Papaya performance unaffected by lateral shoot pruning[1,2]

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ABSTRACT

The practice of axillary shoot removal in young (3 to 4 mo) trees of papaya cultivar Puerto Rico 6-65 was examined in field experiments in 1993 and 1995 to determine whether or not subsequent performance is affected. No significant differences were observed between pruned and unpruned plants for flowering date, fruiting date, fruit yield, days to virus infection or virus severity. Significant differences were observed between years for all variables. In an unpruned papaya germplasm collection of 40 genotypes planted in 1993 and 1995, 17 (43%) had no lateral branch development, and 21 (53%) had a mean branch number of less than one per tree. Only two genotypes had a mean branch number greater than one per tree. The pruning of axillary shoots on young papaya plants apparently has no effect on flowering, fruiting or disease control. Most papaya genotypes produce few or no lateral branches when left unpruned. Any lateral branches that are produced can be removed at the time of the first harvest.

Key words: *Carica papaya,* lateral branches, pruning

RESUMEN

Poda de brotes laterales no afecta el comportamiento de la papaya

En experimentos de campo en 1993 y 1995 se examinó la práctica de remover los brotes laterales de arboles jovenes (3 a 4 meses) de papaya, cultivar Puerto Rico 6-65, para determinar si se afecta el comportamiento posterior del cultivo. No se observaron diferencias significativas entre árboles podados y no podados para la fecha de floración, fecha de primera cosecha, días a infección por virus o severidad de infección viral. Las diferencias entre años fueron significativas para todas las variables. En una colección de 40 genotipos de papaya sin podar, sembrada en 1993 y 1995, 17 (43%) no desarrollaron ninguna rama lateral y 21 (53%) tuvieron un promedio de menos de una rama lateral por árbol. Solo dos genotipos tuvieron un promedio mayor de una rama lateral por árbol. La poda de los brotes laterales en plantas jóvenes de papaya aparentemente no afecta la floración, producción de frutas o control de enfermedades. La mayoría de los genotipos de papaya producen pocas o ningunas ramas laterales cuando no se

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podan. Se puede remover cualquier rama que el árbol tenga al momento de la primera cosecha.

INTRODUCTION

Papaya (*Carica papaya* L.) is a tropical perennial fruit with a semi-woody trunk which may reach a height of 6 m or more. It is typically unbranched, but trunks of young (3 to 4 mo) papaya trees have abundant axillary shoots, most of which cease to grow unless apical dominance is removed. Pruning is a horticultural procedure routinely used in the production of many fruits (Mieke et al., 1991). In Puerto Rico the pruning of lateral shoots in young papaya plants is commonly practiced by growers.[4] Purported benefits include earlier flowering and fruiting, enhanced insect and disease control due to increased air circulation and pesticide penetration of the plant canopy, and prevention of lateral branch development.

Since removal of lateral shoots in young papaya plants represents an additional agricultural operation which increases the cost of production, this practice has been questioned by some growers. This experiment was designed to examine the effects, if any, of lateral shoot pruning on subsequent performance of papaya in the field. A separate unpruned papaya germplasm experiment was used to determine the effect of genotype on lateral branch number.

MATERIALS AND METHODS

The pruning experiment was conducted with the commercial cultivar Puerto Rico 6-65. Seeds were sown in the greenhouse 1 February 1993 for the first planting and 16 March 1995 for the second planting. Plants were transplanted to the field at the Lajas Experiment Station 7 April 1993 and 22 May 1995 for the respective plantings. Plant spacing was 1.52 m within the row and 3.7 m between rows. The soil is Fraternidad clay (Typic Haplusterts, very fine, montmorillonitic isohyperthermic), with a pH of 6.7, 3.50 mg/kg P and 0.51, 18.33 and 15.84 cmol/kg K, Ca and Mg, respectively. Mean annual rainfall is 1,100 mm. Normal management practices for papaya production were followed (Agric. Exp. Sta., 1987), and malathion 25% WP[5] was applied weekly at a rate of 1.1 kg ai/ha.

