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YIELD POTENTIAL AND DISEASE RESISTANCE OF
DRY BEAN (*Phaseolus vulgaris*) VARIETIES
IN JAMAICA

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INTRODUCTION

Dry bean (*Phaseolus vulgaris*) is one of the most widely utilized grain legumes in Jamaica and it is estimated that some 4,000 to 5,000 tons are utilized annually. Local production has remained more or less static at just over 2,000 tons per annum since 1967 (6), so that reasonably large quantities have been imported every year. In 1972, for example, some 1,615 tons were imported at a value of \$479,000 (2). Several factors contribute to this situation. Dry beans are produced almost exclusively by small farmers on small plots (0.1-1.0 ac.) in the hilly areas of Jamaica under conditions in which farmers have absolutely no control of water. Since the crop is highly sensitive to excesses and deficiencies in soil moisture during the growing period and in addition the beans rapidly deteriorate under prolonged high humidity during the period of maturation, it is not surprising that farmers consider dry beans a "high risk" crop.

Pierre (3,4,5) has reported that in addition to the limitations associated with moisture, the high incidence of diseases also is a major limiting factor to bean production in Jamaica. Many of the diseases to which the crop is susceptible are seed borne e.g. anthracnose, bacterial blights, bean common mosaic. Unfortunately, no facilities are currently available for the production and distribution of disease-free seeds, with the result that farmers save their own seeds and so perpetuate these diseases.

The main objectives of the University's research programme on dry bean were as follows:

1. Improvement of various agronomic practices including spacing, weed control, fertilizer response
2. Identification of the major diseases and development of measures for their control
3. Evaluation of varieties for yield potential and disease resistance.

As the title of this paper indicates, we are primarily concerned here with yield potential and disease resistance.

METHODS AND RESULTS

Evaluation of varieties for yield potential

In a preliminary trial, 35 varieties were planted during the month of August, 1969 in single row replicated plots. In this trial, 10 varieties yielded in the range 500-1,100 kg/ha and 25 varieties produced less than 500 kg/ha. The better performers included many of the kidney types, e.g. Redkote, Charlevoix, Dark Red Kidney, Light Red Kidney and Diacol Minia, Pinto UI 114 and two local selections, Miss Kelly and Round Red. Redkote (1077 kg/ha) was the best yielder and the local standard Miss Kelly yielded 663 kg/ha.

In a second preliminary trial, 41 varieties were planted during the month of December 1969, again in single row replicated plots. In this trial, the following varieties yielded over 2,500 kg/ha - Pinto #114, Great Northern #31, Miss Kelly, Pinto 66/9251/1, Great Northern 1140 and Red Mexican #37. Ten varieties, including Portland Red, Small White and a number of black seeded types, yielded between 2,000 and 2,500 kg/ha. Nineteen varieties yielded in the range 1,000 - 2,000 kg/ha and six varieties produced under 1,000 kg/ha. All the kidney types together with the local selections Cockstone and Round Red were in the last two groups.

Two further trials were carried out in December, 1970 and February, 1974, respectively. A randomised block design with three replications was used in each case with four rows 610 x 48 cm. The results are given in TABLES 1 and 2.

RESULTS

In TABLE 1 the best nine varieties were not significantly different from each other and produced yields in the range 1784 (Sutter Pink) to 2351 kg/ha in the local variety Miss Kelly. Within this range also were included the local varieties Portland Red and Round Red, plus Redkote, Diacol Minia and a number of the Red Mexican types. The number of days to harvest ranged from 73 to 86. Round Red produced the lowest number of pods per plant (5.5) compared to Long Red (11.7). The number of seeds per pod also varied in the different varieties and ranged from 2.3 to 3.9.

In TABLE 2, the varieties ICA Quali, Miss Kelly, Diacol Minia and ICA Duva were not significantly different from each other but there was a significant difference between the yield of these varieties in comparison to the other varieties tested. A total of seven varieties yielded over 2,000 kg/ha. The period to maturation ranged from 63 days in most of the kidney types to 83 days in the case of Mexico 235. The number of pods per plant ranged from 5.1 (Redkote) to 12.8 (Santa Anna) and the number of undeveloped pods per plant ranged from 0.33 (ICA Duva) to 3.33 (Santa Anna).

