PROCEEDINGS

OF THE

32nd ANNUAL MEETING

7-13 July 1996

Pan-American School of Agriculture
Zamorano,
Honduras, Central America

Proceedings Edited
by
Wilfredo Colón

Published by the Caribbean Food Crops Society

Proceedings of the Caribbean Food Crops Society. 32:100-103. 1996

INTEGRATION OF PIGEON PEA ALLELOPATHY IN PEPPER AND TOMATO WEED MANAGEMENT SYSTEMS

Nelson Semidey, Agricultural Experiment Station, HC 01 BOX 11656, Lajas, Puerto Rico 00667.

ABSTRACT. Pigeon pea cultivars Kaki, 2B Bushy, PR 147 and Blanco, and Lines 12, 84, and 92 were evaluated at Juana Diaz, Puerto Rico, for their effect on weed suppression and pepper and tomato yield in the following cropping systems. Pigeon pea was grown from mid-July 1994 until 2 February 1995 when whole plant material above soil surface was mowed and disked into the soil. Pepper and tomato seedlings were transplanted after bedding 9 March 1995 and harvested during June 1995. The seven cultivars reduced weed density, which ranged from 50 to 91% in the pepper management system. Value of produce obtained from the pigeon pea-pepper harvest was estimated at US$19,945/ha, an increase of $9,865/ha over that of no pigeon pea rotation. In the tomato management system, weed suppression ranged from 69% to 89% with the same pigeon pea cultivars. Total value of produce from the pigeon pea-tomato harvest was estimated at $14,626/ha. Pigeon pea allelopathy contributed to weed suppression in both pepper and tomato management systems. Value of produce per unit area per year can be increased by the integration of pigeon pea in a rotation scheme with pepper and tomato.

INTRODUCTION

In Puerto Rico, weed management programs for tomato and pepper include hand-weeding, mechanical cultivation, and the use of herbicides in combination with plastic mulching (Liu, 1990). None of these methods alone can provide full-season control of existing weeds. Based on an economic analysis of total expenses, weed control cost could range from 44% to 77% in tomatoes and 59% to 89% in peppers (Liu, *et al.*, 1987). For this reason, new management strategies are needed to enhance weed control and reduce production cost in these crops.

The results of several studies indicate the potential benefits which pigeon pea rotation may have in crop production systems (Bosque-Fernández, 1986; Hepperly and Diaz, 1983; Talleyrand *et al.*, 1977). Pigeon pea has demonstrated allelopathic activity against grassy weeds (Hepperly *et al.*, 1992). Average reduction in weed density was 57% in a tomato crop that followed pigeon pea (Semidey *et al.*, 1994). Purple nutsedge, one of the most difficult weeds to control, was suppressed up to

93% by pigeon pea cv. 2B Bushy and Kaki and Line 84 in tomato (Semidey, 1995).

The objective of this study was to evaluate cultivars and new lines of pigeon pea for weed suppression in tomato and pepper cropping systems that followed pigeon pea.

MATERIALS AND METHODS

Cultivars and new lines of pigeon peas were field planted in July 1994 at Juana Diaz, Puerto Rico. Plots not planted with pigeon peas were included as check plots following a randomized complete block (RCB) design with eight replications. All plots (2.7 x 4.5 m) were cultivated periodically to prevent weed interference with pigeon peas. Mature pigeon pea pods were harvested from late December 1994 to January 1995. Plant material from each pigeon pea cultivar was soil incorporated by disking after green pod harvesting, and plot identity was maintained. The soil belongs to the San Anton series (fine-loamy, mixed isohypertermic). Two experiments, following a RCB design with four replications, were established with tomato cv. Heatwave and pepper cv. Key Largo six weeks later. For each experiment, three rows 0.90 m apart and 4.5 m long were transplanted for each crop. Metribuzin (0.35 kg a.i./ha) and fluazifop-P (0.28 kg a.i./ha) were applied to all plots and over the top of tomato three and four weeks after planting, respectively. A mixture of paraquat (0.37 kg a.i./ha) and fluazifop-P (0.28 kg a.i./ha) was directed between pepper rows four weeks after planting.

Plots were evaluated for weed emergence, crop stand, crop dry weight, and height three and six weeks after planting (WAP). Peppers and tomatoes were harvested in June 1995 and yield was compared to estimates for each crop. Data were analyzed by ANOVA procedures and means were separated by LSD at $P = 0.05$ level. To estimate reduction in weed density by pigeon pea cultivars, data were compared to the check plots without pigeon pea.

