Factors Influencing Halo Blight Transmission from Externally Contaminated Phaseolus vulgaris Seed

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ABSTRACT

Dry plant refuse from halo blight-infected bean leaves diluted 1:10 with talc and applied to halo blight-free Gallatin 50 seed can result in infected plants. Dilutions greater than 1:10 did not induce infection. The diluting effect of plant refuse from disease-free plants and from soil particles during commercial bean harvest probably reduced the amount of halo blight transmission from seed contamination.

Surface-contaminated Pinto 114 seed did not result in infected plants regardless of the inoculum dilution.

Secondary spread of halo blight occurred in 1966 following a hail storm, but not during the normal rainfall years of 1967 and 1968. All plants were sprinkler-irrigated. Phytopathology 60:371-372.

In halo-blight of bean, *Phaseolus vulgaris* L., bacteria (*Pseudomonas phaseolicola* [Burk.] Dows.) inside the bean seed coat are the primary inoculum. Control depends upon the use of pathogen-free bean seed grown in the semiarid West. Grogan & Kimble (2) presented data, however, indicating that if bean seed were contaminated externally with pulverized, dried infected bean leaf tissue, some of the resulting plants would show halo blight symptoms when planted in field plots irrigated by sprinklers.

The possibility that externally contaminated bean seed might serve as a primary disease source needed consideration and was the basis of this research.

MATERIALS AND METHODS.—Forty pounds of Gallatin 50 bean seed obtained from the Gallatin Valley Seed Co., Twin Falls, Idaho, and 40 pounds of Pinto UI 114 bean seed obtained from the University of Idaho, Twin Falls Branch Experiment Station, Kimberly, Idaho, were used throughout this test. Both sources of seed had been rigorously inspected in the field during the previous 2 years. Five 1-lb. samples of each variety were tested in the laboratory and greenhouse for halo blight contamination, using standard tests (3, 4, 5, 7). Since all tests failed to detect the pathogen, it was assumed that these seed sources were free of the halo blight organism.

Primary leaves of the Tendercrop bean variety infected with the Idaho 07 isolate (race 2) of *P. phaseolicola* were used as the inoculum source. Leaves with 10-20 halo blight lesions were detached, air-dried for 1 week, pulverized, and passed through a 0.175-mm mesh screen (inoculum powder).

Infected plant refuse normally encountered in harvesting equipment is probably diluted with particulate material from healthy plant refuse as well as soil particles. In an attempt to reproduce this dilution effect, the inoculum powder was serially diluted with Celite from 1:10 to 1:1,000,000. The inoculum powder and Celite were mixed in a rotating drum. Seed in control plots was subjected to Celite dust alone.

The original inoculum powder was tested periodically during the summers for viability by adding 0.1 g to *Pseudomonas* F agar (Difco Laboratories) plates. The resulting bacterial colonies were tested serologically, and by inoculating fresh Tendercrop variety bean pods. The inoculum was found to be infectious during the course of the summer.

Inoculum from each dilution was added to seed of each bean variety at the rate of 1 g/30 seeds 6 weeks before planting and stored in paper bags until planted during the last week in May.

All field plots were established at Moscow, Idaho, and sprinkler-irrigated three times during the growing season as a supplement to normal summer rains. The seed was planted in randomized blocks with four replications of seven treatments, and the experiment was repeated during 1966, 1967, and 1968. Each treatment consisted of 30 seeds spaced 6 inches apart, in rows spaced 3 ft apart. The seed was dropped into open furrows about 2 inches deep and covered by hand.

The presence of halo blight lesions on leaf, pod, or stem constituted a positive notation for each plot in each treatment.

RESULTS.—Leaf or pod infections were observed on at least one Gallatin 50 plant in each plot during 1966. This included the control plots, indicating that the secondary disease spread occurred perhaps as a result of a June hailstorm, normal summer rains, or during subsequent irrigation by sprinklers. Lesion development occurred throughout the growing season up to the 1st week in October, although lesions were found in 20 out of 28 plots by 8 August. In 1967 and 1968, however, halo blight occurred in only one plot. In 1967, a single plant, and in 1968, two plants, represented the total infection out of all 28 plots (840 plants). In both years, the disease was only found in the treatment with the most concentrated inoculum (1:10 dilution). The seed from all plots found free of halo blight was harvested and tested in the laboratory and greenhouse. None of the seed was found to be the vector of *P. phaseolicola*. Susceptible bean varieties all became infected, including Pinto UI 114, when inoculated with the Idaho 07 isolate by an artist's spray gun.

DISCUSSION.—Pathogen-free bean seed, both snap-

bean and dry edible types, has been produced in the semiarid West, particularly in Idaho, for more than 30 years. The lack of excessive rains during the growing period (June-August) and the abundance of surface water for furrow irrigation has insured good yields. The importance of seed-borne pathogens, particularly bacteria, has been recognized throughout the entire bean industry. The importance of external contamination, however, has been the subject of much concern and speculation.

My results show that external contamination of bean seed from dry, powdered, infected plant tissue can result in some disease production. The occurrence of a hailstorm in 1966 when the Gallatin 50 plants were in the second trifoliate stage gave dramatic evidence of the disease spread. Since disease readings were not taken prior to this storm, the number of primary infection points within the plots are unknown. During the following 2 years' tests, the number of plants serving as primary infection sources was limited to one in 1967 and two in 1968. If this proportion was similar in 1966, disease spread from these few plants was phenomenal. Although natural infestation can occur during threshing operations, as suggested by Grogan & Kimble (2) the amount of halo blight found in the seed-producing area of Idaho during the past few years has not reflected this increase (1).

Most of the snapbean seed producers treat the seed with some form of chemical, usually an antibiotic, to attempt to eliminate surface contamination. This treatment was found beneficial in Idaho (1) and of questionable value in Wisconsin (6). Continued concern about surface contamination and methods to reduce it should be encouraged. Field inspection and seed testing has, according to Butcher et al. (1), reduced the amount of halo blight under Idaho conditions sufficiently to bring this disease under control. In spite of this potential threat, and because of the current control program, I concur with Grogan & Kimble (2) that bean seed grown in the semiarid West is still the best method of disease control in high rainfall areas.

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