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WEED MANAGEMENT IN DRY BEANS IN PUERTO RICO

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ABSTRACT

An experiment with Arroyo Loro bean was conducted at Isabela, Puerto Rico in 1998 to evaluate potential weed management strategies for dry beans. Trifluralin (0.75 kg/ha) and pendimethalin (1.24 kg/ha) both preplanting, and imazethapyr (0.06 kg/ha) and metholachlor (2.8 kg/ha) both preemergence, were equally effective reducing broadleaf weeds. Preemergence imazethapyr and postemergence bentazon were less effective for grasses than metolachlor, trifluralin, pendimethalim, and bentazon which in combination with sethoxydim at third week controlled 100% of grasses. Bean yield ranged from 1,555 kg/ha (with pendimethalin plus bentazon) to 1,970 kg/ha (with imazethapyr at 5 days) but did not differ significantly (P = 0.05). Harvesting by hand maximized yield recovery since most of the herbicides reduced weed biomass and potential grain loss.

INTRODUCTION

Bean (*Phaseolus vulgaris* L.) is an important component in the puertorrican diet. Around 160 mt of fresh beans and 7 mt of dry beans are produced locally, however, more than 5,000 mt are imported annually at a cost of $15.0 million. Consumers prefer beans instead of other grains and for this reason an increase in production is desirable.

Weed control studies with dry beans have been limited in Puerto Rico. One study conducted at Lajas in 1980 reported that trifluralin, profluralin, and DCPA provided good yields of snap and dry beans (Almod\var and Semidey, 1980). Weed interference may reduce dry bean yield up to 30% (Dawson, 1964). Studies conducted in Arkansas (USA) indicates that a single weed species such as pigweed (*Amaranthus hybridus* L.) reduced snap bean yield over 50% (Lugo and Talbert, 1994). According to Burnside et al. (1998) weed biomass ean be controlled in red kidney beans, either mechanically or chemically, but a combination of the two methods is the most effective and dependable weed control strategy.
The lack of effective weed management strategies in beans are limiting its production in Puerto Rico. The objective of this study was to develop weed management strategies for the control of late germinating weeds in dry beans.

MATERIALS AND METHODS

One experiment with white bean was conducted at Isabela, Puerto Rico in 1998. Arroyo Loro bean was planted 28 January 1998 at about 320,000 seeds/ha. A randomized complete block design with four replications was followed. Plots measured 3.65 m by 6.1 m, with six rows of beans, 60 cm apart. Information of herbicide treatments is presented in Table 1. Sprinler irrigation was applied nine times from January 28 to April 7, 1998. Plots were fertilized with 112 kg/ha, each of N, P_2O_5 and K_2O at second week of planting.

Weed density within a 0.5 m^2 frame was recorded three and six weeks after planting (WAP). Row-crop cultivation was performed in the whole area 4 WAP. Weed samples were collected 9 WAP and biomass determined. Dry beans from 14.8 m^2 were harvested 22 April 1998.

Table 1. Herbicide treatments applied to beans in Isabela, Puerto Rico in 1998.

Treatment number	Common name	Application		
		kg ai/ha	L/ha	timing (Days)*
1, 2, 3	Trifluralin	0.75	1.75	PPI (1 DBP)
3, 6	Imazethapyr	0.06	0.23	PRE (2 DAP)
4	Imazethapyr	0.06	0.23	AE (5 DAP)
5, 7	Metolachlor	2.80	2.90	PRE (2 DAP)
2, 6, 7, 8	Sethoxydim	0.37	2.30	POE (21 DAP)
9, 10	Pendimethalin	1.24	3.50	PPI (1 DBP)
8, 10	Bentazon	0.75	1.75	POE (14 DAP)

*Abbreviations: PPI = preplant incorporated, PRE = preemergence, AE = at emergence, POE = postemergence, DBP = days before planting, DAP days after planting.