Evaluation of Varieties for disease resistance

The bean diseases which occur in Jamaica have previously been reported (3,4,5). These include anthracnose, bacterial blights, bean common mosaic, bean yellow mosaic, golden mosaic, rust, powdery mildew, angular leafspot, Rhizoctonia root rot, Sclerotium wilt and root knot. In addition Rhynchosia mosaic and bean smut (Antyloma sp.) attack beans to some extent. By far the most important diseases are golden mosaic, rust, anthracnose and bacterial blights.

Golden Mosaic:

Golden mosaic is a virus-like disease which is transmitted by a whitefly (Bemisia tabaci) which breeds profusely on poinsettia (Euphorbia pulcherrima). The main hosts are bean, lima bean (Phaseolus lunatus) and an extremely common weed (Phaseolus lathyroides). Over 100 varieties have been tested in Jamaica for resistance to this disease without success. Games (1) has evaluated over 4,000 varieties of beans in Costa Rica and failed to find resistance. In Jamaica, some variability in the response of varieties to this disease has been observed but this is attributed to a varietal preference by the whiteflies rather than varietal tolerance of the pathogen. This disease is prevalent in the lowland areas but the incidence is low during the cooler months from November through March (3).

Rust:

This is a cool season disease which unlike golden mosaic is prevalent during the cooler months. Several varieties have been evaluated for resistance to rust and the results of one of the most recent trials are shown in TABLE 3. Although many resistant varieties have been found, most of them are black or brown-seeded types. Among the red-seeded types, the local variety Miss Kelly is outstanding. Other resistant red types include Mexico 235 - a late, low growing semi-trailing variety - and Portugal, a poor yielder. Some of the newer introductions (ICA Guali, ICA Duva, Diacol Lima, Diacol Calima, Pompadour, BEP-2) appear to be "slow rusters".

Anthraconose:

This is another cool season disease which also is seed borne. Trials in Jamaica indicate the presence of several races of this pathogen to which all the local varieties are highly susceptible. Some of the introduced varieties are resistant to some races of this fungus but because of the wide distribution of the different races control through the use of resistant varieties would be of no significance.

Bacterial Blights:

Two types of common bacterial blight occur in Jamaica. The diseases are seed-borne and can be extremely destructive under conditions of high rainfall. Varietal evaluation for resistance to these diseases is being carried out in Puerto Rico. If sources of resistance are found these will be utilized in our breeding programme.

DISCUSSION

Time of planting was the main contributory factor to the difference in the level of yield obtained in the two preliminary trials. In general, beans grow best under relatively cool weather conditions and it is clear from these trials that all varieties performed better when planted during the cool season, except where there was a superimposition of additional limiting factors.

One such additional factor in the cool season planting was the high incidence of bean rust to which the kidney types and several other varieties are highly susceptible. The high incidence of yet another disease, golden mosaic, also contributed to yield reduction in the August planting.

The level of yield obtained in the major trials are quite similar in the standard varieties Miss Kelly, Portland Red and Charlevoix, the exception being the variety Redkote which produced a much lower yield in the second planting. This again is attributable to the high incidence of rust on this variety and Dark Red Kidney.

Several varieties are resistant to rust but these are mostly black and brown-seeded types and since the consumers in Jamaica prefer the red-seeded types, the main value of these would be as sources of resistance in a breeding programme. A few red-seeded types also are rust resistant and among these, Miss Kelly is outstanding both in terms of resistance and yield potential. Portugal, another rust resistant variety, is a poor yielder and Mexico 235 has the disadvantage of having a low, semi-trailing growth habit. The three varieties, ICA Guali, ICA Duva and Diacol Lima produced yields quite similar to Miss Kelly. These varieties are "slow rusters" and have the advantage of being bush types - a feature which would facilitate mechanical harvesting if this is implemented. These varieties will be released shortly.

