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Research Notes: Interactions of cultural practices with insect-induced stress on soybeans

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1) Interactions of cultural practices with insect-induced stress on soybeans.

Numerous reports exist which characterize yield loss and defoliation relationships. Management guidelines and decisions regarding defoliating pests have been based largely upon findings from one or more of those studies. The use of such studies as decision-making criteria may be limited since most defoliation/yield-related research has been conducted in the Midwest with varieties, growth habits and environmental conditions widely divergent from those found in other areas of production. Secondly, the work reported thus far has been developed on wide rows. Recently, narrow row plantings of soybeans have shown favorable responses in yield optimization studies and growers are shifting to this new cultural practice. Furthermore, there are indications that compensation ability of soybeans to defoliation stress may vary with row spacing. Therefore, the study reported here was the first of a series of experiments designed to refine defoliation thresholds for decision-making purposes under narrow row conditions. Specifically, attempts were made to quantify the interaction of row spacing with the compensation ability of soybeans to defoliation stress.

In 1979 and 1980, two varieties, 'York' and 'Delmar', were planted at three row spacings, 100 cm (40 in.), 76 cm (30 in.), and 18 cm (7 in.), in a split-split plot design with four replications as randomized blocks. Defoliation was achieved by removing 50% of the leaf area by the hole punch method (Pedigo and Hammond, 1978) at the R4-R6 stage of development. Data on seven yield and growth components were collected at harvest from samples of 10 plants in each defoliation x row spacing combination.

Though the data for 1980 have not yet been completely analyzed, some notable trends were present in 1979. The magnitude and direction of responses changed with row spacing and this interaction was similar for both varieties. Reductions in yield and growth components as a result of defoliation were greatest in the 76 cm spacing, intermediate in the 18 cm spacing and lowest in the 100 cm spacing. Only significant reductions in seed weight and number of nodes resulted in the 100 cm spacing which was apparently able to compensate for defoliation more than the other spacings.
According to basic ecologic and agronomic principles, the 18 cm spacing would be expected to have the greatest compensation capacity since it approximates equidistant spacing which maximizes resource utilization with minimum interplant competition. This is further reinforced by the fact that narrow spacings produce higher yields and have a higher leaf area index. However, the 18 cm spacing did not compensate as well as 100 cm but did compensate better than 76 cm spacings.

Thus far, an explanation is available in terms of light interception. The short interplant distance of the 76 cm and 100 cm plantings lends to greater leaf overlap and higher levels of interplant competition for light interception than in the 18 cm plantings. Furthermore, the canopy does not close in the 100 cm plantings and light interception is optimal, from three sides. As a result, the lower canopy of the 100 cm plantings has a greater function in production of photosynthates than in the 18 and 76 cm plantings. This optimal interception scheme could account for the high compensation ability of 100 cm plantings. Due to the distance between plants in the 18 cm plantings, there is a lesser degree of leaf overlap between plants and thus correspondingly less interplant competition for light interception in the upper canopy. The intermediate compensation of 18 cm plantings may be related to minimized interplant competition for light interception since a substantial portion of its upper canopy is free from such competition with adjacent plants. Coupled with other advantages of minimal resource competition which follows from equidistant planting, this may enable 18 cm plantings to compensate for a greater percentage yield loss than 76 cm ones. The relatively poor compensation within the 76 cm spacings can be accounted for by the presence of a high degree of interplant competition as in 100 cm plantings in addition to a closed canopy and reduced light interception in lower leaves as in 18 cm plantings. Another factor, on which data was collected in 1980 and which may be involved, is the degree of branching exhibited by the two varieties.

With increased yields in 18 cm plantings, a smaller percentage of the yield can be lost before economic damage is realized. If these trends are upheld through the complete analysis of the 1979 and 1980 data, then a necessity may exist for the development of new thresholds applicable to both types of planting practices. Increased yields of narrow rows are available. However, in order to achieve the available maximum potential yields and in light of the apparent differential compensation with row spacing, thresholds may need to be refined.
1) Development of cyst nematode on different soybean varieties.

Soybean cyst nematode (SCN) has emerged as one of the most serious pests of soybeans. Over 80% of the cultivable area in southeast Missouri is infested with this organism. Several varieties resistant to SCN race 3 have been developed and released. These included 'Custer', 'Dyer', 'Mack', 'Pickett', 'Forrest', 'Centennial', 'Franklin', and 'McNair 770'. These varieties carried resistance from 'Peking'. However, Peking is not resistant to race 4. PI 88,788, which carries high degree of resistance to race 4, was the donor parent in the development of 'Bedford', J74-51 and D75-10710. Of these, Bedford and J74-51 (now called 'Nathan') have been released. D72-8927 derived its resistance apparently from Peking and PI 90,763 and was selected primarily for resistance to race 2 (personal communication with Dr. E. E. Hartwig).

Under greenhouse conditions, while screening against a mixture of SCN races, all the lines mentioned above show reproduction of at least few white females. This experiment was undertaken to study the rate of SCN population growth in the soil under several of these genotypes. The test was laid out in a randomized block design with 4 replications. The soil samples were taken after planting and at one month intervals, about 5 cm away from the plants. One hundred grams of soil was washed with an elutriator and cysts counted with the help of a stereo-microscope. The data are presented in Table 1.

During the first 2 months, there was only a slight increase in SCN population. This was probably due to the severe hot and dry weather prevailing during 1980. The population increased tremendously between August 1 and