production of vegetable crops would most likely become unprofitable using seepage irrigation. In this situation, the use of a low volume irrigation system would provide a viable alternative for tomato production. Therefore, producers should thoroughly evaluate their individual situation and potential economic circumstances before committing themselves to any tomato irrigation system.

Traditionally, producers have adopted those irrigation systems that are easily combined in their production system and produce favorable returns over costs. Given the results of this study under the prevailing conditions a producer would not abandon an existing seepage system unless lower interest rates and/or extremely high energy costs are realized.

The use of water for irrigation tomato crops will certainly continue to be a major input in the vegetable production system. Therefore, producers who understand that irrigation is an essential production input requiring management, large capital expenditures and continuous cost evaluations will more likely plan an economical irrigation system.

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BLACK BEAN PRODUCTION POTENTIAL IN SOUTH FLORIDA[1]

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Abstract. **A large market for black bean (**Phaseolus vulgaris **L.) exists in south Florida. This is primarily due to an increased population of Latins in the region. Black beans are currently being shipped from New York to meet Florida's increasing demands. The purpose of this investigation was to measure the production of several black bean genotypes grown under south Florida's environmental conditions. Genotypes were evaluated for seed yield and growth characteristics during several seasons at the ARC, Fort Pierce and AREC, Homestead. Seed yields ranged from 433 to 1,389 kg/ha at Fort Pierce and 976 to 2,914 kg/ha at Homestead. No statistical differences in seed yield occurred among genotypes except for the fall 1977 planting at Homestead and the F_8 (Tui x Guali) trial during spring 1981 at Fort Pierce. In two trials at Homestead, four rows/bed had significantly higher seed yield than with two rows/bed. 'Arbolito', 70002, and 70003 were significantly more lodging resistant than 'Black Turtle Soup' or 'Strain 39' in two trials at Fort Pierce.**

Results suggest that black beans can be grown in south Florida, with optimum seed production on four rows/bed. Our seed yields were comparable to those obtained in New York State.

New kinds of vegetables could provide a viable and economically profitable alternative to south Florida's vegetable growers. This would result in a more diverse vegetable industry in south Florida. Prior to large-scale plantings, suitable cultivars, planting and harvesting dates, cultural practices, and pest management programs must be determined. Adequate local, interstate, or foreign markets, and transportation modes must be established to provide a proper distribution chain. Cost analysis must be made to insure growers an economic profit.

A sizable black bean market has existed for several years in south Florida. This market has increased rapidly over the past several years, primarily due to the large and increasing population of Latins into this region. New York state, a major black bean production area (5), has supplied much of Florida's black bean demands. If Florida's grower can economically produce black beans, a local market in south Florida and foreign markets in Central and South America, and the Caribbean are already established. The purpose of this investigation was to evaluate several black bean genotypes for growth and yield characteristics under south Florida's environmental conditions. In addition, disease resistance was also evaluated at Homestead.

Materials and Methods

Fort Pierce, Florida: Several black bean genotypes were evaluated for yield and growth characteristics during fall 1980 and spring 1981 at the Agricultural Research Center. Dolomite limestone (2.24 mt/ha) was preplant incorporated into an Oldsmar fine sand soil. Raised beds were spaced at 2.1 m centers with a 105 cm width. A fertilizer application

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of 4-16-4 ($N-P_2O_5-K_2O$) (1,568 kg/ha) was banded in 105 cm strips and bedded over. An additional application of 8-12-20 ($N-P_2O-K_2O$) (2,352 kg/ha) was banded under a 25 cm black strip of plastic mulch placed in the center of each bed (2). All beds were fumigated with Vorlex (589 l/ha).

The eleven genotypes evaluated during both seasons were: three plant introduction lines, Mexico PI 209456, Mexico PI 203924, and a single plant selection from El Salvador PI 304116-D1-DBK; three single plant selections, 70001, 70002, and 70003 made by Dr. R. F. Sandsted, Cornell University; three cultivars, 'Arbolito', 'San Andres #1', and 'Venezuela #54'; and two commercial cultivars presently grown in the United States, 'Black Turtle Soup' and 'Strain 39'. In a separate experiment during spring 1981, nine F_8 (Tui x Guali) also were evaluated. These selections were primarily evaluated because of their inherent lodging resistance. A full description and nature of their origin has previously been reported (7).

