DETERMINATION OF YIELD LOSS CAUSED BY RUST (Uromyces phaseoli (Reben) Wint.) IN COMMON BEAN (Phaseolus vulgaris L) IN PUERTO RICO*

Hiram Velez-Martinez, University of Puerto Rico, Mayaguez, PR 00708,
Julio Lopez-Rosa, University of Puerto Rico, Mayaguez, PR 00708, and
George F. Freytag, ARS-USDA, Mayaguez, PR 00708

Diseases have been reported as one of the major limiting factors in the production of dry beans in the tropics (Theis et al 1957, Schwartz & Galvez 1980). Since bean rust (Uromyces phaseoli (Reben) Wint.) can be a serious disease in many bean production areas (Arthur 1934), the present investigation was carried out to determine a) the yield losses caused by the disease and b) the relationship between yield loss and other factors such as pustule size, % of infection, and relative susceptibility of the various cultivars.

A series of lines and cultivars were selected to include lines from previous rust studies in PR and lines and cultivars from other countries such as the US and Colombia (CIAT). The field trial was planted on December 11, 1985 in Isabela, PR as a split plot arrangement of a randomized complete block where the main plots were the fungicide treatments and the subplots were varieties with three 3m rows, 10 seed/m, and 1 m between rows. Spreader lines were planted 2 weeks before field plots and inoculation was carried out by hand spraying using local inoculum from near-by fields. Nine applications of fungicide were applied rotating benomyl and oxycarboxin weekly at recomended dosages. Six weekly evaluations of rust incidence were taken following the recomendations of the Bean Rust Workshop held in Mayaguez in 1983.

Results showed that loss in yield due to rust infection fluctuated between 5% in rust tolerant varieties to 75% in susceptible types (table 1). The magnitude of loss in highly susceptible varieties depended on the timing of the initiation of the rust epidemic. If infection begins before flowering, a total loss can occur. Fungicide application was most effective for susceptible varieties but should be applied at 7 day intervals beginning before flowering. On moderately susceptible or tolerant varieties fungicide applications can be delayed until appearance of the rust. In general, cultivars with genetic resistance such as in lines 2W-33-2, B-190, and BAT-41 do not require fungicide applications. A direct relationship was found between size of pustule and % of infection with susceptible varieties such as the pintos showing the largest pustule size (table 2). Regression of % infection on days after planting showed that on susceptible varieties like Pinto 650 (fig.1) the disease incidence advanced rapidly and reached high levels both with and without fungicide treatment while on tolerant varieties like 2W-33-2 (fig.2) the disease advanced slowly and only reached moderate levels of infection when fungicide was used.

References:

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Table 1. Field weight yields of plots treated and not treated with fungicides

Variety	Yield (grams)/plot Fungicide	No Fungicides	Yield Loss Weight	%
PINTO-650	653.44[a/]	162.07	491.37[b/]	75.19
PINTO-114	712.66	256.22	456.29	64.03
VEN-36	1310.51	810.00	493.62	37.66
OLATHE	821.00	514.62	306.38	37.32
M.W.H.R.	567.78	356.38	211.40	37.23
BONITA	1052.98	770.34	284.64	27.19
BAT-153	898.83	728.76	170.07	18.92
2W-33-2	1117.88	1037.48	140.40	11.91
B-190	1268.87	1119.97	148.90	11.74
BAT-41	1182.62	1118.56	63.08	5.34
Averages	965.05	688.14	276.6	28.69

a/ LSD 5 % between varieties = 233.5 g.
b/ LSD 5 % between fungicides treatments for a variety = 159.5 g.

Table 2. Size of rust pustules on bean varieties for the January-March 1986 bean trial.

Variety	Pustule Size Longest	Most Frequent
PINTO 650 +	6 *	6
PINTO 114 +	6 *	6, 5
Ven. 36 +	6, 5 *	6
OLATHE +	5 *	4
M.W.H.R. +	6 *	4, 5
BONITA	6, 5 *	5
BAT 153	5	4, 2
2W-33-2	5	3, 4
BAT 41	4	3, 2
B-190	-	-

* Chlorotic ring around pustule.
+ All size present.

Figure 1. Regression of Log (X/1-X+0.5) where X=% of infection from planting cv Pinto 650

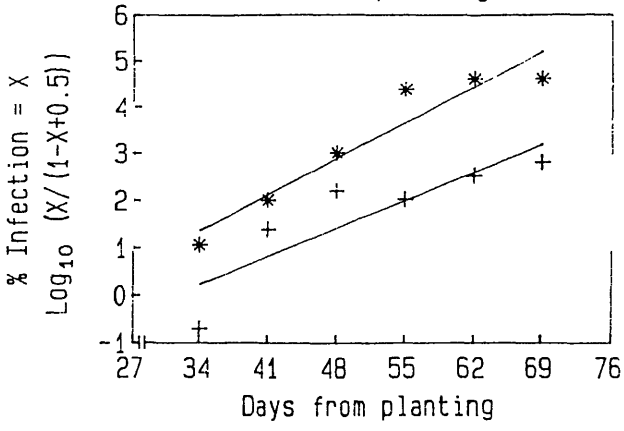

Figure 2. Regression of Log (X/1-X+0.5) where X=% of infection from planting cv 2W-33-2