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**caribbean  
food  
crops society**

**Eighteen  
Annual Meeting  
August 22 to 28<sup>th</sup> 1982  
Dover Convention Centre  
BARBADOS**

Vol. XVIII

## OXYFLUORFEN FOR WEED CONTROL IN COFFEE AND PLANTAIN

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### ABSTRACT

Two field experiments in private farms near the Adjuntas Substation and one field experiment at the Gurabo Agricultural Substation were conducted to evaluate Oxyfluorfen [2-chloro-1-(3 ethoxy-4-nitrophenoxy)-4-trifluoromethyl] benzene/ either alone or in combination with other herbicides for weed control in coffee and plantain. All the experiments were carried out on small plots arranged either in a partially balanced incomplete block design or in a randomized complete block design with four replications. Weed control ratings and phytotoxicity evaluations were made periodically. The number and weight of fruits of plantain were recorded at the harvest and yield data analyzed statistically.

In coffee, Oxyfluorfen (Goal) alone at 2.0 and 4.0 l/ha or mixed with Paraquat at 2.0 l/ha and Glyphosate at 4.7 l/ha gave excellent control of weeds in two established coffee plantains. Similar results were obtained with a newly transplanted coffee plantation.

In plantain, Oxyfluorfen alone at 9.35 and 18.70 l/ha provided excellent pre-emergence control of weeds in plantain. No crop injury was noted at these higher rates of Oxyfluorfen application. Oxyfluorfen at 3.5 l/ha rate in combination with Paraquat at 2.34 l/ha or Glyphosate at 1% concentration gave excellent post-emergent control of weeds with minimum crop injury. Plots treated with Oxyfluorfen at 18.70 l/ha outyielded all other herbicide treated plots including the weeded check.

### INTRODUCTION

Coffee (Coffea arabica L.) and plantain (Musa acuminata x M. balbisiana AAB) are two major agricultural crops in Puerto Rico with gross incomes of 45 and 31 million dollars, respectively, (Anonymous 1980). Both crops are growing in the mountainous region of the Island where labour shortage becomes acute as more and more workers migrate to the city and find employment in the industrial and commercial enterprises. The lack of adequate labor supply has necessitated the increased herbicide usages to combat weeds. During the past few years herbicide research on these two crops has been intensified in Puerto Rico (Boneta 1980, Liu 1981). Oxyfluorfen [2-chloro-1-(3 ethoxy-4-nitrophenoxy)-4-trifluoromethyl] benzene/ known commercially as Goal has shown good promise for weed control in coffee and

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plantain. This paper summarizes our findings on weed control, phytotoxicity and yield of coffee and plantain as influenced by different rates of Oxyfluorfen applications.

## MATERIALS AND METHODS

### Coffee field experiments

Two herbicide experiments on coffee were initiated at Rullán's and Bernazard's farms located near the Adjuntas Agricultural Experiment Substation with an elevation of 588 m. The soil is an Orthoxic, Tropohumults, clayey, oxidic, isohyperthermic with a soil pH 5.0 and organic matter 4.1%. A partially balanced incomplete block design with four replications was used for both experiments. The individual plot consisted of 18 established 3 year old Bourbon coffee trees spaced at 3 m between rows and 1.2 m between the trees. An area of 6 x 5.5 m was treated with Oxyfluorfen at 2.0 and 4.0 l/ha. Oxyfluorfen at 4 l/ha mixed either with Glyphosate at 4.7 and 9.3 l/ha or Paraquat at 2.0 l/ha was also included in the experiment. All herbicide sprays were applied with a knapsack sprayer in 1,136 l/ha of water. Weed control ratings and phytotoxicity evaluations were made on the four coffee trees located in the center of each plot at approximately one month's intervals. No attempt was made to collect the coffee berries for yield information.

