Response of Snapbeans to Increasing Plant Density[1]

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ABSTRACT

The effect of five row spacings (30, 45, 60, 75, and 90 cm) on the marketable yield of three commercial snapbean varieties (Blue Lake 47, Astro, and Harvester) was evaluated in a spring planting at the Isabela and Adjuntas Substations.

At Isabela, the highest yields of Blue Lake 47 (17,084 kg/ha) were obtained at 45 cm between rows; the lowest (8,408 kg/ha) at 90 cm. Maximum yields of Harvester (12,353 kg/ha) were obtained at 30 cm, followed closely by 11,927 kg/ha at 45 cm.

At Adjuntas, the highest yields of Astro (8,497 kg/ha) were obtained with 30 cm between rows; the lowest (5,000 kg/ha) with 75 cm. Maximum yields of Harvester (8,564 kg/ha) were obtained with 45 cm, followed by 8,161 kg/ha with 30 cm. The lowest yield (3,856 kg/ha) was obtained with 90 cm.

In both localities, plants spaced 30 and 45 cm between rows were significantly taller than those at wider spacings due to competition for light.

INTRODUCTION

Low plant populations per unit area are probably one of the main causes leading to low yields of snapbeans. Higher stands could increase yields, although closer rows do not necessarily imply higher plant density, but rather a more uniform distribution of plants in a given area. Snapbeans grown in close rows have higher demands on soil nutrients and moisture than those in wide rows, especially as time for harvest approaches.

Because snapbeans have done relatively well in the flat lowlands of northwestern (3, 4) and southern[3] Puerto Rico, attempts have been made to explore the possibilities of obtaining good yields in other localities. In 1962, Ramírez and Vélez (8) reported the yields of pole and bush snapbeans at Gurabo, in eastcentral Puerto Rico.

Reasonable snapbean yields in the mountainous interior of the island could boost the small farmer's income while reducing the unemployment rate for the area.

The purpose of the study herein reported was to determine the best row spacing for three snapbean varieties in northwestern and westcentral Puerto Rico.

MATERIALS AND METHODS

A snapbean planting was established on March 28, 1977 at the Isabela Agricultural Experiment Substation, in northwestern Puerto Rico, in a

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Coto clay, an Oxisol, using a split-plot design with four replications of two commercial varieties (Blue Lake 47 and Harvester).

Another planting was established on April 21, 1977 at the Adjuntas Agricultural Experiment Substation, at 675 meters above sea level in a Humatas soil, clayey, kaolinitic, ishohyperthermic, also using a split-plot design with four replications of commercial varieties Astro and Harvester.

The main plots were assigned to the row spacings and the subplots to the varieties. Plant densities were 30, 45, 60, 75, and 90 cm between rows and 8 cm between plants in the row, equivalent to theoretical densities of 431,084, 287,389, 215,542, 179,618, and 143,694 plants/ha, respectively. Seed was sown by hand in rows 6 m long.

Dacthal 75W[4] was applied as a preemergent herbicide immediately after planting at the rate of 11.25 kg/ha of the active ingredient. Overhead irrigation was applied twice during the first week and once a week afterward, until flowering. Also, furrow irrigation was used as necessary. A weekly spraying program was followed, mixing Diazinon AG500 and Dithane M-45 at the rate of 1,200 ml and 2.25 kg/ha, respectively, to reduce damage by insects and diseases.

All plants were pulled out and then stripped of pods in a simulated once-over harvest 49 days after planting at Isabela and after 56 days at Adjuntas. Data were recorded for total, marketable, and cull yield.

RESULTS AND DISCUSSION

Table 1 shows the marketable yields obtained with the various plant densities.

At Isabela, Blue Lake 47 reached its maximum marketable yield at the 45 cm spacing; yields dropped constantly as the distance between rows was widened. Harvester optimum yield was registered at 30 cm with a good yield at the 45-cm spacing, following the same tendency of yield reduction as the plant population diminished.

