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PERFORMANCE OF RED KIDNEY AND NATIVE WHITE BEANS AT THREE PLANTING
DISTANCES ON AN OXISOL IN NORTHWESTERN PUERTO RICO^(°), ^(°°)

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INTRODUCTION

Dry beans offer vast possibilities in the humid and subhumid tropics as an important source of dietary protein. Both the native white bean and the red kidney bean types are favorites in the Puerto Rican diet. They are consumed daily, often times twice a day, together with rice. The value of dry bean imports into Puerto Rico exceed \$15 millions/year. Not much is known, however, about its cultivation requirements in tropical environments. The work herein reported as well as work on cultivar selection, P and N fertilization are being conducted as part of an overall program to develop a technological package of practices for dry bean production in the deep, well drained, acid, relatively infertile soils of the tropics. Previous experience with other legume crops under Puerto Rico conditions has pointed to the importance of increased plant populations, which under adequate managements can lead to increased yields (6).

This paper reports on an experiment conducted to evaluate the performance of two field bean types at three planting distances on an Oxisol in northwestern Puerto Rico.

MATERIALS AND METHODS

An experiment was conducted at the Isabela Substation farm on a Coto soil, a Tropeptic Haplorthox, clayey, kaolonitic, isohyperthermic (4), with pH 5.0 ; CEC, 13 meq., and Ca saturation 25%. It is high in Mn and low in available P. Mean annual rainfall is about 1658 mm. Evaporation from a class A pan is approximately 6 mm/day during the summer and 4 mm/day during the winter. The mean annual maximum temperature is 29.4°C while the mean minimum temperature is 18.9°C. Solar radiation ranges from an average of 300 langleys/day in the winter to 600 in the summer. The elevation is about 122 m above sea level.

The experiment followed a split-plot design with six replications. Main

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plots were planting distances, i.e., 30, 45 and 60 cm between rows. The corresponding plant populations were 444, 296 and 222 thousand plants/ha. Subplots were two fieldbean varieties : 27R, a red kidney type, originally from Turrialba, Costa Rica, introduced to Puerto Rico from seedstock from Trinidad ; and Bonita, a selection of a native white bean (3,5). Plots were 3.65 m x 1.52 m. Weeds were controlled with a preemergent application of Dacthal(°°°°) at the rate 13.5 kg/ha. The whole field received a blanket application of 1121 kg/ha of a 10-10-8 fertilizer prior to planting. Seeds were sown on November 20, 1975. The crop of 27R was harvested on February 9, 1976, at 75 days of age, while that of native white beans was harvested eight days later.

Data were taken on dry bean yields, number of seeds/10 pods, weight of 10 plants, and number and weight of pods/10 plants. All data were statistically analyzed.

RESULTS AND DISCUSSION

Table 1 gives data on yield and other agronomic characteristics for the white and red kidney beans at the three planting distances. There were no significant differences in mean yields between varieties and between the three planting distances. They both produced around 2200 kg/ha, irrespective of planting distance. These are good yields for 27R and compare very well with the highest yields, i.e., 1100 kg/ha reported from seed production plots under the conditions prevailing at Trinidad (2). For Bonita, these yields are excellent (3). In 1944, González-Ríos and Riollano (3) compared the performance of native white beans at 30.0 cm vs. 60.0 cm between rows. Plants within the row were spaced at 15.0 cm. Yield increases between 15 and 45% were obtained in the closer planting distances.

Beans appear to respond to length of day (3). Evidently the relative short, cool and drier day of the winter season at Isabela favored growth, flowering pod development, and seed production in both types of beans.

The varieties did not differ significantly as to the weight of 10 plants and pod weight, but in both cases pod and plant weight at 60 cm were heavier than those at either 45 or 30 cm. Mean differences were highly significant. Again there were no significant differences between varieties as to pod weight : 148 for 27R and 151 for Bonita. Pods of plants at 60 cm were heavier than those from the other two treatments. Mean differences were highly significant.

Bonita produced significantly more pods than 27R. The lower number of pods occurred at the 30.0 cm planting. Again, Bonita was by far superior to 27R as to the number of beans/pod (38 vs. 55), the differences being highly significant. Planting distance did not affect this character.

