Effect of Two Triazine Compounds on the Establishment and Forage Yield of Pangolagrass[1]

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ABSTRACT

Atrazine[3] and Simazine were each applied at 1.8, 3.6 and 7.2 kg/ha active ingredient to Pangolagrass 1 day after planting on Corozal clay. All levels of each herbicide gave adequate weed control, but Simazine at the 3.6- and 7.2-kg rates and Atrazine at the highest rate resulted in prolonged phytotoxicity. All herbicides gave increased percent Pangolagrass in the total herbage harvested at 170 days, while only Simazine at 7.2 kg/ha significantly suppressed total herbage yields. Improved rate of establishment of the planted crop is considered to be more important than possible increases in yield resulting from herbicide application.

INTRODUCTION

Pangolagrass, *Digitaria decumbens* Stent. is widely planted throughout the humid and subhumid tropics and subtropics where it is often the leading forage grass of the cattle industry. Establishment of Pangolagrass by stem cuttings or stolons is relatively easily accomplished during rainy seasons or under irrigation; however, it requires about 2 to 5 months of growth before light grazing or cutting can be initiated. For intensive utilization of this forage, more than 4 months of growth are required, depending on the time of planting, rainfall, weed competition and other factors. Although Pangolagrass develops vigorously on fertile soils under humid conditions, competition from weeds is inevitable in the absence of repeated hand weeding or the use of herbicides. Hand weeding of pastures is generally uneconomical. On the other hand, the use of appropriate herbicides might prove beneficial and economical by promoting more rapid establishment, thereby shortening the waiting period before intensive use of the forage can be initiated.

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[3] Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of equipment or materials by the Agricultural Experiment Station of the University of Puerto Rico or an endorsement over other equipment or materials not mentioned.

Compounds such as 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) have been recommended for postemergent control of broadleaved weeds in Pangolagrass pastures (7), but there is limited information on the use of preemergent herbicides in the establishment of this grass. A satisfactory preemergent treatment that would give 4 to 6 weeks of weed control during the early growth of the grass would be especially desirable since this is the most critical period of establishment.

Two triazine compounds, 2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine (Atrazine) and 2-chloro-4,6-bis (ethylamino)-s-triazine (Simazine) applied to a Centipedegrass (*Eremochloa ophiuroides* (Munro) Hack.) planting at low rates (2.24 and 4.48 kg/ha) were relatively non-phytotoxic. Rodríguez and Feliberty (5) found that weed control in this experiment was poor since nutsedge or nutgrass (*Cyperus rotundus* L.) was the predominant species and is normally tolerant of these herbicides. In experiments in Florida fine sand soils Orsenigo and Kretschmer (4) used Simazine at 2.24 kg/ha active ingredient successfully in the establishment of Pangolagrass. Simazine was used with limited success in two unreported establishment trials with Pangolagrass, Stargrass and Signalgrass at Corozal and Adjuntas, Puerto Rico. Both Simazine and Atrazine have been used for weed control in experimental (3,6) and commercial plantings of various other crops in Puerto Rico, but only to a limited extent in forage grass establishment.

This experiment was designed to evaluate three rates of Simazine and Atrazine herbicides in the establishment and yield of Pangolagrass in the humid mountains of Puerto Rico.

MATERIALS AND METHODS

The experiment was conducted at the Corozal Substation, located about 213 m above sea level. The soil is Corozal clay (Aquic Tropudults). Average annual rainfall is 1930 mm; average daily maximum and minimum temperatures are 31° and 17° C with an annual mean temperature of 24° C.

Before the experiment was established, the land was plowed and disc-harrowed twice leaving the area relatively weed-free. Stolons and culms of Pangolagrass were planted at approximately 41- to 46-cm intervals in shallow furrows 76 cm apart and covered lightly with soil. Both Simazine and Atrazine were applied at 1.8, 3.6, and 7.2 kg/ha active ingredients with a compressed air applicator to assigned plots the day after planting. The three levels of each herbicide and control plot were replicated four times in a randomized complete block design. Individual plots were 1.5 × 6.1 m. Fertilizer at a rate of 560 kg/ha of 14-4-10 was topdressed soon after the grass was planted.

