

OBSERVATIONS ON GROWTH AND YIELD OF PAPAYA IN NORTH CENTRAL FLORIDA

J. J. FERGUSON  
Horticultural Sciences Department  
University of Florida, IFAS  
Gainesville, FL 32611-0690

J. H. CRANE  
Tropical Research and Education Center  
University of Florida, IFAS  
Homestead, FL 33031-3314

Additional index words. *Carica papaya*, alternative crops.

**Abstract.** Papaya production, generally limited to southern Florida, has limited potential as an annual crop in north central Florida if large plants, started in the greenhouse, are transplanted to the field in the early spring. Papaya plants (*Carica papaya* L. ‘Cariflora’), started in the greenhouse in Dec., 1995 and 1996, were transplanted to the field in Gainesville in the spring and harvested in late fall. From Apr. to Nov. of each year mean diameter of 18 plants increased from 15 to 157 mm in 1995 and from 20 to 145 mm in 1996; plant height increased from 44 to 265 cm in 1995 and from 51 to 270 cm in 1996. An average of 32 and 25% of fruit set per tree by Sept. reached 50% color break and were harvested in 1995 and 1996, respectively. Harvested fruit weight averaged 1.3 and 1.6 kg per plant in 1995 and 1996, respectively. As temperatures decreased from approximately 26C in October to 10C in Nov., total soluble solids decreased. Plants continued to blossom throughout Nov. and Dec. of each year until temperatures dropped below 0C when cold damage occurred.

Approximately 202 ha of papaya are grown in Florida, primarily in Dade County because of the long growing season and favorable temperatures in this area (Crane et al., 1997). Commercial papaya production worldwide ranges from 15 to 25 MT per ha (Martin, 1984) and in Florida is approximately 33.6 MT per ha (Crane et al., 1995). However, even in tropical areas, trees are commercially productive for only 1-3 years because of various diseases like papaya ringspot virus and bunchy top. Papaya production, especially as a small scale, alternative crop, may be possible in more northern areas of Florida if fruit can be harvested before low temperatures reduce sugar content or cause freeze damage. Furthermore, fruit can be harvested 7-10 months from seeding; relatively few papaya diseases and pests occur in north central Florida; cultivars like ‘Cariflora’ that are also somewhat tolerant to papaya ringspot virus (Crane et al., 1995) are available. Our purpose was to make initial observations on the growth, yield, and total soluble solids (TSS) of papaya (*Carica papaya* L. ‘Cariflora’), started in the greenhouse in Dec., and planted in the field in late spring in Gainesville.

Materials and Methods

Fruit of ‘Cariflora’ papaya were harvested in Homestead, Florida in Nov., 1994 and 1995 from open pollinated plant-

ings in isolated locations to ensure trueness-to-type, as far as possible. Seeds were extracted from fruit and planted in trays in the greenhouse in Dec. of each year in Metro-Mix 300 (Scotts-Sierra Horticultural Products Co., Marysville, Ohio 43041). Minimum greenhouse temperatures were maintained throughout at 29C. Seeds germinated within 2 weeks and were transplanted to 4-liter pots approximately 5 weeks after seed was sown. When plants reached approximately 20-cm in height, they were transplanted to 19-liter pots approximately 8 weeks after seeds were planted. Plants were fertilized twice weekly with a dilute Peters® nutrient solution (20-8.8-16.6) and were watered every other day. In 1995, 12-week old plants, approximately 48-cm tall were transplanted to the field on Mar. 1 and in 1996, 16-week old plants, approximately 56-cm tall were transplanted to the field in Gainesville on Apr. 1, a month later than in 1995 because of cooler spring temperatures. The same site (Arredondo fine sand, loamy, siliceous, hyperthermic Grossarenic Paleudults) was used in both years. In each year one row of papaya plants was interplanted at an 2.4 × 3-m spacing. Since this cultivar is dioecious, producing both male and female plants, three papaya plants were planted 20-cm apart in each of the 18 planting sites and later thinned after blossoming to a 9: 1 female:male ratio. Plants were set approximately 20-cm lower than pot soil level to avoid tree lodging under heavy fruit set. Two weeks after planting and every 2 weeks thereafter 0.45-kg of a granular 6-2.6-4.9 fertilizer with minors was applied within the dripline (Crane et al., 1997). Plants were irrigated 2-3× per week for 2-hours per irrigation with microsprinklers applying 38-liters per hour. After spring planting and in Nov. of each year, stem caliper 20-cm from the soil and plant height were recorded. In Sept. of each year the number of fruit per tree and fruiting height were measured. Ripening fruit were harvested at 50% color break and stored at 22C temperature for 3 days. Fruit weight and TSS were then determined using a Reichert 10430 hand refractometer (Buffalo, N.Y.) Climatological data were obtained from the Weather Office, Agronomy Department, University of Florida, Gainesville.

Results and Discussion

‘Cariflora’ is a dioecious cultivar. For commercial production, two to three plants per site are grown until sex can be determined by flowering. Plants are then thinned to one per site, allowing one male plant to 10 to 20 female plants. However, when ‘Cariflora’ seedlings were grown in the greenhouse from Nov. to Mar. or Apr. under optimum conditions, flowering and even some fruit set occurred, possibly requir-

Table 1. ‘Cariflora’ papaya growth in north central Florida.

3/95	11/95	4/96	11/96	3/95	11/95	4/96	11/96
Stem Diameter (mm)				Tree Height (cm)			
15.1	156.9	20.7	145.0	44.4	265.0	51.2	270.2
±1.9	±44.5	±4.7	±28.5	±10.0	±40.0	±9.2	±38.4

Mean of 18 plants.

