AGRONOMY

SOYBEAN NODULE INHIBITION AND ROOT GROWTH AS INFLUENCED BY NITROGEN SOURCE AND NITROGEN RATE

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"THE PRIMARY OBJECTIVE OF THIS RESEARCH WAS TO EVALUATE THE INFLUENCE OF SUPPLEMENTAL NITROGEN FERTILIZATION ON NODULE FORMATION AND ROOT GROWTH."

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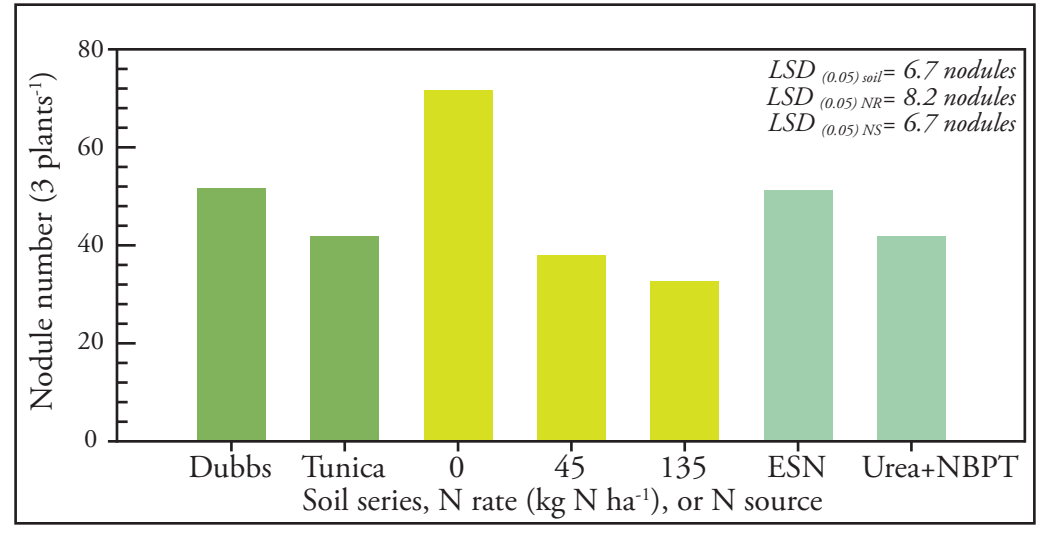
Soybean has the capacity to acquire nitrogen (N) from the atmosphere through biological fixation as well as the ability to utilize available soil-derived N. Symbiotic biological N fixation allows for the soybean to fulfill its great N demand in most production situations. N fixation is the process by which Bradyrhizobia spp. bacteria, infects soybean roots and forms special structures called nodules. Soybean provides carbohydrates and mineral nutrients to the bacteria, while the bacteria provides N to soybean creating a symbiotic relationship. Nitrogen is required in the greatest quantity of all soybean nutrients absorbed from the soil. Symbiotic biological nitrogen fixation, uptake of residual N, or nitrogen fertilizer are the main sources for meeting the nitrogen requirement of soybean. Soybean utilizes either direct root uptake of nitrates or ammonium from the soil environment or the nitrogen gas fixed from the atmosphere by rhizobium in root nodules.

The objective of this research was to evaluate the influence of supplemental N fertilization on nodule formation and root growth. Secondary objectives were i) Determine if N source had an effect on nodulation and root growth, ii) Identify differences across N rates on nodulation and root growth and iii) Define nodulation response

Figure 1. *Belowground parameter mean root length as influenced by either soil texture or N rate.*



on two common Mississippi soils cropped to soybean. The ultimate goal of the research is to provide a greater understanding of N fertilizer effects on nodulation and root growth of soybean plant. We hypothesized that N fertilizer additions at the V4 growth stage may negatively influence nodule formation and root growth.

In greenhouse experiments, aboveground biomass was not influenced by soil texture, N source or rate, or their interactions. Below ground biomass parameters were observed to be influenced by N source, rate, and soil texture. Soybeans seeded in Tunica clay soil produced 15% less belowground biomass when compared to Dubbs silt loam. All belowground parameters paralleled this trend when compared across soil textures. Mean root length was observed to be significantly influenced by N rate. Root length was observed to be greatest when 0 kg N ha^{-1} was applied, as N rate increased mean root length decreased. Similar to root length, untreated soybean had greater mean root area and root diameter than soybean receiving N, and in general as N rate increased belowground biomass decreased. Averaged across N source and soil texture, mean number of nodules present was greatest when using N source ESN. Soybean receiving urea+ NBPT resulted in a 19% decrease in mean number of nodules present when compared to soybean receiving ESN. Any N fertilizer addition resulted in an approximate 52% decrease in mean number of nodules present when compared to soybean receiving no N fertilizer. Overall, N fertilizer additions to soybeans significantly decreased all observed belowground parameters, while aboveground biomass was not affected.

Figure 2. *Belowground parameter mean root area as influenced by either soil texture or N rate.*