

and Wis. (RRR) 83. Our 1977 field studies, in which especially heavy disease pressure was exerted upon our breeding lines, revealed at least two other lines which possess even more resistance. In yield estimation studies, they yielded 27, 235 and 23, 934 lbs. of bean pods/A., compared to Early Gallatin and Tenderette, which yielded 9,078 and 3,301 lbs./A., respectively.

We have made good progress in improving the plant type in our resistant beans, but they are not completely refined. In general, the pods on our beans are borne too low and are too short; and some of the most resistant lines are too late or too bushy. However, we have been able to select away from some of these "less than perfect" traits and obtain some very promising resistant beans which will be significant contributions to the germ plasm resources available to bean breeders everywhere.

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Screening and Selection for Root Rot Resistance in Snapbeans

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We have screened for Pythium and Fusarium root rot resistance in the field and greenhouse. We have followed the procedure described in J. Amer. So. Hort. Sci. 102:373-377. In the greenhouse the tests were made in flats. One to two cm of soil was placed in the bottom of the flat and 12 rows of seed, 10 seeds per row, planted in 35 x 50 cm flats. The Pythium and Fusarium were grown on Armstrong's liquid medium with constant shaking. The suspensions were blended and diluted to  $1 \times 10^5$  propagules of Pythium per ml and  $2 \times 10^5$  macroconidia per ml of Fusarium. Ten ml of Pythium were applied per row directly on the seed, which was then covered with 5 cm of soil and watered. Finally 10 ml of Pythium and 20 ml of Fusarium were applied per row. For the first 5 days the temperature was kept at 20/15C day/night after which the soil temperature was raised to 25C by means of heating cables buried in sand below the flats.

In the field a furrow 5 cm deep was made and the seed planted at the bottom of the furrow. The Pythium and Fusarium were applied directly over the seed at  $2 \times 10^5$  propagules of Pythium and macroconidia of Fusarium per ml with 20 ml of each per 25 cm of row. The furrow was filled back over the seed and the field irrigated. We kept the soil moist for the following three weeks by irrigating 2 to 3 times a week lightly as needed.

We used a mixture of Pythium and Fusarium together because we felt both organisms were present in commercial fields and worked synergistically. Since resistance was quantitative for both organisms to select for one and later for the second seemed inefficient.

We used red kidney as a check on Fusarium since it is resistant to Pythium ultimum and a white snap bean cultivar as a Pythium susceptible check. On average in the field 8/30 of the white susceptible check emerged. We used a 50% survival or better as a criterion for the selection.

Off white seed segregates continue to survive the Pythium better than pure white but some pure white also survive at 65% level or better. The seed color appears to be independent of Fusarium resistance.

In the field we harvested when the pods were slightly punky or about 1 week after market stage but before plant senescence has set in. In the greenhouse initial screening was done in flats. However recently with more advanced material we have started screening in 12 cm pots. Five seed are planted per pot and at three weeks the stand is thinned to 2 and at the same time a root rot rating is made. A subsequent rating is made at seed harvest and also relative plant vigor rating. The screening of single lines in pots avoids the effect of a very susceptible or resistant neighboring row which I feel influences the Fusarium screening process in flats.

A root rot score is made on a 1-10 score with 10 dead and 1 pure white. In most tests Red Kidney averages an 8 score, Cornell 2114-12 a 3.5-4.5 score, N203 and PI 165433 and 5.0, and PI 165426 about 5.5. A score below 6.5 is probably an economic level of resistance.

I have found commercial field evaluation difficult. We put out 10 trials of 12 lines in growers' fields last summer. We had two trials with what I considered were good root rot tests but the commercial crop still produced well since moisture was adequate.

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