

## Effects of *Cercospora kikuchii* on soybeans

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### ABSTRACT

Effects of *Cercospora kikuchii*, the causal organism of purple seed stain of soybeans, were investigated on the varieties 'Amsoy', 'Shelby', 'Lindarin 63', 'Wayne', 'Clark 63', and 'Cutler'. Seedling emergence from purple-stained seeds averaged 5 percentage points lower than that from seed free of purple stain in sandbench tests. Emergence of seedlings from purple-stained seed planted in the field averaged from 7 to 13 percentage points lower than from seed free of purple stain at Worthington, Indiana, and from 10 to 15 percentage points lower at Lafayette, Indiana. Incidence of purple seed stain had no effect on maturity, lodging, plant height, or seed yield in these tests. Incidence of the disease in harvested seed did not differ appreciably between plots planted with purple-stained and purple-stain-free samples. Phytopathology 63:796-797

*Additional key words:* purple seed stain, seedling emergence.

These studies were initiated to determine the effects of high incidence of seed infections by *Cercospora kikuchii* (Matsumoto & Tomoyasu) Gardner, on agronomic performance of soybeans [*Glycine max* (L.) Merrill]. The U. S. Department of Agriculture grain standards suggest that seed lots with 20 percent purple-stained soybeans shall not be graded higher than U.S. Number 3 (8). Seed certification standards do not discriminate against purple-stained seed (3); however, the discoloration caused by *C. kikuchii* is objectionable to seed producers (1, 2).

Data on the significance of this disease deals primarily with its effects on germination and emergence. Murakishi (6) reported a 19% reduction in germination of purple-stained seeds compared to apparently healthy seed when germinated on dextrose agar. Lehman (5) reported that soybean seed infected with *C. kikuchii* germinated almost as well as normal seeds, but seedlings from infected seeds are likely to be stunted or killed after emergence. Sherwin & Kreitlow (7) found that seed infected with *C. kikuchii* germinated normally and produced stands comparable to those from noninfected seeds.

**MATERIALS AND METHODS.**—*Laboratory studies.*—Seed of Amsoy, Shelby, Wayne, and Clark 63 were divided into two samples, purple-stained and free of purple stain. The number of seed infected with *C. kikuchii* was determined for each sample after incubating 100 seed on potato-dextrose agar for 1 week at 24 C. Fifty seeds from each sample were planted 2.5 cm deep in each of three replications in a sandbench immediately after harvest and following 3, 6, and 12 months' storage. After 10 days the percent emergence was determined.

*Field studies.*—Seed of soybean varieties, divided into purple-stained and purple-stain-free samples, were planted at Worthington and Lafayette, Indiana. Percent emergence was determined at the first to third trifoliolate stage. Additional agronomic data were recorded on lodging, plant height, maturity date, and seed yield. Percent purple-stained seed was determined on a 200-seed sample from each harvested plot. At Worthington, Indiana, a split-plot design was used with six replications in which samples were main plots and single rows of the varieties Lindarin 63, Amsoy, Wayne, and Clark 63 were subplots. Rows were 5.5 m long and spaced 1 m apart with 200 seeds per row. The experiment was conducted in 1968 and 1970. At Lafayette, Indiana, 400 seeds of each sample of Amsoy, Wayne, and Cutler were planted in four-row plots 3 m long with 1 m spacing between rows. Three replications of the test were planted in 1970 and 1971. Following emergence counts, each plot was thinned to 13 plants per meter of row to control effects of differential stands on the agronomic characteristics evaluated.

**RESULTS AND DISCUSSION.**—*Laboratory studies.*—Plating purple-stained and purple-stain-free seed confirmed visual classification. *Cercospora kikuchii* was isolated from 3 to 11% of apparently normal seeds, but was isolated from 92 to 99% of the purple-stained seed. Similar results have been reported by Kulik (4). Analysis of variance of germination data indicated a significant reduction in percent emergence of purple-stained seed, averaging 5% over all varieties. Interactions of presence of purple stain with storage time and varieties were nonsignificant, indicating a uniform reduction in percent germination across varieties and over the four storage periods.

*Field studies.*—Emergence of purple-stained seed averaged 72% compared to 82% for seed free of purple stain for the varieties grown at Worthington in 1968 and 1970. Interaction of presence of purple stain with years and varieties was nonsignificant indicating a consistent reduction in emergence of purple-stained seed for all four varieties during the 2 years tested. There were no significant differences between samples for any of the agronomic characters evaluated. The incidence of purple stain in the harvested seed did not differ significantly between the two samples in Amsoy, Wayne, and Clark 63. However, the incidence of purple stain in the harvested seed was 8 percentage points higher in the sample of Lindarin 63 planted with diseased seed than the sample planted with seed free of this disease.

At Lafayette, plots sown with purple-stained seed averaged 74% emergence compared to 86% for plots sown to seed free of this disease. Reduction in emergence associated with purple-stained seed ranged from 10 percentage points for Wayne to 15 percentage points for Amsoy. Performance of the two samples differed for the three varieties in the 2 years of the test. Emergence of purple-stained Wayne was reduced from 97 to 85% in 1971. The difference in emergence between samples of Amsoy and Cutler was not significant in 1971. In contrast, in 1970 emergence of purple-stained Amsoy was reduced from 74 to 56%, and of Cutler from 90 to 73%. The decrease in emergence of Wayne associated with purple stain, from 79 to 70%, was not significant in 1970. There were no significant differences between purple-stained and purple-stain-free samples for lodging, plant height, seed yield, or incidence of purple stain in harvested seed.

In these tests, reduced emergence was the main characteristic associated with purple-stained seed. Agronomic performance of the two samples at Worthington may not have differed because stand of the sample infected with *C. kikuchii* was not sufficiently reduced. By thinning plots to a uniform stand at Lafayette, only effects of the disease on plant vigor were measured. Disease development, however, was not severe enough to affect agronomic

characteristics of these plants. The low incidence of purple-stained seed in the harvested plots suggests environmental conditions were not highly favorable to development of the disease from infected seed. Where environments are favorable to disease development, detrimental effects of infected seed sources may occur.

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