All plots were evaluated by visual ratings for weed control and toxicity of the herbicide to the Pangolagrass. Ratings ranged from 1 to 10, representing poor to excellent weed control and low to high phytotoxicity. The ratings were made at 17, 34 and 48 days after the herbicides were applied. The first harvest was made 170 days after planting. At this time percent Pangolagrass in the harvested material was estimated, and the fresh forage was weighed, sampled, and removed from the plots. Dry matter content was determined for all samples. From these data, total dry herbage and Pangolagrass component yields were calculated for each treatment.

TABLE 1.—*Weed control ratings at 17, 34 and 48 days after herbicide application on Pangolagrass* [1]

Herbicide	Active ingredient	Days after herbicides were applied		
		17	34	48
	Kg/ha		*Rating*[2]	
Simazine	7.2	7.0 a	6.5 a	8.0 a
Atrazine	7.2	7.0 a	5.8 a	7.8 a
Atrazine	3.6	7.0 a	6.5 a	7.3 a
Atrazine	1.8	6.5 a	5.5 a	7.0 a
Simazine	1.8	6.0 a	5.3 a	7.0 a
Simazine	3.6	6.0 a	4.7 a	5.7 a
Control	0	1.0 b	1.0 b	1.0 b

[1] Each rating is the mean of four replications with 1 to 10 representing poor to excellent weed control.

[2] Means followed by the same letter are not significantly different at the 1% level of probability.

RESULTS AND DISCUSSION

WEED CONTROL

Ratings for weed control at 17, 34 and 48 days after treatments were applied (table 1) indicated that each herbicide at 1.8 kg/ha or more active ingredient provided weed control superior to that of the control plots. Differences in weed control between the two herbicides and among the three rates of application were not significant. Apparently no more than 1.8 kg/ha of active ingredient were required for adequate early control of weeds in this experiment.

Principal weeds observed in the experimental areas were goosegrass (*Eleusine indica* (L) Gaertn.), foxtail (*Setaria geniculata* (Lam.) Beauv.), junglerice (*Echinochloa colonum* (L.) Link.), oxalis (*Xanthoxalis corniculata* (L.) Small.), pigweed (*Amaranthus dubius* Mart), sensitive plant (*Mimosa pudica* L.) and nutsedge or nutgrass (*Cyperus rotundus* L.). In control plots seedling annual grasses were the early

dominant weed species. Nutsedge and oxalis were the only weeds of significance remaining in the treated plots. These species appeared unaffected by the herbicide treatments except for some discoloration of the leaves of oxalis. Control of annual weedy grasses and pigweed appeared to be the principal effect of herbicides at this site.

At the first harvest, 170 days after treatment, estimated percent Pangolagrass (table 2) was higher for all herbicide treatments than for the control plots; again, no differences existed between herbicides or among rates of 1.8 to 7.2 kg/ha, further indicating that 1.8 kg/ha active ingredient gave adequate control under the existing conditions.

PHYTOTOXICITY

The intermediate and high rates (3.6 and 7.2 kg/ha) of Simazine were more injurious to Pangolagrass than any other treatment (table 3), while

TABLE 2.—*Total herbage and the Pangolagrass component obtained from the first harvest, 160 days after planting Pangolagrass and treating with preemergent herbicides*[1]

Herbicide	Active ingredient	Total herbage[2]	Pangolagrass[2]	Component[3]
	Kg/ha	*DM kg/ha*	*%*	*DM kg/ha*
Atrazine	3.6	5352 ab	92 a	4903 a
Simazine	3.6	5659 a	85 a	4815 a
Simazine	1.8	4840 ab	84 a	4049 ab
Atrazine	1.8	4269 ab	84 a	3572 ab
Atrazine	7.2	4147 ab	82 a	3317 ab
Simazine	7.2	3708 b	80 a	2961 b
Control	0	5986 a	62 b	3756 ab

[1] Each value is the mean of four replications.

[2] Means followed by the same letter are not significantly different at the 1% level of probability. Percentage values were transformed to arcsine x for statistical analysis.