Seeds were hand planted 5 cm apart and approximately 7 cm deep on October 1, 1980 and February 10, 1981. Two rows, 61 cm apart, were planted on each bed at equal distances from the strip mulch. Plots were 3.7 m and 3 m in length for the two experiments consisting of the 11 genotypes and the one experiment with the nine F_8 selections, respectively. All experiments were designed as randomized complete blocks using four replications. Due to a small seed supply, only two replications were used to evaluate the nine F_8 selections.

Subjective lodging ratings were made just prior to harvesting on a scale of 1 (erect) to 5 (prostrate). Pod dryness and leaf retention were measured in the fall of 1980 just prior to harvesting. Plants from the center 3 m of each plot were hand harvested on January 6, 1980 and May 15, 1981, for the fall and spring experiments, respectively. Remaining leaves were removed and plants were placed in burlap sacks to air dry for 30 days. Plants were weighed (biological yield = roots + stems + pods + seeds) and then placed through a portable bean thresher to determine seed yields. Harvest index (HI) was calculated as seed yield x 100 divided by biological yield. Analysis of variance was performed on all measured growth and yield variables.

Homestead, Florida: Several black bean genotypes grown in two and four row/bed management systems were evaluated for seed yield during fall 1977 and 1979 and lodging during fall 1977 at the Agricultural Research and Education Center. For both seasons the experiments were a split-plot with row number/bed the main-plot and genotype the split-plot. Main-plots were arranged in two and four randomized complete blocks in 1977 and 1979, respectively. Main-plots were 41 m long and split-plots were 6 m long with 0.9 m alleys between each plot.

Raised beds were spaced at 1.8 m centers with a 105 cm width on Rockdale fine sandy loam. An 8-44-11-2 ($N-P_2O_5-K_2O-MgO$) fertilizer (550 kg/ha) with 20% N and K_2O-controlled release Osmocote was spread and rototilled into the bed in 1977. A 9-13-12-2 fertilizer (990 kg/ha) with 33% N and K_2O controlled release Osmocote was rototilled into the bed in 1979. Rows were spaced 50 cm apart in the 2 row/bed system and 30 cm apart in the 4 row system. The seeding rate was 32/m of row.

The genotypes evaluated during both seasons were: two cultivars, 'Black Turtle Soup' and 'Venezuela #54'; a single plant selection from El Salvador PI 304116-D1-DBK and from Mexico PI 203924-D2-DBK. In 1977 two additional plant introductions were Mexico IP 209461 and Norway PI 27687; and one cultivar, 'ICA-Pijao'. One additional cultivar, 'San Andres #1' was evaluated in 1979.

All lines were screened for the bean rust *Uromyces phaseoli* (Pers.) Wint. var. *typica* Arth., white mold *Sclerotinia sclerotiorum* (Lib.) d By., damping off *Rhizoctonia solani* Keuhn, and common bacterial blight *Xanthomonas phaseoli* (E. F. Sm.) Dows, in field trials for each test year.

Plants from individual plots were harvested and placed in burlap sacks. A portable bean thresher was used to determine seed yields. Separate analysis of variance for each season was performed.

Results and Discussion

Fort Pierce, Florida: No seed or biological yield differences occurred among genotypes during the fall or spring seasons (Table 1). Seed yields ranged from 1,115 to 1,389 kg/ha in the fall and 468 to 925 kg/ha in the spring. The lower seed yields during the spring may be partly attributed to the higher day temperatures as compared to the fall. High temperatures have been reported to adversely affect pod set in *Phaseolus vulgaris* (1, 3, 6). However, seed yields in the fall were similar to those obtained in New York state. In New York state, dry bean seed yields ranged from 952 to 1,691 kg/ha between 1963 and 1969 (4).

