GLADSTONE ROAD AGRICULTURAL CENTRE
CROP RESEARCH REPORT NO. 5

EVALUATION OF TWO STRING BEAN (*PHASEOLUS VULGARIS* L.) VARIETIES GROWN FOR THE FRESH MARKET

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ABSTRACT

In order to select improved crop varieties suitable for the environmental conditions of The Bahamas, two string bean varieties, 'Ambra' and 'Hialeah', were evaluated at the Gladstone Road Agricultural Centre in a small plot replicated trial during 2011. After 64 days of growth the pods were evaluated for quality characteristics. Evidence from this study indicated that there were significant differences among the two varieties with respect to the total number of pods per plant, weight of pods per plant and pod length. 'Hialeah' yielded 4.5 tonnes per hectare, while 'Ambra' yielded 3.4 tonnes per hectare. The two string bean varieties did not experience any incidence of diseases or serious pest problems. These results indicate that the two varieties tested are expected to do well, if cultivated under similar growing conditions and planting time.

String bean (*Phaseolus vulgaris* L.)

Introduction:

The common bean (*Phaseolus vulgaris* L.) is cultivated over a wide range of climate and soil conditions. It produces well on marginal soils and is tolerant of drought and heat stress (Kumar *et al*., 2006). It is the most widely distributed of its species (Singh, 1999) and is an important food crop in Africa, Latin America and the Caribbean. In its dried state, it is an important source of protein but is also an important vegetable crop when cultivated for its immature whole pods. In different locations, these immature pods are referred to as string beans, snap beans, French beans or green beans. They are rich in protein and iron and contain essential nutrients such as ascorbic acid, Vitamin A, Vitamin B and calcium (Kelly and Scott, 1992; Ndegwa *et al*., 2006). This crop is grown locally for its fresh and dried seeds but, as string beans, is not cultivated on a wide scale in The Bahamas. This legume has much potential when cultivated as a vegetable for the fresh market. It is a high value specialty crop that can be used by farmers to diversify their agricultural

production. Because of their ability to fix nitrogen into the soil (Amanuel *et al*., 2000, Rondon *et al*., 2007), leguminous crops can be used, together with other soil amendments, to improve the performance of those cropping systems subsisting under poor soil conditions. The introduction of high yielding, disease tolerant varieties with quality characteristics acceptable to the local market is essential to the improvement of local production. An important first step in the production of high yielding string beans is the selection of the appropriate varieties, since some varieties are more suited to other climate and soil conditions. By cultivating the appropriate varieties, local farmers can become leading producers of this specialty crop.

Objective:

The objective of this study was to assess the suitability of two string bean varieties for production in The Bahamas.

Materials and Methods:

The variety trial was conducted at the Gladstone Road Agricultural Centre from the 22nd November 2010 to the 24th January 2011. The two varieties were evaluated in a completely randomised design with four replications. Before planting, the experimental plots were treated with the pre-emergent herbicide, Dacthal®. The two string bean varieties examined were 'Ambra' and 'Hialeah', both from the Harris Moran Seed Company and developed for the fresh market. These beans are short, bush type plants that do not require support. They are early maturing varieties that produce all of their pods within a short period of time, after which production ceases.

The varieties were planted in double rows with spacing of 20 cm (8 in) between plants within the row. The rows were 1.5 m (5 ft) apart. The usual cultural practices were observed to ensure that an even stand of plants was established in the field plots. The plants were side dressed with 8-18-8 fertiliser, applied in one application at a rate of 30 g (1.0 oz) per plant, at the flowering stage. The rows were irrigated with a drip irrigation system which supplied water throughout the growing season. The plants were not treated with insecticides or fungicides, in order to determine their resistance or susceptibility to insect pests and diseases.

The mean daily maximum and minimum temperatures for the trial period were 24.1°C (75.3°F) and 16°C (60.8°F), respectively. The total rainfall for the period was 13.5 mm (0.53 in). Weather information was obtained from the Meteorological Department of The Bahamas.

Observations were made on the time of flowering and number of days to harvest. Upon maturity of the green pods, the beans were harvested by hand. For this study, all observations and measurements were made on the initial harvest of marketable pods. Twenty five plants were harvested at random from each of the four plots, for both varieties. The pods were graded, then weighed and measured. Pod length (cm) was measured with a ruler. Twelve pods were selected randomly from each plot to assess the post-harvest quality characteristics of the two varieties. They were examined for disease levels and visible signs of chlorosis. Colour and shape were determined by visual examination. The fibre content was determined by breaking the pod and determining whether it snapped cleanly or did not snap, due to excessive string and seediness.

Statistical Analyses:

All experimental results were analysed using Instat+™ and ASSISTAT. Instat is an interactive statistical package, copyright © 1999-2005, Statistical Services Centre, University of Reading, UK. All rights reserved. ASSISTAT, Version 7.5 beta (2008), website – http://www.assistat.com, by Fransisco de Assis Santos e Silva, Federal University of Campina-Grande City, Campina Grande, Brazil.

Results:

Analysis of variance (Table 1) indicated that there was a significant difference in the number of pods per plant, pod length and total weight of pods per plant among the two varieties under study. There was no significant difference in plant height. Both varieties emerged 7-10 days after planting, though the variety 'Hialeah' appeared earlier than 'Ambra' by 2-3 days. Stand establishment was very good for the variety 'Hialeah', while a noticeable number of seeds were late in germinating, or did not germinate at all, for the variety 'Ambra'. The mean number of days after planting for the first flowers to appear was 45, while approximately 50% flowering occurred after 50 days.

