Research Note

*USE OF CLOMAZONE IN PLANTAIN (*MUSA ACUMINATA*)*[1]

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Plantain (*Musa* spp., AAB) is a crop widely grown throughout the tropics. This crop plays a fundamental role in Puerto Rico's agricultural sector; plantain production was estimated at $69 million (Dept. of Agric., 2011). Among the field management practices used in producing plantain, weed control is one of the most costly. If not controlled, weed competition reduces plant development, yield and fruit quality (Liu and Rodríguez, 1988). The use of herbicides in combination with hand weeding is the standard practice for weed control. The vast majority of plantain producers, many of them low-income farmers, rely only on glyphosate for controlling weeds. Glyphosate, however, is not efficient in controlling *Commelina diffusa* (dayflower), *Ipomoea* spp. (morningglory) and *Parthenium hysterophorus* (feverfew), weeds commonly found in plantain fields. Clomazone, a preemergence herbicide that controls grasses and broadleaves, is registered in Puerto Rico for use in root crops, but not for use in plantain (Lugo and Díaz, 2007). In a study, conducted by Semidey and González-Vélez (2006), clomazone alone or in mixture with glyphosate was more effective than glyphosate alone in reducing weed densities in pumpkin. The objective of our experiments was to collect the efficacy and phytotoxicity data needed for establishing a tolerance level of clomazone in plantain for a possible registration.

Two field experiments were established at the Gurabo field station of the Agricultural Experiment Station, University of Puerto Rico. At this location, soil type is primarily of the Mabí series (fine, montmorillonitic, isohyperthermic Vertic Eutropepts). Plot size was 55.6 m^2 with planting distances of 3.04 m between rows x 1.2 m between plants. Fifteen plants of the Maricongo cultivar were planted per plot. A randomized complete block design with four replications was used. All plots were drip-irrigated as needed. The experiments were planted two months apart.

The first experiment evaluated rates of clomazone: 1) clomazone at 1.12 kg ai/ha preemergence (PRE); 2) clomazone at 2.24 kg ai/ha PRE; 3) clomazone at 2.24 kg ai/ha - uncovered corm PRE; and 4) glyphosate at 1.12 kg ai/ha (480 g/L formulation) postemergence (POE) as a control. In the second experiment, clomazone was evaluated at 1.12 kg ai/ha at different times of application. Treatments were 1) clomazone at two weeks after planting (WAP); 2) clomazone at 4 WAP; 3) clomazone at 6 WAP; and 4) glyphosate as a control at 1.12 kg ai/ha (480 g/L formulation); this treatment was applied four weeks

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after planting. Clomazone was applied with a portable CO_2-pressured backpack sprayer, delivering 187 L /ha, and glyphosate was applied using a backpack sprayer with a 8002 flat fan nozzle tip at 4.14 x 10^5 Pa pressure.

For the first experiment, weed control was evaluated eight weeks after treatment application by visual rating. Weed control was determined on a scale from 0 to 100, where 0 means no control and 100 means complete control. For the second experiment weed control was determined four weeks after the last clomazone treatment application (6 WAP). Phytotoxicity was visually rated on a scale from 0 to 100 on plantain plants, where 0 means no injury and 100 means completely killed. Phytotoxicity was rated three times after herbicide application in the first experiment and once in the second experiment. Once the evaluations were made for treatment effectiveness, glyphosate at 1.12 kg ai/ha (480 g/L formulation) was applied two more times for weed control. Harvest was 13 months after planting. Plant height, yield and yield components were recorded. Means were separated using LSD ($P \leq 0.05$). In both experiments, the most common weeds were junglerice [*Echinochloa colona* (L.) Link], purple nutsedge (*Cyperus rotundus* L.), and wild poinsettia (*Euphorbia heterophylla* L.).

In the clomazone experiment, significant differences were found among treatments for grass and broadleaf control. Clomazone treatments controlled more than 98% of grasses and more than 92% of broadleaves; however, when glyphosate was applied alone, grass control was 29% (Table 1). By the time the evaluation was conducted, glyphosate had lost its effect and subsequent rains allowed a second growth of weeds. No significant differences were obtained among treatments for crop injury or phytotoxicity (Table 1).

When time of application for clomazone was evaluated, significant differences were found among treatments for grass and broadleaf control. When clomazone was applied 2 and 4 WAP, grass control was more than 94%, whereas when applied at 6 WAP, control was only 63% (Table 2). When clomazone was applied 4 and 6 WAP, broadleaf control was 66% and 55%, respectively. Clomazone applied 2 WAP controlled 73% of broadleaves; control was significantly higher than when clomazone was applied 6 WAP. When glyphosate was applied, there was high weed control. The latter result was related to applications made at early weed stages.

For both experiments, no differences were obtained among herbicide treatments for plantain plant height, yield or yield components (Table 3). Yield and yield components were those expected for a commercial plantain field. Results from these trials show that clomazone is an herbicide with potential use in plantains. Relatively few weed management tools are available for tropical crops; thus continued research is needed to obtain new herbicide registrations.

TABLE 1.—*Effect of clomazone rate on weed control and crop injury.*

Herbicide	Rate	Weed control[1]		Crop injury[2] (Phytotoxicity)
		Grasses	Broadleaves	
	kg ai/ha	%		
clomazone	1.12	98 a	92 a	0
clomazone	2.24	99 a	94 a	6
clomazone	2.24 -uncovered corm	99 a	95 a	6
glyphosate[3]	1.12	29 b	28 b	0

[1]Weed control was recorded eight weeks after herbicide application. Values with the same letters in a column are not significantly different using the LSD procedure, $P < 0.05$.

[2]Means were not significantly different.

[3]Control treatment.

TABLE 2.—*Effect of clomazone time of application on weed control and crop injury.*

Herbicide	Rate	Weed control [1]		Crop injury[2] (Phytotoxicity)
		Grasses	Broadleaves	
	kg ai/ha	---------- % ----------		
clomazone 2 WAP	1.12	97 a	73 b	0
clomazone 4 WAP	1.12	94 a	66 bc	2
clomazone 6 WAP	1.12	63 b	55 c	1
glyphosate[3]	1.12	97 a	99 a	0

[1]Weed control was recorded four weeks after application of clomazone 6 WAP. Values with the same letters in a column are not significantly different using the LSD procedure, $P < 0.05$.
[2]Means were not significant.
[3]Control treatment.

TABLE 3.—*Average plant characteristics, yield and yield components in plantain experiments.*[1]

Parameters evaluated	Experiment 1 Herbicide rates	Experiment 2 Time of application
Height at flowering (m)	2.3	3.4
Number of leaves at flowering	12.2	12.6
Number of leaves at harvest	5.3	5.0
Bunch weight (kg)	13.2	13.2
Fruit number	48.4	48.3
Fruit length (cm)	24.4	24.2
Fruit diameter (cm)	4.0	3.9

[1]There were no significant differences in plant characteristics, yield or yield components between experiments. Data presented is an average for all treatments.

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