Fluazifop and quizalofop, grass herbicides, in coffee[1]

Lii. C. Liu[2], Felipe M. Román[3] and Nilsa M. Acín-Díaz[4]

ABSTRACT

Two experiments (nursery and field) were conducted at the Adjuntas substation during 1990 and 1991 to evaluate fluazifop {(±) [2-[4-[[5-(trifluoro-methyl)-2-pyridinyl]oxy] phenoxy]propanoic acid]} and quizalofop {(±)-2-[4[(6-chloro-2-quinoxa(inyl)oxy]phenoxy] propanoic acid} for weed control and phytotoxicity in coffee (*Coffea arabia* L.). Fluazifop at 0.28 and 1.12 kg ai/ha and quizalofop at 0.22 and 0.90 kg ai/ha were applied as a postemergence spray. The herbicides at the indicated rates gave good to excellent control of all grasses present in both experiments. No crop injury was noted with either herbicide. The highest coffee berry yield of 14,088 kg/ha obtained in plots treated with fluazifop at 1.12 kg ai/ha rate was not significantly different (P = .05) from the lowest yield of (10,038 kg/ha) obtained in plots treated with quizalofop at 0.22 kg ai/ha rate.

RESUMEN

Dos graminicidas en cafetales

Durante la evaluación de dos herbicidas para gramíneas en cafetales en la subestación de Adjuntas se hicieron en 1990 y 1991 dos experimentos con herbicidas a nivel de campo y del vivero de cafe. Se evaluó la eficacia y la fitotoxicidad de fluazifop {ácido(±) [2-4[4-5- (trifluorometil)-2 piridinil]fenoxi] propanóico} y quizalofop {ácido (+) [2-[(6-cloro-2-quinoxialinil) oxi] fenoxi] propanóico} para el control químico de gramíneas en el cultivo del cafe (*Coffea arabica* L.). Fluazifop se aplicó a razón de 0.28 y 1.12 kg ia/ha y quizalofop 0.22 y 0.90 kg ia/ha. Ambos herbicidas a las dosis indicadas como posemergentes controlaron bien y excelentemente las gramíneas presentes en los predios experimentales. No se observaron daños fitotóxicos en las plantas de café por el efecto de los herbicidas. La mayor producción de cafe uva, de 14,088 kg/ha en las parcelas tratadas con fluazifop a razón de 1.12 kg ia/ha, no fue significativamente diferente (P = .05) de la producción más baja de 10,038 kg/ha que se obtuvo con quizalofop a razón de 0.22 kg ia/ha.

INTRODUCTION

In 1988-89, local coffee production was 14,515,200 kg of dry coffee beans with a farm value of $ 58.6 million (2). This value represented

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[2]Researcher, Department of Crop Protection
[3]Research Assistant, Department of Horticulture
[4]Associate Chemist, Department of Crop Protection

about 10 % of the total agricultural gross income of the island for that fiscal year. Coffee is today the first among all agricultural crops since the decline of sugarcane production some 10 years ago.

Of all the pests that are attacking coffee trees, the most expensive to keep under control are the weeds. Weeds may interfere severely with coffee seedlings and trees during their earlier stages of growth and continue throughout the entire life span. As the number of sun-grown coffee plantations continues to increase (10), weed control problems become worse, especially during the rainy season, with grass weeds as the dominating species.

Earlier attempts with the use of weed killers have encountered a number of setbacks as evidenced by the herbicide injury provoked by 2,4-D, TCA and monuron (5,8). These drawbacks did not deter the continued research efforts of weed scientists from coffee growing countries. In Puerto Rico, Boneta (3) evaluated the effectiveness of dalapon, paraquat and glyphosate for use in coffee groves. He obtained good to excellent weed control with these herbicides. In a subsequent study, Boneta (4) gathered sufficient efficacy and residue data of glyphosate in coffee leading to a full registration in Puerto Rico. This herbicide lacks the selectivity to coffee; therefore, glyphosate sprays should be directed carefully to weeds, avoiding any contact with coffee trees. A later study by Boneta (6) determined that effectiveness of oxyfluorfen in coffee was limited to young and actively growing weeds.

