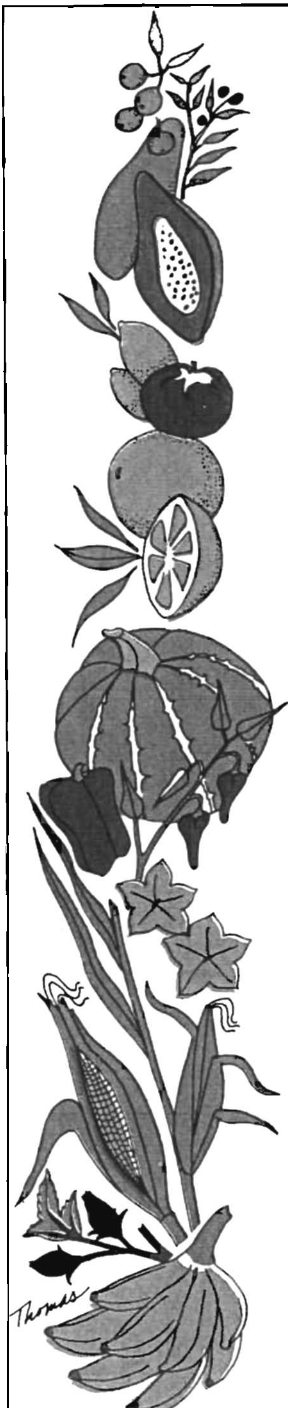

CARIBBEAN FOOD CROPS SOCIETY

30

THIRTIETH ANNUAL MEETING 1994

ST. THOMAS, U.S.V.I.

Vol. XXX

WEED MANAGEMENT IN A PIGEONPEA-TOMATO CROPPING SYSTEM

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ABSTRACT

Pigeon pea-tomato cropping sequence was initiated in July 14, 1993 at Juana Diaz, Puerto Rico to evaluate weed suppression from pigeon pea residues and herbicides. Herbicides such as metribuzin (0.56 kg ai/ha), prometryn (2.24 kg ai/ha), oxyfluorfen (0.28 kg ai/ha), and imazethapyr (0.07 kg ai/ha) applied pre-emergence to pigeonpea decreased weed density up to 100 % for the first two weeks. Weed density increased after four weeks and no differences were detected among herbicides. Pigeonpea yield ranged from 2026 kg/ha (green pods) with imazethapyr to 2980 kg/ha with handweedings. Weed density was evaluated in a tomato transplanted in the same plots March 4, 1994. Weed density was not significantly different among previous herbicide treatments applied to pigeon pea. Average reduction in weed density was 57% in plots where pigeonpea was grown and incorporated.

INTRODUCTION

In tropical areas weed control problems are particularly acute due to continuous cropping, with overlapping growing seasons, and the absence of cold periods that interrupt life cycles of weeds. In Puerto Rico, weed management programs for tomatoes include handweeding, mechanical cultivation, and chemicals in combination with plastic mulching (Liu, 1990). None of these methods alone provide full-season control of existing weeds. Weed control cost in tomatoes could be from 44 to 77% of total expenses. New management strategies are needed to enhance weed control and reduce production cost in tomatoes.

Crop rotation, for the utilization of allelopathic plant residues or herbicide sequences, is a potential strategy which could be integrated in tomato management system to supplement current practices of weed control. The results of several studies indicate the potential benefits which pigeonpea rotation may have in crop production systems (Bosque-Fernández, 1986; Hepperly and Diaz, 1983; Talleyrand et al., 1977). Pigeonpea has demonstrated allelopatic activity against weeds (Hepperly et al. 1992). The combination of the allelopathic effects of pigeon pea and the residual activity of herbicides could be used to enhance weed control in tomato.

The objective of this study was to evaluate weed suppression from pigeonpea residue and herbicides in a pigeonpea-tomato cropping system.

MATERIALS AND METHODS

A field experiment was established with Kaki pigeon pea plantings July 14, 1993 at Juana Diaz, Puerto Rico. The soil belongs to the San Anton series (fine-loamy, mixed isohyperthermic). A two-way split plot design was followed with four replications. Main plots were four pre-emergence herbicides applied to pigeon pea one day after planting. Plot consisted of twelve rows 0.91 m apart and 6.1 m long. Subplots consisted of two equal areas of six rows; one area in which pigeonpea was planted (+PP) and another that was not planted to pigeonpea (-PP). Herbicides treatments included imazethapyr (0.07 kg ai/ha), metribuzin (0.56 kg ai/ha), prometryn (2.24 kg ai/ha), and oxyfluorfen (0.28 kg ai/ha), and the untreated check. Untreated plots were handweeded from three to nine weeks after planting (WAP). Green pigeonpea was harvested in January 27, 1994. The remaining plant material was mowed and disked for soil incorporation five days later.

