Effect of Soil Temperature and Pseudomonas glycinea on Emergence and Growth of Soybean Seedlings

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ABSTRACT

An isolate of *Pseudomonas glycinea* from soybean (*Glycine max*) seed significantly reduced emergence of inoculated Amsoy soybean seed at constant soil temperatures of 20, 25, 30, and 35 C, respectively, with the greatest reduction occurring at 35 C. Mean height of 6-day-old seedlings from inoculated seed were significantly less than from noninoculated seed only at 25 C. There were no significant differences between the mean dry weight of seedlings from inoculated or noninoculated seed. Isolates similar to the one used for these studies may be an important factor in evaluating soybean seed quality. Phytopathology 62:296-297.

Additional key words: soybean seed quality, bacterial blight of soybean.

Seed transmission of *Pseudomonas glycinea* (1) in soybean (*Glycine max* [L.] Merr.) was mentioned as a possible method of overwintering by Coerper (2), but Kendrick & Gardner (5) were the first to demonstrate it. Seed harvested from an area directly under pod lesions, and from diseased pods not under lesions, produced several blighted plants when planted in sterilized soil (5). Graham (4), using seed from severely infected soybean plants, reported the transmission of blight via seed. According to Graham (4), the small amount of primary inoculum was sufficient to eventually spread the disease throughout all test plots. The pathogen was apparently able to survive in or on seed for 6 months. Kennedy (6) transmitted *P. glycinea* from seed to healthy leaves by forcing washings from seed lots collected from several states into healthy leaves.

The earlier publications reported bacterial blight of soybean as a disease of seedlings and of maturing plants. Recently, however, Nicholson & Sinclair (7) isolated from several seed lots a strain of *P. glycinea* which significantly reduced germination of Amsoy soybean at an air temperature of 30 C. This paper reports the effect of soil temperature on emergence and growth of seedlings from noninoculated Amsoy soybean seed and of those inoculated with *P. glycinea*.

A lyophilized culture of the rough colony isolate of *P. glycinea* (7) was used to inoculate shake cultures of Difco nutrient broth containing 1% sucrose and 0.5% sodium chloride. Certified Amsoy soybean seeds were soaked for 5 min in 1.7% sodium hypochlorite, then in 70% ethanol for 2 min, and finally were thoroughly rinsed with sterile, distilled water. Fifty seeds from each lot were planted at 5-cm depths in glazed crocks containing a 1:1 mixture of autoclaved, silt-loam soil-vermiculite (Terralite brand) mixture. The glazed crocks (7.5-liter capacity) were placed in water controlled-temperature tanks 24 hr prior to planting to attain the desired soil temperature. The water level was adjusted to 2.5 cm above the soil line. There were eight crocks/tank, four containing noninoculated seed and four containing inoculated seed at each temperature of 20, 25, 30, 35, and 40 C, ± 1 C. Soil temperatures were checked twice daily. Water was applied to soil daily at soil temperatures of 25, 30, or 35 C, twice daily at 40 C, and on alternate days as necessary at 20 C. Soil at 15 C was watered once prior to planting, and was sufficient for the entire test period. Emergence rate and height of seedlings were recorded 6 days after planting, and dry weight was recorded after 48 hr at 70 C. Inoculated seeds were selected at random, and portions of the cotyledons were plated on Difco lima bean agar (LBA) 6 days after inoculation. The experiment was conducted twice, and the data from each were combined for statistical analysis.

Only colonies of *P. glycinea* identical to those produced by the isolate used were observed growing on all pieces of inoculated seed plated on LBA.

The emergence of seedlings from inoculated seed was significantly reduced at all temperatures (Fig. 1), even though the optimum for in vitro growth of *P. glycinea* is 24-26 C (2). Emergence from inoculated seed was greater at 30 C, the optimum for germination of soybean seed (3), than at either 25 or 35 C. Germination occurred at 15 C, but plants failed to emerge. Emergence occurred at 40 C, but seedlings did not develop beyond the cotyledonary stage.

Seedlings from inoculated seed were significantly reduced in height below those from noninoculated seed only at 25 C. There was no significant effect of inoculation on plant height when means over all temperatures were analyzed. There were no significant differences in mean dry weight of seedlings between inoculated and noninoculated seed at any temperature. The average dry weight per seedling at 6 days after emergence was 15-16 mg.

