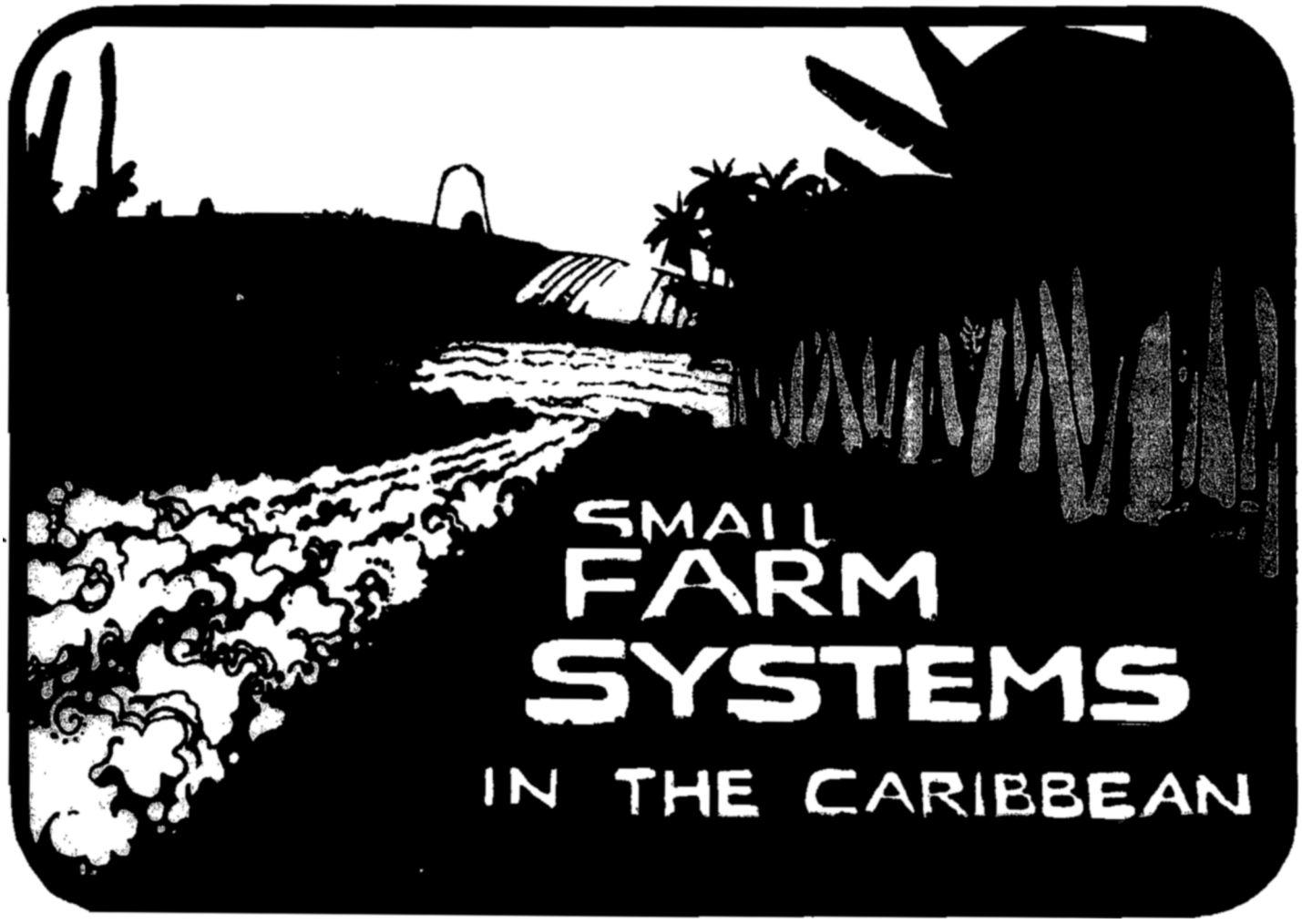
CARIBBEAN FOOD CROPS SOCIETY

Sociedad Caribeña de Cultivos Alimenticios
Association Caraïbe des Plantes Alimentaires

Vol. XX

PROCEEDINGS

OF THE 20th ANNUAL MEETING – ST. CROIX, U.S. VIRGIN ISLANDS – OCTOBER 21-26, 1984



Published by
THE EASTERN CARIBBEAN CENTER, COLLEGE OF THE VIRGIN ISLANDS *and* THE CARIBBEAN FOOD CROPS SOCIETY

Weed Competition in Transplanted Sweet Peppers

L. C. Liu J. González-Ibáñez Megh R. Goyal
Agricultural Experiment Sration, Mayaguez Campus
University of Puetto Rico, Venezuela Contract Starion
Río Piedras, Puerto Rico 00927

Two field experiments were conducted in 1983-84 at the Fortuna Research and Development Center, Puerto Rico, to determine the economic threshold of pigweed (*Amaranthus dubius*), jungle rice (*Echinochloa colonum*) and horse purslane (*Trianthema portulacastrum*) and their critical period of competition in drip irrigated peppers (*Capsicum annuum* L. var. Cubanelle). Pepper seedlings were 42 days old at transplanting. In the economic threshold study, weed populations were adjusted to 0, 2, 5, 10, 20, 40, 80 or 120 plants/m². In the critical period study, weeds were allowed to grow for 0, 12, 24, 36, 48 or 60 days after transplanting and were kept free until harvest. The economic threshold was found to be 2 to 5 plants/m² for pigweed; 5 to 10 plants/m² for jungle rice; and 20 plants/m² for horse purslane. The critical period of weed competition ranged from 24 to 36 days.
Keywords: Peppers; weeds; competition; economic threshold; critical period; drip/trickle irrigation.