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[5]Trade names in this publication are used only to provide specific information. Mention of a trade name does not constitute a warranty of equipment or 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.

A randomized complete block design was used, with five trees per experimental unit and 12 replications. Treatments were pruning or no pruning of lateral shoots, at four months of age. Data were recorded for days to anthesis, days to fruiting, fruit yield, days to virus infection and virus score. Days to virus infection was calculated as the number of days from seed sowing to appearance of the first virus symptoms. Virus score was evaluated visually 448 days after sowing (25 April 1994) for the 1993 planting, and 445 days after sowing (3 June on 1996) for the 1995 planting, on a scale of 1 to 9 where 1 = no symptoms; 3 = leaves normal size and shape, little distortion or mottling, fruit set normal; 5 = leaf size reduced, moderate distortion and/or mottling, fruit set reduced; 7 = leaf size reduced ≈ 50%, distortion and/or mottling, little or no fruit set; and 9 = leaf size severely reduced, severe distortion and/or mottling, no fruit set, eventual death. Enzyme linked immunosorbent assay (ELISA) was used to confirm the presence of papaya ringspot virus in a random sample of symptomatic plants. Data were subjected to analyses of variance to examine differences between pruning treatments and years.

A separate papaya germplasm experiment was used to determine the effect of plant genotype on lateral branch development. This experiment consisted of field plantings in 1993 and 1995 of 40 papaya genotypes replicated three times in a randomized complete block design. Experimental units consisted of four plants. Planting dates, plant spacing and management were the same as previously described. No pruning of lateral shoots was practiced in this experiment. The number of actively growing lateral branches was determined for each tree at 420 days after sowing for the 1993 planting, and at 368 days after sowing for the 1995 planting. Dormant spurs were not counted.

RESULTS AND DISCUSSION

Significant differences between years were observed for days to anthesis, days to fruiting, fruit yield, days to virus infection and virus score. Pruning of lateral shoots, however, had no effect on any of the measured variables (Table 1). Promotion of earlier flowering and fruiting, one of the main reasons axillary shoot removal is practiced, was not observed in the pruned plants. Likewise, there was no significant difference in fruit yield between pruned and unpruned plants.

Despite weekly application of malathion, all plants exhibited symptoms of virus infection by 409 d after sowing for the 1993 planting, and by 416 d after sowing for the 1995 planting. Pruning had no effect on days to virus infection or virus score. If pruning of lateral shoots had been effective in enhancing control of aphid vectors of virus, the virus-

TABLE 1.—*Effect of lateral shoot pruning on days to anthesis, days to fruiting, fruit yield, days to virus infection and virus score in papaya cultivar Puerto Rico 6-65 planted at Lajas, Puerto Rico, in 1993 and 1995.*[1]

Variable	Year	Treatment	
		Pruning	No pruning
Days to anthesis	1993	139.6	138.2
	1995	109.2	110.3
Days to fruiting	1993	278.5	283.2
	1995	272.2	272.1
Fruit yield (t/ha)	1993	81	76
	1995	68	72
Days to virus infection	1993	389.1	390.1
	1995	362.7	369.4
Virus score[2]	1993	7.0	7.0
	1995	7.5	7.6

[1]Significant differences were observed between years for all variables ($P \leq 0.1$ for fruit yield, $P \leq 0.05$ for all other variables); however, none of the differences between pruning treatments are statistically significant.

[2]Plants were visually evaluated for virus symptoms with a scale of 1 (highly resistant) to 9 (highly susceptible).

free period logically would have been extended in pruned plants, and the virus score would also have been lower, since symptoms become more severe the longer plants have been infected.

Lateral branching in papaya is undesirable because fruits formed on these branches are smaller and mature later than fruits on the main trunk. Furthermore, lateral branches may interfere with machinery and harvesting operations, and are prone to breakage when subjected to a heavy fruit load. In these experiments, the formation of lateral branches from axillary shoots present in unpruned young plants of Puerto Rico 6-65 rarely occurred. Of the 60 unpruned plants in each experiment, four (6.7%) produced one or two lateral branches in the 1993 planting, and 11 (18.3%) had a mean of two branches in 1995. In adjacent plantings of the same cultivar, only two of 36 (5.6%) unpruned plants produced one or two branches in 1993, and four of 47 (8.5%) had a mean of 2.5 branches in the 1995 planting.