At Adjuntas, the same pattern was observed. For instance, Astro scored its maximum marketable yield at 30 cm, followed by the 45-cm spacing; yields dropped progressively to the 75-cm spacing, then rose slightly at 90 cm. Harvester reached its peak at 45 cm. Yield declined steadily to the 90-cm spacing.

This tendency agrees in general with the findings of Montalvo (5), who mentioned a close relation between plant density and yield/unit area. The latter increased as the former increased up to a limit of approximately 300,000 plants/ha.

[4] Trade names in this publication are used for the sole purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of the equipment or materials by the Agricultural Experiment Station of the University of Puerto Rico or an endorsement over other equipment or materials not mentioned.

TABLE 1.—*Marketable yield in (kg/ha) of three snapbean varieties in five plant densities at the Isabela and Adjuntas Substations, 1977*

Plant density		Variety			
		Blue Lake 47	Harvester	Astro	Harvester
Plants/ha × 1000		*Kg/ha*	*Kg/ha*	*Kg/ha*	*Kg/ha*
		Isabela		*Adjuntas*	
431	16,344 a[1]	12,353 a	8,497 a	8,161 a	
287	17,084 a	11,927 a	8,161 a	8,564 a	
216	13,071 b	10,851 ab	5,829 b	7,197 a	
180	11,905 b	9,035 bc	5,000 b	6,053b	
144	8,408 c	7,914 c	5,919 b	3,856 b	
Mean	13,362	10,416	6,681	6,766	

[1] Values in rows followed by one or more letters in common do not differ significantly at the 5% level.

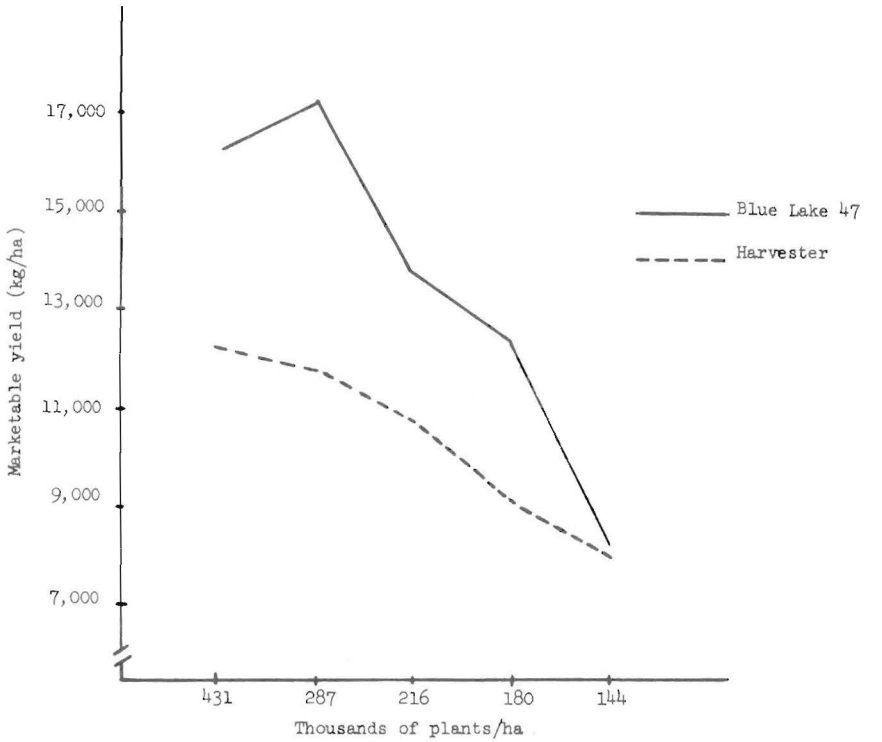

FIG. 1.—Marketable yields of snapbean varieties Blue Lake 47 and Harvester grown at Isabela, 1977.

Mullins (6) reported that 45-cm rows were commercially feasible and that mechanical cultivation, which seems a necessity because of lack of effective herbicides, is possible with 45-cm rows.

