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USING REDUCED RATES OF POSTEMERGENCE HERBICIDES IN SOYBEANS

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Postemergence herbicides have been used successfully in soybeans for many years. Postemergence applications have an advantage over soil applications in that they can be used after weeds have emerged and have been identified, thereby allowing the herbicide to be targeted to the weed species present.

Labeled herbicide rates usually are set at somewhat high levels by manufacturers to ensure that the herbicide will control labeled weeds effectively over a broad range of management and environmental conditions. Sometimes, with improved management and/or under certain environmental conditions, herbicide rates can be reduced and adequate weed control still obtained. This situation would result in increased producer profits and reduced potential for herbicide runoff or leaching into surface or groundwater.

Postemergence herbicides are generally more effective on smaller weeds, so applying them earlier in the cropping season may allow the use of reduced rates. This study was initiated to investigate: a) the effectiveness of reduced rates of the postemergence herbicides Basagran, Blazer, Classic, Cobra, Pursuit, and tankmixes of Basagran plus Blazer and Classic plus Pinnacle and b) the necessity of cultivation in a reduced-rate postemergence herbicide system.

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Procedures

Thirteen field experiments were established at nine locations in Kansas over a 4-yr period from 1988 to 1991. Conventional tillage practices were used prior to soybean planting. Treflan or Prowl herbicide was soil-applied to control grassy weeds. Individual plot size at all locations was 10 ft (4 rows) wide and 30 ft long. Plots at Beloit (1990 and 1991), Gardner, Hiawatha, Manhattan, McFarland, Powhattan (1991), Seneca, and Topeka (1991) were arranged in a randomized complete block design. Plots at Eudora, Powhattan (1989 and 1990), and Topeka (1990) were arranged in a randomized complete block design in a split-plot arrangement with herbicide rate as the main plot and cultivation treatments as the subplots. Treatments at all locations were replicated three times.

Postemergence herbicide applications were made with either a CO2 backpack sprayer or a tractor-mounted sprayer. At all locations, spray solutions were delivered through 8003 flat-fan nozzles at 20 gal/acre and a pressure of 20 psi.

The postemergence herbicides Basagran (in 1988, 1989, 1990, and 1991); Blazer (in 1988, 1989, and 1990); Classic (in 1988, 1989, and 1990); Cobra (in 1991); Pursuit (in 1991); or a combination of Basagran plus Blazer (in 1988, 1989, 1990, 1991) or of Classic plus Pinnacle (in 1991) were applied at either 2 or 4 wk after planting (WAP) of the soybeans. Several weeds were present at different growth stages when herbicides were applied at 2 WAP and 4 WAP. Common cocklebur at Eudora, not emerged and 5 leaves; at Gardner, cotyledon and 5 leaves; at Topeka (1990), cotyledon and 5 leaves. Common sunflower at Manhattan, cotyledon and no measurement; at Topeka (1990), cotyledon and 6 leaves; at Topeka (1991), 1 leaf and 4 leaves. Puncturevine at Beloit (1991), 3 in. diameter and 6 in. diameter. Smooth pigweed at Beloit (1990), 2 leaves and 4 leaves; at Gardner, cotyledon and 4 leaves; at McFarland, Powhattan (1989), and Topeka (1990), 2 leaves and 4 leaves. Velvetleaf at Gardner, cotyledon and 5 leaves; at Hiawatha, 1 leaf and 4 leaves; at McFarland, cotyledon and 3 leaves; at Powhattan (1989), cotyledon and 4 leaves; at Powhattan (1990), cotyledon and 5 leaves; at Powhattan (1991), 1 leaf and 5 leaves; at Seneca, 1 leaf and 4 leaves. Giant ragweed also was present at 2 WAP in Manhattan, cotyledon stage. Soybeans at 2 WAP were at the unifoliate stage at all locations, except Eudora (cracking) and Hiawatha and Powhattan, 1991 (1 trifoliate leaf). At 4 WAP, soybeans ranged from 2 to 4 trifoliate leaves. In 1988, 1989, and 1990, herbicide rates applied at 2 WAP were either a currently recommended and labeled rate (1X), ½ the recommended labeled rate (½X), or ¼ the recommended labeled rate (¼X). In 1991, herbicide rates applied at 2 WAP included the ½X and ¼X rate treatments. Recommended