[3] Means followed by the same letter are not significantly different at the 5% level of probability.

the same herbicide at 1.8 kg/ha active ingredient caused no apparent injury at any time. At 17 days Atrazine at 1.8 to 7.2 kg had caused some crop injury, but after 48 days the 1.8- and 3.6-kg rates were equal to the control. Atrazine has been shown by Liu and Cibes to be generally more toxic than Ametryne, Prometryne and Diuron (1) and to have relatively high mobility in leaching experiments (2). This tends to explain the apparent early toxicity and rapid reduction in phytotoxicity of Atrazine treatments to the Pangolagrass in this experiment. After 48 days only Atrazine at the highest rate and Simazine at 3.6 and 7.2 kg/ha were damaging to the Pangolagrass. After 170 days Simazine at the highest rate continued to suppress growth of the planted grass (2,961 vs. 4,903

and 4,815 kg/ha with Atrazine and Simazine, respectively, at 3.6 kg). This reduction, however, was not significantly greater than that apparently caused by weeds in the control plots, as indicated by Pangolagrass yields (table 2).

Only Simazine at 7.2 kg/ha active ingredient significantly suppressed total yields of the combined herbage at 170 days; conversely, all herbicide treatments significantly increased percent Pangolagrass as shown in table 2. Assuming that a superior quality forage results from increased Pangolagrass content, these data suggest the use of one of these or similarly effective herbicides under similar establishment conditions. The increase in the Pangolagrass component is also an indication of increased vigor and rate of establishment of the planted grass with all

TABLE 3.—*Phytotoxicity ratings at 17, 34 and 48 days after herbicide applications on Pangolagrass plots*[1]

Herbicide	Active ingredient	Days after herbicides were applied		
		17	34	48
	Kg/ha		*Rating*[2]	
Simazine	7.2	6.5 a	8.5 a	7.7 a
Simazine	3.6	6.5 a	6.5 b	6.7 a
Atrazine	7.2	4.5 b	3.5 c	4.3 b
Atrazine	3.6	3.0 b	3.3 c	2.5 bc
Atrazine	1.8	3.0 b	1.8 cd	2.0 c
Simazine	1.8	2.8 bc	1.3 d	2.0 c
Control	0	1.0 c	1.0 d	1.0 c

[1] Each rating is the mean of four replications with 1 to 10 representing low to high phytotoxicity.

[2] Means followed by the same letter are not significantly different at the 5% level probability.

herbicide treatments, with the possible exception of Simazine at the highest rate.

Only at the 3.6-kg rates of both Atrazine and Simazine did dry matter yields of the Pangolagrass component tend to be increased materially beyond that of the control plots and these apparent yield increases were not significant at the 5% confidence level. Herbicide levels of 1.8 and 3.6 kg/ha showed good weed control, marked increase in percent Pangolagrass, and caused little or no prolonged damage. Even though the 7.2-kg/ha level of each herbicide was phytotoxic to Pangolagrass, no significant reduction in percent of the grass component was observed at 170 days. Based on these data, 1.8 to 3.6 kg/ha active ingredient of either Atrazine or Simazine would appear beneficial to the establishment of

Pangolagrass. Some preference might be given to Atrazine because of its less prolonged phytotoxic effect.

Unless application costs are excessive, early yield gains and improved forage quality through increased Pangolagrass content of the herbage should offset the cost of a suitable preemergent herbicide. In addition, early coverage of the ground by the planted forage species should reduce subsequent weed competition as well allow earlier grazing at intensive stocking rates.

RESUMEN

Dos yerbicidas s-triazinas, Atrazine y Simazine se aplicaron a niveles de 1.8, 3.6 y 7.2 kg. de ingrediente activo por hectárea a la yerba Pangola un día después de sembrarla en la Subestación de Corozal.

Las evaluaciones a base de observaciones visuales para el control del yerbajo y de fitotoxicidad a la yerba Pangola indicaron que en todos los niveles de cada yerbicida se logró un control adecuado, y que Simazine al nivel de 3.6 y 7.2 kg./ha. y Atrazine al nivel de 7.2 kg. fueron fitotóxicos por tiempo prolongado.

Los dos yerbicidas a todos los niveles causaron un incremento en el porcentaje de la yerba Pangola en el componente vegetal total (Pangola más malezas) cuando el experimento se cosechó a los 170 días. Sin embargo, solo Simazine, al nivel de 7.2 kg., causó una disminución significativa en la producción del componente vegetal total. De igual forma, Simazine al nivel más elevado disminuyó el crecimiento de la yerba Pangola, pero solo en comparación con los tratamientos en los niveles intermedios de cada yerbicida.

Mucho más importante que los posibles incrementos en producción de la yerba, fue la rápidez de establecimiento de la forrajera, la cual presumiblemente atenúa el problema de yerbajos y a la vez permite el uso intensivo más temprano de la yerba.

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