Weed Control in Field Corn with Postemergence Herbicides

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ABSTRACT

A field experiment was conducted in 1991 and 1992 at New Mexico State University's Agricultural Science Center at Farmington, New Mexico, to evaluate the response of field corn and annual grass and broadleaf weeds to selected postemergence herbicides. All of these herbicides increased corn yields more than 40% as compared to the untreated controls. In 1991, barnyardgrass and green foxtail control with dicamba plus DPX-79406 increased 18 and 15% as compared to 1990. Prostrate pigweed control with dicamba plus 2-4-D decreased 16% in 1991 as compared to 1990. All treatments gave more than 92% control of Russian thistle, redroot pigweed, and kochia. The results of this study emphasize the need for good weed control to attain optimum corn yields.

CONTENTS

Weed Control in Field Corn with Postemergence Herbicides[1]

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Approximately 92,000 acres of field corn were grown in New Mexico in 1991. San Juan County, in northwestern New Mexico, ranks third with 12,300 acres in corn production[3]. Most of this production occurs under sprinkler irrigation on coarse-textured soils.

Most corn producers in northwestern New Mexico do not have the proper incorporation equipment required for preplant-incorporated or preemergence herbicides on coarse-textured soils. The implements and energy needed for proper incorporation are expensive compared to postemergence application.

Controlling weeds is essential to a high-yielding corn crop. If weeds are not controlled, yields can be reduced by as much as 40 to 60% (2,3). Research has shown that early control is important. Allowing weeds to grow for three weeks after planting caused the yield to decrease by 1,008 pounds per acre (lb/A) (1). However, permitting weeds to grow up to five weeks after planting caused yield losses of approximately 1,230 lb/A (1). Some weeds such as pigweeds (*Amaranthus* spp.) at one per 5" spacing in the corn row reduced yield by 1,680 lb/A (1). Arnold et al. found that prostrate pigweed, kochia, barnyardgrass, and Russian thistle decreases corn yields by approximately 60% (2).

Prostrate and redroot pigweed (*Amaranthus blitoides* S. Wats, *Amaranthus retroflexus* L.), kochia (*Kochia scoparia* (L.) Schrad), Russian thistle (*Salsola iberica* Sennen and Pau), barnyardgrass, (*Echinochloa crus-galli* (L.) Beauv.), and green foxtail (*Setaria viridis* (L.) Beauv.) are six common weeds found in field corn in northwestern New Mexico. Little research has been done on controlling these weeds in field corn grown in northwestern New Mexico.

Many herbicides are approved for use on field corn grown on medium or fine-textured, highly organic soils. However, little information is available regarding how effective and safe herbicides are for field corn grown under sprinkler irrigation on low-organic-matter, coarse-textured soils. The objective of this research was to determine how well selected postemergence herbicides worked when applied at normal use rates for season-long weed control in sprinkler-irrigated, field corn grown on low-organic-matter, coarse-textured soils.

MATERIALS AND METHODS

Field experiments were conducted in 1990 and 1991 at NMSU's Agricultural Science Center at Farmington, New Mexico. The soil was a Wall sandy loam soil (sand 69%, silt 19%, and clay 12%) ranging from 0.1 to 0.3% organic matter. Soils were fertilized according to NMSU recommendations based on soil tests. The fields were plowed, fertilized, and leveled before the herbicides were applied and the field corn (Super Crost 5460 and Northrup King S5340 varieties) was planted.

Super Crost 5460 and Northrup King S5340 were planted on May 8, 1990, and May 3, 1991, respectively. Seeds were planted with a John Deere 71 flex planter at 7" apart and 2" deep in rows spaced 34" apart. Individual plots were four rows, 30 feet (ft) long, with three replications arranged in a randomized complete block design. Irrigation water was applied by a solid-set sprinkler system. Approximately 35" of water were applied during both growing seasons.

Treatments were applied May 29, 1990, and May 21, 1991, when field corn was in the three- to four-leaf stage (3" high). Weed heights at application were: prostrate pigweed, two- to four-leaf stage (0.25"); redroot pigweed and Russian thistle, two- to four-leaf stage (0.5"); kochia, small rosette stage (0.5"); barnyardgrass, two- to three-leaf stage (1"); and green foxtail, two-leaf stage (1").

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[1]Mention of a proprietary herbicide does not imply registration under FIFRA as amended, or endorsement by New Mexico State University.

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[3]New Mexico Agricultural Statistics, 1991.