labeled rates used in these tests were: Basagran at 0.75 lbs ai/acre; Blazer at 0.50 lbs ai\acre; Basagran at 0.75 lbs ai/acre plus Blazer at 0.50 lbs ai/acre; Classic at 0.008 lbs ai/acre; Classic at 0.004 lbs ai/acre plus Pinnacle at 0.004 lbs ai/a; Cobra at 0.20 lbs ai/acre; and Pursuit at 0.063 lbs ai/acre. At all locations except Manhattan, 1X rate treatments also were applied at 4 WAP as the standard, commercial-use treatments. Additionally, at Eudora, Powhattan (1989 and 1990), and Topeka (1990), subplots of each herbicide rate were cultivated at 4 WAP.

All postemergence herbicide applications except the Cobra treatment included a urea-ammonium nitrate fertilizer solution as a spray adjuvant at 1 gal/acre. All Classic, Classic plus Pinnacle, and Pursuit applications also included the use of a nonionic surfactant at 0.25% (v/v). All Cobra applications included the use of crop oil concentrate at 1 qt/acre.

Visual ratings of weed control and crop damage were made at 8 WAP. A visual rating of 0 was defined as no control or damage compared with untreated plants. A rating of 100 was defined as complete control or death.

Grain yields were measured at the Powhattan (1989, 1990, 1991) locations by harvesting the middle two rows of each four-row plot.

Results

Broadleaf Weed Control, 1988–1990. Postemergence applications of 1X and ½X rates at 2 WAP resulted in weed control similar to that obtained from standard (1X, 4 WAP) treatments in six of seven studies with Basagran, Blazer, and Basagran plus Blazer and five of seven studies with Classic (Table 1). At Manhattan, no standard treatment was applied for comparison. However, all herbicide rates with the exception of Blazer at ¼X rate applied at 2 WAP at Manhattan controlled weeds acceptably. Acceptable weed control was considered to be 85% and greater. At Eudora, the standard treatment controlled weeds more consistently than the 1X and ½X rates applied at 2 WAP. One-quarter rates applied at 2 WAP resulted in weed control comparable to that of the standard treatment in four of seven studies with Blazer and Classic, five of seven studies with Basagran, and six of seven studies with Basagran plus Blazer.

At Eudora, all herbicides applied at 2 WAP resulted in unacceptable broadleaf weed control. Cold, damp soil conditions for approximately 2 wk following soybean planting slowed soybean and weed emergence in comparison with that at other locations, causing most weeds to emerge after the herbicides were applied. Postemergence herbicides applied at the rates used in these studies have minimal soil activity and normally will not control weeds that emerge after application.

Table 1. Broadleaf weed control with reduced herbicide rates and no cultivation.