Florida Agricultural Experiment Station Journal Series No. N-01447.

Table 2. 'Cariflora' papaya yield in north central Florida.\*

Fruit/tree		Fruit harvested (% of total fruit produced)		Weight of harvested fruit (kg)		Fruiting height (cm)	
9/95	9/96	1995	1996	1995	1996	9/95	9/96
72 ± 28	27 ± 17	34.5 ± 13.4	26.7 ± 22.8	1.36 ± 0.31	1.36 ± 0.62	52.4 ± 11.0	52.0 ± 23.0
*30-134	8-60	18-65	7-71	0.70-1.41	0.81-2.4	30-65	30-90

\*Mean of 18 trees.

\*Height of first fruit from soil level.

\*Range.

ing only one sexed plant per site. From Apr. to Nov. of each year, mean diameter of 18 plants increased from 15 to 157 mm in 1995 and from 20 to 145 mm in 1996; plant height increased from 44 to 265 cm in 1995 and from 51 to 270 cm in 1996 (Table 1). Cooler average temperatures during Mar., 1996 (17C) than Mar., 1995 (21C) as well as the potential for March freezes in Gainesville postponed planting a month later than in 1995. By Sept., 1995 an average of 72 fruit per tree had set, compared with 27 fruit per tree in Sept., 1996. Commercial yields vary from 30 to 150 fruits per tree per year (Purseglove, 1968). An average of 35% (25 fruit) and 28% (8 fruit) of fruit set per tree by Sept. reached 50% color break and were harvested from Oct. to Dec. in 1995 and 1996, respectively. The number of fruit harvested each year were similar. Fruit weight and fruiting height were also similar in both years (Table 2). The original cultivar release of 'Cariflora' by Conover et al. (1986) reported fruit weight ranging from 0.65 to 0.75 kg, compared to the 0.70 to 2.4 kg range in this experiment, probably resulting from outcrossing in the nursery. As average and minimum temperatures decreased from Oct. to Dec., TSS of 5 to 10 fruit with at least 50% color break harvested each week from the entire planting also decreased from 11 to 7% in 1995 and from 10 to 7% in 1996 (Table 3). Conover et al., (1986) however, reported that TSS of 'Cariflora' papaya in south Florida averages 9.5-10.8%.

Plants continued to blossom until temperatures dropped below 0 C when cold damage occurred to leaves, fruit and eventually the trunk. Soil banking to a height of three feet did not protect trunks within the bank from cold damage in 1995 when minimum ambient temperatures were as low as -1 C. Four to five of the 18 trees planted each year lodged due to heavy fruit load but continued to mature fruit. Planting deeper than 20-cm may prevent this problem. Few, if any nutrient deficiencies, insect or disease damage were served. Although relatively high fertilization rates were used to optimize growth, further research could determine minimum fertilization rates under north central Florida conditions.

Several growers in Alachua county are currently producing 'Cariflora' and 'Red Lady' cultivars with limited success, either as greenhouse crops or as greenhouse grown seedlings transplanted to the field. Other commercial papaya cultivars as well as short season cultivars of other crops like cassava

Table 3. Temperatures and TSS\* of 'Cariflora' papaya in north central Florida.

Preceding 7 days	1995			1996		
	Temperature (C)		TSS (%)	Temperature (C)		TSS (%)
	Mean	Minimum		Mean	Minimum	
7 Oct.	27	21	11	23	16	10
14 Oct.	26	21	9	19	11	10
21 Oct.	21	11	9	19	2	10
28 Oct.	20	4	8	22	7	9
4 Nov.	21	8	8	20	2	7
14 Nov.	14	2	no harvest	14	-1	9
21 Nov.	12	-1	7.5	18	10	8.5
28 Nov.	13	-2	7	16	2	9
7 Dec.	17	6	6	14	1	7
14 Dec.	13	-6	7	13	-1	no harvest
21 Dec.	17	-3	no harvest	99	-5	no harvest
28 Dec.	5	-7	no harvest	16	4	no harvest

\*Mean of 5-10 fruit with 50% color break harvested each week.

should be evaluated for greenhouse and field production in this area, especially in terms of precocity, TSS, and fruit size. As an alternative, commercial, annual crop for north central Florida, papaya production would require greenhouse facilities at least during the winter for seedling germination and early growth and for sustained production of saleable fruit during the late fall. Production of 4-5 month old potted plants of monoecious or even dioecious cultivars as a nursery crop for sale to homeowners also has potential.

### Literature Cited

- Conover, R. R., E. Litz and S. E. Malo. 1986. 'Cariflora', a papaya ringspot-tolerant papaya for South Florida and the Caribbean. HortScience 21(4):1072.
- Crane, J. H., A. J. Dorey, B. A. Schaffer and R. T. McMillan, Jr. 1995. Comparison of papaya ringspot virus effects on 23 cultivars and 18 selections of papaya (*Carica papaya*) in South Florida. Proc. Fla. State Hort. Soc. 108:354-357.
- Crane, J. H., M. B. Thomas and J. J. Ferguson. 1997. Fertilizer recommendations for Florida papaya. Citrus Veg. Mag. 62:34-36.
- Martin, F. W. 1984. Handbook of tropical food crops. CRC Press. Boca Raton.
- Purseglove, J. W. 1968. Tropical crops: dicotyledons. John Wiley & Sons, New York.