El Salvador PI 304116 and 'Black Turtle Soup', had higher harvest indices than the other genotypes, except when compared with 70001, 70002 and 'Strain 39' during the fall season. This suggests that these two genotypes may have a greater photosynthetic efficiency since a larger portion

Table 1. Mean seed yield, biological yield, and harvest index of several black bean genotypes during fall 1980 and spring 1981 at Fort Pierce, ARC, Florida.

Genotype	Fall 1980 Seed yield (kg/ha)	Fall 1980 Biological[z] yield (kg/ha)	Fall 1980 Harvest[y] index (%)	Spring 1981 Seed yield (kg/ha)	Spring 1981 Biological[z] yield (kg/ha)	Spring 1981 Harvest[y] index (%)
Arbolito	1284	2754	46.6	584	1726	33.1
Mexico PI 209465	1248	2532	49.4	632	1691	37.7
El Salvador PI 304116	1287	2387	54.2	884	2040	42.1
San Andres #1	1277	2727	46.9	925	2459	36.3
Venezuela #54	1303	2899	45.2	774	2267	33.5
Mexico PI 203924	1140	2605	44.1	638	1535	40.2
70001	1389	2749	50.4	545	1517	36.2
70002	1218	2389	50.9	608	1482	40.3
70003	1331	2700	49.0	468	1238	36.5
Black Turtle Soup	1203	2214	54.3	658	1482	44.6
Strain 39	1115	2126	52.4	769	1238	40.5
LSD (0.05)			4.2			

[z]Biological yield = roots + stems + pods + seeds.
[y]Harvest index = (seed yield/biological yield) x 100.

of the dry weight accumulated in reproductive plant parts (seeds) rather than vegetative plant parts (roots, stems, pods).

Lodging resistance was significantly higher for 'Arbolito', 70002, and 70003 as compared with 'Black Turtle Soup' or 'Strain 39' during both seasons (Table 2). Lodge resistant genotypes with pods high off the ground at harvesting can be expected to result in lower harvest losses and improved seed quality, particularly in humid regions (8). Upright plants of mature dry beans, dry more rapidly and withstand greater weathering than those windrowed and left on the ground (5).

Table 2. Mean lodging rating, pod dryness, and leaf retention for several black bean genotypes during fall 1979 and spring 1980 at Fort Pierce, ARC, Florida.

	Fall 1980			Spring 1981
	Pod[z] dryness	Leaf[z] retention	Lodging[zy] rating	Lodging[zy] rating
	...... (%)			
Arbolito	90.5	13.0	1.8	1.5
Mexico PI 209465	92.5	13.8	3.5	3.3
El Salvador PI 304116	93.0	3.5	4.3	3.0
San Andres #	88.8	13.8	2.0	2.5
Venezuela #54	85.0	16.3	2.3	3.0
Mexico PI 203924	71.3	30.0	2.3	2.8
70001	92.5	11.3	2.5	1.0
70002	93.8	4.3	2.3	1.0
70003	93.0	11.8	2.3	1.0
Black Turtle Soup	87.5	15.0	4.8	4.5
Strain 39	95.0	5.0	3.3	3.3
LSD (0.05)	10.7	14.1	0.9	0.8

[z]Readings taken just prior to harvesting.
[y]Lodging rating based on 1 (erect) to 5 (prostrate).

Mexico PI 203924 had significantly lower pod dryness and higher leaf retention just prior to harvesting than the other genotypes during fall 1980 (Table 2). No differences for pod dryness or leaf retention occurred among the other genotypes. No chemical defoliant has been cleared by the EPA for dry beans, therefore, genotypes exhibiting higher and uniform pod dryness and lower leaf retention prior to harvesting are very desirable. These characteristics will most likely attribute to lower seed yield losses during the combine harvest operation.