All treatments were applied with a compressed-air backpack sprayer mounted in the back of a John Deere AMT 622. The sprayer was calibrated to deliver 30 gallons per acre (gal/A) at 30 pounds per square inch (psi). The chemical designations for the proprietary herbicides evaluated were as follows:

Common name	Trade name
atrazine + dicamba	Marksman
cyanazine	Bladex
dicamba	Banvel
DPX-79406	none
nicosulfuron	Accent
pendimethalin	Prowl
primisulfuron	Beacon
2,4-D	Weedone LV-4

Weed control for each treatment was estimated visually, on a scale of 0 to 100 by comparison to untreated controls, where 0 equaled no control or crop injury and 100 equaled dead plants. Evaluations were made approximately six weeks after application. Handweeded controls were hoed about every two weeks starting in late May until late August.

Field corn was harvested December 5, 1990, and November 5, 1991 by combining the center two rows of each plot using a John Deere 3300 combine equipped with a load cell. Corn grain yields were converted to a 15.5% moisture basis and reported in bushels per acre (bu/A).

All data were subjected to analysis of variance. Treatment means were separated by Fisher's LSD test at the 5% level of significance. A significant year-by-treatment interaction was found for visual ratings of prostrate and redroot pigweed, barnyardgrass, and green foxtail, but not for kochia or Russian thistle, and yield. For consistency, all data were analyzed separately for each year.

RESULTS AND DISCUSSION

Redroot and prostrate pigweed and barnyardgrass infestations were heavy, while kochia, green foxtail, and Russian thistle infestations were light throughout the experimental area in both years (tables 1 and 2).

In 1990, all treatments except the untreated check controlled redroot and prostrate pigweed, and kochia, (data not presented). All treatments controlled barnyardgrass and green foxtail excellently except dicamba in combination with DPX-79406, or 2,4-D, and the untreated check. All treatments except the untreated check gave excellent control of Russian thistle (table 1).

In 1991, all treatments except the untreated check gave 100% control of kochia and Russian thistle (data not presented). Barnyardgrass and green foxtail were controlled excellently with all treatments except dicamba plus 2,4-D, and the untreated check. Barnyardgrass and green foxtail control increased 18 and 15% with dicamba plus DPX-79406, as compared to 1990. All treatments gave excellent control of redroot and prostrate pigweed except dicamba plus 2,4-D, and the untreated check. Prostrate pigweed control decreased 16% with dicamba plus 2,4-D, as compared to 1990 (table 2). No crop chlorosis or stunting was apparent in any of the treatments during both years.

Weeds were strong competitors with field corn, reducing yields by more than 40% in both years. In 1990, atrazine plus dicamba at 1.2 pound active ingredient per acre (lb ai/A) plus Agri-Dex at 0.25% volume per volume (v/v) significantly produced more corn than did atrazine plus dicamba plus primisulfuron, dicamba in combination with cyanazine or pendimethalin, and the untreated check. Corn yields were 66 to 107 bu/A higher in the herbicide treated plots than the untreated check (table 3).

In 1991, yields of Northrup King S5340 were reduced an estimated 5 to 20% because two spotted spider mite infested some plots. Spider mites live on both upper and under leaf surfaces. These mites live on the sap of the plant, causing the corn leaves to fire, have a pale sickly appearance, and gradually die and drop. Atrazine plus dicamba at 1.2 lb ai/A significantly produced more corn than did atrazine plus dicamba at 0.8 lb ai/A; atrazine plus dicamba at 1.2 lb ai/A plus Agri-Dex at 0.25% v/v; atrazine plus dicamba in combination with cyanazine, pendimethalin, or primisulfuron; dicamba in combination with cyanazine, pendimethalin, or 2,4-D; and the untreated check. Corn yields were 62 to 106 bu/A higher in the herbicide treated plots than the untreated check (table 3).

CONCLUSIONS

The results of these tests showed that all the herbicides evaluated were safe and gave good to excellent control of broadleaf weeds. However, not all were effective for controlling annual grass in field corn grown on coarse-textured soils. Atrazine plus dicamba in combination with primisulfuron, and dicamba in combination with cyanazine or pendimethalin resulted in significantly less corn than the handweeded check in 1990. The same three treatments also reduced yields in 1991, but the difference was not significant from the handweeded check.

Over the two-year period, the highest yielding treatment was atrazine plus dicamba at 1.2 lb ai/A with or without the addition of Agri-Dex at 0.25% v/v.

Table 1. Control of three annual weeds with herbicides in Super Crost 5460 field corn, evaluated six weeks after application, at Farmington, New Mexico, 1990.

