Proc. Fla. State Hort. Soc. 96:90-92. 1983.

WEED CONTROL IN SNAP BEANS

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Additional index words. Phaseolus vulgaris, herbicides, grass, broadleaf weeds.

Abstract. **Snap beans (Phaseolus vulgaris L.) were grown to evaluate several herbicides during 1982 and 1983. Broadleaf weeds provided more competition than grasses and sedges. Principal weeds were garden spurge (Euphorbia hirta L.) in 1982 and wild mustard [Brassica kaber (DC.) Wheeler] in 1983. Adequate control of broadleaf weeds without a reduction in bean vigor was provided by 0.75 lb./acre ethalfluralin + 3.0 lb./acre EPTC, and 2.0 lb./acre metolachlor. Trifluralin at 0.75 lb./acre provided adequate broadleaf weed control in 1983 but not in 1982. Preemergence treatments that provided adequate grass control, principally broadleaf signalgrass [Brachiaria platyphylla (Griseb.) Nash] in the first season, and large crabgrass [Digitaria sanguinalis (L.) Scop.] and goosegrass (Eleusine indica L. Gaertn.) in the second season, without crop injury included ethalfluralin + EPTC, 0.75 lb./acre pendimethalin, and 2.0 lb./acre metolachlor. Postemergence grass control was excellnt with 0.2 lb./acre sethoxydim, 0.25 lb./acre fluazifop-butyl, and 0.25 lb./acre CGA 82725 [2-propynyl 2-[4-(3,5-dichloro 2-2-pyridinyl) oxy] phenoxy] propanoate. Moderate to good sedge control was obtained with EPTC and metolachlor treatments.**

Snap beans are grown extensively in Florida for the fresh and processing market. Most of the approximately 50,000 acres planted annually is on mineral soils. Although beans grow quite rapidly, weed control is a serious production problem. Herbicides currently available for use on snap beans are not widely used because of inconsistent weed control by some and high cost of others. Recently, preemergence and postemergence grass herbicides have been developed that may provide effective weed control in snap beans without crop injury. Studies reported here were conducted to evaluate several herbicides applied alone and in combination for weed control in snap beans.

Methods and Materials

Studies were conducted in the springs of 1982 and 1983 in Gainesville, FL. 'Sprite' snap beans were grown on separate sites of Blichton fine sandy soil. Herbicides were applied preplant incorporated, preeemergence (Table 1), and postemergence to crop and weeds (Tables 2 and 3). Herbicide treatments were arranged in randomized block designs in plots 15 x 4 ft with 4 replications. The areas were fumigated with 6 gal/acre of ethylene dibromide in early February of each year. Fertilizer was applied at 1,100 lb./acre 6-3.5-5 N-P-K and rototilled into beds 4-ft apart. Herbicides were applied over the entire row in 29 gal/acre of solution at 30 psi with two 8004 teejet nozzles.

In 1982, the preplant incorporated herbicides were applied on April 1 and rototilled 1.5 to 2.0 inches into the bed. Beans were seeded and then the preemergence herbicides were applied. A delayed preemergence treatment was applied on April 6 before bean cotyledons emerged and postemergence treatments were applied on May 10. Plant vigor and weed control ratings were made on May 13 and on June 4. Signalgrass was the predominate grass. Broadleaf weed population were approximately 50% garden spurge, 20% cutleaf evening primrose (*Oenothera laciniata* Hill), 10% dog fennel [*Eupatorium capillifolium* (Lam.) Small], and 20% cudweed (*Gnaphalium* spp.). Annual sedge (*Cyperus compressus* L.) was present in low populations. Control treatments were hand cultivated on May 15 and beans were harvested on May 28 and June 4.

In 1983, preplant incorporated treatments were applied, beans seeded, and preemergence treatments were applied on April 7. About 70% of the total weed population in these plots was wild mustard. Large crabgrass, goosegrass, and purple nutsedge (*Cyperus rotundus* L.) populations were about 10% each. Hoed control plots were hand weeded on May 11 and on May 26. On May 12 all plots were mechan-

[1]Florida Agricultural Experiment Stations Journal Series No. 5152.

Table 1. Early snap bean vigor and weed control as influenced by herbicide treatment in 1982 and 1983.

