

PRODUCTION, FRUIT QUALITY, NUTRITIONAL VALUE, AND CONSUMER PREFERENCE OF SPAGHETTI SQUASH¹

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Abstract. Spaghetti squash (*Cucurbita pepo* L.) 'Vegetable' and 'Hasta La Pasta' were evaluated for yield, fruit quality, and consumer preference during the fall of 1997 at the Indian River Research and Education Center (IRREC) in Ft. Pierce. Fruit number per acre was not significantly different between varieties. 'Vegetable' spaghetti squash had significantly higher fruit yield (lb/acre) and average fruit size (lb/fruit) than 'Hasta La Pasta'. A fruit quality preference study was conducted based on at a local supermarket. 'Hasta La Pasta' was preferred to the traditional 'Vegetable' type based on appearance, taste, and texture. Of the 58 consumers polled, 66% indicated they would purchase the 'Hasta La Pasta' as compared to only 28% for 'Vegetable' variety. In the spring 1998 trial, a with-in row spacing (WRS) (18 in vs. 24 in) trial was conducted at the IRREC-Ft. Pierce. Fruit yields were similar between WRS. 'Hasta La Pasta' had more fruit that were smaller in size than 'Vegetable'. However, total fruit yields (lb/acre) were similar between varieties. Fruit sugar content did not differ between varieties. However, total carotenoids (an indication of Vitamin A content) were significantly higher for 'Hasta La Pasta' than 'Vegetable' spaghetti squash. Based on yields, nutritional value, and particularly consumer preference, 'Hasta La Pasta' would be a viable spaghetti squash type for Florida's conditions.

Introduction

Variety trials are of great importance to growers, seed companies, researchers, and extension personnel. However, spaghetti squash (*Cucurbita pepo* L.) variety trials are seldom conducted in Florida. Variety selection is one of the most important decisions a grower must make (Stoffella et al., 1985). Developing new kinds and types of vegetable crops may be beneficial to both the grower and the consumer. Diversification of vegetable crops may expand a grower's market, simultaneously increase a consumer's choice of vegetables, and improve nutritional value.

Spaghetti squash are typically grown as a winter squash. The 'Vegetable' spaghetti squash variety is characterized as having cylindrical fruit. Fruit produced on this vining plant are four to five inches in diameter and eight to nine inches long with rounded ends and have an off-white flesh or 'spaghetti' appearance. The rind is hard and is ivory or muted yellow

low in color at maturity which is approximately 90 days after seeding. In the early nineties, Burpee Seed Company developed an 'orange type' of spaghetti squash named 'Hasta La Pasta'. The 'Hasta La Pasta' spaghetti squash is characterized as a unique variety produced on a compact bush plant that features small, oblong fruit 7 to 8 inches long with a rich orange flesh (Anonymous, 1996). The rind has a deep orange color at maturity, which is approximately 85 days after seeding. Producers and consumers share minimal knowledge on differences among spaghetti squash types. Beany and Stoffella (1997) reported a greater preference by consumers for the vegetable type as compared with the orange type of spaghetti squash. The purpose of this investigation was to evaluate the production, yield differences, nutritional value, and consumer preferences of these two spaghetti squash varieties.

Materials and Methods

The trials were conducted at the Indian River Research and Education Center, Fort Pierce, FL during the fall of 1997 and the spring of 1998. Soil type was an Oldsmar fine sand (sandy, siliceous, hyperthermic Alfic Arenic Haplaquods). Raised beds, 8 inches high and 44 inches wide, were spaced on 7-ft centers during the fall of 1997 and 21-ft centers during the spring of 1998. A fertilizer consisting of 27N-48P-22K lb/acre was incorporated into the beds. Additional fertilizer, 103N-67P-202K lb/acre, was applied to the bed surface in two bands, 24 inches apart and 1 inch deep, in grooves on each bed shoulder. Beds were covered with a white polyethylene mulch.

Throughout the growing seasons, subsurface irrigation maintained the water level at about 14 inches below the soil surface. Applications of insecticides and fungicides were made on a weekly basis for control of insects and diseases. Paraquat was used to control weeds between the beds. All pesticides were applied according to recommended label instructions.

During the fall of 1997, 'Vegetable' and 'Hasta La Pasta' spaghetti squash seeds were sown in hills 24 inches apart (Hammer and Stoffella, 1996) with 3 seeds/hill. Seeding and harvesting dates and days to harvest are presented in Table 1. Hills were thinned to one plant per hill 21 days after seeding. Plots were 60 ft long and consisted of 30 plants each, equivalent to 3,112 plants per acre. Each variety was replicated four times in a randomized complete block design.