Lateral branch production may be affected by papaya genotype (Table 2). Of the 40 genotypes evaluated for this trait, 17 (43%) had no lateral branch development and 21 (53%) had a mean branch number of less than one per tree. Two genotypes, Villalba and Honey Gold, had a mean branch number of greater than one per tree. Villalba had prolific branching, with up to five fruit bearing branches in addition to the

TABLE 2.—*Genotype, origin, mean lateral branch number (± standard error), and number of papaya plants evaluated in 1993 and 1995 field plantings at Lajas, Puerto Rico.*

Genotype	Origin	Mean ± SE	No.
Villalba	Puerto Rico (USA)	1.6 ± 0.3	23
Honey Gold	South Africa	1.1 ± 0.3	22
Solo 40	Hawaii (USA)	0.9 ± 0.3	21
HCAR 60	Nigeria	0.9 ± 0.3	22
Higgins	Hawaii (USA)	0.9 ± 0.3	19
Line 2	Hawaii (USA)	0.8 ± 0.2	21
Ostrem 370	Hawaii (USA)	0.7 ± 0.3	23
Paco	Puerto Rico (USA)	0.6 ± 0.3	18
HCAR 62	Nigeria	0.5 ± 0.3	20
HCAR 78	Nigeria	0.5 ± 0.3	19
Yuen Nong No. 1	China	0.4 ± 0.3	21
HCAR 65	Nigeria	0.4 ± 0.3	17
HCAR 59	Nigeria	0.3 ± 0.1	16
HCAR 64	Nigeria	0.3 ± 0.2	19
Cartagena	Dominican Republic	0.3 ± 0.2	20
HCAR 201	Unknown	0.2 ± 0.1	22
Sunrise	Hawaii (USA)	0.2 ± 0.1	17
Rafael	Puerto Rico (USA)	0.1 ± 0.1	15
HCAR 77	Nigeria	0.1 ± 0.1	20
HCAR 30	Thailand	0.1 ± 0.1	24
Puerto Rico 6-65 Dwarf	Puerto Rico (USA)	0.1 ± 0.1	18
Kaek Dum	Thailand	0.1 ± 0.1	16
HCAR 82	Unknown	0.1 ± 0.1	18
Puerto Rico 6-65	Puerto Rico (USA)	0.0 ± 0.0	22
Tainung No. 5	Taiwan	0.0 ± 0.0	22
HCAR 80	Unknown	0.0 ± 0.0	24
HCAR 1	Unknown	0.0 ± 0.0	22
HCAR 184	Hawaii (USA)	0.0 ± 0.0	19
HCAR 79	Unknown	0.0 ± 0.0	18
HCAR 36	Unknown	0.0 ± 0.0	16
Honey Dew	Unknown	0.0 ± 0.0	23
Giant Panama Eet	Panama	0.0 ± 0.0	20
Khag Naun	Thailand	0.0 ± 0.0	15
Tommy	Puerto Rico (USA)	0.0 ± 0.0	24
HCAR 48	Nigeria	0.0 ± 0.0	20
HCAR 186	Unknown	0.0 ± 0.0	12
HCAR 185	Unknown	0.0 ± 0.0	22
Cariflora	Florida (USA)	0.0 ± 0.0	24
HCAR 81	Unknown	0.0 ± 0.0	21
Washington 5	India	0.0 ± 0.0	24
LSD ($P \leq 0.05$)		0.5	

main trunk. Puerto Rico 6-65 did not produce branches in this experiment.

The data suggest that the pruning of axillary shoots on young papaya plants is an operation that has no apparent effect on flowering, fruiting or disease control. In addition to increasing the cost of production, the pruning operation decreases photosynthetic area in the young plant and creates wounds which could allow pathogen entry. Most papaya genotypes produce few or no lateral branches when left unpruned. Any lateral branches that are produced can be removed at the time of the first harvest.

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