THE EFFECT OF RATE OF PLANTING ON INCIDENCE OF BROWN STEM ROT IN SOYBEAN

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ABSTRACT

The incidence of brown stem rot of soybeans (*Glycine max*), caused by *Cephalosporium gregatum*, increased as the space between plants within the row was increased during three successive growing seasons in field plots with a previous cropping history of 2 years or less in soybeans. The percent of plants showing brown stem rot at 6- and 12-inch spacing was significantly higher than that at 1-, 2-, and 4-inches. Plots with a cropping sequence of 5 or more years of continuous soybeans showed no significant differences between planting date and incidence of brown stem rot. Spacing and crop history could be important factors in evaluating varieties or breeding lines for resistance to *C. gregatum* or in conducting brown stem rot disease surveys.

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Several factors affect the incidence of brown stem rot caused by Cephalosporium gregatum of soybean (Glycine max). Cropping sequence is important (1, 2, 3, 4). The disease increased as much as 61% in a single year when soybeans were grown in the same field in successive years (4). In Iowa, the occurrence of brown stem rot increased from 6% in 1956 to 53% in 1964 (1). In Illinois, 100 and 97% of all fields surveyed in 1968 and 1969, respectively, contained infected plants (6).

C. gregatum reduces yield in soybean through reduction in seed size and number (8). Losses may be up to 40% in some varieties (4), and late-maturing varieties showed greater yield reduction than early-maturing varieties (8). Our study showed that the space between plants within a field row also can have an effect on the incidence of brown stem rot.

MATERIALS AND METHODS

Field plots with their location and cropping history were: (i) in 1969, at Lincoln and Seymour, Illinois, and Agronomy South Farm, University of Illinois, Urbana, all grown to soybeans for the previous 5 years; (ii) in 1970, at Savoy, Illinois, in sod for at least 10 years, and the South Farm cropped to soybeans for 6 years; and (iii) in 1971, at the South Farm with alfalfa for 3 years, followed by soybeans for the last 2 years. Planting dates for each year were between May 23-29. Scoring for disease was done between September 19-29 each year. Two varieties susceptible to C. gregatum were used: Clark 63 in 1970 and Amsoy in 1969 and 1971.

There were four to six different spacing combinations of either 1, 2, 3, 4, 5, 6, 8, or 12 inches used in any single year. A randomized complete block design was used with four replications of each spacing at each location. One or two, 20-foot rows for each replicate per spacing was used with 30-inch centers. Border rows were used for all experiments. Least significant differences (LSD) were calculated for all data (7).

Plants were scored after leaf senescence, but while stems were still green. Schneider, et al. (6) found that because many infected plants are brown at the tip or in several segregated areas in the stem, the total percent of browning within the stem was a better criterion for disease rating than height of internal browning or number of nodes browned (5). Isolations were made from stems showing typical browning symptoms. Pith and woody tissues were scraped from stem, plated on acidified soybean seed agar (6), and incubated at 20°C for 20 days. All browned stems with solid piths yielded C. gregatum. Hollow-stemmed plants were infected with organisms other than C. gregatum. If C. gregatum was present it could not compete in vitro with the other organisms present.

RESULTS AND DISCUSSION

In 1969, 95-100% of the plants scored showed internal stem browning in the plots at Seymour and Lincoln. At the South Farm, the percent of plants showing browning increased from 86 at the 1-inch spacing to 98 at the 6-inch spacing (Fig. 1). There was no significant difference in percent of plants showing symptoms between 1- to 6-inch spacing at the South Farm in 1969 or between 1-, 2-, 6-, or 12-inch spacings at the South Farm in 1970. This agrees with previous studies (1, 2, 3, 4) of high incidence of brown stem rot occurring in fields after successive years of soybeans.

At Savoy, in 1970, 24, 30, 41 and 51% of the plants showed stem browning at 1-, 2-, 6-, and 12-inches, respectively. There was no significant difference between the 1- and 2-inch spacings, but all other combinations were significant (Fig. 1). The high percentage of infection in this field, that had been in sod for at least 10 years, might be explained by: (i) the presence of natural inoculum in the soil; (ii) introduction of inoculum from farm implements; and/or (iii) heavy rains during the week of June 22-27 could have washed inoculum from adjacent soybean plots.

In 1971, there was no significant difference between the number of plants showing symptoms at the 2- and 4-inch spacing. All other combinations were significant. The percent of plants showing symptoms of brown stem rot at 6- to 12-inch spacing was significantly higher than at 1-, 2-, or 4-inch spacing in those plots with a cropping history of soybeans 2 years or less.

These results confirm earlier studies (4) which showed that when soybeans follow soybeans in crop rotation, the number of plants showing stem browning from C. gregatum increases. Dunleavy and Weber (4) and Gray, et al. (5) have attributed soybean yield losses to C. gregatum. Our study shows that the incidence of brown stem rot is influenced by seeding rate when soybeans are sown to fields with a cropping history of 2 years or less of soybeans.

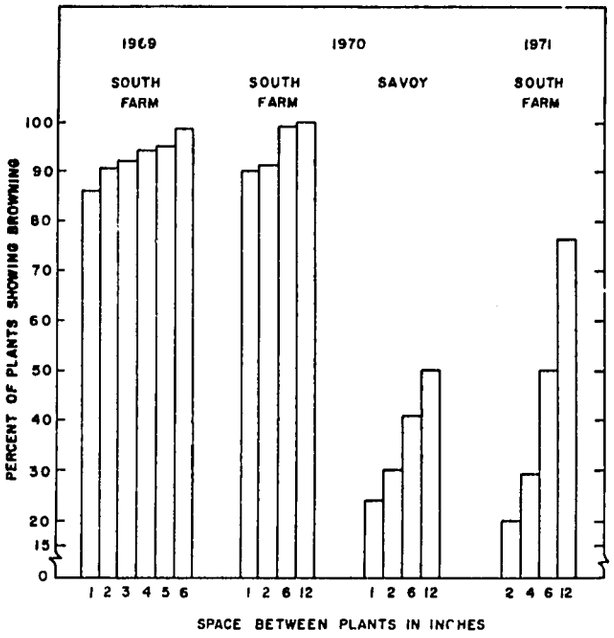

FIGURE 1. Percent of 'Amsoy' or 'Clark 63' soybean plants infected with Cephalosporium gregatum as influenced by space between plants within the row from 1 to 12 inches at the South Farm or Savoy during 3 growing seasons. There are no significant differences between percentages at South Farm in 1969 and 1970; the LSD .05 for Savoy = 10; and for South Farm, 1971 = 11.

The percent of plants with stem and pith browning significantly increased with an increase in spacing between plants within rows with cropping histories of 2 years or less. This was not expected and is difficult to explain. Spacing affects root development, branching, and other factors which may influence the processes of infection. The spacing and cropping history of a field plot are factors that could be important in evaluating varieties or breeding lines for resistance to C. gregatum. The seeds of breeding lines are often planted singly and at distances between plants that are greater than those used by growers.

Crop rotation and high rate of planting appears to be an advantage in reducing the amount of brown stem rot in soybean fields with a short cropping history of soybeans. In disease surveys, the incidence of brown stem rot would be influenced by plant spacing, as well as by cropping history.

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