Treatment[y]	Rate and application method[y]		Rating[z] May 13, 1982 Plant vigor	Broad leaf	Grass	May 11, 1983 Plant vigor	Broad leaf	Grass	Sedge
Hoed check	—	—	—	—	—	10.0	10.a	10.0a	10.0a
Unhoed check	—	—	5.5a[x]	0.0	0.0b	10.0	0.0c	0.0b	0.0e
EPTC	3.0	ppi	9.0a	7.0	7.0a	9.7	8.7a	10.0a	9.7a
EPTC + Profluralin	2.6+ 0.5	ppi	8.0a	9.0	7.5a	—	—	—	—
Profluralin	0.75	ppi	9.0a	7.5	8.5a	—	—	—	—
Pendimethalin	0.75	ppi	9.0a	8.5	8.5a	9.7	6.7ab	9.7a	3.7cd
Ethalfluralin	0.75	ppi	9.0a	5.5	6.0a	9.0	8.3a	9.7a	8.3ab
Ethalfluralin + EPTC	0.75+ 3.0	ppi	8.5a	5.5	9.0a	9.0	8.7ab	10.0a	9.7a
Trifluralin	0.75	ppi	7.5a	2.0	7.0a	8.7	5.7ab	6.3a	2.3de
Pendimethalin	0.75	pre	—	—	—	9.0	7.7a	9.7a	5.3bcd
Napropamide	2.0	pre	—	—	—	8.0	2.7bc	6.3a	6.3abc
Metolachlor	2.0	pre	7.0a	6.0	8.0a	9.7	9.0a	10.0a	9.0ab
Metolachlor + DNBP	2.0+ 3.0	pre+ dpre	1.5b	6.5	9.5a	—	—	—	—

[z]Rating of 10 equals no plant injury or complete weed control, 0 equals plant death or no weed control.
[y]Herbicides were applied preplant incorporated (ppi), preemergence to the crop (pre), or delayed preemergence (dpre) at rates in lb./acre.
[x]Mean separation in columns by Duncan's multiple range test, 5% level.

ically cultivated in the row middles and on the sides of the beds. Postemergence treatments were applied on May 17. Plant vigor and weed control ratings were made on May 11 and June 3 and beans were harvested on June 6.

Results and Discussion

Snap bean plant vigor ratings made 5 to 6 wk after herbicide application indicate that bean tolerance was good to excellent to the preplant incorporated and preemergence herbicides in both seasons (Table 1). However, beans were seriously injured by delayed preemergence application of metolachlor + DNBP. A 1.5 to 2-inch rain occurred 1 to 2 days after application of the latter 2 herbicides and apparently moved the DNBP into the bean root zone and reduced plant growth. Control of broadleaf weeds at the time of the early rating was acceptable with all treatments except ethalfluralin, ethalfluralin + EPTC, trifluralin, and napropamide. Due to plot to plot variability and loss of 2 replications because of heavy rains, differences between treatments were not significant in 1982. Grass populations in these plot areas were low, but control was good to excellent with all herbicide treatments. Grass control ratings were lower with ethalfluralin, trifluralin, and napropamide than with the other treatments. Early purple nutsedge control was excellent with EPTC, ethalfluralin, metolachlor, and ethalfluralin + EPTC.

Bean vigor and weed control ratings made later in the season also indicated that several herbicides provided good weed control without crop injury (Tables 2 and 3). At the June 4, 1982 rating, plant vigors were good to excellent with all treatments except EPTC + profluralin, metolachlor + DNBP, bentazon, and the unhoed check. Foliar injury and reduced growth were observed with the 3 herbicide treatments. Broadleaf weed control was good with metolachlor alone and with metolachlor + fluazifop-butyl. Grass control was excellent with all treatments that contained fluazifop-butyl and with sethoxydim, CGA 82725, pendimethalin alone, and with ethalfluralin + EPTC. Sedge control was poor with all treatments except those that contained metolachlor and with the ethalfluralin + EPTC combination. Bean yields were quite variable and not significantly influenced by treatment. However, lowest yields were obtained with metolachlor + DNBP, the unhoed check, trifluralin + fluazifop-butyl, and with the 0.25 lb./acre CGA 82725 treatments.

