



Snap Bean Variety Evaluation on Yield and Postharvest Quality in Florida Sandy and Muck Soils

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ADDITIONAL INDEX WORDS. snap beans, pods, variety trials, bean yield

Florida ranks first nationally in the production, acreage, and total value of fresh market snap beans (*Phaseolus vulgaris* L.) with approximately 36% of the total U.S. market with 32,200 acres with a volume of 6,440 million bushels (30-lb bushel) at a market value of \$135 million in the 2009–2010 season. High yield and deep green pod color are the main characteristics to the Florida snap bean industry. The objectives of these trials were to update the Florida snap bean varieties recommendations. Two snap bean variety trials were conducted in fall 2010 in sandy (Myakka City, FL) and muck (Belle Glade, FL) soils evaluating 13 and 11 snap bean varieties, respectively. Data collection at Myakka City consisted of total marketable and unmarketable yields, pod size, fresh pod weight, color, and soluble solids. At Belle Glade, only marketable yield and pod size were measured. Weather conditions during the trials were cold to cool with four freeze events at Myakka City and no freeze events at Belle Glade. In Myakka City, ‘Ambra’, ‘Bronco’, ‘Carlo’, ‘Dusky’, ‘Eureka’, and ‘Prevail’ had the highest yields, but not the deepest green color. At Belle Glade, ‘Bronco’, ‘Caprice’, ‘Carlo’, ‘Eureka’, ‘Prevail’, and ‘Valentino’ had higher yields among the varieties evaluated. Based on marketable yield and color, no single variety outperformed the others in the most favorable categories.

Florida produces 100% of the fresh market snap beans grown in the U.S. during the winter months (Mossler and Nesheim, 2009). Therefore, Florida ranks first nationally in the production of fresh market snap beans with 36% of the U.S. total production (USDA, 2010). In the 2009–2010 growing season, Florida harvested 32,200 acres with a volume of 6,440 million bushels (30-lb bushel) of fresh snap beans at a market value of \$135 million (FDACS, 2010). Miami-Dade and Palm Beach counties are the primary production regions for fresh market snap beans with Miami-Dade comprising 57% and Palm Beach accounting for 14% of the Florida bean acreage. However, production is widespread throughout the State with additional production regions in north-central Florida (Alachua County) and southwestern Florida (Hendry County) (Mossler and Nesheim, 2009).

Snap beans are typically planted in South Florida between September and April as fall, winter, and spring crops (Olsen et al., 2011). Planting depth ranges from 1 to 1.5 inches with 18 to 36 inches between rows and 2 to 4 inches between plants with a plant population of approximately 172,240 plants per acre (Olson et al., 2011). Maturity dates to harvest range from 45 to 60 d after seeding (Mossler and Nesheim, 2009). Snap bean growers

can potentially suffer losses due to chilling stress or frost/freeze from November to January (winter and spring plantings) when snap beans are at various stages of development (Hansen et al., 1999). Florida average snap bean yields are approximately 180 thirty-pound bushels/acre (Olson et al., 2011). Ninety-five percent of Florida snap beans are mechanically harvested (Mossler and Nesheim, 2009). A previous snap bean variety evaluation showed that mechanically harvested plants produced lower yields than manually harvested plants (Tyson, 1985). This was probably due to a higher level of accuracy when plants are manually harvested, since mechanical harvesting equipment may skip pods on smaller plants and may not achieve the removal force required to remove pods of certain varieties.

Snap bean quality is based on several factors including yield, disease resistance, horticultural quality, adaptability, and market acceptability. Different recommended varieties of snap beans are normally used by growers to overcome environmental conditions prevailing in the different production areas (Olson et al., 2011). The USDA standards for grades of snap beans describes U.S. Fancy grade as having similar variety characteristics, uniform size, being well formed, bright, clean, fresh, young and tender, firm, free from soft rot and insect, disease, or mechanical damage (USDA, 1990). Of these characteristics, the two most important to the Florida commercial snap bean industry was yield and color (deep green pod). Each year snap bean varieties will be released to

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the market, but these varieties need to be evaluated under Florida environmental conditions. The purpose of this study was to evaluate snap bean varieties for commercial production in Florida.