Table 1. Analysis of variance (ANOVA) for number of pods per plant, pod length, total weight of pods per plant and plant height among two string bean varieties. Standard error is for each treatment mean. Error mean square has 199 df. *, ** and *** denote statistical significance at 5, 1 and 0.1% level of confidence, respectively. NS indicates differences between means not significant.

		----------Significance levels----------			
Source	df	Number of pods per plant	Pod length (cm)	Total weight of pods per plant (g)	Plant height (cm)
Varieties	1	**	**	**	NS
Error	198				
Std. Err		0.5	0.1	2.8	0.4

The yield and yield contributing characteristics of the two bean varieties are shown in Table 2. The variety 'Hialeah' outperformed 'Ambra' in all categories, with the exception of plant height, which proved not to be of significance.

Table 2. Number of pods per plant, pod length (cm), total weight of pods per plant (g) and plant height (cm).

Variety	Number of pods per plant	Pod length (cm)	Total weight of pods per plant (g)	Plant height (cm)
Ambra	21.5b	14.7b	104.0b	23.3a
Hialeah	26.5a	15.8a	135.1a	23.1a

The t-test at a level of 5% probability was applied. Means with different letters differ significantly.

The two varieties evaluated had acceptable green colour, pod length, appearance, and fibre content (Table 3). In general, they displayed little variation in the post harvest quality characteristics observed. Plates 1 and 2 give some indication of the quality of the two bean varieties. Pods were healthy in appearance. No serious pest or disease problems were evident.

Table 3. Post-harvest quality characteristics of two string bean varieties evaluated at the Gladstone Road Agricultural Centre during 2011.

Variety	Stated number of days to maturity	Actual number of days to maturity	Pod colour	Pod curvature	Fibre/String content	Visible signs of disease or chlorosis
Ambra	52	64	green	straight-slightly curved	absent	none
Hialeah	53	64	green	straight-slightly curved	absent	none

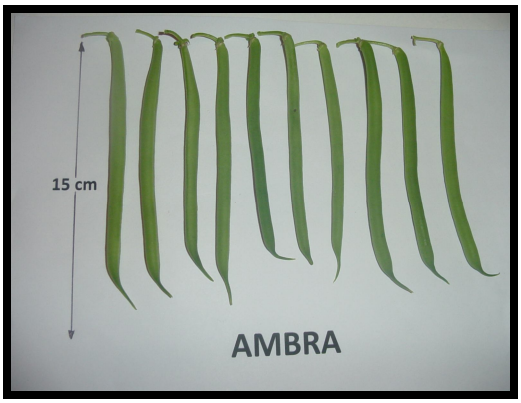

Plate 1.

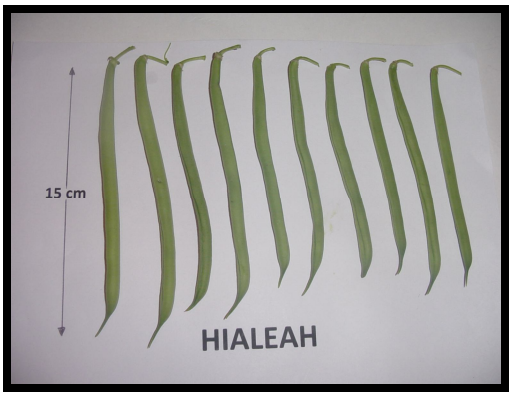

Plate 2.

Discussion:

The results of this experiment suggest that the varieties 'Ambra' and 'Hialeah' can be grown successfully for the fresh market. The pod characteristics of both varieties are of a high quality and meet market standards (USDA-AMS, 1997). The pods were produced on healthy plants with very few immature or deformed pods. The two varieties produced pods that tended to all mature at the same time in a concentrated set. However, the variety 'Hialeah' appears to be superior to 'Ambra' with respect to yield responses. The differences in pod number, pod length and weight of pods per plant could be due to genetic variability among the two varieties (Amanullah, *et al*., 2006).

The mean weight for each of the two varieties was expressed as kg per plant. By extrapolation, the two string beans yielded 3.4 tonnes per hectare ('Ambra') and 4.5 tonnes per hectare ('Hialeah'). These yields are well below the world average (FAOSTAT, 2008) of 6.9 tonnes per hectare, but are within the range for developing countries, which fluctuates between 2.4 and 4.3 tonnes per hectare (Soejono, 1992).

The differences in the stated number of days to maturity and the actual number of days to maturity may be attributed to any number of factors, including climatic, environmental or growing conditions. It is recommended that the string bean varieties be subjected to further performance trials to evaluate their productivity at different planting dates.

This short-term crop of approximately 60 days allows it to fit well into the crop rotation system of local farmers. The preliminary assessment of the quality characteristics of the two string beans revealed traits that could lead to their selection for growing in The Bahamas. The varieties 'Ambra' and 'Hialeah' are promising with respect to pest and disease tolerance, pod quality and yield potential. The two varieties tested are expected to do well, if cultivated under similar growing conditions and planting time.

General Comments:

It should be noted that this study represents data from a single growing season. Further cropping cycles will need to be completed before final recommendations are made on these varieties. Research on these string bean varieties, along with other vegetable legumes, will continue. Based on feedback from select persons who were requested to test the cooking quality of the two

varieties, both had good texture and flavour. Under experimental conditions, the string bean varieties 'Ambra' and 'Hialeah' produce quality pods that are acceptable on the local market.

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