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BEAN VARIETY AND GERMPLASM EVALUATION IN COLORADO

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Disease management research and extension projects have relied upon multidisciplinary efforts between pathology, breeding, agronomy and entomology, as well as support from industry personnel and growers. A network of testing sites and cooperators is used to evaluate new germplasm and varieties for their adaptation, disease/pest resistance, and yield potential in various production systems. Pathology efforts have focused on disease diagnosis and distribution, determining disease resistance/susceptibility of germplasm and varieties, cooperating with local seed certification programs, and pesticide screening and scheduling.

The pesticide work has focused upon the evaluation of labeled and experimental products for their effectiveness in managing white mold, rust or bacterial diseases. White mold fungicide work has utilized pivot injection as well as spray plots to evaluate products such as Topsin M, Benomyl, Ronilan and Mertect 340F. Rust fungicide work has utilized injection and spray applications of Bravo 500, Maneb formulations, Dithane FZ, sulfur combinations, Baycor, Tilt, and another experimental product from Dupont. Timely applications of many of these products effectively and economically improved bean yields under severe rust pressure. Bacterial fungicide work has utilized early applications of copper based products such as Kocide 606, Copper Count N, Citcop 5E, and TriBasic Copper to reduce bacterial disease (including common bacterial blight) incidence and severity during light to moderate epidemics. Future work will continue to emphasize pesticide screening and scheduling effects upon disease development and yield responses in Colorado.

The germplasm and variety research has been quite intensive and productive, and will be reviewed in a separate paper. Colorado's program is therefore designed to develop various strategies for crop improvement and disease management based upon local, national and international resources and technology. A multidisciplinary approach is being used to integrate research and extension objectives and responsibilities with those of industry and growers in Colorado and surrounding regions.

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Pythium root rot of white bean in Ontario

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During a two-year period (1981-1982) 760 white bean plants with stem or root lesions were taken from 59 fields in southern Ontario. The number of plants sampled per field ranged from 5 to 120. Fields were sampled once between two and 10 weeks after seeds were sown. Stems and roots were washed thoroughly in running tap water, immersed in 0.5% NaOCl for one minute and rinsed in sterile distilled water. Segments of stem and root lesions 0.5 to 1 cm long were placed on corn meal agar amended with pimaricin (100 mg/L) and vancomycin hydrochloride (100 mg/L). After one or two days incubation at 25 C colonies were subcultured to V-8 agar and species of Pythium were identified.

Pythium was isolated from 35% of 595 stem lesions and 15% of 1855 root lesions. The most abundant type of isolate produced spherical vegetative bodies 24 µm in diameter but no oospores. This type, referred to as P. "spherical", made up 69% of stem isolates and 50% of root isolates. Other species commonly isolated were P. paroecandrum (root 32%, stem 5%), P. salpingophorum (root 12%, stem 23%), and P. rostratum (root 4%, stem 2%). Pythium ultimum, P. oligandrum and P. arrhenomanes were rare (1% or fewer of isolates). When tested against seedlings grown in vermiculite, all isolates of the common species caused rotting of fine roots similar to that observed in the field. Few isolates caused rotting of the stem. Root weight was reduced significantly by 11 of 16 isolates of P. "spherical" and 8 of 10 isolates of P. paroecandrum. None of 10 isolates of P. rostratum or of 15 isolates of P. salpingophorum reduced root weight.

To determine the effect of Pythium on yield of white bean, cv. Seafarer, under field conditions, soil was treated with Lesan (32 kg a.i./ha in 9.1 L water per 6.1 m row length along a band 30 cm wide four weeks after seeding) or with Vorlex (272 L/ha injected 14 cm deep on 30 cm centres four weeks before seeding) or with both products. Thirteen weeks after seeding, when seeds were fully developed in the pods but before extensive defoliation had occurred, plants were dug from the central 4.5 m of the centre row of three-row plots. Dry weights of roots and shoots and seed weights (18% moisture) per plant were determined. Soil samples were collected at seeding and 5, 9 and 13 weeks thereafter and populations of Pythium and Fusarium were determined by dilution plating on selective media.

Lesions occurred most commonly on fine roots and occasionally on thicker, structural roots but were rare on stems. Frequently the rotted bases only of fine roots remained. The only known pathogens of bean roots detected by microscopic examination of roots and by plating root segments on media suitable for isolating known fungal pathogens were P. "spherical" and P. paroecandrum. Root colonizers such as Fusarium solani and F. oxysporum were isolated but the pathogens Fusarium solani f. sp. phaseoli, Rhizoctonia solani and Thielaviopsis basicola were not.

In 1976, Lesan increased shoot weight 66%, root weight 79% and seed yield 47%. It decreased Pythium populations 68% and Fusarium populations 16%. Vorlex increased shoot weight 136%, root weight 100% and seed yield 79%. It decreased Pythium populations 83% and Fusarium populations 59%.

In 1977, Lesan increased root weight 16% and seed yield 33% and reduced Pythium populations 58%. It did not significantly (P = 0.05) alter Fusarium populations. Vorlex increased root weight 30% and seed yield 29% and reduced Pythium populations 81% and Fusarium populations 62%. The combination of chemicals increased root weight 51% and seed yield 65% and reduced Pythium populations 90% and Fusarium populations 65%.

Lesan selectively inhibited Pythium and species of this fungus were the only known pathogens of bean roots detected at the test location. From the increases in yield that followed treatment of soil with Lesan, 47% in 1976 and 33% in 1977, it is estimated that Pythium reduced yields by 32% in 1976 and 25% in 1977. Vorlex supressed Pythium more than did Lesan. The greatest increases in root weight and seed yield and the greatest reductions in Pythium populations were produced by Vorlex alone in 1976 and by Vorlex plus Lesan in 1977. The 79% increase in yield produced by Vorlex represents an estimated loss in yield of 44%. The 65% increase in yield in 1977 following treatment with Vorlex plus Lesan represents a yield loss of 39%. Pythium was the only pathogen observed in the roots. It is concluded that P. "spherical" and P. paroecandrum are common causes of feeder root necrosis of beans in Ontario and can cause yield reductions of 30 to 40 per cent.