During the experimental period, both Bonita and 27R appeared to be free of any damage from either insects or diseases, which is an added advantage to encourage their cultivation. Generally, the leafhopper, *Empoasca fabalis*, prevails during the summer months. According to Cruz (1), *Empoasca spp.* is the insect that most se-

(°°°°) Trade names are used in this paper solely for the purpose of providing specific information. Mention of a trade name does not constitute a warranty of materials by Cornell University or by the Agricultural Experiment Station of the University of Puerto Rico or an endorsement over materials not mentioned.

verely affects bean plantings. He has found tolerant cultivars and claims that the resistance is a type of tolerance that permists a dense insect population without serious harm to the crop. Bonita is one of the most tolerant cultivars. This experiment was planted in November 26, 1975 and the beans grew through the drier, cooler months of the year, which may have been a determinant factor in producing healthy, clean plants. The good drainage of the Coto Oxisol might also have been important in avoiding root rot, anthracnosis and chlorosis. The red kidney type appeared to mature a little earlier than the native white bean.

In general, while plants and pods were heavier and pods more expensive since more seed is required. However, this reduction in cost may offset by the more frequent weeding needed as spacing between rows is increased.

It appears as though 27R could be a suitable red kidney bean for home gardens and commercial production in Oxisols. Bonita is definitely suitable those conditions, and was grown in the past in Puerto Rico on a sizeable field scale. Further research to complete a technological package of practices must be undertaken before definitely assessing the commercial potential of these types of dry beans in the acid, deep, well-drained and relatively infertile soils of the humid tropics. In addition, the search for higher yielding cultivars must be intensified.

Table 1.- Yield and other agronomic characteristics of red kidney and native white beans grown on an Oxisol

Variety	Values for indicated parameter at indicated planting distance ^(°)			
	30 cm	45 cm	60 cm	Mean
<u>Yields, kg/ha</u>				
27R	2223	2188	2136	2183
Bonita	2316	2306	2181	2268
Mean	2270	2247	2158	2225
<u>Seed/10 pods, no</u>				
27R	37 a	39 a	38 a	38 a ^(°°)
Bonita	56 b	53 b	57 b	55 b
Mean	46	46	48	47
<u>Weight of 10 plants, g</u>				
27R	165	213	270	216
Bonita	154	174	275	201
Mean	159 b	193 b	272 a	208
<u>Weight of pods/10 plants, g</u>				
27R	119	146	188	148
Bonita	103	130	210	151
Mean	111 b	138 b	199 a	149
<u>Pods/10 plants, no</u>				
27R	49 d	56 c	64 b	56 a
Bonita	88 c	115 b	140 a	114 b
Mean	68	85	102	83

(°) Only sets of values where there are significant differences are lettered.

(°°) Values in a horizontal or vertical column, followed by the same letter are not significantly different at the 5% level using Duncan's multiple range test. Lettered values are compared vertically for varieties and horizontally for mean planting distances.

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ABSTRACT

The effect of planting distance on yields and yield components of two field bean varieties : 27R, a red kidney bean imported from Trinidad ; and Bonita, a selected native white bean , was evaluated in a Coto clay, a Tropeptic Haplorthox. Planting distances included 30, 45 and 60 cm between rows. Mean yield differences between varieties and between planting distances were not significant. However, a field-wide average of around 2200 kg/ha was obtained, a satisfactory yield under the prevailing conditions. Plant and pod weight did not differ between varieties, but with the 60 cm distance between rows they were heavier than at 30 cm and 45 cm Bonita produced more pods than 27R ; the lower number occurred with the 30 cm distance. Bonita produced an average of 5.5 seeds/pod ; 27R, only 3.8. Both varieties appeared to be free fo any insect or disease damage.

RESUMEN

Dos variedades de habichuelas : 27R, colorada, tipo diablo, importada de Trinidad y Bonita, una selección nativa de tipo blanco, se compararon en cuanto a rendimientos y components de rendimiento. Se sembraron a tres distancias entre hileras : 30.0, 45.0 y 60.0 cm. La 27R se cosechó a los 75 días y la Bonita, 8 días más tarde. No se registraron diferencias significativas entre variedades ni entre distancias entre hileras. Sin embargo, se obtuvo un rendimiento promedio de alrededor de 2200 kg/ha, rendimiento satisfactorio dentro de las condiciones en que se realizó el experimento y para Oxisols, que son suelos profundos, de buen desague, pero acidos y relativamente infértiles. No hubo diferencias significativas en el peso a 60 cm de distancia ambas eran más pesadas que a 30 y a 45 cm. Bonita produjo 5.5 semillas/vaina ; 27R, sólo 3.8. Ambas variedades parecen ser resistentes a enfermedades e insectos en el área de Isabela.