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LIMA BEAN (PHASEOLUS LUNATUS) PRODUCTION AND DISEASE RESISTANCE TRIALS IN JAMAICA

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ABSTRACT

Lima bean, an important grain legume in the Caribbean and Central America region has never been produced to meet demand. The main causes for this are low producing types and diseases. An attempt was made to test F hybrids for hybrid vigour. The plants were destroyed by the bean golden mosaic virus disease. A next trial was established to evaluate some selections from Jamaica showing a high degree of resistance to the disease, along with others from Africa, Brazil, Central America and the U.S.A. All succumbed to the disease. The paper also describes the bean vegetative propagation method and list the selections tested.

INTRODUCTION

The Lima Bean (Phaseolus lunatus) is a native to Tropical America, being grown widely before the Europeans (McKie 1943, Erickson 1982). The crop is currently an important grain legume in Central America, Northern South America and the West Indies, where it is produced mostly at subsistence levels. Its greatest commercial importance is as a processed vegetable in the USA.

The crop is well suited to the tropics because of its tolerance to high temperature, its resistance to most pests and diseases of legumes, a high drought tolerance, and its moderate perennial habit (Erickson 1982). It is extensively grown in Jamaica in small farm plots along hedges or on various supports, under the name 'broad bean'. Production has never met demand, and currently about 250 tons of dried grains are imported annually for processing, from the USA. One processor has offered to purchase 125 tons of locally produced good quality grains at a competitive price, and several farmers have expressed the desire to produce the crop.

No previous research has been done on lima bean in Jamaica, and very little elsewhere, despite its wide distribution and suitability to the climate. The major production limitation recognized in Jamaica are low-producing selections and the bean golden mosaic virus disease.

The research being reported on here was initiated to test for high-yielding lima bean selections, but as this was soon hampered by the bean golden mosaic virus (Pierre 1975), emphasis was switched to that disease.

F1 hybrids of lima beans are reported to possess strong hybrid vigour, and a small plant in Brazil in 1982 gave extremely high yield (20 tons per ha. extrapolated), (Erickson personal communication). Although no previous attempt was made to utilize F1 hybrid varieties among edible legumes because of the high cost of producing hybrid seeds, as an efficient method of vegetative propagation or cloning was developed, this trial was attempted.

Test No. 1

MATERIALS AND METHODS

The trial was established at the CARDI Experimental Garden at UWI Campus, Mona, Kingston in March 1985 to evaluate four promising F1 hybrid varieties of lima bean from Purdue University, Indiana, U.S.A. These are described in Table 1.

The Plantlets were prepared at Purdue University as follows. Two-node cuttings were made from green house grown stock plants and immediately placed in a contalner with water to prevent wilting. They were subsequently dipped in Hormodin 2 and stuck in perlite in small 12"x18" flats. One tablespoon full of Osmocote 20-20-20 was applied to each flat before the cuttings were placed in them to allow for a ready supply of nutrients as roots were initiated. About 50 cuttings were placed in each flat. The flats were placed under continuous mist until the plants were properly rooted, at which time nitrogen at 200 ppm was applied. At four weeks the plantlets were removed from the medium, labelled and packaged and taken to Jamaica.

A plot consisted of 4 rows of a variety each of 20 plants set one foot apart. The rows were spaced 6 feet apart. The plots were arranged in a randomized complete block design and were replicated four times. Irrigation was by overhead sprinkler system and the soil watered to saturation every four days. Weed control was by hand. The plants were supported on wooden poles.

All the plants died within seven days due to excessive heat and transplant shock. Another set wae prepared in the same manner as the first, but this time they were properly hardened - off before they were planted in the same garden using the same design and cultural care, and cultural care, and these survived and grew.

RESULTS AND DISCUSSION

Within 28 days of planting, some of the lima beans began flowering, and by day 42 after planting, plants in all the plots showed slight symptoms of a virus disease. By day 56 after planting all the plants showed yellowing, one of the distinct symptoms of bean golden mosaic disease. The common whitefly vector Bemisia tabaci was present in low populations. No significant statistical data on yield could be collected because of the high disease mortality that resulted. However the F1 hybrid plants showed more vigour than their parents, and withstood the virus disease infection much longer before drying up. Seeds were harvested from some of the F1 hybrid plants, but none from the parent cultivars. The dried vines were also cut at ground level and weighed (See Table 2 for Data).

The rate of lima bean infection, and the high degree of mortality caused by the bean golden mosaic virus disease, suggest that before any work is done on bean yield, it would be prudent to attempt ways of controlling or mitigating the effects of the disease. Because of the difference observed between F1 hybrid and the cultivars, future work should be continued with the former.

Test No. 2

Preliminary observations shown in Test No. 1 indicated that 4 selections of high yielding lima beans from the USA succumbed to the bean golden mosaic virus disease at Mona in Jamaica. It would be unwise to continue introducing new selections unless some accepted level of tolerance or resistance to the disease is assured. This could be done by selection or breeding. Since several cultivars of lima bean are grown in South St. Elizabeth, Jamaica, often under hot dry conditions suitable to the common vectors, it was decided to compare these selections with introduced ones against the disease.

MATERIAL AND METHODS

A field collection of 14 lima bean selections were made from St. Elizabeth and 1 from St. Andrew, from vines which showed little or no symptoms of the bean golden mosaic virus. These were compared with 14 selections from Purdue University. Table 3 lists the exact origin of each selection.