Since the introduction of fluazifop and quizalofop in the early 1980s (1,9), considerable progress has been made on grass control in broadleaf crops. Liu and Goyal (7) have tested these compounds for weed control in tomatoes and peppers in Puerto Rico with great success. The present study extends our researh efforts to cover coffee. The efficacy and phytotoxicity data of fluazifop {(±) (R)-2-[4-[[(5- (trifluoromethyl)-2-pyridinyl]oxy] phenoxy] propanoic acid} and quizalofop { (±) [2-[4[6-chloro-2-quinoxya(inyl) oxy] phenoxy] propanoic acid} in a nursery and a field experiment will be reported in this paper.

MATERIALS AND METHODS

Nursery

A nursery experiment was conducted in 1990 at the Adjuntas substation, located in the central humid mountain region of Puerto Rico, at an elevation of 588 meters. Twenty nursery beds, each consisting of an aggregate of 25.4-cm tall plastic bags, were planted 22 August 1990 with Bourbon coffee seedlings. The size of each seed bed was 10.7 x 29.9 m. Five treatments were replicated four times in a completely randomized block design. Fluazifop at 0.28 and 1.12 kg ai/ha and fuizalofop at 0.22 and 0.90 kg ai/ha were applied two times (17 October and 26 November

1990) over the top of 2 1/2-month-old seedlings. The herbicide was sprayed with an E-Z type plastic knapsack sprayer at a spray volume of 548 l/ha. Weed control and phytotoxicity were evaluated periodically.

Field Experiment

A field experiment was conducted at the Adjuntas substation from June 1991 to December 1991. The soil at the experimental site is an Alonso clay, (Orthoxic Trophohumults, clayey, oxidic, isohyperthermic) with a pH of 4.2 and 3.9% organic matter. Six treatments were replicated four times in a randomized complete block design. Three-year-old coffee trees (cv. Pacas) were selected for use in this trial. Each plot consisted of eight trees with a planting distance of 1.2 m within the row and 1.8 m between the row. Fluazifop and quizalofop were applied at the same rates used for the nursery experiment. The herbicides were sprayed at approximately 2-month intervals (24 June, 19 August and 19 and 23 September 1991). A knapsack sprayer was used for each herbicide with 0.25% v/v of X-77 at a spray volume of 1,121 L/ha. The control plots were hand weeded once (19 August 1991); only grass weeds were removed. Weed control and phytotoxicity evaluations were made periodically. The ripened coffee berries were hand picked four times, starting early September and ending December 1991. The accumulated yield data were analyzed by analysis of varince and Duncan's multiple range test.

RESULTS AND DISCUSSION

The predominant weed species present in the experimental area were fireweed [*Erechtites hieracifolia* (L.) Raf.], balsam apple (*Momordica charantia* L.), sowthistle (*Sonchus oleraceus* L.), morning glory [*Ipomoea tiliaceae* (Willd) Choisy], Bermuda grass [*Cynodon dactylon* (L) Pers.], crab grass [*Digitaria sanguinalis* (L) Scop], jungle rice [*Echinochloa colona* (L) Link], goose grass [*Eleusine indica* (L) Gaertn.], red tassel flower [*Emilia sonchifolia* (L)DC3], wild poinsettia (*Euphorbia heterophylla* L.) and purple nutsedge (*Cyperus rotundus* L.).

Herbicides provided good to excellent control of grasses throughout the course of this experiment (table 1). Quizalofop controlled grasses slightly better than fluazifop. Visual evaluation indicated that none of the herbicides caused crop injury. Good to excellent grass control by fluazifop and quizalofop was achieved under field conditions (table 2). Quizalofop gave slightly better grass control than fluazifop. None of these herbicides controlled broadleaf weeds. The herbicides did not cause any crop injury in the field experiment. The highest coffee berry yield (14,088 kg/ha) was obtained in plots treated with fluazifop (1.12 kg ai/ha) (table 2). It was followed by a yield of 13,624 kg/ha with the quizalofop (0.90 kg ai/ha)

TABLE 1.—*Weed control and phytotoxicity evaluation of fluazifop and quizalofop applied as a broadcast spray in a nursery experiment at the Adjuntas substation in 1990*

Treatment (kg ai/ha)	Grass control[1]		Phytotoxicity[2]	
	11-26-90	1-16-91	11-26-90	1-16-91
Control	0	0	0	0
Fluazifop (0.28)	84	83	0	0
Fluazifop (1.12)	100	95	0	0
Quizalofop (0.22)	90	95	0	0
Quizalofop (0.90)	100	98	0	0

[1]Weed control ratings are based on a 0 to 100% scale; 0 = no control, 100 = perfect control.