Table 1. Seeding, harvesting dates, and number of days to harvest of 'Vegetable' and 'Hasta La Pasta' spaghetti squash.

Variety	Date		Days to Harvest
	Seeded	Harvested	
	Fall 1997		
'Vegetable'	August 4	November 10	98
'Hasta La Pasta'	August 4	November 10	98
	Spring 1998		
'Vegetable'	March 18	June 9	83
'Hasta La Pasta'	March 18	June 26	100

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The center 20 plants of each 30-plant plot were harvested once. Fruit from each plot were counted and weighed. Mean fruit yields were calculated on a per plant and per acre basis. Mean fruit size (lb/fruit) was calculated for each plot. Each variable was subjected to an analysis of variance. Statistical analyses were conducted using the Statistical Analysis System (SAS) computer program (SAS Institute, 1988).

Harvested marketable fruit for each variety were marketed at a local supermarket. The researcher and a hostess conducted an in-store promotion with special signs, labels, and microwave-cooked samples for tasting. Consumers completed an appearance, taste, and textures survey after sampling each variety of spaghetti squash and were offered recipes (Beany and Stoffella, 1997).

During the spring of 1998, 'Vegetable' and 'Hasta La Pasta' spaghetti squash seeds were sown in hills 18 and 24 inches apart (Hamner and Stoffella, 1996) with 3 seeds/hill. Seeding and harvesting dates and days to harvest are presented in Table 1. Hills were thinned to one plant per hill 21 days after seeding. Plots were 22.5 ft long at 18 in with-in row spacing (WRS) and 30 ft long at 24 in WRS. Plots consisted of 15 plants each, equivalent to 1,383 plants per acre at 18 in WRS and 1,037 plants per acre at 24 in WRS. Each variety was replicated four times in a split-plot experimental design.

The center 10 plants of each 15-plant plot were harvested once. Fruit from each plot were counted and weighed. Mean fruit yields were calculated on a per plant and per acre basis. Mean fruit size (lb/fruit) was calculated for each plot. Each variable was subjected to an analysis of variance. Since WRS*VAR interactions for all variables were nonsignificant, only main effects of WRS and varieties are presented. Means of main effects were subjected to an F-test. Statistical analyses were conducted using the Statistical Analysis System (SAS) computer program (SAS Institute, 1988).

A compositional sugar analysis was conducted on fruit from each variety. Individual fruit were peeled, longitudinally cut in half, and uniformly grated over the entire surface to a depth of about 5-mm. The grated tissue from each of the six individual fruit replications was used for the compositional analysis. Exactly 10.0 g of randomly selected tissue was homogenized in 80% ethanol for 1 minute at high speed using a Virtis homogenizer. The resulting slurry was immediately boiled for 15 minutes, cooled and filtered through Whatman #4 paper; the residue and original container were washed with an additional 80% ethanol and made to a final volume of 100 ml. About 5 ml were filtered through a 0.45 µ filter membrane before HPLC analysis using a Bio-Sil Amino 55 resin column (Bio-Rad Labr.) following the procedure of Picha (1985).

Total carotenoids were determined using a slight modification of the procedure of Reddy and Sistrunk (1980). Exactly 0.100 g tissue was extracted until colorless with 10 ml hexane using a Thomas E-40 tissue grinder (A. H. Thomas Co., Philadelphia, PA). Samples were filtered through Whatman #1 paper and the absorbance read at 440 nm and compared to a beta-carotene standard curve. Total carotenoids were expressed on a fresh weight basis (mg/100 g).

Results and Discussion

Fall 1997 Production Trial

The vining 'Vegetable' variety was intermingling with plants in neighboring beds and between beds. The compact-bush 'Hasta La Pasta' variety maintained its fruit on the bed

Table 2. Fall 1997 spaghetti squash yields and fruit size as influenced by variety.

Variety	Fruit yield		Fruit Size (lb/fruit)
	No./acre	lb/acre	
'Vegetable'	9,762	30,784	3.15
'Hasta La Pasta'	9,685	16,151	1.67
Significance ²	NS	**	**

²Nonsignificant (NS) or significant at the 1%(**) level, respectively.

with few fruit between beds. Typically, the 'Vegetable' variety matures in 100 days and the 'Hasta La Pasta' in 80 days (Anonymous, 1996). Beany and Stoffella (1997) reported that the 'Vegetable' variety matured in 85 days and the 'Hasta La Pasta' in 81 days during the spring. In this trial, both varieties matured in 98 days.