The site used for this trial was the same as the previous one, to take advantage of the high disease infectivity that could exist there. Each trial plot consisted of 2 rows of 4 plants of a selection. The plants were set at 1 meter apart and the rows were 1 meter apart. There were no guard rows. The trial was planted in a completely randomized design with 4 replications. Two plants were supported by a single wooden pole placed between the rows.

At 8 days after establishment the missing spots were planted with new seeds. Plants that died later were not replaced. Irrigation was by over-head sprinkler, and water was applied 4 days to soil saturation. Weed control was manual. The vines were tied to the poles with cotton cord, the apparently healthy ones done first, and the diseased ones after. No attempt was made to control any pest or disease during the trial, and during the evaluation some of the plants were touched by hand. After each evaluation the plants were shaken gently with a steel rod to encourage movement of the vector in the plots. The plants were monitored regularly for early disease symptoms.

RESULTS AND DISCUSSION

The first symptoms of bean golden mosaic virus (slight mottling of the leaves) was noticeable by 48 days after planting, and all the plants showed some symptoms by the 94th day. During the period the population of the known insect vector Bemesia tabaci (Pierre 1974) remained low, varying from 0 to 4 per leaf and 0 to 38 on a plant. None of the plants produced any grains.

The complete destruction of lima bean plants by the bean golden mosaic virus disease did not necessitate statistical proof that all the entries tested were susceptible to the disease. The high degree of disease infection suggested that the area was ideal for the test and the methodology used was good. Further research needs to be done on the crop, particularly in the area of disease control. The ideal is to seek a resistant or highly tolerant good yielding selection, but other approaches such as vector control or time of planting should be attempted.

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REFERENCES

Erickson, H. T. 1982. Lima bean legacy. Hort. Sci. 17(5):702.

Erickson, H. T. 1982. Exploiting the Lima Bean (Phaseolus lunatus) for the tropics. Stencilled Report. Department of Hort. Sci., Purdue University, USA.

McKie, W. W. 1943. Orlgin, disposal and variability in lima beans (Phaseolus lunatus) Hilgardia 15: 1-29.

Pierre, R. E. 1974. Observation on the golden mosaic of bean (Phaseolus vulgaris) in Jamaica. In: Bird, J. and R. Moramorosch. Tropical Diseases of Legumes, pp. 55-59. Academic Press, NY.

Schoneweis, S. D. 1988. Vegetative propagation to utilize heterosis in lima bean (Phaseolus lunatus). MSc. Thesis, Horticulture Department. Purdue University, Indiana, USA 1988.

Table 1. Description of Lima Bean Selections from Purdue University and tested at Mona, Kingston, March 1985

Selections	Colour	Shape	No Seed/Kg	Habit	Photo Period Response
C*X BGH** 273	Buff	Potato	1044	Vine	Short Day
C X BGH 836 F1	Gold/Black	Potato	2904	Vine	Short Day
BGH 273	Buff/Tan	Long/Flat	406	Vine	Short Day
BGH B36	Brown/Mix	Potato	2238	Vine	Short Day

* A small seeded day neutral determinate US cultivar
** Inbred cultivars from Brazil

Table 2. Dried Bean Yield and Vine Weight (Grams) from Lima Bean Trial No. 1 at Mona,Kingston

Sslections	Total yield/4 Reps	No. of Plants	Av. Vine Wt.
C X BGH 273 F1	1162	19	56.81
C X BGH 836 F1	406	14	37.17
BGH 273	0	0	0
BGH 836	0	0	0

Table 3. Source of Lima Bean Selections used in the 2nd Trial at Mona vs Common Bean Mosaic Virus

Selection No.	Name	Source
	Purdue University Entries	
1	BGH 128	Purdue University, USA
2	BGH 188	Purdue University, USA
3	BGH 273	Purdue University, USA
4	BGH 476	Purdue University, USA
5	BGH 633	Purdue University, USA
6	BGH 4069	Purdue University, USA
7	Liberia Collection	Liberia
8	Belem Collection	Belem
9	Prize Taker	Purdue University, USA
10	Hendersons	Purdue University, USA
11	Fordhook 242	Purdue University, USA
12	Costa Rica 412	Costa Rica
13	Guatemala 289	Guatemala
14	Guatemala 926	Guatemala
15	Hybrid C X Monteiga F2	Purdue University, USA
16	Hybrid C X BGH 273 F2	Purdue University, USA
17	Hybrid C X BGH 275 F2	Purdue University, USA
18	Hybrid C X BGH F2	Purdue University, USA

Table 3. cont'd. Source of Lima Bean Selections...

	Jamaican Entries	
1	Crafton Banton	Southfield, St. Elizabeth
2	Billy Beckford	Malvern, St. Elizabeth
3	Cassley Salmon	Leeds, St. Elizabeth
4	Mrs. M. Smith	Top Hill, St. Elizabeth
5	Crafton Banton II	Southfield, St. Elizabeth
6	Basil Rowe	Leeds, St. Elizabeth
7	Wilford Smith	Top Hill, St. Elizabeth
8	John Forbes	Top Hill, St. Elizabeth
9	Charles Powell	Nain, St. Elizabeth
10	Hazel Burton	Top Hill, St. Elizabeth
11	Jean Wittshire	Cheapside, St. Elizabeth
12	Merton Forbes	Top Hill, St. Elizabeth
13	?	Malvern, St. Elizabeth
14	Peggy Miller	Malvern, St. Elizabeth
15	Brian Topper	Mount James, St. Andrew