One other interesting variety is MRP-2 - a white-seeded pea bean of the type used in the pork and beans industry. This variety also is a "slow rustier" and it appears to have a higher yield potential than the other pea beans which have been evaluated. This variety also will be released shortly.

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REFERENCES

1. GAMEZ, R. (1971). Los virus del frijol en Centroamerica. I. Transmision por moscas blancas (*Bemisia tabaci* Genn) y plantas hospedantes del virus del mosaico dorado Turrialba 21 (1) 22-27.
2. GOVERNMENT OF JAMAICA. External Trade Statistics 1972.
3. PIERRE, R.E. (1974). Observations on golden mosaic of bean (*Phaseolus vulgaris* L.) in Jamaica. Proc. Grain Leg. Dis. Workshop, Univ. Puerto Rico. In Press.
4. PIERRE, R.E. (1972). Identification and control of diseases and pests of 'red pea' (*Phaseolus vulgaris*) in Jamaica. Univ. West Indies Rpt. Bull. 6 : 31p.
5. PIERRE, R.E. (1968). Bean diseases in Jamaica. Proc. Carib. Food Crops Soc. 6 : 42-44.
6. REPORT ON DOMESTIC FOOD CROPS 1971. Agric. Plan. Unit, Min. of Agric.

TABLE 1. Seed yield and other characteristics of dry bean varieties grown at Lawrence Field, St. Catherine, Jamaica in Dec. 1970.

Varieties	Seed Yield (a) (kg/ha 88% DM)	Growth Habit	Seed Characteristics		Podding Characteristics		No. of Days to Harvest
			Colour	100 D.Wt. (gm)	No/ph	Seeds/pods	
Miss Kelly (L)	2351 a	Semi-trailing		24.8	9.0	3.9	80
Portland Red (L)	2210 ab	Semi-trailing	Dk. Red	20.5	10.6	3.7	73
Diacol Minia 85/364	2181 abc	Bush	Wh. Str.	48.6	8.0	2.8	86
Redkote	2084 abcd	Bush	Dk. Red	43.7	7.0	2.3	78
Red Mexican #36	1974 abcd	Semi-trailing	Red	28.5	10.5	3.4	86
Red Mexican #34	1959 abcd	Semi-trailing	Red	26.4	9.6	3.6	86
Red Mexican #37	1837 abcd	Semi-trailing	Red	26.6	7.9	3.6	75
Round Red (L.)	1812 abcd	Bush	Red	24.6	5.5	2.9	73
Sutter Pink	1784 abcd	Semi-trailing	Pink	27.9	10.5	3.6	73
Rig Bend	1734 bcd	Semi-trailing	Red	23.8	9.3	3.6	86
Dark Red Kidney	1725 bcd	Bush	Dk. Red	33.4	7.5	2.4	73
Red Mexican #35	1705 bcd	Semi-trailing	Red	29.6	7.8	3.1	86
Pinto #114	1652 bcd	Semi-trailing	Brown Str.	31.5	6.1	3.9	75
Long Red (L)	1628 bcd	Bush	Red	22.2	11.7	3.9	75
Great Northern #59	1612 cd	Semi-trailing	White	26.9	7.8	3.2	79
Charlevoix	1502 d	Bush	Red	38.4	5.8	3.2	73

Coef. of Variation 16.2%

(a) Treatments followed by the same letter are not significantly different by Duncan's Multiple Range Test at 5% or less.

TABLE 2. Seed yield and other characteristics of dry bean varieties grown at Lawrence Field, St. Catherine, Jamaica in February, 1974.