At the June 3, 1983 rating, beans were highly tolerant of most herbicide treatments. Plant vigor was reduced with the 0.2 lb./acre sethoxydim and the bentazon treatments as compared to the cultivated check treatment. Control of wild mustard was good to excellent with EPTC, pendimethalin, ethalfluralin, trifluralin, metolachlor, bentazon, and the highest rate of CGA 82725. As expected, broadleaf weed control was poor with the postemergence grass herbicide treatments. All of these grass herbicide treatments provided excellent grass control except the 0.125 lb./acre fluazifop-butyl treatment, preemergence applied pendimethalin and bentazon treatments. Purple nutsedge control was good with EPTC alone and in combination with ethalfluralin, and with metolachlor alone.

Table 2. Snap bean vigor, weed control on June 4 and bean yield as influenced by herbicide treatment in 1982.

Treatment	Rate and application method[y]		June 4, 1982 rating[z]				Yield (bu/acre)
			Plant vigor	Broad-leaf	Grass	Sedge	
Hoed check	—	—	10.0a[x]	10.0a	10.0a	10.0a	178
Unhoed check	—	—	5.0d	0.0h	0.0d	0.0c	109
EPTC	3.0	ppi	8.0a-d	5.5a-g	5.5abc	4.6abc	236
EPTC +	3.0+	ppi+					
Fluazifop-butyl	0.25	pe	8.0a-d	4.0b-h	10.0a	2.6bc	178
EPTC +	2.6+						
Profluralin	0.5	ppi	5.5cd	6.5a-e	3.5bcd	5.0abc	200
Profluralin	0.75	ppi	8.5a-d	3.0d-h	6.0abc	2.0c	203
Profluralin +	0.75+	ppi+					
Fluazifop-butyl	0.25	pe	9.5ab	6.5a-e	10.0a	4.6abc	211
Pendimethalin	0.75	ppi	9.0abc	6.0a-f	8.0ab	5.0abc	236
Pendimethalin +	0.75	ppi					
Fluazifop-butyl	0.25	pe	10.0a	3.6c-h	9.5a	4.6abc	207
Ethalfluralin	0.75	ppi	9.5ab	5.0b-h	6.0abc	5.1abc	240
Ethalfluralin +	0.75+	ppi+					
Fluazifop-butyl	0.25	pe	9.5ab	5.5a-g	10.0a	4.6abc	203
Trifluralin	0.75	ppi	8.5a-d	4.0b-h	6.0abc	4.1abc	167
Trifluralin +	0.75+	ppi+					
Fluazifop-butyl	0.25	pe	6.0bcd	3.6c-h	9.5a	1.1c	127
Ethalfluralin +	0.75+						
EPTC	3.0	ppi	9.0abc	8.0abc	8.5ab	9.0ab	178
Metolachlor	2.0	pre	8.0ad	7.0a-d	3.6bcd	9.5a	200
Metolachlor +	2.0+	pre+					
Fluazifop-butyl	0.25	pe	10.0a	8.5a-b	10.0a	10.0a	261
Metolachlor +	2.0+	pre+					
DNBP	3.0	dpre	5.5cd	4.0b-h	9.5a	10.0a	51
Bentazon	1.0	pe	6.5a-d	5.0b-h	1.1cd	1.1c	182
Sethoxydim	0.2	pe	7.5a-d	1.5fgh	10.0a	1.6c	167
Sethoxydim	0.4	pe	7.0a-d	3.5c-h	10.0a	1.1c	160
Fluazifop-butyl	0.25	pe	7.5a-d	2.1e-h	10.0a	1.1c	174
Fluazifop-butyl	0.50	pe	7.0a-d	4.5b-h	10.0a	1.6c	171
CGA 82725	0.25	pe	7.5a-d	1.1gh	10.0a	1.6c	120
CGA 82725	0.50	pe	9.0abc	1.6fgh	10.0a	4.1abc	196

[z]Rating of 10 equals no plant injury or complete weed control, 0 equals plant death or no weed control.
[y]Herbicides were applied preplant incorporated (ppi), preemergence to the crop (pre), delayed preemergence (dpre), or postemergence (pe) at rates in lb./acre. Postemergence treatments were applied with 1 qt/acre oil.
[x]Mean separation in columns by Duncan's multiple range test, 5% level.

