

How Does Kip Grow 150+ bu/acre Soybeans? Is K⁺ a Key?

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Objective:

The overall objective of this proposal is to evaluate the importance of key management practices employed by Mr. Cullers in achieving record soybean yields. Specific objectives include (i) comparisons between the application of N, P, and K nutrients as mineral fertilizer and as poultry litter; (ii) quantification of foliar K application on yield and leaf K concentrations; (iii) determine the effect of foliar micronutrient application on yield; and (iv) evaluate the effects of intensive and moderate irrigation frequency.

Procedures:

A field was selected at the Bradford Research and Extension Center near Columbia, MO and soil samples were collected for standard analyses by the University of Missouri Soil Testing Laboratory. Control treatment fertilization was based on these soil test results and yield goal according to Univ. of Missouri recommendations. Treatments were laid out in a randomized complete block design and were applied as described below. Prior to planting, poultry litter and mineral fertilizer were applied in equivalent amounts for both large applications of poultry litter (9 t/ac) and yield goal based fertilization. Poultry litter and mineral fertilizer was incorporated into the top soil by a single pass with a disc and soybean were planted in 15" rows. Precipitation events following planting caused standing water on large parts of the field over extended time periods and resulted in a patchy stand and weak soybean seedlings. Thus, the field was disked again and replanted. Drip irrigation was installed for the high-frequency irrigation treatments and deployed as needed over the course of the growing season. However, the above-normal rainfall in 2008, resulted in drip irrigation frequency well below expectations. Applications of foliar K were conducted as for even splits of 9 lb/ac. The application of supplemental soil applied K (36 lb/ac; equivalent to the sum of the four foliar applications of K) was conducted on the same day as the first foliar K application. Foliar micronutrients were applied at the time of the first and third foliar K applications. Data collection conducted over the course of the season include root sampling for analyses of nodulation, biomass samples, leaf-let samples, samples for plant mapping, and seed harvest.

Following soybean harvest, the second poultry litter application was made (25 Nov.) at the same rates as in the spring and the entire field was disked.

Results:

Results for soybean nodulation characteristics and yield are presented below with the following treatment assignments:

- FH-I: Fertilizer treatment matching the nutrients applied by 9 tons/ ac of poultry litter; Irrigated
- PH-I: Poultry litter application at 9 tons / ac; Irrigated
- FC-I: Fertilizer control: fertilization based on soil test and yield goal; Irrigated
- PC-I: Poultry litter control: matching nutrient application of fertilizer control; Irrigated
- FH-NI: Fertilizer treatment matching the nutrients applied by 9 tons/ ac of poultry litter; Non-Irrigated

- PH-NI: Poultry litter application at 9 tons / ac; Non-Irrigated
- FC-NI: Fertilizer control: fertilization based on soil test and yield goal; Non-Irrigated
- PC-NI: Poultry litter control: matching nutrient application of fertilizer control; Non-Irrigated
- FH: Fertilizer treatment matching the nutrients applied by 9 tons/ ac of poultry litter; averaged across irrigation environments
- PH: Poultry litter application at 9 tons / ac; averaged across irrigation environments
- FC: Fertilizer control: fertilization based on soil test and yield goal; averaged across irrigation environments
- PC: Poultry litter control: matching nutrient application of fertilizer control; averaged across irrigation environments

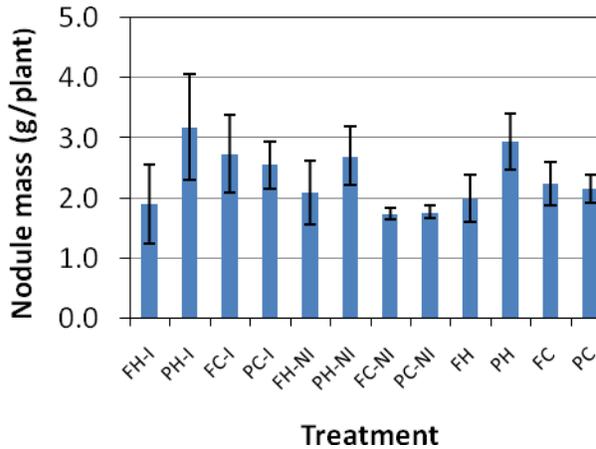


Figure 1. Soybean root nodule mass per plant as affected by fertility treatment.

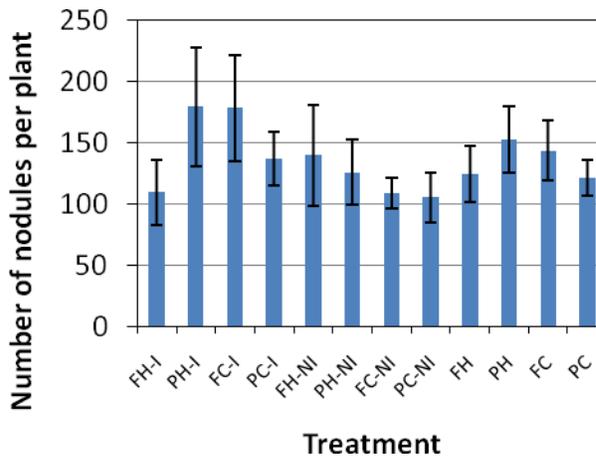


Figure 2. Soybean root nodule number per plant as affected by fertility treatment.

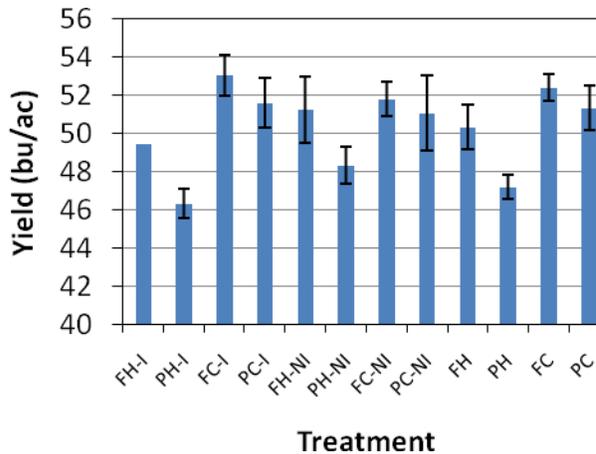


Figure 3. 2008 soybean seed yield as affected by fertility treatment.

Soybean root nodule mass and number both responded to the high poultry litter treatments (Fig. 1 and 2). The highest 2008 seed yield was produced by the high fertilizer treatments (Fig. 3).

2009 Research:

The fall 2008 poultry litter treatments have already been applied and worked in. In the spring of 2009, soybeans will be planted, treated, grown and harvested as in 2008. Hopefully, 2009 will be a “normal” year!

Budget for 2009:

Category	2009
Personnel	
Graduate Research Assistant (50%)	\$14,500
Benefits	\$2,030
Laboratory analyses (soil and plant spls)	\$3,840
Field Supplies*	\$3,500
Travel (professional meeting)	\$1,200
Total	\$25,070

*fertilizer, irrigation expenses (fuel and riser repair), seed, pesticides, machinery repair