Herbicide	Rate	Weed control[1,2]		
		BYGR	GRFT	RUTH
	(lb ai/A)		%	
atrazine + dicamba[3] (pm)	0.8	100	97	99
atrazine + dicamba[3] (pm)	1.2	100	100	100
atrazine + dicamba (pm)	0.8	100	98	99
atrazine + dicamba (pm)	1.2	100	100	100
atrazine + dicamba (pm) + cyanazine	0.8+1.0	100	100	100
atrazine + dicamba (pm) + pendimethalin	0.8+1.0	100	100	100
atrazine + dicamba (pm) + nicosulfuron	0.8+0.047	100	100	100
atrazine + dicamba (pm) + DPX-79406	0.8+0.047	100	100	100
atrazine + dicamba (pm) + primisulfuron	0.8+0.032	100	100	100
dicamba + cyanazine	0.38+1.0	100	100	100
dicamba + cyanazine + pendimethalin	0.38+1.0+1.0	100	100	100
dicamba + pendimethalin	0.38+1.0	98	97	100
dicamba + DPX-79406	0.38+0.047	82	85	100
dicamba + 2,4-D	0.25+0.25	0	0	100
handweeded control	—	100	100	100
untreated	—	0	0	0
av. no. of weeds/yd^2	—	11	6	3
LSD 0.05	—	11	6	3

[1]Based on a visual scale from 0 to 100, where 0 = no control and 100 = dead plants.

[2]BYGR = barnyardgrass, GRFT = green foxtail, and RUTH = Russian thistle.

[3]Applied with Agri-Dex at 0.25% v/v, and pm = packaged mix.

Table 2. Control of four annual weeds with herbicides in Northrup King S5340 field corn evaluated six weeks after application, at Farmington, New Mexico, 1991.

Herbicide	Rate	Weed control[1,2]			
		BYGR	GRFT	RRPW	PRPW
	(lb ai/A)	%			
atrazine + dicamba[3] (pm)	0.8	100	100	100	99
atrazine + dicamba[3] (pm)	1.2	100	99	100	100
atrazine + dicamba (pm) + cyanazine	0.8+1.0	100	100	100	100
atrazine + dicamba (pm) + pendimethalin	0.8+1.0	100	100	100	100
atrazine + dicamba (pm) + DPX-79406	0.8+0.047	100	100	100	100
atrazine + dicamba (pm) + primisulfuron	0.8+0.032	100	100	100	100
dicamba + cyanazine + pendimethalin	0.38+1.0+1.0	100	100	100	100
dicamba + DPX-79406	0.38+0.047	100	100	100	100
atrazine + dicamba[3] (pm)	1.2	99	100	100	100
atrazine + dicamba (pm) + nicosulfuron	0.8+0.047	99	98	100	100
atrazine + dicamba (pm)	0.8	98	99	100	99
dicamba + cyanazine	0.38+1.0	98	100	96	90
dicamba + pendimethalin	0.38+1.0	98	97	100	100
dicamba + 2,4-D	0.25+0.25	0	0	92	84
handweeded control		100	100	100	100
untreated		0	0	0	0
av. no. of weed/yd^2		11	6	15	21
LSD 0.05		2	2	2	4

[1]Based on a visual scale from 0 to 100, where 0 = no control and 100 = dead plants.

[2]BYGR = barnyardgrass, GRFT = green foxtail, RRPW = redrootpigweed and PRPW = prostrate pigweed.

[3]Applied with Agri-Dex at 0.25% v/v, and pm = packaged mix.

Table 3. Effects of herbicide treatments on yield of Super Crost 5460 and Northrup King S5340 field corn in 1990 and 1991, at Farmington, New Mexico.

Herbicide	Rate	Yield[1] 1990	1991
	(lb ai/A)	———bu/A———	
atrazine + dicamba[2] (pm)	0.8	203	170
atrazine + dicamba[2] (pm)	1.2	213	178
atrazine + dicamba (pm)	0.8	199	193
atrazine + dicamba (pm)	1.2	201	204
atrazine + dicamba (pm) + cyanazine	0.8+1.0	197	173
atrazine + dicamba (pm) + pendimethalin	0.8+1.0	196	160
atrazine + dicamba (pm) + nicosulfuron	0.8+0.047	203	177
atrazine + dicamba (pm) + DPX-79406	0.8+0.047	198	182
atrazine + dicamba (pm) + primisulfuron	0.8+0.032	184	166
dicamba + cyanazine	0.38+1.0	172	172
dicamba + cyanazine + pendimethalin	0.38+1.0+1.0	196	182
dicamba + pendimethalin	0.38+1.0	177	169
dicamba + DPX-79406	0.38+0.047	193	181
dicamba + 2,4-D	0.25+0.25	204	162
handweeded control		206	189
untreated control		106	98
LSD 0.05		21	29

[1]Corn yields adjusted to a 15.5% moisture basis.

[2]Applied with Agri-Dex at 0.25% v/v, and pm = packaged mix.

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