caribbean
food
crops society

Eighteen
Annual Meeting
August 22 to 28th 1982
Dover Convention Centre
BARBADOS

Vol. XVIII

EVALUATION OF A NEW GRASS KILLER IN SELECTED VEGETABLES

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INTRODUCTION

In weed control studies in intensively cultivated vegetable crops during the wet season in Trinidad, Brathwaite (1978a, b, 1979, 1981) reported that grass weeds were the most common species which occurred. The growth of these annual and perennial grasses was frequently rapid and severe being aided by the high fertilizer levels used in the cultivation of the crops. Although safe and effective herbicides for use as pre-plant incorporated and/or pre-emergence treatments have been identified for early weed control at significantly reduced cost in the crops studied, many farmers still rely solely on manual weedings and post-emergence applications of paraquat and diquat. These common practices of effecting weed control exhibit serious constraints, for example, labour for hand weeding is not only difficult to obtain but is expensive, frequently hand weeding is ineffective because of the wet soil conditions, and the use of the contact herbicides often results in significant crop damage primarily because of timing and application methods. The identification and use of selective post-emergence herbicides for the control of grass weeds is a possible approach to safe and effective weed control in broad-leaved vegetables. Recently, such herbicides have been developed and their potential use reported (Plowman, Stonebridge and Hawtree, 1980; Ingram and Slater, 1980; Slater and Hirst, 1980). This study was conducted to evaluate the effectiveness of one of these chemicals, fluazifop-butyl (Table 1) to control grass weeds and to check its effects on bodie bean (Vigna unguiculata (L.) Walp.), cabbage (Brassica oleracea var. capitata L.), and sorrel (Hibiscus sabdariffa var. sabdariffa) under rainfed conditions.

MATERIALS AND METHODS

The experiments were conducted near St. Augustine, Trinidad, during the wet season of 1981 on loam soils. The sorrel experiment was on an Orange Grove loam with 26% clay, 3.0% organic matter, a pH of 5.4, and a cation exchange capacity (CEC) of 4.0 meq/100g. The bodie bean and cabbage experiments were on a River Estate loam which had 21% clay, 2.3% organic matter, a pH of 6.5, and a CEC of 10.8 meq/100 g. Individual plots were

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Table 1.--Some information on fluazifop-butyl[1/]

Chemical Name	Code number of samples used	Trade name	Active ingredient	Mode of Action
Butyl 2 - /4- (5-trifluoromethyl - 2 - pyridyloxy) phenoxy/	PP009	Fusilade	250 g fluazifop-butyl per litre	Fluazifop-butyl moves in both the xylem and the phloem, and appears to adversely interfere with ATP production. The first visible symptom, usually within 48 hours of application, is a cessation of growth. Meristematic tissue in the nodes and buds become necrotic, young leaves show chlorosis through necrosis. The oldest leaves show senescent pigment changes. The selectivity is believed to be due to rapid degradation followed by conjugate formation in broad-leaved plants.

1/ Mainly from Plowman et al. (1980)

5x 1.8 m in sorrel, 8 x 2.2 m in bodie bean and 10 x 3 m in cabbage and were replicated at least three times in a randomized block design. Spacings were 60 x 15, 45 x 10, and 60 x 30 cm in sorrel, bodie bean, and cabbage, respectively. Total precipitation was 568, 510, and 465 mm in sorrel, bodie bean, and cabbage, respectively.

The plots were disc ploughed and rotavated twice before sowing cultivar Dwarf Early Red sorrel and cultivar Los Baños Bush Sitao No. 1 bodie bean and transplanting five-week old seedlings of cultivar Kono Cross cabbage during August - September. All cultural practices except grass weed control followed the recommendations of Ganpat (1973a) for sorrel, Ferguson (1973) for bodie bean, and Charles (1976) and Ganpat (1973b) for cabbage.

Alloxydim-sodium and fluazifop-butyl were applied over-the-top when weeds were growing actively with seedlings of annual grass weeds having 4 to 8 leaves and perennial grass weeds having about 6 leaves per shoot. Treatments were applied with a knapsack sprayer at doses shown in Table 2 and 3 at a volume of 200 - 300 litres of clean water per hectare. Agral 90[2/] was included in the fluazifop-butyl treatments at a rate of 0.1% of spray volume. Gramoxone, where included as a treatment, was used as recommended. One of the check plots was maintained weed-free throughout the season and the other was an unweeded check plot. No early weed check was done in any of the crops.

