Methods for controlling jointvetch and waterprimrose in rice fields in Puerto Rico[1]

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ABSTRACT

A trial was conducted at the Gurabo Substation, Gurabo, Puerto Rico, to evaluate different methods (biological, manual and chemical) for controlling jointvetch (*Aeschsynomene sensitiva* Sw.) and waterprimrose [*Ludgia erecta* (L.) H. Hara] in rice. The sequential applications of either propanil [N-(3,4-dichlorophenyl) propanamide] or thiobencarb [S-(4-chlorphenyl) methyl diethylcarbamothioate] as early postemergent, followed by a mixture of 2,4-D [(2,4-dichlorophenoxy) acetic acid] and bentazon [3-(1-methylethyl)-(1H)-2,1,3-benzothiadiazin-4-(3H)—one 2,2-dioxide] were found to be the two best treatments. Both treatments outyielded all others except the weeded check. The sequential application of propanil followed by Collego™ (a mycoherbicide) gave only fair weed control and produced a poor yield.

INTRODUCTION

Jointvetch and waterprimrose are two troublesome weeds present in rice fields in Puerto Rico. Both weeds are difficult to control with the existing method because they are highly resistant to propanil and 2,4-D treatments. Consequently, they compete severely with the rice plants during the mid to late growing season. They also interfere with harvest operations. Recent advances in the use of fungi or biological weed control have opened a new avenue for integrated weed control research. The integration of biological control with other control methods, such as chemical and manual, is one aspect of weed control research which merits our special attention. The objectives of this study were to compare different methods, either alone or in combination, for controlling jointvetch and waterprimrose, and determine the economic feasibility of the abovementioned control methods for their possible adoption by farmers.

REVIEW OF LITERATURE

Manual weeding is still practiced by farmers in Asian countries, but in the United States, chemical control is the standard practice in rice cultivation (15). Propanil has been the standard herbicide during the past two decades and continues to be a leading herbicide (19). Other herbicides, such as molinate, thiobencarb, oxadiazon, and bifenox, have also been widely used. It is therefore evident that chemical methods have

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controlled a wide variety of weeds. However, jointvetch and waterprimrose are two troublesome weeds that are not completely controlled by chemical means. In 1969, Daniel et al. (5) discovered an endemic anthracnose disease of north jointvetch incited by the fungus *Colletotrichum gloeosporioides* (Prenz.) Sacc. f. sp. *aeschynomene*. Daniel, Templeton and others (4, 14, 17, 18) tested this fungus. Recently, the Upjohn Company has developed a dry formulation of *Colletotrichum gloeosporioides* f. sp. *aeschynomene* for jointvetch control marketed under the trade name of "Collego". For two consecutive years this mycoherbicide has been tested commercially in Arkansas with good results. The recent introduction of bentazon has further broadened the weed control spectrum in rice production (3, 19). In Puerto Rico, considerable intensive rice production research has been conducted on fertilization, varieties, planting season, evapotranspiration, production costs and pest control (1, 2, 8, 9, 10, 11, 12, 13). Weed control research in Puerto Rico has been limited to the chemical method (7, 8).

MATERIALS AND METHODS

The experiment was established on a Coloso silty clay (fine, mixed, nonacid, isohyperthermic Aeric Tropic, Fluvaquents) at the Gurabo Substation. The layout of the experiment was a randomized complete block with four replications. The first part of the experiment was devoted to jointvetch control and the second part included waterprimrose control. Rice cultivar Mars in 454 g was planted December 15, 1985, on each plot (3.1 x 3.1 m). The rice seeds were broadcast over the soil surface and subsequently incorporated with a rake. Jointvetch seeds were planted in the first half of the area and waterprimrose in the second half. All plots except weeded checks, received an early post emergence treatment of either propanil at 3.36 kg ai/ha or thiobencarb at 4.48 kg ai/ha December 17, 1985. A portable CO_2 sprayer fitted with an 8002 nozzle tip was used for herbicide application. The spray volume was 514 l/ha at 2.7 kg per cm^2. The rice field was permanently flooded until 3 weeks before harvest. A second herbicide application, which included a mixture of amine salt of 2,4-D at 1.12 kg ai/ha and bentazon at 1.12 kg ai/ha, was made January 10, 1986. Collego™ [a], a mycoherbicide, was applied twice (January 31 and February 14, 1986) at the rates recommended by the manufacturer, i. e., 234 ml/ha (component a) and 0.34 kg/ha (component b). The check was hand weeded three times (January 31, February 24, and March 14, 1986). The time spent on each handweeding was recorded. The first fertilizer application, with a 15-5-10 analysis at the rate of 454 g per plot, was

[a]Trade names in this publication are used only to provide specific information. Mention of a trade name does not constitute a warranty of equipment of materials by the Agricultural Experiment Station of the University of Puerto Rico, nor is this mention a statement of preference over other equipment or materials.

made January 2, 1986. A second fertilizer application with the same analysis and application rate was made 5 weeks later. Malathion at a rate of 5 ml per gallon of water was applied for insect control (February 14, 1986). A mixture of benomyl and malathion (1.12 kg ai/ha + 2.34 l/ha) was applied March 3, 1986, as a preventive measure for leaf blight (*Piricularia oryzae*) and insect control. The weed control ratings were made periodically. The rice was cut about 10 cm from the soil surface (April 22 and 23, 1986) when the grain had an average of 20% moisture.