Seedbeds were well prepared and tomato seedlings were transplanted in March 4, 1994 in the same plots where the preemergence herbicides were applied to pigeon pea. Six rows of tomato (cv. Duke) were transplanted 1.82 m apart in the main plots. Three rows were planted for subplots. Metribuzin at 0.35 kg ai /ha was applied over the top of tomato one week after transplanting (WAT). Weed density by species was recorded three and six WAT. Grass weeds were controlled with fluazifop-P (0.28 kg/ha) postemergence at third week. Weeds emerging between rows were controlled mechanically after third week. Data on tomato fruit number were recorded from May 24 to June 1, 1994. Fruit number was recorded by sampling immature and mature tomatoes from three plants. Fruit yield and quality was severely affected by insect damage at the end of May, and for these reason data on fruit number will be presented only.

The main effect of weed control treatments as well as the possible interaction between pigeonpea treatments and herbicides were analyzed using the statistical analysis system and LSD test at 0.05 probability level.

RESULTS AND DISCUSSION

Predominant weed species in the experimental area were junglerice (Echinochloa colona L.) and small spider flower (Cleome gynandra L.). Metribuzin, prometryn, oxyfluorfen, and imazethapyr significantly reduced weed density in pigeonpea for the first two weeks, when compared to the untreated check (Table 1). There were no differences in weed density among herbicide treatments at 4 WAP. Reduction in weed density in the untreated plots was due to handweeding performed after third week. Green pod yield ranged from 2026 kg/ha with imazethapyr to 2980 kg/ha with handweeding, however, differences were not significant at the 0.05 probability level. Thus, herbicide efficacy was as good as the handweedings in pigeonpea.

Table 1. Weed density and green-pod yield from pigeonpea treated with pre-emergence herbicides[a].

Treatment	Rate (kg ai/ha)	Weed number/0.5 m² 2 WAP[b]	Weed number/0.5 m² 4 WAP	Pod yield (kg/ha)
Imazethapyr	0.07	6 b	67 a	2026 a
Metribuzin	0.56	11 b	36 a	2397 a
Prometryn	2.12	1 b	11 a	2968 a
Oxyfluorfen	0.28	0 b	34 a	2432 a
Untreated[c]	-	71 a	11 a	2980 a

[a]Means followed by the same letter are not significantly different according to Fisher's protected LSD test at $P \leq 0.05$.
[b]Abbreviations: WAP = Weeks after planting.
[c]Handweeded from 3 to 9 WAP.

Weed density was not different among the five herbicide-sequences, either with pigeonpea (+PP) or without (-PP) pigeonpea incorporation (Table 2). However, pigeonpea decreased weed density compared to plots without pigeonpea. Incorporation of pigeonpea reduced average weed density by 57%. Tomato yield was affected by insects, especially the super lopper (Pseudoplusia includens) which caused severe fruit damage. For this reason fruit number was recorded as the yield indicator. No significant differences were detected for tomato fruit number recovered with herbicide treatments, irrespective of pigeonpea incorporation.

Table 2. Herbicide-sequences effect on weed number and tomato fruit number[a].

	Weed number/0.5 m^2		Fruit number/ha	
Treatment[b]	-PP[d]	+PP[d]	-PP	+PP
Imazethapyr-MET-F[c]	106 a	28 a (73[e])	53490 a	47522 a
Metribuzin-MET-F	75 a	43 a (43)	50000 a	35022 a
Prometryn-MET-F	67 a	42 a (37)	34910 a	53153 a
Oxyfluorfen-MET-F	86 a	53 a (38)	35022 a	50900 a
Untreated-MET-F	101 a	20 a (80)	30068 a	30743 a
Mean	87 A	37 B (57%)	40698 A	43468 A

[a]Means followed by the same letter are not significantly different according to Fisher's protected LSD test at $P \leq 0.05$.
[b]Same treatments applied to pigeon pea. See Table 1 for herbicide rates.
[c]Metribuzin (MET) at 0.35 kg ai/ha was applied over the top of tomato one week after transplanting followed by fluazifop-P (F) at 0.28 kg ai/ha the third week.
[d]Abbreviations: +PP = with pigeon pea, -PP = without pigeon pea.
[e]Numbers in parenthesis means percent weed reduction by pigeon pea.

CONCLUSIONS

A pigeonpea crop with or without herbicides decreased weed density in the following tomato crop. Weed reduction in tomato can be attributed to allelopathic interference from pigeonpea residues. Pigeonpea enhanced weed control of the standard metribuzin treatment applied early post-emergence to tomato. A pigeonpea-tomato cropping system may be possible in terms of weed suppression, however, further studies need to be conducted to evaluate pigeonpea effect on tomato yield.

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