Materials and Methods

Two snap bean variety trials were conducted on sandy soils on a commercial farm at Myakka City, FL, and at the UF/IFAS/Belle Glade Research and Education Center on muck soils at Belle Glade, FL. The Myakka City trial consisted of 13 and the Belle Glade trial consisted of 11 snap bean varieties (Table 1). Seeds were provided by commercial seed companies. Seeding and production practices in both locations followed grower standards, thus varied by location (Table 2). At both locations the crops were harvested manually by removing the pod from the bush. Fertilization and pest management were per grower standards in both trials.

Data collection in Myakka City consisted of total marketable and unmarketable yields, pod size (length and width), fresh pod weight, color, and percent soluble solids. In Belle Glade, only marketable yield and pod size (length and width) were measured. Total marketable and unmarketable yields were measured by weighing the marketable and unmarketable pods at harvest (Table 2). Pod quality was determined by collecting a sample of 10 pods of each variety and measuring pod length, width measured

Table 1. Bush beans varieties and seed sources during fall 2010 in Myakka and Belle Glade, FL.

Myakka City		Belle Glade	
Variety	Seed company	Variety	Seed company
Ambra	Harris Moran	Bronco	Asgrow Seed Co.
Bronco	Asgrow Seed Co.	Caprice	Harris Moran
Caprice	Harris Moran	Carlo	Asgrow Seed Co.
Carlo	Asgrow Seed Co.	Eureka	Asgrow Seed Co.
Dusky	Rogers/Syngenta	Hickok	Harris Moran
Eureka	Asgrow Seed Co.	HMX 8122	Osborne Seed Co.
Hickok	Harris Moran	Inspiration	Rogers/Syngenta
HMX 8122	Osborne Seed Co.	Lewis	Harris Moran
Inspiration	Rogers/Syngenta	Prevail	Rogers/Syngenta
Lewis	Harris Moran	Terminator	Basin Seed Co.
Prevail	Rogers/Syngenta	Valentino	Seedway
Terminator	Basin Seed Co.	---	---
Valentino	Seedway	---	---

Table 2. Snap bean variety evaluation at both locations during fall 2010.

Location	Myakka City, FL	Belle Glade
Experimental design	RCBD (4 reps)	RCBD (4 reps)
Irrigation	Seepage	Seepage
Plot size	20 ft (2 rows)	45 ft
Harvest unit	5 ft (double row)	10 ft (single row)
Planting date	5 Oct. 2010	4 Oct. 2010
Linear ft	13,000	17,424
Bed spacing (center to center)	3.3 ft	2.5 ft (no beds)
Bed height	8–10 inches	---
Bed width	16–18 inches	---
Distance between rows	10 inches	Single row
Plant spacing	3 inches	4 inches
Plant population	105,600	52,272
Row	North–South	North–South
Harvest date	15 Dec. 2010	6 Dec. 2010

with a standard sieve sizer and rated 1 to 5 (1 = thinner and 5 = wider), pod fresh weight, pod color rated 1 to 7 (1 = light green, 7 = dark green; garden bean color chart, Syngenta/Rogers, Boise, ID), and soluble solids using a using a refractometer (Master M Series, Atago).

Results and Discussion

Weather conditions were cold to cool and dry at both locations (Table 3). The average air temperature was lower in Myakka City than Belle Glade. There were four freeze events in Myakka City on 7, 8, 14, and 15 Dec. 2010, but only the tops of the plants were damaged. There were no freeze events at Belle Glade before harvest. The total rainfall was similar at both trial locations and averaged 1.6 inches at Myakka City and 1.3 inches at Belle Glade.

At Myakka City, total marketable bean yields were significantly higher with ‘Ambra’ than ‘Caprice’, ‘Hickok’, ‘HMX 8122’, ‘Inspiration’, ‘Lewis’, ‘Terminator’, and ‘Valentino’ (Table 4). However, marketable yield with ‘Ambra’ was not significantly different than that with ‘Bronco’, ‘Carlo’, ‘Dusky’, ‘Eureka’, and ‘Prevail’. There were no significant differences in unmarketable yield among varieties. At the Belle Glade location, total bean yield was significantly higher with ‘Caprice’ than ‘Hickok’, ‘Inspiration’, ‘Lewis’, and ‘Terminator’. However, ‘Caprice’ marketable yield was not significantly different than the yield with ‘Bronco’, ‘Carlo’, ‘Eureka’, ‘HMX 8122’, ‘Prevail’, and ‘Valentino’.

