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Relationship of Rust Disease Progress and Yield Components in Pinto Beans

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Previous research results have demonstrated that rust infection (Uromyces appendiculatus) on dry edible beans (Phaseolus vulgaris) in southwest Nebraska can reduce yields. It has also been demonstrated that this disease can be controlled by the proper timing of fungicide applications or using resistant cultivars.

The effect of rust severity on the components of bean yield were monitored during the 1982, 1983, and 1984 season. In 1982, as rust severity increased (up to 45%), seed yield and seed size decreased. In 1983, rust intensity was too low to allow any definite conclusions to be drawn. In 1984, 18 different fungicide treatments were used to evaluate rust control, as well as to compare different degrees of rust intensity with several components of yield. The pinto cultivar UI 111 was used in this 1984 study. Initial fungicide applications were applied when the first signs of rust were observed. Rust severity readings, expressed as % leaf area infected, were recorded 56, 62, 71, 77, 83 and 91 days after planting.

There was a highly significant correlation of rust severity with yield, total pods, total seeds and seeds/plant except at the 56-day reading. A major difference was found when the 1984 data was evaluated and compared to the 1982 data. In 1982 seed size was found to be significantly reduced at high rust intensity (BIC 26:42-43) while in 1984 no significant seed size differences were observed (Table 1). Since seed size was positively correlated with yield and yield was negatively correlated with rust intensity, the relatively lower yields observed in 1984 (protected plot = 1546 lb/A) compared to 1982 protected plot = 2113 lb/A) may explain the lack of significance in seed size. In other words when growing conditions result in small seeds, as in 1984 (Table 2), rust intensity influences this component less dramatically than when seed size is more normal (1250 - 1300 seeds/lb).

From the yield component correlation in Table 1, it can be seen that 62-71 days after planting and at low rust intensities (Fig. 1) the correlations are significant for number of pods, number of seeds, number of filled pods as well as seed weight. Thus, early rust intensity readings could be used to predict yield loss and final intensity.

Table 1. Correlation coefficients for bean yield components vs rust disease severity.

Days after planting	Yield	Total Pods	Normal Pods	Unfilled Pods	Total Seeds	Seed Size	Seeds/Plant	Seeds/Pod
56	-0.11 NS	-0.36 NS	-0.25 NS	-0.35 NS	-0.09 NS	-0.11 NS	0.11 NS	0 30 NS
62	-0.51**	-0.53*	-0 56 NS	0.11 NS	-0.56**	-0.15 NS	-0 46*	-0.20 NS
71	-0.72**	-0.65**	-0.75**	0.34 NS	-0.76**	-0.29 NS	-0.70**	-0.28 NS
77	-0.78**	-0.69**	-0.80**	0.33 NS	-0.82**	-0.32 NS	-0.81**	-0.32 NS
83	-0.75**	-0.67**	-0.81**	0.44*	-0.80**	-0.26 NS	-0.78**	-0.23 NS
91	-0.74**	-0.64**	-0.79**	0.49*	-0.78**	-0.27 NS		-0.24 NS

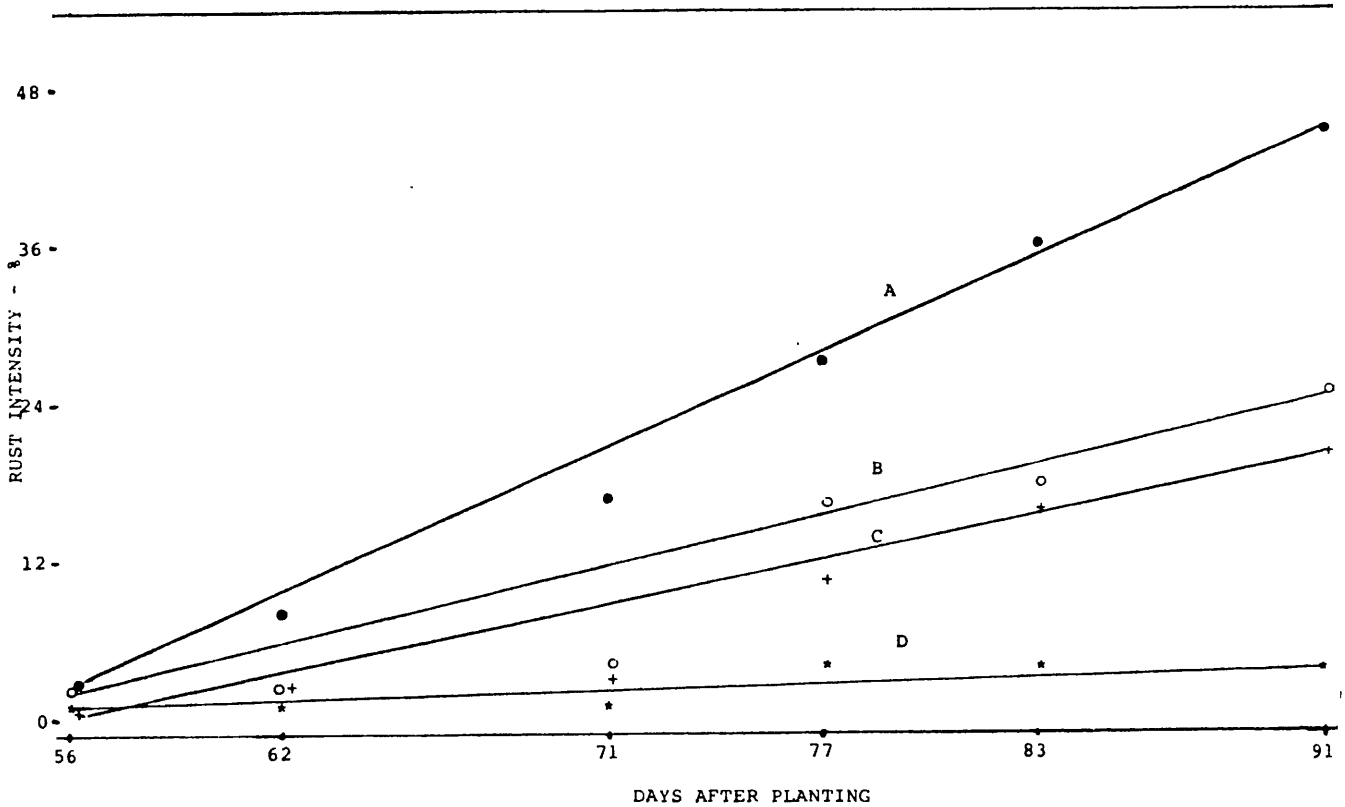

Fig. 1. Rust intensity at various time intervals after planting pinto UI III beans at North Platte, NE. Lines B, C, D represent different fungicide treatments while A is untreated control.

Table 2. Final rust intensity and seed weight of Pinto beans in selected treatments at North Platte, NE.

Treatment	Applications	Yield lb/A**	Rust-%*	Seed size No. seeds/lb
no spray		902	44	1697
Dithane-Granular	2	1037	24	1875
Dithane-WP	2	1310	20	1668
Dithane-WP	4	1546	4	1548

* Final rust as % leaf area affected; mean of four reps

** Mean yield from center row of 3-row plots 15 ft long