Herbicide	Rate	Timing	Location												
			Bel. 1990	Bel. 1991	Eud.	Gard.	Hiaw.	Manh.	McFarl.	Powh. 1989	Powh. 1990	Powh. 1991	Top. 1990	Top. 1991	Sen.
	lbs ai/acre	WAP[a]	percent[b]												
Basagran	0.75	2	88	—	63	—	32	97	83	65	99	—	50	—	—
	0.38	2	58	28	55	91	22	92	93	95	97	58	43	99	99
	0.19	2	33	33	20	82	37	85	91	78	90	40	48	66	96
	0.75	4	61	56	93	62	33	—	97	89	86	37	45	99	99
Blazer	0.50	2	70	—	72	—	95	94	98	98	89	—	77	—	—
	0.25	2	83	—	37	—	94	91	93	99	75	—	81	—	—
	0.13	2	70	—	42	—	88	74	99	96	50	—	43	—	—
	0.50	4	70	—	97	—	90	—	99	94	74	—	70	—	—
Blazer + Basagran	0.50 + 0.75	2	73	—	88	—	97	85	99	80	96	—	83	—	—
	0.25 + 0.38	2	68	40	27	98	95	95	93	99	93	73	79	82	99
	0.13 + 0.19	2	68	58	42	98	92	86	97	88	84	52	55	82	95
	0.50 + 0.75	4	80	61	96	98	92	—	99	99	93	40	50	96	98
Classic	0.008	2	43	—	30	—	42	98	99	100	58	—	88	—	—
	0.004	2	48	—	53	—	18	99	97	85	48	—	45	—	—
	0.002	2	50	—	47	—	10	98	91	88	35	—	30	—	—
	0.008	4	22	—	95	—	77	—	97	80	45	—	43	—	—
Cobra	0.20	2	—	—	—	—	—	—	—	—	—	—	—	—	—
	0.10	2	—	27	—	99	—	—	—	—	—	47	—	96	88
	0.05	2	—	37	—	97	—	—	—	—	—	43	—	91	78
	0.20	4	—	86	—	99	—	—	—	—	—	60	—	99	73
Classic + Pinnacle	0.004 + 0.004	2	—	—	—	—	—	—	—	—	—	—	—	—	—
	0.002 + 0.002	2	—	30	—	83	—	—	—	—	—	52	—	99	93
	0.001 + 0.001	2	—	28	—	53	—	—	—	—	—	60	—	80	97
	0.004 + 0.004	4	—	82	—	59	—	—	—	—	—	57	—	99	98
Pursuit	0.063	2	—	—	—	—	—	—	—	—	—	—	—	—	—
	0.032	2	—	43	—	97	—	—	—	—	—	87	—	97	100
	0.016	2	—	53	—	99	—	—	—	—	—	43	—	85	77
	0.063	4	—	69	—	99	—	—	—	—	—	68	—	100	99
None	—		0	0	0	0	0	0	0	0	0	0	0	0	0
LSD (.05)			36	17	30	16	24	21	27	17	16	24	22	18	10

[a]WA P= weeks after planting. [b]Visual weed control ratings were made 8 weeks after planting.

Table 2. The effect of cultivation on broadleaf weed control in a reduced-rate herbicide system.

Herbicide Rate[a]	Timing	Cultivated	Location: Eud.	Powh. 1989	Powh. 1990	Top. 1990
	WAP[b]		percent			
1 X	2	yes	68	98	91	88
		no	63	90	86	75
1/2 X	2	yes	69	99	87	79
		no	43	96	78	62
1/4 X	2	yes	63	96	78	56
		no	38	93	64	44
1 X	4	yes	97	96	86	74
		no	95	93	75	52
None	–	yes	53	66	20	23
		no	0	0	0	0
LSD (0.05)			16	7	12	13

[a]1X = recommended label rate; l/2X = 50% of recommended label rate; l/4X = 25% of recommended label rate.
[b]WAP = weeks after planting.

Table 3. The effects of reduced herbicide rates on soybean yields across herbicides.

Herbicide Rate	Timing	Cultivated	Location: Powh. 1989	Powh. 1990	Powh. 1991
	WAP		bu/acre		
1 X	2	yes	26	47	—
		no	25	44	—
1/2 X	2	yes	26	46	—
		no	25	41	43
1/4 X	2	yes	28	42	—
		no	28	40	44
1 X	4	yes	26	44	—
		no	27	42	46
None	—	yes	28	23	—
		no	21	21	44
LSD (0.05)			2	3	9

Broadleaf Weed Control, 1991. Postemergence applications at ½X rates at 2 WAP resulted in control similar to that obtained from standard (1X, 4 WAP) treatments in four of five studies with Basagran, Basagran plus Blazer, Classic plus Pinnacle, Cobra, and Pursuit. One-quarter rates applied at 2 WAP resulted in weed control comparable to that of the standard treatment in four of five studies with Basagran plus Blazer and Cobra, three of five studies with Basagran and Classic plus Pinnacle, and two of five studies with Pursuit.