At the Myakka City location, ‘Dusky’ had significantly higher pod width than ‘Carlo’, ‘Eureka’, ‘Hickok’, ‘HMX 8122’, ‘Inspiration’, ‘Terminator’, and ‘Valentino’ (Table 5). However, they were not significantly different than ‘Ambra’, ‘Bronco’, ‘Caprice’, ‘Lewis’, and ‘Prevail’. There were higher pod weights in ‘Ambra’, ‘Dusky’, and ‘Lewis’ than ‘Bronco’, ‘Carlo’, ‘Eureka’, ‘Hickok’, ‘Inspiration’, ‘Terminator’, and ‘Valentino’. However, they were not significantly different than ‘Caprice’ and ‘Prevail’. The highest pod color ratings were obtained from ‘Hickok’, ‘HMX 8122’, ‘Lewis’, ‘Terminator’, and ‘Valentino’ (deepest color pods). The lowest color ratings were obtained from ‘Ambra’, ‘Bronco’, ‘Caprice’, ‘Carlo’, ‘Dusky’, and ‘Prevail’. There

Table 3. Summary of average, minimum, maximum temperature, and rainfall during fall 2010 in Myakka and Belle Glade, FL, during fall 2010.²

Period	Temp (°F)			Total rainfall (inches)
	Avg	Min	Max	
<i>Myakka City</i>				
Oct. 2010	71.9	58.9	86.5	0.0
Nov. 2010	65.7	54.8	78.9	1.2
Dec. 2010 ^y	48.3	36.1	61.6	0.1
Avg/total	62.0	49.9	75.6	1.3
<i>Belle Glade</i>				
Oct. 2010	73.9	63.8	86.1	0.6
Nov. 2010	68.1	57.2	81.0	0.9
Dec. 2010 ^y	56.9	44.7	70.4	0.1
Avg/total	66.3	55.2	79.2	1.6

²Weather data were obtained from Florida Automated Weather Network (FAWN) from University of Florida/IFAS, South west Florida Research and Education Center, Immokalee and Gulf Coast Research and Education Center in Balm, FL.

^yDuring Dec. 2010, there were freeze four events on 7 Dec., 8 Dec., 14 Dec., and 15 Dec. in Myakka City. No freeze events were reported in Belle Glade.

Table 4. Marketable and unmarketable yield categories of bush bean varieties grown in Myakka City and Belle Glade, FL, during fall 2010.

Variety	Total marketable	Unmarketable
	----- Yield (30-lb bu/acre)-----	
	<i>Myakka City</i>	
Ambra	459 a	102
Bronco	287 abc	36
Caprice	233 bc	77
Carlo	380 abc	97
Dusky	298 abc	133
Eureka	347 abc	81
Hickok	266 bc	49
HMX 8122	247 bc	55
Inspiration	252 bc	102
Lewis	201 c	68
Prevail	410 ab	86
Terminator	232b c	87
Valentino	194 c	66
<i>P</i> value	0.03	0.43
Significance	*	NS
	<i>Belle Glade</i>	
Bronco	310 abc	---
Caprice	354 a	---
Carlo	320 abc	---
Eureka	326 ab	---
Hickok	260 cd	---
HMX 8122	325 ab	---
Inspiration	228 d	---
Lewis	272 bcd	---
Prevail	327 ab	---
Terminator	259 cd	---
Valentino	333 ab	---
<i>P</i> value	0.0001	
Significance	**	

²Within columns, means followed by different letters are significantly different according to Duncan's Multiple Range Test at 5%.

NS, **, *Nonsignificant or significant at $P \leq 0.01$ and 0.05, respectively.

were no significant differences in pod length and soluble solids among varieties. In Belle Glade, 'HMX 8122' had significantly longer length among varieties tested. The highest pod width was with 'Caprice'; however, it was not significantly different than 'HMX 8122' and 'Lewis'.

