Effect of four herbicides on establishment and forage yield of Guinea grass in Puerto Rico[1]

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ABSTRACT

A field experiment was conducted at the Gurabo substation to evaluate atrazine, simazine, diuron and tebuthiuron for pre-emergence control of weeds in a Guinea grass pasture. Tebuthiuron at 3.36 kg ai/ha was the most effective herbicide in controlling weeds, but was also very phytotoxic to the pasture even at a lower rate. The remaining herbicides provided satisfactory weed control and were not as phytotoxic to Guinea grass. There were no significant yield differences among herbicide-treated plots except for the plot with diuron. Diuron-treated plots at 3.36 kg ai/ha outyielded those with other herbicide treatments and the weeded check, but no significant statistical differences in yield were observed among plots with diuron at 3.36 kg ai/ha atrazine at 4.48 kg ai/ha and the hand-weeded check.

RESUMEN

Efecto de cuatro herbicidas sobre el establecimiento y el rendimiento en forraje de la yerba guinea

Se estableció un experimento de campo en un suelo Mabí arcilloso en la subestación de Gurabo para evaluar el efecto de atrazine, simazine, diuron y tebuthiuron en el control pre-emergente de malezas en el pasto de guinea. Los efectos de estos herbicidas en distintas concentraciones se compararon con dos testigos: desyerbo a mano y sin desyerbo. El tratamiento que mejor reprimió el crecimiento de las malezas fue tebuthiuron a 3.36 kg. p.a./ha., pero resultó fitotóxico al pasto aun a la concentración más baja; los demás yerbicidas evaluados también controlaron satisfactoriamente las malezas. Ninguno de los otros yerbicidas le causó daño severo por fitotoxicidad al pasto. No hubo diferencias significativas en cuanto a rendimiento de pasto en la mayoría de los tratamientos de yerbicidas con la excepción de diuron a 3.36 kg. p.a./ha. Las parcelas tratadas con diuron a 3.36 kg. p.a./ha. superaron estadísticamente en rendimiento a la mayoría de los tratamientos de yerbicidas, pero fueron igual a atrazina a 4.48 kg. p.a./ha. y el testigo desyerbado.

INTRODUCTION

Guinea grass, *Panicum maximum* Jacq., a native plant of tropical Africa, was introduced in Puerto Rico by merchant ships carrying slaves (6). This grass is very aggressive and competitive, subsequently establishing itself as one of the major pastures in Puerto Rico. Caro et al. (2, 9) found that guinea grass and Napier grass increased body weight of

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cattle in a similar manner, and also that both grasses were superior to pangola grass. Weeds pose a serious management problem to local farmers in forage grass production. The pastures should be maintained weed free from their initial establishment; chemical weeding during this stage is most effective and economical for forage grass production (1). Spain and Sotomayor (8) reported that simazine and atrazine at rates of 1.8 to 7.2 kg/ha controlled weeds effectively during the establishment of pangola grass. However, preference was given to atrazine by virtue of its less pronounced phytotoxicity. Excellent control of broadleaf weeds in two pangola grass pastures was reported by González-Ibáñez (3). He used a Tordon 101 mixture and a dicamba/2,4-D mixture. In a subsequent study, González-Ibáñez (4) found that glyphosate at 1 to 2% effectively controlled cortadera grass in pangola-guinea grass and in native grass pastures. Rodríguez-Domínguez (7) studied several herbicides for weed control in a stargrass pasture. He found that simazine was the safest compound for preemergence use. He also found that hexazinone was the best postemergence herbicide for increasing forage yields over the hand-weeded check. Lugo et al. (5) found that tebuthiuron at 1.68 kg ai/ha controlled weeds and was not too phytotoxic to stargrass. Other preemergence herbicides, such as atrazine, simazine and diuron also controlled weeds satisfactorilly for 8 weeks. There is no information on the use of herbicides for the establishment of guinea grass pastures in Puerto Rico.

The present study was thus initiated to evaluate atrazine [6-chloro-N-ethyl-N-(1-methyl ethyl)1,3,5]; triazine (2,4-diamine); simazine (6-chloro-N,N-diethyl-1,3,5); triazine (2,4-diamine); diuron [N-(3,4-dichlorophenyl)-N,N-dimethylurea]; and tebuthiuron [N-5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2yl-N,N-dimethylurea] for preemergence control of weeds in a guinea grass pasture.

MATERIALS AND METHODS

The experiment was established on a Mabí clay at the Gurabo substation in July 1990. The Mabí clay belongs to the Vertic Eutropepts of the soil order Inceptisols. The soil was plowed and disc-harrowed twice. The experimental design was a randomized complete block with four replications. Each plot consisted of four rows 3.05 m long spaced at 70 cm apart. Stumps of Guinea grass clone #3622 were obtained from the pasture grass collection at the Corozal substation and planted in 15-cm deep furrows.