Peppers are second only ro tomatoes among vegetables of economic impottance in Puerto Rico. Their commercial production in 1980-81 was 4,064 metric tons with a farm value of $2.1 million (Anon., 1981). In the same year, 2,245 metric tons of peppers were imported into Puerto Rico from the nearby Caribbean Basin and U.S. mainland ro meet rhe local demand. One of the major factors limiting local pepper production has been the high cost of labor required to control weeds. In Puerto Rico, Goyal (1983) found that weeding accounted for 27.1% of the labor in a non-mulched pepper field. Before mulching becomes a standard practice in pepper fields, we need ro know ro whar extent pepper plants tolerate weed competition without it significantly affecting their yield. In the States, Mendt and Monaco (1979) studied prickly sida (*Sida spinosa* L.) and cocklebur (*Xanthium pennsylvanicum* Wallroth) competition in transplanted peppers. They found that cocklebur reduced pepper yield, bur prickly sida did not. As these two weeds are not common to pepper fields in Puerto Rico, we directed out research efforts to specific weed-pepper competition found undet our conditions. Most of the published research on peppers in Puerto Rico has been confined to fertilization (Alers-Alers and Orego-Santiago, 1977; Rivera and Irizarry, 1984). Weed control data are scarce.

Two field expetîments on transplanted peppers were thus conducted at the Fortuna Research and Development Center, Juana Díaz, Puerto Rico during 1983 and 1984 ro determine the economic threshold of pigweed, jungle rice and horse purslane in peppers; and the crirical period of weed competition in peppers. Information of this nature can also be used as guidelines for an integrated weed control program.

MATERIALS AND METHODS

Experiment 1983

The experiment was conducted on a San Antón soil (30% sand, 35% silt, 35% clay, 17% organic matter, pH 7.1) at the Fortuna Research and Development Center, Juana Díaz near Ponce, located in the semi-arid tegion of Puetto Rico. The field was prepared by plowing and harrowing twice and partitioned into 3.1 × 3.7 m plots. Each plot consisted of 20 pepper plants arranged in four rows. The plant spacing was 0.3 m down rhe row. The layout of the experiment was a randomized complete block design with four replications. Forty-two day old pepper seedlings (var. Cubanelle) were transplanted on September 8, 1983 on both sides of a biwall drip line in a zigzag patrern at a distance of 15 cm from the drip line. The drip irrigation system described by Goyal (1983) was used in this study. The pepper plants received the first application of fertilizer (10-10-8) at the rate of 224 kg/ha on September 20, 1983 and a second application of the same fertilizer at the rate of 392 kg/ha one month later. Insect and disease control were achieved by spraying a recommended rate of Malathion once on September 20, 1983; Lannate twice on October 19 and 28, 1983; and Manzate once on November 18, 1983.

In the economic threshold study, individual weeds (pigweed, jungle rice and horse purslane) were adjusted by hand to 5, 10, 20, 40, 80, and 120 weeds/m², 21 days after transplanting. The populational densities were maintained until the last harvest by removal of excessive number of weeds. In the critical petiod, mixed weeds were removed by hand or hoe at 0, 12, 24, 36, 48 to 60 days after transplanting. The plots were kept weed-free theteafter. The gross income from different ttearments was calculated on the basis of a farm level price of $0.84/kg of peppers, using the marketable pepper yield from five pickings. The net terurn was obtained by deducting the cost of production as described by Lloréns et al. (1984). The experiment was terminated on December 27, 1983.

Experiment 1984

The first experiment was repeated on the same site during the summer of 1984. The same design and planting distance were used as in the previous experiment, with a minor modification. The modification consisted of the eliminarion of the 120 weeds/m² treatment and the addition of a 2 weeds/m² treatment in the economic threshold study. The 42-day old pepper seedlings (var. Cubanelle) were transplanted on March 1, 1984. The same weed adjustment and removal methods were adopted as in the winter experiment. The pepper plants received a first application of fertilizer at the rate of 224 kg/ha on March 23, 1984 and a second application of the same formula at 785 kg/ha on May 8, 1984. Pest control was achieved by applying recommended rates of Lannate twice (March 14, and April 19, 1984) and Kocide twice (April 13 and 18, 1984). Chlorotalonil, at a 0.5 kg/ha rate, was applied on May 25, 1984. Gross income from the peppers was

TABLE 1. The net return for peppers derived from different populational densities of three weeds.