RESULTS AND DISCUSSION

None of the pigeon pea cultivars affected plant dry weight or height of tomato and pepper (data not included). All pigeon pea cultivars or lines reduced weed density in tomato at three and six WAP (Table 1). Weed reductions were non significant in pepper at three WAP, however, reduction was evident at six WAP. Herbicides applied to pepper and tomato at three to four WAP reduced weed density in all plots, except in the check. Line 84 was more consistent in weed suppression, with 89% and 91% weed reduction at six WAP pepper and tomato, respectively. Cultivar Blanco

was not consistent in weed suppression; however, differences among cultivars and lines were not significant in either crop.

Table 1. Average weed density and reduction three and six weeks after transplanting (WAP) tomato and pepper in plots previously planted with different pigeon pea cultivars[a].

Cultivar	Tomato		Pepper	
	No. weeds/0.5 m^2			
	3 WAP	6 WAP	3 WAP	6 WAP
Kaki	66(68)[b]*	22 (84)*	114 (40)	38 (71)*
2B Bushy	71 (65)*	22 (84)*	141 (25)	35 (73)*
PR 147	60 (71)*	28 (80)*	88 (53)	29 (78)*
Line 12	68 (67)*	27 (81)*	129 (32)	47 (64)*
Blanco	75 (63)*	32 (77)*	126 (33)	65 (50)*
Line 92	77 (62)*	44 (69)*	103 (46)	31 (76)*
Line 84	90 (56)*	16 (89)*	78 (59)	12 (91)*
Check	204	142	189	129

[a]Weed counts within a 0.5 x 1.0 m frame thrown at the middle of the plot.
[b]Numbers in parentheses means % reduction as compared to check.
*Significant reduction compared to check plots using LSD at $P < 0.05$.

At six WAP, average weed density was reduced 81% (from 142 to 27 plants/0.5 m^2) in tomato, and 71% (from 129 to 37 plants/0.5 m^2) in pepper that followed pigeon pea (Table 2). Tomato and pepper yields recovered from plots planted with individual pigeon pea cultivars and lines were similar to yields produced in plots without pigeon pea (only data of average yields are presented). Value of produce (gross income) for a single year may be increased when the value of pigeon pea produce was added to the value of tomato or pepper. Integration of pigeon pea in both cropping systems may contribute to weed suppression and also to increased gross income.

Table 2. Weed density and average gross income expected in different cropping systems.

Cropping system	Weed density[a] kg/ha	Crop yield no./0.5 m^2 $/ha	Value of produce[b] $/ha	Estimated increase
Pigeon pea-tomato	27	7,474 + 7,213	14,626	9,865
Pigeon pea-pepper	37	7,474 + 12,090	19,945	9,865
Tomato only[c]	142	7,330	4,760	0
Pepper only	129	12,920	10,080	0

[a]Weed counts within a 0.5 x 1.0 m frame at six weeks after planting.
[b]Estimated value per kg in 1994-95 was as follows: tomato, $0.66; pepper, $0.78; and green pigeon pea, $1.32.
[c]Tomato yield was lower than expected because of virus diseases.

REFERENCES

Bosque-Fernádez, P. A. 1986. Efecto de residuos de gandul en tres cultivos subsiguientes. M.Sc. Thesis. University of Puerto Rico, Mayagüez Campus. 42pp.

Hepperly, P., H. Aguilar-Erazo, R. Perez, M. Diaz, and C. Reyes. 1992. Pigeon Pea and velvet bean allelopathy. p. 357-370, In: Rizvi S. J. H. and V. Rizvi Eds. Allelopathy: Basic and applied aspects. Chapman and Hall, London.

Hepperly, P.R. and M. Díaz. 1983. The allelopathic potential of pigeon pea in Puerto Rico. J. Agric. Univ. P.R. 67:450-455.

Liu, L. C. 1990. Weeds of tomatoes and methods for their control. p:34-36. In: Foro Técnico: Cultivo, producción y elaboración de tomate. Agric. Exp. Sta. Juana Diaz, Puerto Rico.

Liu, L. C., M. Antoni-Padilla, M.R. Goyal, and J. González-Ibáñez. 1987. Integrated weed management in transplanted tomatoes and peppers under drip irrigation. J. Agric. Univ. P. R. 71:349-358.

Semidey, N. 1995. Pigeon pea rotation reduces purple nutsedge population in tomato. Abtr. Ann. Meet. Puerto Rican Soc. Agric. Sci. p:22.

Semidey, N, L.E. Rivera and R. Medina. 1994. Weed management in a pigeon pea-tomato cropping system. Proceeding Caribbean Food Crop Soc. 30:273-276.

Talleyrand, H., R. Perez-Escolar, M.A. Lugo-López, and T.W. Scott. 1977. Utilization of N from crop residues in Oxisols and Ultisols. J. Agric. Univ. P. R. 61:450-455.