RESULTS AND DISCUSSION

Predominant weed species in the experimental area were wild poinsettia (*Euphorbia heterophylla* L.), junglerice [*Echinochloa colona* (L.) Link], horse purslane (*Trianthema portulacastrum* L.) and johnsongrass [*Sorhum halepense* (L.) Pers.]. There were no significant ($P < 0.05$) in density of broadleaf weeds at 3 WAP (Table 2). At 3 WAP, trifluralin, metolachlor, and pendimethalin treatments were more effective for grasses than imazethapyr (Treat. 6) and bentazon (Treat. 8).

Trifluralin (Treat. 1, 2, and 3) and pendimethalin plus bentazon (Treat. 10), and imazethapyr (Treat. 3, 4, and 6) and metholachlor (Treat. 5 and 7) were equally effective reducing broadleaf weeds at 6 WAP (Table 2). All these treatments reduced broadleaf weeds density more than bentazon alone (Treat. 8) for the first three weeks. At 6 WAP, imazethapyr at 5 DAP was less effective for grasses than metolachlor, trifluralin, and bentazon treatments, which in combination with sethoxydim (at third week) controlled 100% of grasses.

Table 2. Weed density three and six weeks after planting dry beans at Isabela , Puerto Rico in 1998.

Treatment	Broadleaves		Grasses	
	3 WAP no./0.5m²	6 WAP no./0.5m²	3 WAP no./0.5m²	6 WAP no./0.5m²
1	17 a[1]	7 bc	1 d	0 b
2	10 a	5 b	1 d	0 b
3	7 a	4 b	1 d	2 b
4	20 a	4 b	11 c	7 a
5	10 a	5 b	0 d	0 b
6	16 a	9 ab	38 a	0 b
7	9 a	6 b	0 d	0 b
8	33 a	15 a	26 b	0 b
9	6 a	8 ab	0 d	0 b
10	8 a	4 b	0 d	1 b

[1]Means within columns followed by the same letters are not significantly different according to LSD (0.05) test.

Weed biomass at 9 WAP and dry bean yield is presented in Table 3. All herbicide combinations were more

effective reducing broadleaf weeds biomass than imazethapyr applied 5 DAP (Treat 4, Table 3). However, imazethapyr applied 5 DAP was more effective reducing broaleaves than pendimethalin combinations (Treat. 9 and 10). Trifluralin, imazethapyr, and metolachlor , all alone or combined with sethoxydim provided better biomass control of broadleaf weeds than pendimethalim alone (Treat. 9). Bean yield ranged from 1,555 kg/ha (with pendimathalin plus bentazon) to 1,970 kg/ha (with imazethapyr at 5 DAP) but did not differ significantly. Harvesting by hand maximized yield recovery since most of the herbicide treatments reduced weed biomass and potential grain loss at the end of the growing season.

CONCLUSION

An effective weed management strategy for dry beans should include: 1) the application of a preplant incorporated herbicide such as trifluralin or pendimethalin , if not possible bean planting must be followed by 2) a preemergence herbicide such as imazethapyr or metholachlor , which can be followed by 3) postemergence sethoxydim for grasses at third week, and finally 4) mechanical cultivation at fourth week is recommended.

The application of postemergence bentazon 14 days after planting, followed by sethoxydim one week later, plus cultivation at the fourth week may successfully substitute the above mentioned strategy.

Table 3. Weed biomass nine weeks after planting and bean yield at Isabela, Puerto Rico in 1998.

Treatment	Weed biomass		Bean yield kg/ha
	Grasses g / 0.5 m²	Broadleaves g / 0.5 m²	
1	0 b[1]	23 bc	1,930 a
2	4 b	16 bc	1,820 a
3	2 b	12 bc	1,820 a
4	82 a	3 c	1,710 a
5	8 b	23 bc	1,840 a
6	1 b	21 bc	1,970 a
7	4 b	18 bc	1,690 a
8	24 b	18 bc	1,880 a
9	1 b	66 a	1,575 a
10	0 b	45 ab	1,555 a

[1]Means within column followed by the same letters are not significantly different according to LSD (0 05) test.

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