[2]Phytotoxicity evaluation is based on a 0 to 100% scale; 0 = no crop injury, 100 = completely killed.

TABLE 2.—*Weed control, phytotoxicity and coffee yield as influenced by fluazifop and quizalofop applied as a directed spray in a field experiment at the Adjuntas substation in 1991*

Treatment (kg ai/ha)	Grasse control[1]		Phytotoxicity[2]		Berry yield[3]
	7-22-91	9-17-91	7-22-91	9-17-91	kg/ha
Control #1	100	0	0	0	10,712 a
Fluazifop (0.28)	85	61	0	0	12,702 a
Fluazifop (1.12)	94	98	0	0	14,088 a
Control #2	100	0	0	0	12,848 a
Quizalofop (0.22)	95	89	0	0	10,038 a
Quizalofop (0.90)	99	98	0	0	13,624 a

[1]Weed control ratings are based on a 0 to 100 % scale; 0 = no control, 100 = perfect control.

[2]Phytotoxicity evaluation is based on a 0 to 100% scale; o = no crop injury, 100 = completely killed.

[3]Values followed by the same letters do not differ significantly at P = 0.05 level of probability.

treatment. Other treatments produced only intermediate yields. The lowest berry yield of 10,038 kg/ha was obtained with quizalofop (0.22 kg ai/ha). There was a higher coffee yield with the use of fluazifop (1.12 kg ai/ha) and quizalofop (0.90 kg ai/ha) than with controls. However, there were no significant (P = .05) yield differences. This lack of differences

could be attributed to the fact that short term grass control provided by both herbicides did not sufficiently improve the growth and yield of the long-term growing coffee trees.

Both fluazifop and quizalofop are experimental compounds and should not be used commercially at the present time. As soon as their registration is approved by the Environmental Protection Agency, both herbicides could be effective to control grasses in coffee nurseries and newly transplanted and young coffee plantations. As both herbicides are proved to be absolutely safe to coffee plants, their application could be made over the top of coffee trees without any risk of crop injury.

LITERATURE CITED

1. Anonymous, 1983. Assure-experimental grasses herbicide (formerly Dpx-6202) E. I. DuPont de Nemours & Co. Inc. U. S. A. Technical Bulletin.
2. Anonymous, 1989. Ingreso Agrícola de Puerto Rico 1988-89. Departamento de Agricultura. Oficina de Estadísticas Agrícolas, Santurce, Puerto Rico.
3. Boneta-García, E. G., 1980. Frequency of herbicide applications to coffee grove. *J. Agric. Univ. P.R.* 64: 249-58.
4. ——, 1983. Effect of three postemergence herbicides on coffee growth and weed control. *J. Agric. Univ. P.R.* 67(3)262-69.
5. Havis, J. R., 1952. Daños a cafetos causados por herbicidas. *Turrialba* 2: 170.
6. Liu, L. C. and E. G. Boneta-García, 1983. Oxyfluorfen weed control in coffee and plantain. Proc. 18th annual meeting of *Caribbean Food Crops Soc.* 18: 215-20.
7. —— and M. R. Goyal 1989. Selective herbicides to control grass weeds in transplanted tomatoes and peppers. *J. Agric. Univ. P.R.* 73: 261-68.
8. Orsenigo, J. R., R. H. Segall, O. Smith and F. L. Wellman, 1953. Systematic foliage distortions in coffee attributed to 2, 4-D. *Turrialba* 3: 100.
9. Plowman, R. E., W. C. Stonebridge and J. N. Hawtree, 1980. Fluazifop-butyl, a new selective herbicide for the control of annual and perennialgrass weeds. Proc. British Crop Protection Conf. *Weeds* 1: 29-37.
10. Vicente-Chandler, J., 1977. Programa para una Agricutura Moderna en Puerto Rico. 1977-78 al 1980-81. Mimeografía al gobernador de P.R., San Juan, P. R.