Nod and Non-Nod Soybean Rotation Influence on Sorghum Grain Yield & Quality

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Introduction

- Crop rotation and soil amendments increase yield and soil NO_3-N
- Biologically fixed N by previous crops is not widely studied
- Little study of management influence on sorghum grain quality

Objective

- Evaluate nodulating (NB) and non-nodulating (NNB) soybean and soil amendment application to separate biologically fixed N and other rotational effects on:
  - soil NO_3-N and H_2O
  - sorghum growth
  - grain yield and quality

Material & Methods

- Sorghum-soybean rotation study conducted on Sharpsburg silty clay loam at Mead NE in 2003-2004.
- RCBD design with a split-plot treatment arrangement and four replicates
- Whole plot factor (cropping sequence): continuous sorghum (S-S), and sorghum following NB and NNB
- Sub-plot factor (soil amendment): zero, N (84 kg ha\(^{-1}\)), and manure (17 to 26 Mg ha\(^{-1}\), 196 to 378 kg N ha\(^{-1}\))
- Parameters measured were Soil NO_3-N & H_2O, LAI and dry matter production, grain yields and N concentration, test weight and true density, tangential abrasive dehulling device (TADD), and scanning electron microscopy

Background

Previous studies – maize rotated with NB and NNB with different N levels.
- Maloney et al. (1999) – No maize yield difference between NB and NNB previous crop at any N levels
- Gentry et al. (2003) and Bergerou et al. (2004) - Biologically fixed N played a minor role in the rotation effect, and rotation effect largely due to soil N availability (mineralization/immobilization) or other factors.

Soil NO_3-N and H_2O

Large soil NO_3-N differences at V6
- NNB-S, N = 68 to 106 kg ha\(^{-1}\)
- NB-S, manure = 184 to 189 kg ha\(^{-1}\)
- S-S, zero = 11 to 20 kg ha\(^{-1}\)
Largest soil H_2O differences at anthesis
- S-S, zero = 100 to 114 cm\(^3\) m\(^{-3}\)
- NNB-S, N = 91 to 108 cm\(^3\) cm\(^{-3}\)
- NB-S, manure = 87 to 104 cm\(^3\) cm\(^{-3}\)

Fig. 2. Micrographs of kernels

Climate

Precipitation: 2003 = 298 mm; 2004 = 342 mm;
30-yr = 480 mm
Temp: 2003 = 2004 = 20°C; 30-yr = 22°C

Table 1. Grain Yield and Quality

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*F test probabilities (P > F)

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1-Disk-plant-soil H_2O equal-manure plots greater OM and nutrient levels
2-More NO_3-N at planting and V6
3-Greater LAI and vegetative growth
4-Less H_2O at anthesis
5-Higher grain and stover yields
6-Higher test weight and less TADD removal (i.e. harder kernels)

Conclusion

- Most of soybean rotation effect not due to biologically fixed N
- Other sources of N (soil OM) and N availability very important
- NB-S > NNB-S > S-S
- Manure > N > Zero
- Grain N increased with N supply from rotation and soil amendment
- TADD removal had an inverse relation with grain N
- Soybean rotation and soil amendment application increased sorghum kernel hardness

Summary

- Evaluate nodulating (NB) and non-nodulating (NNB) soybean and soil amendment application to separate biologically fixed N and other rotational effects on:
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  - grain yield and quality