Chemical Weed Control in Sweetpotatoes[1]

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ABSTRACT

Two field experiments were conducted to evaluate herbicides for chemical weed control in sweetpotato plantings at the Isabela and Fortuna, Agricultural Experiment Substations, located in the northwestern humid and southern dry coasts of Puerto Rico, respectively. Pre-emergence herbicides were sprayed on Miguela sweetpotato cultivar two days after planting on weed-free soil. Weed control ratings taken eight weeks after treatment application showed effective control with the use of diphenamid (N,N-dimethyl-2,2-diphenylacetamide) alone or in combination with chloramben (3-amino-2,5-dichlorobenzoic acid) or DCPA (dimethyl tetrachloroterephthalate). There was no visible crop injury.

There was no significant difference in tuber yields among herbicidal treatments at the two locations. Yields of herbicide-treated plots were comparable to those obtained from the handweeded control at Fortuna.

INTRODUCTION

Sweetpotatoes (*Ipomoea batatas* (L.) Lam) rank third among the most important starchy crops grown in the Island, with a farm value of approximately $2 million. During fiscal year 1974–75 nearly 71,000 hundredweight were imported. A factor limiting local production is scarcity of laborers. Efficient and economical weed control methods are essential to improve production. Mechanical cultivation does not control weeds effectively in sweetpotato plantings because of its prostrate growth habit. Sweetpotatoes can be raised without cultivation if the weeds can be controlled until about 8 weeks after planting, when the vines have covered the ground enough to form a natural barrier against weed growth.

The most desirable herbicide would be one in which a single preplant or post-transplant application would provide complete weed control under a wide range of conditions and locations. Earlier herbicides caused serious injury to the crop (4, 5, 7). Now there is a large number of registered, effective herbicides used in various areas of the United States (2, 3, 6). These materials have not been evaluated for local soils, climatic conditions, and commercial sweetpotato varieties. The present report deals with such an evaluation.

MATERIALS AND METHODS

Two field experiments were conducted at Isabela and Fortuna Agricultural Experiment Substations, located in the northwestern humid

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and southern dry coasts of Puerto Rico, respectively. At Isabela the experiment was established in a Coto clay (Oxisol) with a pH of 4.8 and a CEC of 13 meq/100 g of dry soil. At Fortuna the soil is a San Antón silty clay (Mollisol) having a pH near neutrality and a CEC of 29 meq/100 g of dry soil. The experiments were initiated in September 1971 at Isabela and October 1972 at Fortuna. Rainfall provided adequate soil moisture at Isabela, but periodic irrigations were necessary at Fortuna.

Vines of Miguela cultivar, a popular white-fleshed type, were used at both sites. A complete block design with five replicates was used. Each plot had four rows 3 feet (0.91 m) apart and 20 feet (6.1 m) long. Yield data were obtained from the two inner rows. The three herbicides tested were: N,N-dimethyl-2,2-diphenyl acetamide (diphenamid) available as

TABLE 1.—*Effect of herbicide treatments on weed control and sweetpotato yields (Minguela CV.), Isabela Substation, September 1971*

Treatment	Rate	Weed rating at 8 weeks	Yield
	Lb/acre	*%*	*Cwt/acre*
Diphenamid	8	58[1]	188 ab[2]
Diphenamid	10	70	214 ab
Diphenamid	12	74	211 ab
Diphenamid + Chloramben	4 + 4	82	251 a
Diphenamid + Chloramben	4 + 1	70	232 a
Diphenamid + DCPA	4 + 4	74	251 a
Diphenamid + DCPA	4 + 2	70	240 a
Nonweeded control		0	168 b

[1] 0 = no control; 100 = perfect control.

[2] Means with one or more letters in common do not differ significantly at the 0.05 level of probability.

Enide 50 W[3] and Dymid 80 W; 3-amino-2,5-dichlorobenzoic acid (chloramben) available as Amiben; and dimethyl tetrachloroterephthalate (DCPA). Herbicides were sprayed in 40 gal/acre of water (61.28 l/ha) over the foliage 2 days after planting at the rates indicated in tables 1 and 2. A nonweeded control treatment was included at both sites. An additional weed-free control was also included at Fortuna. Periodic weed control evaluations were made with a final one 8 weeks after treatment application. Percent weed control was calculated from a scale where 0 indicated no control and 100, perfect control.

Land preparation and cultural practices were those considered desirable and normally used by the farmers in commercial production. Soil insects were controlled with Parathion 15% at the rate of 20 lb/acre (22.4

[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.

kg/ha) and the vines were treated with Chlordane at 1 lb/acre (1.12 kg/ha) in 50 gal of water. A 6-6-12 fertilizer formulation was applied 15 days after planting at 600 lb/acre (672.6 kg/ha). Foliage insects were controlled with Malathion at 2 pints/acre (2.34 1/ha) in 100 gal (378.5 liters) of water.

The experimental plots were harvested 5 months after planting, and tuber yields recorded.