Test herbicides were applied with a portable CO_2 sprayer as aqueous spray broadcast over the planted guinea grass 19 July 1990, the same day of planting. A boom fitted with four Teejet #8002 jets was used to deliver 323 L/ha spray volume. The herbicides used included atrazine

(AATREX), simazine (PRINCEP), diuron (KARMEX) and tebuthiuron (SPIKE). There were also weeded and unweeded check plots. Weeds were removed manually 20 August 1990. Weed control and phytotoxicity were rated at 4 and 8 weeks after planting. Weed control rating is based on a scale of 0 to 100, where 0 = no control and 100 = perfect control. Phytotoxicity was evaluated on a similar scale, where 0 = no phytotoxicity, 100 = complete stand reduction. Guinea grass and weeds were harvested 60 days after planting, and fresh and dry weights were recorded for statistical analysis.

RESULTS AND DISCUSSION

The predominant weed species in plots were para grass [*Brachiaria purpurascens* (Raddi) Hehr.], pascuita (wild poinsettia) (*Euphorbia heterophylla* L.), pigweed (*Amaranthus dubius* Mart. ex Thell), morning glory [*Ipomoea tiliacea* (Willd) Choisy], water-primrose [*Ludwigia erecta* (L) H. Hara]; jungle rice [*Echinochloa colona* (L) Link], Mexican weed [*Caperonia palustris* (L) St. Hil.], bur (*Urena lobata* L.), garden spurge [*Chamaesyce hirta* (L) Millsp.], wild bean [*Vigna luteola* (Jacq.) Benth], soap bush (*Malvastrum coromandelianum* L.) and purple nutsedge (*Cyperus rotundus* L.). Weed control rating at 4 weeks after herbicide application indicates that tebuthiuron at either 1.68 or 3.36 kg ai/ha was the most effective weed control (table 1) for both broadleaf weeds and grasses. Satisfactory weed control was also attained with both rates of simazine, atrazine and diuron (table 1). Weed control rating at 8 weeks after herbicide application indicated that tebuthiuron at either

TABLE 1.—*Percentage of weed control and phytotoxicity ratings at 4 and 8 weeks after herbicide application*

		Weed control at					
		4 weeks		8 weeks		Phytotoxicity	
Treatment	Rate	Broadleaf	Grass	Broadleaf	Grass	4 week	8 week
	kg ai/ha	%	%	%	%	%	%
Atrazine	2.24	85	70	70	55	5	0
Atrazine	4.48	89	75	80	65	10	5
Simazine	2.24	84	75	80	60	5	0
Simazine	4.48	85	80	85	70	10	5
Tebuthiuron	1.68	95	89	90	80	20	10
Tebuthiuron	3.36	100	95	98	95	30	20
Diuron	1.68	80	65	80	50	5	0
Diuron	3.36	85	69	85	55	10	5
Weeded	—	100	75	100	75	0	0
Non-weeded	—	0	0	0	0	0	0

TABLE 2.—*Dry and fresh weights of weeds and guinea grass at Gurabo, P.R.*

Treatment	Rate	Weeds		Guinea grass	
		Fresh weight	Dry weight	Fresh weight	Dry weight
	ka ai/ha	*kg/ha*	*kg/ha*	*kg/ha*	*kg/ha*
Atrazine	2.24	1,607 bc	460 bc	16,850 bc	5,108 bc
Atrazine	4.48	1,436 bc	413 bc	20,916 ab	6,338 ab
Simazine	2.24	1,456 bc	415 bc	16,300 bc	4,939 bc
Simazine	4.48	1,177 bc	335 bc	18,531 bc	5,611 bc
Tebuthiuron	1.68	1,118 bc	318 bc	15,581 bc	4,721 bc
Tebuthiuron	3.36	15 c	3 c	8,029 d	2,434 d
Diuron	1.68	1,959 b	560 b	19,299 b	5,847 b
Diuron	3.36	2,278 b	655 b	26,280 a	7,965 a
Non-weeded	—	5,614 a	1,607 a	11,833 cd	3,586 cd
Hand-weeded	—	949 bc	272 bc	20,487 ab	6,209 ab

[1]Means with letters in common with columns do not differ significantly at P = 0.05.

rate showed better control of both types of weeds than did the other three herbicides. Tebuthiuron at either rate was more phytotoxic than the other three herbicides.

With reference to fresh weights, weed infestation was lowest in the tebuthiuron 3.36 kg ai/ha rate (table 2). There were no significant fresh weight differences among all other herbicide treatments. Similar trends were evident for weed dry weights (table 2).

Diuron at 3.36 kg ai/ha, atrazine at 4.48 kg ai/ha and the handweeded check gave significantly higher Guinea grass yield than the other herbicide treatments (table 2). Tebuthiuron at 3.36 kg ai/ha significantly reduced Guinea grass fresh and dry weight yield.

Our finding that tebuthiuron at 3.36 kg ai/ha is more phytotoxic than all other herbicides agrees with results obtained by Lugo et al. (5). However, the forage yield was not significantly reduced by tebuthiuron at 3.36 kg ai/ha in Lugo's study, whereas, Guinea grass yield was significantly reduced with tebuthiuron at 3.36 kg ai/ha in the present study. The resistance of stargrass to yield loss might be attributed to differences in pasture species.

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