Seed and biological yield differences occurred among the nine F_8 (Tui x Guali) selections evaluated in spring 1981 (Table 3). Seed yields ranged from 433 to 1,142 kg/ha. Selections 80-7 and 80-8 had seed yields of over 1,000 kg/ha. No differences in HI occurred among genotypes. Since seed yields increased proportionally with biological yields, no differences in harvest indices occurred. All nine selections were exceptionally lodge-resistant. Similarly, high lodging resistance for these same selections was reported in New York state (7). Ultimately, these selections can be used in a black bean breeding program to incorporate lodging resistance into existing high yielding cultivars.

Homestead, Florida: The influence of row number/bed on seed yields of several black bean genotypes was measured in fall 1977 (Table 4) and 1979 (Table 5). No significant seed difference occurred among genotypes during fall 1979, however, the row number/bed x genotype interaction was significant in fall 1977. Seed yield increase between the two rows/bed and four rows/beds was much higher for 'ICA-Pijao' when compared with the other genotypes, thereby resulting in a significant row number/bed x genotype inter-action. In both experiments, four row/beds had significantly higher seed yields than two row bed. It can therefore be concluded that a four row/bed management system achieves higher seed yields than a two row/bed system. Lodging ratings differed among genotypes but not between 2 and 4 rows/bed in fall 1977. Mexico PI 209465 and 'ICA-Pijao' had less lodging than other genotypes except 'Venezuela #54'.

Mexico PI 209465, El Salvador PI 304116 and 'San Andres #1' were 50 to 80% more tolerant to rust, white mold, damping off, and common bacterial blight than 'Black Turtle Soup'.

Table 3. Mean seed yield, biological yield, harvest index, and lodging rating for nine F_8 (Tui X Guali) selections during spring 1981 at Fort Pierce, ARC, Florida.

Genotype	Seed yield	Biological[z] yield	Harvest[y] index	Lodging[x] rating
	...... (kg/ha)		(%)	
80-3	562	1507	39.3	1.0
80-4	696	1758	39.9	1.0
80-5	433	1130	38.4	1.0
80-6	754	1820	41.9	1.5
80-7	1079	2637	40.9	1.0
80-8	1142	2950	38.7	1.0
80-9	937	2323	39.8	1.5
80-10	660	2009	32.9	2.5
80-11	835	2197	37.9	1.0
LSD (0.05)	284	693		

[z]Biological yield = roots + stems + pods + seeds.
[y]Harvest index = (seed yield/biological yield) x 100.
[x]Lodging rating based on 1 (erect) to 5 (prostrate).

Table 4. Effects of genotype and row number/bed on black bean seed yields and lodging during fall 1977 at Homestead AREC, Homestead, Florida.

Genotype	Seed Yield			Lodging Rating		
	Rows/bed			Rows/bed		
	2	4	Mean	2	4	Mean
	.... (kg/ha)					
Mexico PI 209465	1037	1830	1433	1.5	2.0	1.8
El Salvador PI 304116	1240	1708	1474	2.5	3.0	2.8
ICA-Pijao	976	2846	1599	1.5	2.0	1.8
Venezuela #54	1708	2073	1891	2.0	2.5	2.3
Mexico PI 203924	1647	2094	1870	3.0	3.0	3.0
Black Turtle Soup	1525	1951	1667	3.0	3.0	3.0
Norway PI 276327	1301	1830	1477	2.5	2.5	2.5
Mean	1347	2003		2.3	2.6	
LSD (0.05) for Genotype x Row Number			476	LSD (0.05) for Genotype		0.7

[z]Lodging rating based on 1 (erect) to 5 (prostrate).

Table 5. Effects of genotype and row number/bed on black bean seed yields during fall 1979 at Homestead AREC, Homestead, Florida.

