

Preliminary Trials of Six Red Bean (*Phaseolus vulgaris* L.) Cultivars on an Ultisol in Jamaica^{1,2}

Audrey L. Wright, Abdul H. Wahab, Howard Murray and Miguel A. Lugo-López³

ABSTRACT

Field trials were conducted to evaluate the performance of six cultivars of red beans (*Phaseolus vulgaris* L.) viz. Miss Kelly, Tom Red, ICA Duva, ICA Guali, California Light Red and 27-R on a newly terraced Ultisol in Jamaica. Seed yields varied from 1182 kg/ha for Miss Kelly to 528 kg/ha for ICA Guali. The most productive cultivars, Miss Kelly, Tom Red and ICA Duva, produced yields of 1182, 1023 and 934 kg/ha, respectively. Miss Kelly and Tom Red performed significantly better than California Light Red, 27-R and ICA Guali. Cultivar 27-R had significantly more pods/plant, whereas Miss Kelly had significantly more seeds/pod than all other varieties. Nodulation scores did not differ significantly among cultivars.

INTRODUCTION

The low income group constitutes about 70% of the Jamaican population. It is estimated that dietary protein intake of this group falls short of requirements by about 14%. At present, edible grain legumes contribute only a small percentage of the protein consumed. However, these legumes have the potential for improving the quality of the Jamaican diet. These considerations have formed the basis for increasing the acreage and volume of production of legumes in Jamaica. In the Government of Jamaica's Five-Year Development Plan 1978-1982, it is proposed that there should be an increase of 11,366 ha devoted to the production of edible legumes over this period (7).

Most research efforts on legumes in Jamaica have been confined to the lowland areas. Notwithstanding the differences in edaphic, climatic, disease and pest conditions between the plains and hilly regions, often varieties which have been selected for cultivation on the lowlands have also been used on the hillsides. Since a large proportion of the island's food legumes is produced on the hillsides, it is important that recommendations based on results obtained from research conducted in the lowland ecological zone be tested for their adaptability to the hillsides. This paper

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³ Agronomist, Ministry of Agriculture/Jamaica; Former Research Specialist, Inter American Institute for Cooperation to Agriculture (IICA)/Jamaica, now Asst. Agricultural Development Officer, U.S. AID/Haiti; Soil Conservationist, Ministry of Agriculture/Jamaica; and Professor and Soil Scientist (ret.), now Consultant, College of Agricultural Sciences, University of Puerto Rico, Mayagüez Campus.

reports the result of a red bean (*Phaseolus vulgaris* L.) variety trial, conducted on newly constructed bench terraces at the Allsides Pilot Development Project in the Parish of Trelawny.

MATERIALS AND METHODS

The site at Allsides, Trelawny, has an elevation of 800 m and consists of newly constructed bench terraces. The soil is a deep Ultisol, locally classified as Wirefence clay loam. Soil samples were taken at the site prior to planting with 10 borings at the 0–45 cm layer. Particle size distribution was determined by the pipette method (5); organic matter by chromic acid titration and pH (1:2.5 soil-water ratio) with a glass electrode. Cation exchange capacity was determined by the ammonium acetate method; Ca and Mg, by the Versenate titration method (3); K, with 0.5 N CH₃COOH extract; Mn, Cu, and Fe, colorimetrically; P, by the Truog method (1). Exchangeable Al was extracted with N KCl and determined by the double titration method (6). Nitrogen was determined by the Kjeldahl method. Bulk density was determined from undisturbed soil columns; water was retained at 1/3 bar by means of pressure plates.

Temperatures during the trial period (November 1978 to January 1979), were within the range (10° to 35° C) and are considered favorable for growth of *Phaseolus vulgaris* L. (9). Total rainfall amounted to 92.5 mm, and potential evaporation from a class A pan totaled 258 mm.

Plots were 2.5 m wide and 2 m long. Seeds were sown in four rows spaced 50 cm apart and at 10 cm within the row resulting in a density of 200,000 seeds/ha. Grain yields were estimated from the two center rows. The cultivars tested were Miss Kelly, Tom Red, ICA Guali, California Light Red, 27R and ICA Duva. A randomized complete block design with three replicates was used.

Immediately following the harvest of a crop of yams, the test area comprising two terraces was forked. Fertilizer was applied in the furrows 5 cm below seeding depth, at planting time. The soil was not limed. N as urea, P₂O₅ as triple superphosphate, and K as muriate of potash were used at the rates of 50, 300 and 150 kg/ha, respectively. The experiment was planted from the 1st to the 3rd November, 1978, and harvested between January 17 and 24, 1979.

Pests and diseases were controlled by applications of Rasudin and Maneb⁴ at the rates of 33 and 332 g a.i./ha, respectively.

The following data were recorded: a) nodulation score—by sampling 10 plants from the guard rows, at the 50% flowering stage; b) number of

⁴ Trade names in this publication are used only to provide specific information. Mention of a trade name does not constitute a warranty of equipment or materials by the Agricultural Experiment Station of the University of Puerto Rico, nor is this mention a statement of preference over other equipment or materials.

Pods/plant and seeds/pod at harvest; c) grain yield at 10% moisture level; and d) weather data, i.e., rainfall, temperature, evaporation from a Class A pan, and sunshine hours.

RESULTS AND DISCUSSION

Table 1 shows that the soil is strongly acid (pH 4.9) and high in exchangeable Al (6.70 meq/100 g); however, the soil was not limed. Levels of available P, Mg and Zn were low, while those of N and K were low to medium low. The plough layer had a bulk density of 1.2 g/cm³, a field capacity (1/3 bar) of 50% and a cation exchange capacity of 14.0 meq/100 g (2).