Varieties	Seed Yield (a) (kg/ha 80.0K)	Growth Habit	Seed Characteristics		Podding Characteristics			No. of Dis. Incidence Days to Harvest	Rust G. Mos.	
			Colour	100 Wt (gm)	No/plant	No/undev/pl	Seed/pod			
ICA Quali	3068	a	Bush	Dk Red Wh Str	51.5	7.7	0.56	3.5	73	Trace -
Miss Kelly (L)	2901	a	Semi-trailing	Lt Red Red Str	23.7	9.6	0.56	4.2	71	None -
Diacol Nina	2705	ab	Bush	Dk Red Wh Str	47.3	8.1	0.36	2.9	73	Trace 0.7
ICA Duva	2536	abc	Bush	Dk Red	44.4	8.6	0.33	2.4	73	Trace -
Portland Red (L)	2150	-bcd	Semi-trailing	Dk Red	17.5	9.9	0.63	4.1	66	Mod. 0.3
Pompadour	2144	-bcd	Bush	Red Wh Str	31.9	5.7	1.06	3.1	71	Light -
Mexico 235	2032	---cde	Semi-trailing	Red	28.1	8.2	1.40	3.2	83	None -
Diacol Calima	1757	---def	Bush	Dk Red Wh Str	39.4	8.0	0.50	3.1	71	Trace -
Charlevoix	1618	---defg	Bush	Dk Red	35.8	6.5	1.83	2.5	63	Mod. -
27-R	1545	---efgh	Bush	Lt Red	35.1	5.7	1.26	3.8	66	Mod. -
NEP-2	1465	---efgh	Bush (tall)	White	10.2	12.7	0.66	5.3	78	Trace -
Santa Anna	1432	---fgh	Semi-trailing	Red	28.3	12.8	3.33	2.2	66	Light -
Dark Red Kidney	1176	---fgh	Bush	Dk Red	35.6	5.8	1.53	2.4	63	Severe 0.3
Redkote	1117	---fgh	Bush	Dk Red	33.9	5.1	1.56	3.1	63	Severe -
Portugal	950	-----	Semi-trailing	Red	30.4	6.1	2.03	3.4	78	None -

Coef. of Variation 15.6%

(a) Treatments followed by the same letter are not significantly different from each other by Duncan's Multiple Range Test at 5% or less.

TABLE 3. Response of selected bean varieties to rust.

Code	Variety	Seed Colour	Rust Reaction (a)	
			Jamaica	Puerto Rico
71	PRSTO/15R42/1EK	Black	2	0
72	PRSTO/15R42/52EK	Black	2	0
73	PRSTO/15R42/55EK	Black	2	3
74	PRSTO/15R42/57EK	Black	2	4
75	PRSTO/15R42/57EK	Black	2	0
76	PRSTO/15R42/148EK	Red	2	0
77	PRSTO/15R42/167/4EK	Buff	2	0
78	PRSTO/15R42/180EK	Brown	2	0
79	PRSTO/15R42/189/1EK	Brown	2	3
80	PRSTO/15R42/193/1EK	Brown	2	0
81	PRSTO/15R94/2EK	Brown	2	0
82	PRSTO/15R277EK	Red	5	3
83	PRSTO/15R297/1EK	Buff	3	0
84	PRSTO/15R292EK	Buff	2	0
85	PRSTO/15R210EK	Brown	5	3
86	PRSTO/15R66/1EK	Black	3	3
87	PR HTL/1R 63	Black	2	0
88	PR HTL/1R 69	Black	3	0
89	PR HTL/1R101	Black	2	2
90	PR HTL/1R103	Black	2	0
91	PR HTL/1R113	Black	2	0
92	PR HTL/1R136	Black	2	0
6	Charlevoix	Dk Red	5	0
13	Redkote	Dk Red	5	0
14	Portugal	Red	2	0
58	ICA Duva	Dk Red Wh Str	5	0
59	ICA Quali	Dk Red Wh Str	5	0
60	Diacol Calima	Dk Red Wh Str	5	0
61	Diacol Nina	Dk Red Wh Str	5	0
63	Mexico 235	Red	2	0
93	27-R	Lt Red	5	0
94	NEP-2	White	2	0
95	Pompadour	Red, Wh Str	5	0
	Miss Kelly (L)	Lt Red, dk red str	2	0
	Portland Red (L)	Dk Red	5	0
	Long Red (L)	Red	5	0

(a) Jamaica reaction grades based Davison's 1-5 scale () in which 1 = immune; no necrosis or other evidence of infection; 2 = hypersensitive necrosis; 3 = pustules under 300²/ha.; 4 = pustules 301-495²/ha.; 5 = pustules over 500²/ha. In the Puerto reaction grades 0 = no infection.