RESULTS AND DISCUSSION

The predominant grasses included jungle rice [*Echinochloa colonum* (L.) Link.], finger grass (*Chloris inflata* Link.), crabgrass [*Digitaria sanguinalis* (L.) Scop.] and goose grass [*Eleusine indica* (L.) Gaertn.]. The broadleaved weeds were wild bush bean (*Macroptilium lathyroides* L.), purslane (*Portulaca oleracea* L.), niruri (*Phyllanthus niruri* L.), eclipta [*Eclipta alba* (L.) Hassk.], blue dayflower (*Commelina diffusa* Burn. f.), Mexican weed [*Caperonia palustris* (L.) St. Hil.], morning glory [*Ipomoea tiliacea* (Willd.) Choisy], jointvetch (*Aeschynomene sen-*

TABLE 1.—*Effect of different herbicide treatments on control of weeds, including jointvetch, in rice grown at the Gurabo Substation (1986)*

Treatment	Weed control ratings					Grain yield
	Grasses		Broadleaved weeds		Jointvetch	
	1-10-86	2-6-86	1-10-86	2-6-86	4-22-86	
						kg/ha
1. Propanil at 3.36 kg/ai/ha	90	80	73	60	0	2,316 b[1]
2. Thiobencarb at 4.8 kg ai/ha	90	80	54	50	0	2,185 b
3. Propanil at 3.36 kg ai/ha followed by a mixture of 2,4-D at 1.12 kg ai/ha + bentazon at 1.12 kg ai/ha	90	90	69	98	95	3,202 ab
4. Thiobencarb at 4.48 kg ai/ha followed by a mixture of 2, 4-D at 1.12 kg ai/ha + bentazon at 1.12 kg ai/ha	90	90	50	100	95	2,940 ab
5. Propanil at 3.36 kg ai/ha followed by Collego at 234 ml/ha (component a) 0.34 kg/ha (component b)	90	80	73	53	20	2,495 b
6. Weeded check	—	95	—	95	90	3,949 a

[1] Values with one or more letters in common do not differ at the 5% probability level (Duncan Multiple Range Test).

sitiva Sw.) and waterprimrose [*Ludwigia erecta* (L.) H. Hara]. As jointvetch and waterprimrose became prevalent during the mid to late growing season of rice, the early weed control evaluation was limited to grasses and broadleaf weeds as a group. The first application of either propanil or thiobencarb controlled both grasses and broadleaf weeds well at the first evaluation date (tables 1 and 2). The second application of 2,4-D and bentazon mixture improved considerably the control of broadleaved weeds with only slight improvement in grass control. At the last evaluation date this mixture controlled jointvetch and waterprimrose excellently. The follow-up Collego treatments gave poor control of jointvetch and did not control waterprimrose at all. Collego did not control jointvetch to a commercially acceptable level. As the weeds encountered in the experimental rice fields consisted of multiple species, it would not be feasible to use Collego alone for controlling only one species of weed and leaving behind other predominant weed species intact.

The highest grain yield was obtained in the weeded check in the first part of the experiment. The plots treated with propanil followed by a mixture of 2,4-D and bentazon, and thiobencarb followed by the same mixture ranked second and third in yield, respectively. However, grain

TABLE 2.—*Effect of different herbicide treatments on control of weeds, including waterprimrose, in rice grown at the Gurabo Substation (1986)*

Treatment	Weed control ratings					Grain yield
	Grasses		Broadleaved weeds		Waterprimrose	
	1-10-86	2-6-86	1-10-86	2-6-86	4-22-86	
						kg/ha
7. Propanil at 3.36 kg ai/ha	90	75	63	40	0	3,156 a[1]
8. Thiobencarb at 4.48 kg ai/ha	90	75	42	30	0	3,249 a
9. Propanil at 3.36 kg ai/ha followed by a mixture of 2,4-D at 1.12 kg ai/ha bentazon at 1.12 kg ai/ha	90	85	58	98	95	4,788 a
10. Thiobencarb at 4.48 kg ai/ha followed by a mixture of 2,4-D at 1.12 kg ai/ha + bentazon at 1.12 kg ai/ha	90	85	40	95	90	4,759 a
11. Propanil at 3.36 kg ai/ha followed by Collego at 234 ml/ha (component a) 0.34 kg/ha (component b)	90	75	60	50	0	3,432 a
12. Weeded check	—	95	—	95	85	4,968 a

[1] Values with one or more letters in common do not differ at the 5% probability level (Duncan Multiple Range Test).

yield with these two treatments did not differ significantly from yields from treatments of either propanil or thiobencarb alone. Table 2 shows there were no significant differences in yield among different treatments in the second part of the experiment.

RESUMEN

Métodos del control del moriviví bobo y el clavo acuático en arrozales en Puerto Rico

Se realizó un experimento con arroz en el cual se evaluaron distintos métodos para desmalezar (biológico, manual y químico), especialmente para combatir el moriviví bobo (*Aeschynomene sensitiva*) y el clavo acuático (*Ludwigia erecta*). Con aplicaciones en serie de propanil a razón de 3.36 kg pa./ha a thiobencarb a razón de 4.48 kg ia/ha como posemergente temprano seguidas por una mezcla de 2,4-D a razón de 1.12 kg pa/ha y bentazon a razón de 1.12 kg ia/ha se pudo erradicar excelentemente ambas malezas. En las parcelas tratadas así se logró un mejor rendimiento de arroz que con los demás tratamientos excepto con el testigo desyerbado a mano.

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