### Plantain field experiment

A herbicide experiment on plantain was conducted at the Gurabo Substation on a Mabi clay. The soil is Vertic, Eutropepts, fine montmorillonite, isohyperthermic with a soil pH of 6.9 and organic matter content of 2.6%. A randomized complete block design with four replications was used in this experiment. The plot size was 5.5 x 7.3 m in width and length with 12 plants. The corms of plantain cultivar Maricongo were planted December 2, 1980. Pre-emergence application of Oxyfluorfen at 9.35 and 18.70 l/ha was applied with a knapsack sprayer the same day of planting. The spray volume for the pre-emergence spray was 281 l/ha. Post-emergence applications of Oxyfluorfen at 3.5 l/ha in combination with Paraquat at 2.34 l/ha or with Glyphosate at 1% were made twice on January 27, 1981 and June 19, 1981. Ametryn at 4.48 kg ai/ha (pre-emergence) + Glyphosate at 1% was included as a standard treatment. Weed control ratings and phytotoxicity evaluations were made periodically. The marketable fruit bunches were harvested at mature/green stage during 12 to 16 months after planting. The data on fruit number and weight were analyzed statistically.

## RESULTS AND DISCUSSION

### Coffee field experiments

The predominant weed species present included guinea grass (Panicum maximum Jacq.), para grass (Brachiaria purpurescens (Raddi) Henr.), crab grass (Digitaria sanguinalis (L.) Scop.), sour paspalum (Paspalum conjugatum Berg.), morning glory (Ipomoea tiliacea (Willd) Choisy), dayflower (Commelina diffusa Burm. f.), turkey berry (Solanum torvum Sw.), pudding vine (Cissus sicyoides L.), and bur (Urena lobata L.). The effectiveness of Oxyfluorfen either alone or in combination with Paraquat or Glyphosate is presented in table 1. The results thus presented indicate that Oxyfluorfen at 2.0 and 4.0 l/ha provide excellent control of most weeds mentioned above in both Rullán's and Bernazard's farms. Oxyfluorfen at 4.0 l/ha in combination with either Paraquat or Glyphosate also provide effective control of major weeds. No apparent coffee injury was noted from any of Oxyfluorfen treatments. All the data collected thus far point to the great potential of Oxyfluorfen for weed control in coffee. Similar results were obtained on the use of Oxyfluorfen as a pre-emergence herbicide in a newly transplanted coffee plantations at the Adjuntas Substation.

### Plantain field experiment

The predominant weed species present included jungle rice (Echinochloa colonum (L.) Link.), spurge (Euphorbia heterophylla L.), wild bean (Phaseolus adenanthus G.F.W. Meyer), niruri (Phyllanthus niruri L.), morning glory (Ipomoea tiliacea (Willd.) Choisy), hemp sesbania (Sesbania exaltata (Raf.) Cory), purple nutsedge (Cyperus rotundus L.), foxtail (Setaria geniculata (Lam.) Beauv.), dayflower (Commelina diffusa Burm. f.), Bermuda grass (Cynodon dactylon (L.) Pers.), sensitive plant (Mimosa pudica L.), and galinsoga (Galinsoga urticaefolia (HBK) Benth.). Oxyfluorfen at 9.35 l/ha rate gave excellent pre-emergence control of most of the above-mentioned weeds except purple nutsedge (table 2). Increasing Oxyfluorfen to 18.70 l/ha rate improved slightly weed control but again it did not control purple nutsedge. The mixture of Oxyfluorfen either with Paraquat or Glyphosate provided excellent postemergence control of most weeds. The standard treatment of Ametryn (pre) + Glyphosate gave acceptable weed control performance. No crop injury was noted when either rate of Oxyfluorfen was applied alone. However, minor crop injury was observed when Oxyfluorfen was mixed with either Paraquat or Glyphosate. Apparently, the drift effect of post-emergence application was responsible for the said injury. The injury was subsequently outgrown after one to two months of treatments. The highest number and weight of plantain fruits was obtained with Oxyfluorfen at 18.70 l/ha rate. The second highest number and weight of fruit was that of Oxyfluorfen at 3.5 l/ha plus Paraquat at 2.34 l/ha rate. The third highest yield was achieved by Oxyfluorfen at 3.5 l/ha plus Glyphosate at 1%. The weeded check ranked fourth in yield. Oxyfluorfen alone at 9.35 l/ha and Ametryn at 4.48 kg ai/ha + Glyphosate at 1% produced slightly lower yield than weeded check. The nonweeded check as expected yielded poorly.