Table 3. Snap bean vigor and weed control on June 3 and bean yield as influenced by herbicide treatment in 1983.

Treatment	Rate and application method[y]		June 3, 1983 rating[z] Plant vigor	Broad-leaf	Grass	Sedge	Yield (bu/acre)
Hoed check	—	—	10.0a[x]	10.0a	10.0a	10.0a	327a-g
Unhoed check	—	—	8.3bcd	0.0e	0.0c	0.0e	338a-f
EPTC	3.0	ppi	9.3ab	9.3ab	9.5a	6.5a-d	363abc
Pendimethalin	0.75	ppi	8.8abc	7.5ab	9.5a	4.0cde	334a-g
Pendimethalin +	0.75+	ppi+					
Fluazifop-butyl	0.25	pe	8.0bcd	6.3bcd	9.5a	2.8de	261c-h
Ethalfluralin	0.75	ppi	8.5a-d	7.8ab	9.3a	5.8a-d	319a-h
Ethalfluralin +	0.75+	ppi+					
Fluazifop-butyl	0.25	pe	8.3bcd	6.0bcd	9.8a	4.5bcd	301b-h
Ethalfluralin +	0.75+	ppi					
EPTC	3.0		8.5a-d	7.3abc	9.8a	6.0a-d	356a-d
Trifluralin	0.75	ppi	9.3ab	8.0ab	8.3a	5.5bcd	367ab
Pendimethalin	0.75	pre	8.8abc	6.8abc	6.8b	4.8bcd	316a-h
Napropamide	2.0	pre	8.3bcd	7.3abc	9.5a	5.5bcd	257d-h
Metolachlor	2.0	pre	9.5ab	9.0ab	10.0a	7.3a-c	348a-e
Metolachlor +	2.0+	pre+					
Fluazifop-butyl	0.25	pe	9.0abc	8.0ab	9.8a	6.5a-d	280b-h
Sethoxydim	0.2	pe	7.0d	3.0d	9.0a	3.0de	221h
Sethoxydim	0.4	pe	8.0bcd	4.0cd	9.0a	3.0de	298b-h
Fluazifop-butyl	0.125	pe	8.8abc	5.8bcd	6.5b	3.0de	280b-h
Fluazifop-butyl	0.25	pe	9.3abc	6.8abc	9.8a	3.8cde	294b-h
Fluazifop-butyl	0.50	pe	8.8abc	6.0bcd	9.8a	3.6de	232gh
Bentazon	0.75	pe	7.5cd	7.8ab	1.0c	5.8a-d	240f-h
CGA 82725	0.25	pe	8.5a-d	6.3bcd	8.5a	3.0de	250eh
CGA 82725	0.50	pe	9.0abc	7.5ab	9.5a	3.3de	330a-g

[z]Rating of 10 equals no plant injury or complete weed control, 0 equals plant death or no weed control.
[y]Herbicides were applied preplant incorporated (ppi), preemergence to the crop (pre), delayed preemergence (dpre), or postemergence (pe) at rates in lb./acre. Postemergence treatments were applied with 1 qt/acre oil.
[x]Mean separation in columns by Duncan's multiple range test, 5% level.

Snap bean yields in 1983 were similar with the hoed and unhoed treatments. Apparently, mechanical cultivation approximately 5 wk after seeding reduced weed competition to a level that bean growth was not seriously influenced by weed growth in the row (1, 2, 3). Yields significantly below the check treatment were obtained only with the 0.2 lb./acre sethoxydim and 0.75 lb./acre bentazon treatments. This reduced yield was related to severe broadleaf weed competition with the former treatment and crop injury with the latter treatment. Although the differences in yield were not significant with the other treatment, yield variation was apparent. Results of regression analysis indicated that correlations between crop vigor and yield and between broadleaf weed control and yield were highly significant in both years. The 2 correlation coefficients (r) for the above combinations for 1982 data were 0.70 and 0.45 and for 1983 were 0.55 and 0.46, respectively. The predominate weeds in these plots were broadleaf weeds and their control level was related to yield. Grass and sedge populations were low and provided little competition with the snap beans. During the 2 seasons, herbicide treatments that provided good to excellent broadleaf control generally produced the higher bean yields.

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