There were differences in yield and quality among varieties planted at both locations due to weather conditions and soil types. Deep green pod color is currently considered one of the most important factors to growers when selecting snap bean varieties together with marketable yields (Kahn and McGlynn, 2009). Seed companies are producing varieties based on these factors (personal communication, Johnny Parker). But, historically, fresh snap beans purchased by consumers in the market were a light shade of green (Kahn and McGlynn, 2009). However, in the 1990s a predominant seed company introduced dark green color snap beans to the market, promoting them based on attractiveness to consumers (Brooker and Eastwood, 1992). But, there was no marketing information to suggest that consumers will prefer a deep green color. In a 2001 and 2004 study evaluating consumer preference to pod color among five different snap bean varieties, it was found that although consumers were able to distinguish differences in color among varieties, there was no correlation between color and likelihood of purchase (Kahn and

Table 5. Quality categories for selected bean varieties grown in Myakka City and Belle Glade, FL, during fall 2010.

Variety	Length	Width	Pod	Color	Brix
	(inches)	(rating 1-5) ²	fresh wt (oz)	(rating 1-7) ³	
	<i>Myakka City</i>				
Ambra	5.96 ^x	3.55 abc	0.267	2.0 d	4.85
Bronco	5.44	3.40 abcd	0.228	2.5 cd	4.85
Caprice	5.79	3.73 ab	0.255	3.0 bc	4.95
Carlo	5.39	3.16 cd	0.218	2.3 d	4.94
Dusky	5.66	3.90 a	0.271	3.0 bc	4.85
Eureka	5.56	3.33 bcd	0.214	0.0 e	3.90
Hickok	5.44	3.30 bcd	0.230	3.8 a	4.95
HMX 8122	5.87	3.38 bcd	0.253	3.8 a	5.05
Inspiration	5.63	3.18 cd	0.233	3.5 ab	4.90
Lewis	5.63	3.73 ab	0.260	4.0 a	4.95
Prevail	5.64	3.73 ab	0.256	3.0 bc	5.00
Terminator	5.58	3.23 bcd	0.205	4.0 a	4.90
Valentino	5.23	2.95d	0.192	3.9 a	4.85
<i>P</i> value	0.10	0.004	0.0001	0.0001	0.51
Significance	NS	**	**	**	NS
	<i>Belle Glade</i>				
Bronco	7.85 de	2.48 b	---	---	---
Caprice	8.02 cde	2.93 a	---	---	---
Carlo	7.84 de	2.25 b	---	---	---
Eureka	7.93 cde	2.38 b	---	---	---
Hickok	7.98 cde	2.25 b	---	---	---
HMX 8122	8.89 a	2.58 ab	---	---	---
Inspiration	8.41 b	2.48 b	---	---	---
Lewis	8.27 bc	2.63 ab	---	---	---
Prevail	7.65 e	2.48 b	---	---	---
Terminator	8.08 bcd	2.40 b	---	---	---
Valentino	7.83 de	2.53 b	---	---	---
<i>P</i> value	0.0001	0.03			
Significance	**	*			

²1 = thinner and 5 = wider.

³1 = light green and 7 = dark green.

³Within columns, means followed by different letters are significantly different according to Duncan's Multiple Range Test at 5%.

NS, **, *Nonsignificant or significant at $P \leq 0.01$ and 0.05, respectively.

McGlynn, 2009). In another study interviewing retail shoppers, it was determined that shoppers had a slight preference for light over dark bean pods (Brooker and Eastwood, 1992). However, color selection was not associated with purchase. These studies suggest that although pod color may be a factor in consumer bean selection, it is not the overriding factor. Therefore, there is a discrepancy between industry standards and consumer preference.

Future research should concentrate on adding additional factors such as plant height since it can be an important factor in mechanical harvest, postharvest quality, disease incidence, and pod removal force. Additionally, bean variety evaluations should use mechanical harvesting methods, since 95% of Florida's acreage is harvested by machinery.

Currently, there is not an official bean variety recommendation by bean region and season (Olson et al., 2011). However, based on an informal survey the primary varieties planted by growers in Myakka City were 'Caprice', 'Valentino', 'Dusky', and 'Frontier' while in Belle Glade 'Prevail', 'Caprice', and 'Valentino' were the most prevalent. Based on marketable yield and pod color being the most important attributes to the Florida bean industry it can

be concluded that no single variety outperformed the others in these two categories combined. A grower may want to choose certain varieties based on individual characteristics and what meets his or her needs.

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