TABLE 1.—Selected physical and chemical properties of the 0–45 cm soil layer of a newly terraced Ultisol planted to red beans (*Phaseolus vulgaris* L.)

Property	Value
Clay, %	62.78
Silt, %	22.01
Sand, %	15.21
Organic matter, %	3.05
Water retained at 1/3 bar, %	50.00
Bulk density, g/cm ³	1.20
pH (1:2.5)	4.90
Cation exchange capacity, meq/100 g	14.00
Exchangeable Al, meq/100 g	6.70
Exchangeable calcium, meq/100 g	5.50
Exchangeable magnesium, meq/100 g	1.40
Nitrogen, %	0.15
Phosphorus, p/m	13.60
Potassium, p/m	168.00
Copper, p/m	1.30
Iron, p/m	92.00
Manganese, p/m	8.10
Zinc, p/m	3.60

In spite of the net negative atmospheric water balance over the entire crop cycle (92.5 mm of rainfall and 258 mm potential evapotranspiration), there was adequate soil moisture at planting which resulted in good crop stands and vigorous plant growth. Furthermore, the crop benefited from several brief showers at the podding and grain filling stages. Despite the overall negative atmospheric water balance recorded throughout the life of the crop, yields of the three most productive cultivars were comparable to those obtained by farmers in other parts of the island (4).

Germination of all cultivars, except 27R, was approximately 95%. Seeds of cultivar 27R germinated poorly (60%), because of poor viability. Generally, plant stands were good and growth was vigorous. Pest damage was mainly caused by leaf miners although damage was slight. Cutworm

damage was minor shortly after germination. Plants were relatively disease-free up to the flowering stage. Thereafter, powdery mildew infected all cultivars. Rust also was observed on all cultivars, except ICA Guali. ICA Duva and Miss Kelly had a low incidence of rust. These observations are not in agreement with those of Pierre (8), who reported that cultivar Miss Kelly was resistant to rust. One possible explanation for this is that the seeds of Miss Kelly are often contaminated with those of cultivar Cockstone, which is similar in appearance to Miss Kelly, but susceptible to rust. There was a slight incidence of bacterial blight, angular leaf spots, and anthracnose, but at levels that would appear not to have affected growth and development of plants.

Table 2 shows seed yields, number of pods/plant, number of seeds/pod and number of nodules. Cultivars Miss Kelly, Tom Red and ICA Duva produced yields equivalent to 1182, 1023 and 934 kg/ha, respectively.

TABLE 2.—Yield and yield components of six red bean cultivars (*P. vulgaris* L.) grown at Allsides, Trelawny, Jamaica

Cultivar	Seed yield at 10% H ₂ O kg/ha	Pods/plant	Seeds/ pod No.	Nodules/plant
Miss Kelly	1182 ^{c1}	5.8 ^{bc}	4.4 ^d	30.5 ^a
Tom Red	1023 ^c	5.9 ^{bc}	3.9 ^c	14.9 ^a
ICA Duva	934 ^{bc}	4.5 ^{bc}	3.2 ^b	14.1 ^a
ICA Guali	528 ^a	4.1 ^{ab}	2.8 ^{ab}	2.9 ^a
California				
Light Red	674 ^{ab}	4.2 ^{ab}	2.6 ^a	9.9 ^a
27R	648 ^{ab}	6.1 ^c	3.9 ^c	2.8 ^a
Coefficient of Variation (%)	20.2	19.6	8.6	117.6

¹ Treatments followed by the same letter do not differ significantly at the 5% level, Duncan's Multiple Range Test.

These yields did not differ at the 5% level. Miss Kelly and Tom Red, however, performed significantly better than ICA Guali, California Light Red, and 27R. The lowest yield, 528 kg/ha, was obtained from ICA Guali.

Cultivars 27R, Miss Kelly, Tom Red, and ICA Duva produced the greatest number of pods/plant. ICA Guali and California Light Red had significantly lower number of pods/plant than the other cultivars. Miss Kelly had significantly more seeds/pod than the other varieties. The comparatively low number of seeds/pod and pods/plant produced by ICA Guali and California Light Red contributed to their overall low yield (table 2).

Nodulation scores were highest for those cultivars which produced the highest yields and lower for those which produced the lowest yields (table 2). However, because of a large variation in the nodulation scores between

plots, no significant difference was recorded for this parameter. The overall mean number of nodules/plant was 13 and ranged from 3 to 31.

The results of this trial indicate that cultivars Miss Kelly, Tom Red and ICA Duva, produced acceptable yields which averaged 1050 kg/ha of high quality seeds. Miss Kelly and ICA Duva had an additional advantage because they were not seriously affected by rust, which is one of the major diseases of red beans in Jamaica.

RESUMEN

Se evaluó el comportamiento de seis cultivares de habichuelas coloradas sembradas en bancales en un Ultisol inclinado en Jamaica. Las cultivares incluidas en el experimento fueron Miss Kelly, Tom Red, ICA Duva, ICA Guali, California Light Red y 27-R. Los rendimientos fluctuaron de 1182 kg/ha en el caso de la cultivar Miss Kelly a 528 kg/ha de la cultivar ICA Guali. Las cultivares de mayor producción fueron Miss Kelly, Tom Red e ICA Duva. Los rendimientos de las cultivares Miss Kelly y Tom Red fueron significativamente más elevados que los de California Light Red, 27-R e ICA Guali. La cultivar 27-R produjo más vainas por planta y la Miss Kelly más granos por vaina que todas las demás cultivares. Estas diferencias fueron significativas. No hubo diferencias significativas, en nodulación entre las cultivares.

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