Marketable fruit yields per acre were significantly higher for 'Vegetable' (30,784 lb/acre) than for 'Hasta La Pasta' (16,151 lb/acre) (Table 2). Marketable number of fruit per acre was not significantly different between varieties. Mean fruit size (lb/fruit) was significantly lower for 'Hasta La Pasta' than 'Vegetable' squash.

Spring 1998 Production Trial

The vining 'Vegetable' variety did not intermingle with plants in neighboring beds, 21 ft apart, as in the fall trial (7 ft apart). With-in row spacing was manipulated to determine if this would affect the vining habit associated with the 'Vegetable' variety and ultimately the yields of either variety.

In contrast to the fall trial, the 'Vegetable' variety matured in 83 days and the 'Hasta La Pasta' variety matured in 100 days.

Within the main effect of variety, marketable number of fruit per acre was significantly higher for 'Hasta La Pasta' (8,262) than for 'Vegetable' (5,471) with no significant difference in marketable pounds of fruit per acre (Table 3). Mean fruit size (lb/fruit) was significantly lower for 'Hasta La Pasta' squash. Neither WRS nor the interaction of WRS*variety were significantly different for each measured yield trait (Table 3).

During the trials, both varieties exhibited minimal rind/flesh damage from the melonworm [*Dinphania hyalinata* (L.)] and exterior fruit discoloration just prior to harvest. However, percent cull fruit did not differ among varieties (Data not shown).

Table 3. Spring 1998 spaghetti squash yields and fruit size as influenced by variety and with-in row spacing.

Main effect	Fruit yield		Fruit size (lb/fruit)
	No./acre	lb/acre	
Variety (VAR)			
'Vegetable'	5,471	18,261	3.34
'Hasta La Pasta'	8,262	16,451	2.00
Significance ²	**	NS	**
With-in row spacing (WRS) (inches)			
18	7,278	17,765	2.57
24	6,455	16,947	2.77
Significance ²	NS	NS	NS
WRS*VAR	NS	NS	NS

²Nonsignificant (NS) or significant at the 1%(**) level, respectively.

Table 4. Consumer quality preference of 'Vegetable' and 'Hasta La Pasta' spaghetti squash during Fall 1997.^a

Quality attribute	'Vegetable'	'Hasta La Pasta'	Neither
	%		
Appearance	17.2	77.6	5.2
Taste	22.4	67.2	10.4
Texture	20.7	55.2	24.1
Purchase	27.6	65.5	6.9

^aTotal of 58 consumer responses.

Consumer Preference Evaluation

In a side-by-side taste test, consumers indicated that the appearance, taste, and texture of the orange type squash, 'Hasta La Pasta' was more desirable than that of the pale yellow 'Vegetable' squash (Table 4). Of the consumers surveyed, 65.5% indicated they would purchase the 'Hasta La Pasta' squash as compared with the 'Vegetable' squash.

Compositional Analysis

Sugar composition (% fructose, glucose, sucrose, and total sugar) was similar between 'Vegetable' and 'Hasta La Pasta' spaghetti squash (Table 5). Total carotenoids are an indication of beta-carotene content (Purcell, 1962) which is the precursor of Vitamin A (RDA, 1980). 'Hasta La Pasta' had a significantly higher total carotenoid content than 'Vegetable' spaghetti squash (Table 5). This suggests that 'Hasta La Pasta' may have a higher Vitamin A content than 'Vegetable' spaghetti squash.

Conclusions

These results suggest that 'Hasta La Pasta' can be grown successfully under Florida's environmental conditions and are preferred by consumers over the traditional 'Vegetable' spaghetti squash. Compositional fruit analysis suggests that

Table 5. Sugar composition and total carotenoid content of two spaghetti squash varieties.

Variety	Fructose	Glucose	Sucrose	Total Sugar	Total carotenoid (mg/100g)
	%				
'Vegetable'	0.81	0.90	0.36	2.06	0.38
'Hasta La Pasta'	0.73	1.00	0.23	1.96	1.82
Significance ^a	NS	NS	NS	NS	**

^aNonsignificant (NS) or significant at the 1% (**) level, respectively.

'Hasta La Pasta' may have a higher nutritional (Vitamin A) content than 'Vegetable' spaghetti squash. Additional nutritional research is needed on spaghetti squash, not only on beta-carotene, but also on other vitamins and minerals.

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