Plant heights were measured, and grass weed control and crop vigour were assessed at 14, 21, and 42 days after treatment using a scale of 0 - 100% with 100 for complete control of grasses or death of the crop while 0 was no grass control or full health and vigour of the crop. Plant stands were determined at 7 days after germination and 21 and 42 days after treatment. Observations were made on dates of flowering and maturity. Forty-two days after treatment the number of weeds were counted in the unweeded check plots.

Each crop was harvested on four occasions and the total marketable produce yields were expressed as kg/ha.

Analysis of variance was computed on the data. Duncan's multiple range test was used to indicate significant differences among treatment means and the 5% level of probability was selected to test hypotheses.

1/ Mention of a trade name in this paper is used solely to provide specific information and does not constitute an endorsement of the product by the University of the West Indies and the Ministry of Agriculture, Lands and Food Production of the Government of Trinidad and Tobago over other products not mentioned.

Table 2.--Weed control ratings as influenced by weed control treatments in sorrel

Treatment and application rate	Weed control[1/]	
	Days after treatment	
	21 days	42 days
(Kg ai/ha)		
Clean weeded check	100	100
Unweeded check	0	0
Gramoxone	100	100
Fluazifop-butyl 3.0	93	94
Fluazifop-butyl 2.0	100	90
Fluazifop-butyl 1.0	94	93
Fluazifop-butyl 0.5	90	89
Fluazifop-butyl 0.25	100	96

1/ Rating system 0-100: 0 = no control
100 = complete kill of weeds

Table 3.--Weed control ratings as influenced by weed control treatments in bodie bean and cabbage

Treatment and application rate	Weed control[1/]			
	Days after treatment			
	21 days		42 days	
	bodie bean	cabbage	bodie bean	cabbage
(Kg ai/ha)				
Clean weeded check	100	100	100	100
Unweeded check	0	0	0	0
Alloxydim-sodium 0.5	26	23	20	10
Fluazifop-butyl 0.5	96	94	100	99
Fluazifop-butyl 0.25	86	84	92	92
Fluazifop-butyl 0.125	73	73	60	54

1/ Rating system 0-100: 0 = no control
100 = complete kill of weeds.

RESULTS AND DISCUSSION

All crops showed excellent germination with optimum plant stands at 7 days after germination. Generally crop growth was good in all experiments. No serious pest problems were encountered. Cowpea severe mosaic virus in bodie bean was the only disease observed, however, only three plants were rogued.

The weed flora in sorrel was composed of grasses 78%, broadleaved weeds 18%, and sedges 4%. The predominant weeds were Rottboellia exaltata L., Paspalum fasciculatum Willd., Brachiaria spp., Eleusine indica (L.) Gaertn., Amaranthus dubius Mart., and Cyperus rotundus L. In bodie bean the weed composition was grasses 54%, broadleaved weeds 36%, and sedges 10%. Main weeds were similar to those in sorrel, except P. fasciculatum, with the addition of Digitaria sanguinalis (L.) Link., and Cenchrus echinatus L. In cabbage, grasses, broadleaved weeds and sedges accounted for 8, 25 and 67% of the total weed flora, respectively. The predominant weeds were similar to those in bodie bean.

There was no crop injury in any of the fluazifop-butyl of Alloxydim-sodium plots in any of the experiments nor any effects on date of flowering and maturity, plant height and plant population. Sorrel injury from Gramoxone attributed to improper application technique, was unacceptable.

All fluazifop-butyl treatments gave good to excellent control at all evaluations in sorrel (Table 2) and at 14 and 21 days after treatment in bodie bean and cabbage (Table 3). Data at 14 days after treatment are not shown. At 42 days after treatment only the higher rates gave acceptable grass control.

The effects of the weed control treatments on sorrel calyx yields are shown in Table 4. Fluazifop-butyl at rates of 0.25, 1.0 and 2.0 kg ai/ha produced calyx yields that were equivalent to that of the clean weeded check and over three times that from the unweeded check. Yields were significantly reduced below that of the clean weeded check by the other fluazifop-butyl treatments. However, there was no significant difference between the yields of any of the fluazifop-butyl treatments. The yield following Gramoxone treatment was significantly lower than that of the clean weeded check treatment but similar to those of fluazifop-butyl at rates of 0.5, 1.0 and 3.0 kg ai/ha.