Population densities	Net return per hectare (dollar)					
	Horse purslane		Jungle rice		Pigweed	
	1983	1984	1983	1984	1983	1984
0 plants/m^2 (control)	6,033 a[1]	5,452 a	2,011 a	6,466 a	1,146 a	7,830 a
2 "	--	4,087 ab	--	4,948 ab	--	-3,245 b
5 "	2,353 a	3,647 ab	-3,673 b	4,460 ab	-5,826 b	-2,741 b
10 "	2,366 a	3,445 ab	-5,086 bc	1,119 b	-6,111 b	-6,075 c
20 "	-381 b	1,660 bc	-5,416 bc	-2,048 c	-6,330 bc	-6,342 cd
40 "	-904 b	1,768 bc	-6,635 cd	-4,061 c	-8,204 c	-7,692 d
80 "	-859 b	-140 c	-7,421 d	-5,045 c	-8,332 c	-7,586 d
120 "	-1,201 b	--	-7,911 d	--	-8,318 c	--

[1]Means followed by the same letter or letters do not differ significantly at the 0.05 level.

calculated on the basis of a farm level price of $0.75/kg, using the marketable yield from five pickings. The net return was calculated as in the winter experiment. The experiment was terminated on June 25, 1984.

RESULTS AND DISCUSSION

Economic Threshold Study

Table 1 shows the net return for the peppers derived from different populational densities of three weeds. Statistical comparisons were made among the net returns derived from different weed densities and the control (0 plant/m^2). The economic threshold of horse purslane was 20 plants/m^2 for both 1983 and 1984; that of jungle rice was 5 plants/m^2 in 1983 and 10 plants/m^2 in 1984; that of pigweed was 5 plants/m^2 in 1983 and 2 plants/m^2 in 1984. The cost of producing Cubanelle peppers in Puerto Rico amounted to an average of $8, 959 per hectare (control plots). The results of the present study indicate that a horse purslane density of 20 plants/m^2 would leave a farmer with no net earnings from a pepper crop. Similarly, a jungle rice population of 5 plants/m^2 would incur economic losses to growers. A pigweed population as low as 2 plants/m^2 would be sufficient to cause financial predicament to local farmers.

Critical Period of Weed Competition Study

The predominant weed species in plots, listed in their decreasing order of abundance, were: pigweed (*Amaranthus dubius*), jungle rice (*Echinochloa colonum*), horse purslane (*Trianthema portulacastrum*), spiderflower (*Cleome gynandra*), crabgrass (*Digitaria sanguinalis*), goose grass (*Eleusine indica*), purslane (*Portulaca oleracea*), and sprangletop (*Leptochloa filiformis*). Table 2 shows that pepper yield was significantly reduced after 36 days of weed competition in 1983. The weed competition was even more severe in 1984 than in 1983 and yield was significantly reduced after only 24 days of weed competition. These results suggest that in pepper production weeds should be removed within 24 days, but no later than 36 days after transplanting.

TABLE 2. Effect of time of weed removal on yield of peppers grown in a San Antón soil.

Duration of weed competition	Yield of peppers (kg/ha)	
	1983	1984
0 day	15,380 a[1]	17,801 a
12 days	15,271 a	19,347 a
24 "	13,467 ab	14,342 b
36 "	10,524 b	11,250 c
48 "	4,706 c	6,042 d
60 "	895 d	4,689 d
All the time infested	81 d	743 e

[1]Means followed by the same letter or letters do not differ significantly at 0.05 level.

Acknowledgements

This research was funded through P.L. 89-808 Section 406 CSRS-USDA. The authors are thankful to Mr. Luis E. Rivera and Mr. Luis Torres-Correa for their assistance at different stages of this study.

References

1. Alers-Alers, S. and E. Orego-Santiago. 1977. Lack of response of sweet peppers to P levels, P placements and timing of N application in southern Puerto Rico J. Agric. Univ. P.R. 61(3):389-91.
2. Anonymous. 1981. Agricultural Statistics for 1980-81, Office of Statistics, Commonwealth of Pueno Rico.
3. Goyal, Megh R. 1983. Labor-input requirements for experimental production of summer peppers under drip irrigation. J. Agric. Univ. P.R. 67(1):22-27
4. Goyal, Megh R., R. Guadalupe-Luna, L.E. Rivera, and E.R. Hernández. 1984. Effects of plastic mulch types on crop performance of drip irrigated winter and summer peppers. J. Agric. Univ. P.R. 68(3):297-305.
5. Lloréns, E.A., E. González-Villafañe, and Daniel Vargas. 1984. Gastos e ingresos en la producción de hortalizas en la costa sue de P.R. Boletín de la Univ. P.R. (In press).
6. Mendt, R.A., and T.J. Monaco. 1979. Prickly sida and cocklebur interference in transplanted peppers. Proc. South Weed Sci. Soc. 32:149.
7. Rivera, E., and H. Irizarry. 1984. Effect of fertilization with phosphorus, sulfur and micronutrients on yields of peppers growing on an alkaline soil. J. Agric. Univ. P.R. 68(1):1-4.