies 1.12 kg/ha of mefluidide suppressed the height of wild mustard 84% and redroot pigweed 66%. The height of barnyardgrass, common lambsquarters, kochia, yellow foxtail, and wild oat was suppressed 48 to 54%. Translocation of ^{14}C-mefluidide or its metabolites was mostly acropetal 25 days after treatment. Of the recovered radioactivity, 77% moved acropetally in wild mustard, 51% in redroot pigweed, and less than 25% in barnyardgrass, common lambsquarters, and wild oat. In general, sugarbeet tolerance to mefluidide increased with age, but suppression of foliar growth was observed at all rates and all stages of growth in greenhouse and field studies. In the field, root and recoverable sucrose yields were decreased significantly as the rate of mefluidide was increased when sugarbeets were treated at the eight-leaf stage; decreases were not significant when plants were treated either at the four- or twelve-leaf stage. Competition was minimized when weeds were clipped and sprayed with 0.68 kg/ha of mefluidide, but mefluidide applied to weed-free sugarbeets reduced root yields 5.7% and sucrose yields 7.3%. Mefluidide may be more beneficial in sugarbeet

production by preventing growth of new foliage from sugarbeet crowns in the fall when edaphic and environmental conditions tend to promote regrowth and subsequent decreases in root quality.

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