At Beloit, all herbicides applied at 2 WAP except Basagran plus Blazer at ¼X rate resulted in less weed control than that provided by the standard treatment. Dry soil conditions following soybean planting delayed weed emergence, resulting in most weeds emerging after the herbicides were applied.

Cultivation. Data analysis indicated no significant herbicide by cultivation or herbicide by cultivation by rate interactions in the four studies where the cultivation treatment was included. Therefore, cultivation data were averaged over herbicides (Table 2). One cultivation at 4 WAP appeared to increase the broadleaf weed control by all herbicides and rates applied, although the difference was not statistically significant at the $P < 0.05$ level. In all studies except Eudora, the ¼X rate treatment applied at 2 WAP and followed by a cultivation 2 wk later provided weed control similar to that of the standard treatment with no cultivation.

Soybean Grain Yield, 1989-1991. Soybean grain yield was measured at the Powhattan sites. Data analysis indicated no significant herbicide by cultivation or herbicide by cultivation by rate interactions. Therefore, yield data were averaged over herbicides and cultivation (1989 and 1990) (Table 3). Soybean yields were similar at all herbicide rates. A cultivation at 4 WAP in 1989 resulted in higher soybean grain yields in the no-herbicide treatment but not in herbicide-treated plots. A cultivation at 4 WAP in 1990 significantly increased soybean yields with the ½X rates applied at 2 WAP and with the no-herbicide treatment and slightly increased yield with the other herbicide rates. Grain yields in 1990 were lower in the no-herbicide treatments than in the herbicide-treated plots. In 1990, applications of 1X or ½X rates at 2 WAP and one cultivation at 4 WAP resulted in higher grain yields than did the full 1X rate applied at 4 WAP with no cultivation. In 1991, all herbicide rates resulted in increased soybean grain yields compared to the no-herbicide treatment.

Summary

Postemergence herbicides applied at 2 WAP at ½X rates resulted in broadleaf weed control similar to that obtained, from standard treatments of 1X rates applied at 4 WAP in 10 of 12 studies with Basagran and Basagran plus Blazer;

six of seven studies with Blazer; five of seven studies with Classic; and four of five studies with Classic plus Pinnacle, Cobra, and Pursuit. One-quarter rates applied at 2 WAP were equivalent to standard treatments for broadleaf weed control in eight of 12 studies with Basagran, 10 of 12 studies with Basagran plus Blazer, four of seven studies with Blazer and Classic, three of five studies with Classic plus Pinnacle, four of five studies with Cobra, and two of five studies with Pursuit. One cultivation at 4 WAP increased broadleaf weed control with all herbicide treatments.

Conclusions

Application rates of the herbicides used in these studies can be reduced, if growers are willing to make additional management decisions/inputs. Applying these postemergence herbicides earlier in the season when weeds are smaller allows the use of lower herbicide rates, while maintaining weed control equivalent to or better than that achieved with the labeled rate. Early postemergence herbicide applications provided consistent weed control as long as weeds had emerged prior to the applications. Applying the postemergence herbicides before weed emergence resulted in reduced weed control compared with the standard 4 WAP application.

A timely cultivation following the herbicide applications at 2 WAP appeared to improve weed control somewhat, especially with the ¼X rates, and may be a necessary component when using those rates. Application of ¼X rates at 2 WAP followed by one cultivation 2 wk later provided weed control equivalent to that of 1X rates applied at 4 WAP and not cultivated.

Note: Trade names are used to identify products; no endorsement is intended or criticism of similar products not mentioned.

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