These results show this isolate of *P. glycinea* to be a pre-emergence pathogen which prevents germination of infected seed over a temperature range of 20-35 C. Data indicate that it does not affect postemergence growth. Kendrick & Gardner (5) apparently experienced a reduction in emergence, but no mention was made of pre-emergence seed decay as experienced in our experiments. Assay for *P. glycinea* can be used as an added measure of seed quality in soybean. Therefore, presence of this isolate of *P. glycinea* in soybean seed may have an important

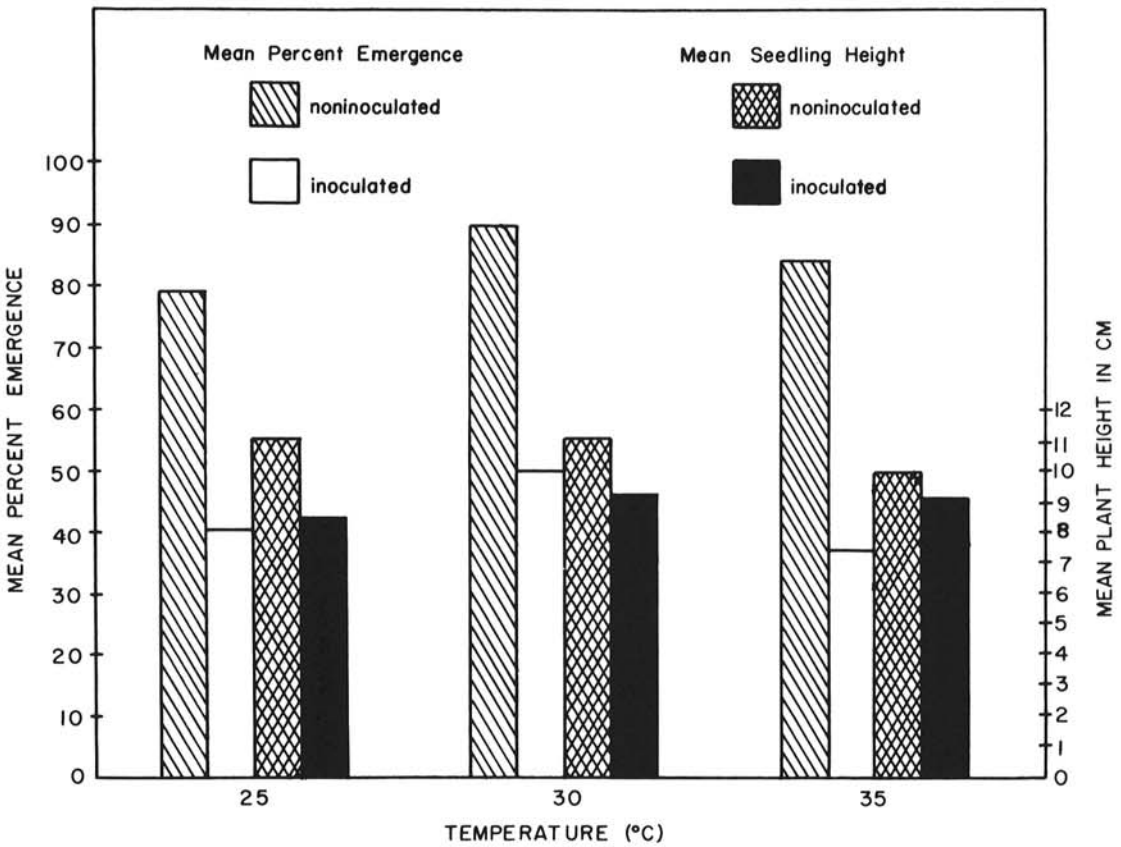

Fig. 1. The mean per cent emergence ($LSD_{.05}$ = 8.7; $LSD_{.01}$ = 11.6) and height ($LSD_{.05}$ = 2.2; $LSD_{.01}$ = 2.9) of soybean seedlings from Amsoy seed noninoculated or inoculated with an isolate of *Pseudomonas glycinea* and grown at three soil temperatures.

influence on judgment of seed quality and the emergence of infested or infected seed.

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