RESULTS AND DISCUSSION

ISABELA EXPERIMENT

Data on weed control and tuber yields of sweetpotatoes in the Isabela experiment are shown in table 1. Weed control ratings made 8 weeks after treatment application show a high degree of effectiveness with the

TABLE 2.—*Effect of herbicide treatments on weed control and sweetpotato (Miguela CV.) yields, Fortuna Substation, October 1972*

Treatment	Rate	Weed rating	Yield
	Lb/acre	%	*Cwt/acre*
Diphenamid	6	75[1]	155.3 a[2]
Diphenamid	10	76	155.9 a
DCPA	10	58	109.1 ab
DCPA	14	66	122.6 a
Diphenamid + Chloramben	4 + 4	79	130.3 a
Diphenamid + Chloramben	4 + 3	75	158.2 a
Diphenamid + Chloramben	4 + 2	79	151.5 a
Diphenamid + Chloramben	4 + 1	72	162.1 a
Hand-weeded control		100	157.9 a
Nonweeded		0	67.6 b

[1] 0 = no control; 100 = perfect control.

[2] Means with one or more letters in common do not differ significantly at the 0.05 level of probability.

combination of diphenamid at 4 lb/acre (4.48 kg/ha) and chloramben at 4 lb/acre (4.48 kg/ha). In general, herbicide treatments showed good weed control except for diphenamid at the 8 lb/acre (8.96 kg/ha) rate. The weed population consisted mainly of crabgrass (*Digitaria sanguinalis* L.), jungle rice (*Echinochloa colonum* L.), goosegrass (*Eleusine indica* L.), pigweed (*Amaranthus* spp) and foxtail (*Setaria* spp). There was no visual indication of injury to the sweetpotato vines from applied herbicides, even at the higher concentrations used. The rates of actual material used in this study generally were higher than the rates recommended in the United States, i.e., the recommended rate of diphenamid for sweetpotatoes in the U.S. is 6 lb/acre (6.73 kg/ha) for clay soil. However, it is well known that the acid, leached, heavy soils of the tropics require higher dosages of herbicides for comparable effectiveness than in temperate zones (1).

The yield of marketable tubers, when compared with the commercial production of the area, appeared to be very good in all experimental plots. There was no significant difference in tuber yield among herbicide treatments. Moreover, only the herbicide combinations showed a significant increase in yield over the weedy control.

FORTUNA EXPERIMENT

Table 2 shows that weed control 8 weeks after treatment application was also very good at the Fortuna Substation. All herbicide treatments seemed to be equally effective except for DCPA, which showed lower weed control percentages. As at Isabela, herbicide combinations did not seem to improve the effectiveness of applied herbicides. Some of the weed species present in the experimental area included pigweed (*Amaranthus dubius* L.), guinea grass (*Panicum maximum*), crabgrass (*Digitaria* spp), purslane (*Portulaca oleracea*) and millito (*Panicum adepersum*).

The yield of marketable tubers at Fortuna (table 2) was lower than that obtained at Isabela (table 1). A possible reason for the lower yields may have been a shortage of irrigation water during the growing season. Irrigation is essential for optimum yields in the dry southern part of the Island. The difference in planting dates provides a second explanation. The experiment at Isabela was planted in September, which is considered to be the best planting date for optimum yields of sweetpotatoes. As at Isabela, there was no significant difference in tuber yield among the herbicide treatments. The coefficients of variation were high at 23% and 20% for the Fortuna and Isabela experiments, respectively, which may have possibly reduced the chances of obtaining significant differences.

Results show that herbicides, when compared to hand weeding, provide a feasible means for controlling weeds in sweetpotatoes under the experimental conditions of Isabela and Fortuna, without affecting the yield of marketable tubers. It is also evident that from the point of view of weed control, diphenamid is effective alone or in combinations with chloramben or DCPA.

RESUMEN

Dos experimentos de campo se establecieron en las Subestaciones de Isabela y Fortuna, Puerto Rico para evaluar yerbicidas en el control químico de yerbajos en batatales. Los yerbicidas preemergentes se aplicaron mezclados con agua cubriendo toda el area 2 días después de sembrarse la variedad Miguela. A las 8 semanas de aplicados los tratamientos aún se notaba un control efectivo de los yerbajos con el uso de difenamida (N,N-dimetilo-2,2-difenilacetamida) solo, en combinación con Chloramben (3-amino-2,5-ácido diclorobenzoico) o con DCPA (dimetilo-2,3,5,6-tetracloroterefталato). No hubo síntomas visuales de daño al follaje como consecuencia de los yerbicidas.

No hubo diferencias significativas entre los tratamientos de yerbicidas en cuanto a rendimiento de batatas por acre, entre las parcelas tratadas con yerbicidas y los obtenidos en las desyerbadas a mano.

LITERATURE CITED

1. Audus, L. J., The Physiology and Biochemistry of Herbicides, Academic Press, London and New York, 1964.
2. Grief, J. K., and Al-Tikrita, A. D., Weed control in sweetpotatoes, Proc. Northeast. Weed Control Conf. 19: 41–2, 1962.
3. Johnson, N. A., and Amling, H. J., Herbicides for sweetpotatoes in Alabama, Proc. South. Weed Conf. 16: 179–87, 1961.
4. Riggleman, J. D., and Matheus, V. A., Chemical weed control in sweetpotatoes, Proc. Northeast. Weed Control Conf. 17: 58–62, 1963.
5. Thompson, J. T., and Dempsey, A. H., Chemical weed control for sweetpotatoes, Ga. Agr. Exp. Sta. Mimeo Series N.S. 117, 1961.
6. United States Department of Agriculture, Sweetpotato culture and diseases, Agriculture Handbook No. 388, 1971.
7. Welker, W. V., Jr., Effect of herbicides on quality and yield of sweetpotatoes, (A progress report), Northeast. Weed Control Conf. 16: 91, 1962.