The findings from the experiments mentioned above indicate that Oxyfluorfen can be used safely for preemergence weed control in coffee at up to 4 l/ha while plantain had tolerated the same herbicide up to 18.72 l/ha rate. This finding does not necessarily imply that plantain is more tolerant to Oxyfluorfen than coffee. It is well known that the activity of a soil-applied preemergence herbicide depends to a great extent, on the quantity of organic matter and clay minerals present in the soil. As the Mafí clay used for plantain experiment has a high percentage of montmorillonitic clay minerals, this characteristic of the soil tends to minimize the phytotoxic action of Oxyfluorfen to plantain. However, in a plantain experiment in progress at the Corozal Substation, we have noted no Oxyfluorfen phytotoxic problem to plantain at a rate up to 4 l/ha in an Ultisol, a typical plantain growing soil in Puerto Rico.

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Table 1.--Percentage weed control on mature coffee groves as affected by herbicide application during 1981

Herbicide treatments	Rullan's Farm				Bernazard's Farm			
	Dates (1981)							
	Sep. 23	Oct. 28	Dec. 10	Sep. 23	Oct. 28	Dec. 10	Sep. 23	Dec. 10
1. Oxyfluorfen 2 l/a	100.00	100.00	100.00	100.00	87.20	72.50		
2. Oxyfluorfen 4 l/ha	100.00	100.00	100.00	100.00	97.25	80.75		
3. Glyphosate 9.3 l/ha	100.00	100.00	100.00	0	51.25	30.00		
4. Oxyfluorfen (4 l/ha) + Glyphosate (9.3 l/ha)	97.75	100.00	100.00	0	99.50	97.00		
5. Oxyfluorfen (4 l/ha) + Glyphosate (4.7 l/ha)	100.00	100.00	100.00	0	83.75	76.25		
6. Oxyfluorfen (4 l/ha) + Paraquat (2 l/ha)	100.00	100.00	100.00	0	91.00	69.50		
7. Handweeded check	100.00	86.25	85.00	100.00	6.25	1.25		

Table 2.--Effect of different herbicide treatments on fruit number and weight of plantain at the Gurabo Substation

Herbicide treatments	Weed control at 1/			Phytotoxicity at 2/			Fruit production 3/ Number	Weight (kg/ha)	
	12-28-80	1-22-81	2-17-81	6-30-81	12-28-80	1-22-81			2-17-81
1. Oxyfluorfen 9.35 1/ha (pre)	95	89	80	--	0	0	0	115,645 a	28,081 a
2. Oxyfluorfen 18.70 1/ha (pre)	98	94	89	--	0	0	0	126,962 a	32,902 a
3. Oxyfluorfen 3.5 l/ha + Paraquat 2.34 l/ha (post, twice)	--	--	91	95	--	--	10	120,346 a	29,827 a
4. Oxyfluorfen 3.5 l/ha + Glyphosate 1% (post, twice)	--	--	96	100	--	--	15	116,773 a	29,146 a
5. Ametryn 4.48 kg ai/ha (pre) + Glyphosate 1% (post)	80	50	91	90	0	--	8	122,133 a	28,485 a
6. Weeded check	--	90	90	90	0	0	0	118,807 a	29,088 a
7. Non-weeded check	--	0	0	0	0	0	0	58,798 b	13,034 b

1/ Weed control ratings are based on a scale of 0 to 100, where 0= no control, 100= complete control.

2/ Phytotoxicity evaluations are based on a scale of 0 to 100, where 0= no phytotoxicity, 100= completely affected.

3/ Fruit production is based on the average of four replications. Values followed by the same letter in the same column are not statistically different (P = 0.05).