Genotype	Rows/bed		Mean
	2	4	
	...... (kg/ha)		
El Salvador PI 304116	2094	2866	2480
San Andres #1	2175	2734	2455
Venezuela #54	2246	2914	2582
Mexivo PI 203924	2114	2500	2307
Black Turtle Soup	2216	2895	2556
Mean	2169	2783	
LSD (0.05) for Row number			443

Results obtained show that black beans can be grown during the fall or spring season in south Florida. Although no seed yield differences occurred among genotypes in most experiments, 4 row/bed consistently outyielded 2 row bed plants. Further yield evaluations under different environmental conditions are needed. Lodging resistance is an important black bean characteristic for seed production, particularly under the wet and humid growing conditions of Florida. Lodged plants would result in decreased harvestable yields when combined, and increased pod and seed rot when in contact with the soil. 'Arbolito' had the highest lodging resistance in both trials at Fort Pierce. Mexico PI 209465 and 'ICA-Pijao' had the highest lodging resistance in 1977 at Homestead. Adequate pod dryness and low leaf retention during harvesting are needed to facilitate harvesting with combines. Mexico 203924 with low pod dryness and high leaf retention may have considerable seed losses during the combining operation.

In light of all these production problems, seed yields in the fall were comparable to those obtained in New York state. More research in plant population, planting dates, cultural practices, lodging resistance, pest management, and yield quality evaluation is needed to determine the highest economic yields and grower acceptance of black beans in Florida.

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FLORIDA WF75-6 AND WF75-13: NEW BELL PEPPER BREEDING LINES WITH CONCENTRATED FRUIT SET[1]

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Abstract. **Two new bell pepper genotypes were released from the University of Florida for use in breeding programs for early fruit maturity and concentrated fruit set. The lines are derived from a population from 'Yolo Wonder' which apparently was outcrossed with an unknown genotype whose fruit were early maturing and elongated. Plants of 'WF75-6' and 'WF75-13' have a compact habit with heavy foliage. Plants have a multiple branching type of growth, with numerous fruit maturing at one time near the terminal. Plants are as tolerant of bacterial spot as 'Early Calwonder' but are not resistant to the major pepper viruses prevalent in Florida. Fruit are blocky and occasionally elongated. Fruit mature about one week earlier than 'Early Calwonder' and total marketable fruit yields of the two genotypes are greater than 'Early Calwonder.' Plants of 'WF75-6' are shorter than 'WF75-13' and fruit of 'WF75-6' are smaller, firmer, and darker green than either 'WF75-13' or 'Early Calwonder.'**

Production of bell peppers (*Capsicum annuum* L.) in Florida during the 1978-79 season was over 8 million bushels with a total value of $49.4 million (1). Of the 18,100 acres harvested during this period, 65% were in Lee, Collier, Hendry, and Palm Beach counties on Florida's southwest and southeast coasts. The predominant cultivars grown in these areas were 'Early Calwonder' and 'Yolo Wonder,' although several new cultivars have been tested, including 2 virus-resistant cultivars recently released from the University of Florida (2,3). These cultivars have a rangy growth habit with fruit maturing continuously, which requires multiple harvests for maximum yield. Often destruction of the foliage during initial harvests damages immature fruit or causes them to be scalded by the sun. Concentrated fruit set enabling a once-over harvest is a desirable characteristic not available in these commercial cultivars. 'WF75-6' and 'WF75-13' are short, low-branching plants with early maturity and concentrated fruit set.

Origin

'WF75-6' and 'WF75-13' originated as a single plant selection made from a population of 'Yolo Wonder' at the Agricultural Research & Education Center, Bradenton during the Fall 1974 season. The plant was selected because of its abnormal anthers which were shriveled and produced very little pollen, which suggested the possibility of male sterility. The plant was propagated vegetatively and numerous self pollinations were attempted during the Spring 1975 season. A limited number of seed matured, and the resultant seedlings varied in growth habit from rangy to compact; in fruit set from sparse to concentrated; and in tolerance to bacterial spot (*Xanthomonas vesicatoria* (Doidge) Dows.) from low to high. All plants examined produced normal flower parts. Single plant selections were made from the segregating population during the Fall 1975 season, and 2 were designated 'WF75-6' and 'WF75-13.' Plants were evaluated in observational trials for the next four generations and single plant selections were retained from each based upon fruit size, fruit number, concentrated fruit set, pedicle size, and field tolerance to bacterial spot. Plants of these two breeding lines were grown in isolated areas at AREC-Bradenton during the Spring 1978 season and the seed was bulked for use in replicated trials. Plants

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