The effects of the weed control treatments on the yields of bodie bean and cabbage were similar (Table 5). There was no significant difference between the yields of the fluazifop-butyl treatments and the clean weeded check which were all signficantly higher than those of the alloxydim-sodium treatment and the unweeded check which were similar. The alloxydim-sodium treatment produced similar yields as fluazifop-butyl at the rate of 0.125 kg ai/ha.

Under the conditions tested in this study, sorrel, bodie bean, and cabbage, all established at higher than normal densities, showed excellent

Table 4.--Sorrel yield as influenced by weed control treatments

Treatment and application rate	Yield[1/]
(Kg ai/ha)	(Kg/ha)
Clean weeded check	11200 a
Unweeded check	3210 d
Gramoxone	9510 c
Fluazifop-butyl 3.0	9911 bc
Fluazifop-butyl 2.0	10720 ab
Fluazifop-butyl 1.0	10401 abc
Fluazifop-butyl 0.5	10024 bc
Fluazifop-butyl 0.25	10502 ab

1/ Means followed by a common letter are not significantly different at the 5% level according to Duncan's multiple range test.

Table 5.--Bodie bean and cabbage yields as influenced by weed control treatments

Treatment and application rate (kg a.i./ha)	Yield[1/] (kg/ha)	
	bodie bean	cabbage
Clean weeded check	14950 a	13399 a
Unweeded check	7050 c	6764 c
Alloxydim-sodium 0.5	8500 bc	7986 bc
Fluazifop-butyl 0.5	14900 a	13356 a
Fluazifop-butyl 0.25	13450 a	12239 a
Fluazifop-butyl 0.125	11748 ab	10800 ab

1/ Means within a column followed by a common letter are not significantly different at the 5% level according to Duncan's multiple range test.

tolerance of fluazifop-butyl at all rates and provided acceptable control of the commonly occurring grass weeds including the normally difficult-to-control perennial species. Since cereals are not commonly grown after broad-leaved vegetables in Trinidad, these results suggest that fluazifop-butyl can be safely used to provide satisfactory grass weed control in the test crops without causing constraints in the rotational management systems employed in their production. Further testing of this chemical in a wider range of non-gramineous crop is currently in progress but the rate advisable for the crops tested in this study appears to be 0.25 kg ai/ha.

SUMMARY

Fluazifop-butyl (PP009), a new selective post-emergence herbicide for the control of annual and perennial grasses in broad-leaved crops, was evaluated in wet season field trials on loam soils in Trinidad. Good tolerance of the chemical was observed in sorrel (Dwarf Early Red) at rates of 0.25 to 3.0 kg ai/ha, and in bodie bean (Los Baños Bush Sitao No. 1) and cabbage (Kono Cross) at rates of 0.125, 0.25, and 0.5 kg ai/ha. Gross weeds present included Rottboellia exaltata, Brachiaria spp., Eleusine indica, Cenchrus echinatus, Digitaria sanguinalis, and Echinochloa colonum. All rates gave good to excellent grass control at 14, 21 and 42 days after treatment in sorrel and at 14 and 21 days after treatment in bodie bean and cabbage. Grass control by fluazifop-butyl at rates of 0.25 and 0.5 kg ai/ha was acceptable at 42 days after treatment in bodie bean and cabbage. In sorrel, fluazifop-butyl at rates of 0.25, 1.0 and 2.0 produced calyx yields equivalent to that of the clean weeded control, and in bodie bean and cabbage there was no significant difference between the yields of the fluazifop-butyl treatments and the clean weeded control. The rate advisable for sorrel, bodie bean and cabbage appears to be 0.25 kg ai/ha.

ACKNOWLEDGEMENTS

The authors gratefully thank Mrs. Christine Commissiong and Ms Claudia de Landro for secretarial assistance, Messrs. Sarran Harryram and Richard Spence for technical assistance, Dr. George Mason of Caroni Research Station for supplying the sample of alloxydim-sodium, Geo. F. Huggins & Co., Ltd., for supplying the samples of fluazifop-butyl, Federation Chemicals Ltd. for supplying the fertilizer, and Texaco Trinidad Inc. for financial support.

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