Research Notes: Pollination study on three varieties of soybeans using honeybees and leafcutter bees

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Pollination study on three varieties of soybeans using honeybees and leafcutter bees.

Soybeans are known to exhibit a high degree of flower abortion. Schaik and Probst (1958) noted that a large number of flowers open but drop off without ever forming pods. They also noted definite physical differences between shed ovules and viable ones. They stated that if flower shedding could be reduced or eliminated yield would most likely increase. Erickson et al. (1978), working with three soybean varieties obtained significantly higher yields (10-16%) in cages with honeybees (Apis mellifera L.) than in cages without bees for two of three varieties. We reasoned that some flowers might abort because they are never fertilized. Bees might increase the rate of fertilization by cross pollinating these flowers, thus, reduce abortion and increase yields.

We attempted to determine if honeybees and/or leafcutter bees could increase fertilization and reduce flower abortion. The experimental design used was a split-plot design with four replications. Whole plots were pollination treatments including a control with no cage and no bees, a cage with no bees, a cage with honey bees, and a cage with leafcutter bees. Sub-plot treatments included three varieties ('Crawford', 'Essex', and 'Forrest'). Planting date was June 3, 1980, and cages were erected over the designated plots on July 9, 1980 when the first plants began to flower. The cages and bees were left in the field until harvest on October 28, 1980.

Data were obtained on yield and yield components. Yield was recorded as grams/plot, and seed weight was recorded as grams/100 seeds. All plants within each plot were counted to determine plants/plot. Seeds/plant were determined indirectly.
There were no significant differences for yield or any yield component due to pollination treatments. Any differences which might have resulted from the treatments could have been masked by the adverse effects of extremely hot, dry conditions present during flowering and pod development. The negative results of this study do not rule out the possibility of inadequate fertilization as a factor involved in flower abortion. Further investigations are planned to determine if inadequate fertilization affects flower abortion.

References


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2) Hybridization of soybean parental line using the growth chamber.

We would like to make crosses for our breeding program in the growth chamber or greenhouse during the winter months. This will allow us to better utilize our time and personnel. It should also allow us to better match up parents in different maturity groups. Also, we can avoid field crossing which is difficult under the relatively dry, hot, windy conditions present in Oklahoma during the flowering season.

Wilcox (1974) reported that a 12-hour photoperiod resulted in early flowering and good seed production. According to Hammer (1969), the temperature should not be below 21°C nor above 32°C. During the past year, we have conducted several experiments in the growth chamber to determine the environmental conditions which are suitable for early flowering and artificial hybridization. Group V and VI varieties were grown in flats in the growth chamber. Each flat contained 6 rows with 20 plants/row. Rows were 38 cm long with 9 cm spacing between rows. Artificial lighting was provided by a mixture of cool white fluorescent and incandescent lights providing approximately 3,000 foot candles. Temperature was maintained at 26.7°C, and daylength was maintained at 12 hours. Varieties evaluated included 'Forrest', 'Essex', 'Mack', 'Bedford', 'York', 'Dare', 'Sohoma', 'Lee 74', 'Centennial', 'Gail', 'Lancer', and 'Davis'. The group V varieties all began to flower 37 days after planting. Plants were
approximately 15 cm in height. Group VI varieties began flowering from 37 to 41 days after planting. Flowers were small and most anthers dehisced before the flower could be effectively manipulated.

Reducing the temperature to 24°C after flowering began and increasing the humidity within the growth chamber appeared to produce a more satisfactory flower for artificial hybridization. The 3,000 foot candle light intensity and 12-hour photoperiod appear to be satisfactory. Reduced light intensity or reduced temperatures resulted in most varieties not flowering in a reasonably short time.

References


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1) Performance of lines from four generations of a backcrossing program involving Glycine max and G. soja.

We are interested in the possibility of using Glycine soja as a source of genes for improving cultivars of Glycine max. However, some characteristics in G. soja, such as low yield, vining, lodging, shattering, non-defoliation at maturity, poor seed quality, and non-yellow seed coat color are not acceptable in a cultivar. The purpose of our study is to explore the performance of these characters in lines derived from a backcrossing program in which G. soja is the donor parent.

Two G. soja introductions from the USSR, PI 424,001 and PI 326,581, were selected, based on complete fertility of the F₁ generation when crossed to cultivars of G. max. Two crosses were made, PI 424,001 x 'Amsoy 71' (Cross 1)