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

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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.

Results showed that loss in yield due to rust infection fluctuated between 5% in rust tolerant varieties to 75% in susceptible types. The magnitude of loss in highly susceptible varieties depended on the timing of the initiation of the rust epidemic. If infection begins before flowering, maximum loss occurs. 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 application 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. Regression of % infection on days after planting showed that on susceptible varieties like Pinto 650 the disease incidence advanced rapidly and reached high levels both with and without fungicide treatment while on tolerant varieties like 2W-33-2 the disease advanced slowly and only reached moderate levels of infection when fungicide was used.

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 and 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, percent of infection, and relative susceptibility of the various cultivars.

*Research accomplished by the first author in partial fulfillment for the requirements of his MS degree.

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 in a split plot arrangement of a randomized complete block where the main plots were the fungicide treatments and the subplots were varieties with three 3 m rows, 10 seed/row, and 1 m between rows. Spreader rows with susceptible lines were planted 2 weeks before planting the experimental plots and inoculation was carried out by hand spraying using local inoculum from near-by fields. Nine applications of benomyl and oxicarboxin were applied alternated on a weekly basis and at the recommended dosages. Six weekly evaluations of rust incidence were taken following the recommendations 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, maximum 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 percent of infection with susceptible varieties such as the Pintos that showed the largest size of pustules (Table 2). Regression of percent infection on days after planting showed that on susceptible varieties like Pinto 650 (Figure 1) the disease incidence advanced rapidly and reached high levels both with and without fungicide treatment while on tolerant varieties like 2W-33-2 (Figure 2) the disease advanced slowly and only reached moderate levels of infection when fungicide was used.

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.

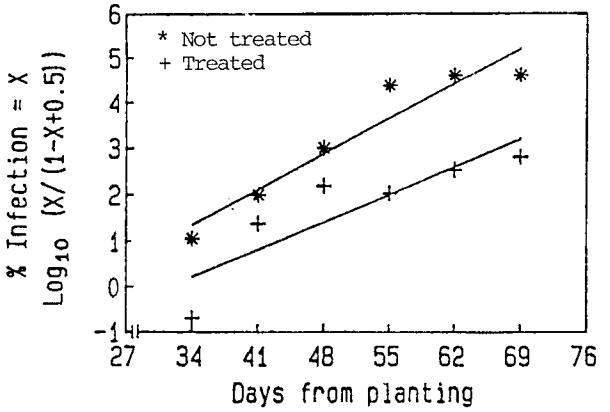

Fig. 1. Regression of Log (X/1-X+0.5) where X=% of infection from planting cv Pinto 650.

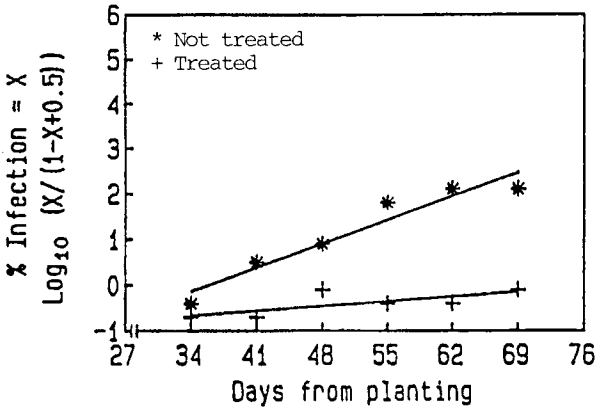

Fig. 2. Regression of Log (X/1-X+0.5) where X=% of infection from planting cv 2W-33-2.

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