

INFLUENCE OF K AVAILABILITY ON SOYBEAN APHID POPULATION DYNAMICS AND YIELD LOSS

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Since the soybean aphid was first observed in Wisconsin during the 2000 growing season, observations of commercial soybean fields have suggested a potential link between potassium deficiency in soybeans and soybean aphid infestations. Subsequent to this, the same phenomenon was also noted in Illinois and Michigan.

The goal of this study is to examine the possibility of plant selection by aphids, rate of growth of aphid populations on plants with adequate potassium availability compared to plants deficient in potassium, and the resulting impact on soybean yield.

Methods

Field experiments were established at Arlington, Wis. in 2001 and 2002 into a field that had been previously established to contain areas with high, medium, and low potassium with respect to growth requirements of the soybean plant.

The experiments contained six treatments: three treatments (high, medium, and low K levels) were allowed to develop aphid infestations, and three treatments received multiple insecticide applications in attempts to keep the plots as free from aphid feeding as possible.

Leaf tissue and soil samples were taken in mid July to allow us to quantify the K⁺ levels in the field and accurately classify the “high, medium, and low” potassium levels in individual plots. Sampling for aphid numbers occurred over the course of the growing season and yields were evaluated at harvest time.

Results

Sampling data from the mid to late part of July until early August showed that aphid populations were highest on the unsprayed treatments, and aphid numbers descended in the order of the amount of K⁺ that was available. However, this was not the case on 16 August when the medium K⁺ level exhibited the highest numbers of aphids. Multiple applications of a foliar insecticide were effective in keeping the spray treatments nearly aphid free throughout the growing season.

Significant differences in yield were noted between sprayed and unsprayed treatments at all three K⁺ levels in both years. In 2002 treatments in the high potassium plots yielded 7.2 bushels/acre greater than the unsprayed high potassium treatment. This same trend was true for the medium and low K⁺ plots where sprayed plots yielded 8.0, and 5.8 bushels/acre greater respectively than those that were not sprayed.

Yield differences attributable to K⁺ deficiency averaged 6.1 bushels/acre between the high and medium, and 17.7 bushels/acre between the medium and low K⁺ level an indication that the

greatest

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yield losses due to K^+ deficiency occur at when K^+ availability is extremely limited (Table 5). Heavy aphid feeding pressure apparently does not interfere with uptake of available potassium because there were no differences in leaf tissue K^+ between sprayed and unsprayed counterparts at all three K^+ levels.

Discussion

This study contained extremely high numbers of aphids in both 2001 and 2002. In each case the aphid populations in this experiment were higher than all other experiments conducted at both the Arlington Research Station as well as the Rock Co. Farm in Janesville. Most notable were the results of plant counts in 2002. While these numbers did not appear to be substantially greater than those observed in 2001, they far outnumbered aphid populations the aphid populations observed in other fields at the Arlington Research Station in 2002. Results of aphid population sampling suggest that the reduced K^+ levels in the soil do not facilitate soybean aphid population outbreaks. However, it does not explain the unusually high numbers of aphids observed in this experiment over two years. One possibility is that the aphids are attracted to the field due to the appearance of the stunted soybean plants resulting from the K^+ deficiency. It may be related to the more open canopy in the stunted plots, or that the characteristically yellow leaves of K^+ deficient plants serves as an attractant to aphids dispersing from other areas. Once aphids colonize these areas they can readily fly to other locations within the field.