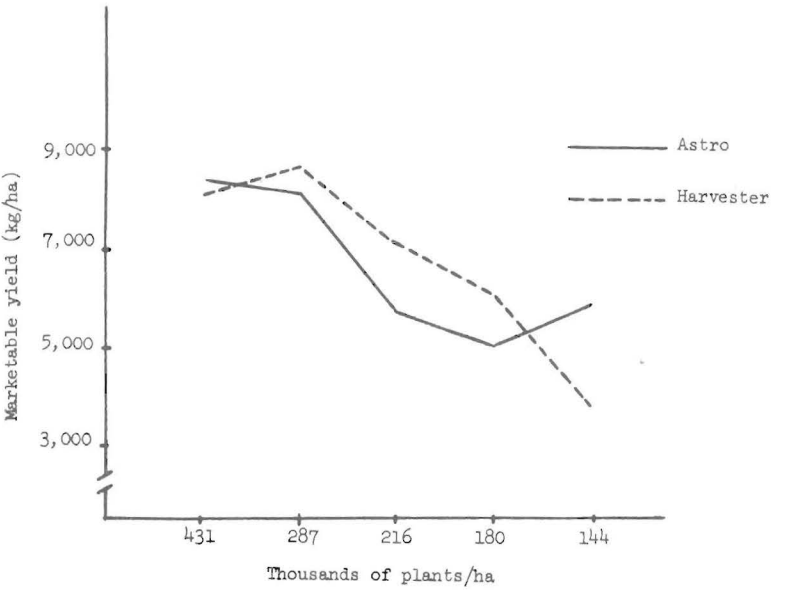

FIG. 2.—Marketable yields of snapbean varieties Astro and Harvester grown at Adjuntas, 1977.

Campbell (1) reported a plant density of 272,000 plants/ha as the population giving the maximum financial return, while Correa (2) stated that 30 cm between rows was the minimum distance with which to obtain the highest yield of varieties Topmost, Pearlgreen, and Tenderwhite. An intermediate spacing of between 30 and 15 cm between rows was most desirable for Harvester.

Optimum plant densities of 287,000 plants/ha were registered for Blue Lake 47 at Isabela (fig 1) and for Harvester at Adjuntas (fig 2). For practical purposes, Harvester at Isabela and Astro at Adjuntas should be planted at 45-cm rows to allow some mechanical cultivation.

According to Peck (7) management of cultural practices plus the beneficial or detrimental effects of environment have more influence on yield and quality of snapbean pods than row width itself.

There were no significant differences in plant height between varieties. However, differences occurred between planting distances. For example, plants in rows at 30 and 45 cm were significantly taller than those at 60-, 75-, and 90- cm spacings. Etiolation occurred in the closer spacings mainly because of the competition for light.

RESUMEN

En las Subestaciones Experimentales de Isabela y Adjuntas se establecieron dos siembras de habichuelas tiernas el 28 de marzo y el 21 de abril de 1977, respectivamente, para evaluar el efecto de cinco distancias entre hileras (30, 45, 60, 75 y 90 cm) sobre los rendimientos de tres variedades, Blue Lake 47, Astro y Harvester.

Con Blue Lake 47, sembrada en Isabela a 45 cm entre hileras, se obtuvo el rendimiento máximo (17,084 kg/ha), y el mínimo (8,048 kg/ha) a 90 cm. El rendimiento, máximo de Harvester (12,353 kg/ha) se obtuvo a 30 cm entre hileras, seguido de 11,927 kg/ha a 45 cm. Para fines prácticos es más conveniente sembrar a 45 cm, ya que requiere menos semilla/ha y permite algún grado de mecanización. El rendimiento mínimo (7,914 kg/ha) se obtuvo en hileras espaciadas a 90 cm.

En Adjuntas, con la variedad Astro, se obtuvo el rendimiento máximo (8,497 kg/ha) a 30 cm entre hileras y el mínimo (5,000 kg/ha) a 75 cm. El rendimiento máximo de Harvester (8,564 kg/ha) se obtuvo de hileras espaciadas a 45 cm y mínimo (3,856 kg/ha) a 90 cm.

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