A DIFFERENT APPROACH TO MANAGING NITROGEN IN SORGHUM

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Abstract

Research conducted over the past fifty plus years has been used to develop a Nitrogen Fertilizer Recommendation "formula" for grain sorghum which considers factors such as Yield Potential, Residual Nitrate N in the soil Profile, the amount of N mineralized from Soil Organic Matter and Previous Crop Residue, and other potential sources of N such as animal manure or N in irrigation water.

The current formula used is as follows:

N Rec = Yld x (1.6) - (20 x %SOM) - PNST - PCA - Manure N - Water N

When complete information is available, and the grower's crystal ball is working well enough to predict yield six months or more in advance, the system performs well. Unfortunately, yield is difficult to predict prior to planting, and averages are almost meaningless. In addition, the complete information needed is not usually available, especially the amount of residual nitrate N available in the soil profile.

Sorghum is grown primarily in areas where soils and climate will not successfully support corn production. Over the past 25 years, county average yields in Central Kansas have been below 50 bushel per acre about 25% of the time, between 50 and 75 bushel per acre 45-50% of the time and above 75 bushel per acre 25-30% of the time. In Western Kansas during the same period, yields have been below 50 bushel 35 to 40% of the time, between 50 and 75 bushel 30 to 35% of the time, and above 75 bushels 25 to 30% of the time. Thus, growing dryland sorghum in Kansas is a risky business.

A successful sorghum crop is dependent on soil moisture at planting to start the crop, and timely rains and seasonal temperatures during the heading and grain fill periods. Since long range weather predictions are not very reliable, the questions then become, can we defer committing substantial dollars for inputs such as N until later in the season, and use technology such as active sensors, to give us a better handle on yield potential and nitrogen needs sometime after planting, and if so, how late can that decision be made?

Another potential value of the sensor technology is an alternative to pulling soil profile tests for estimating residual N. Very few farmers have used the soil profile N test in Kansas. Like yield, the amount of residual N available varies widely from year to year. In survey of profile N levels in field being planted to wheat in 2006, soil residual nitrate varied from 20 to over 400 pounds N per acre, in fields with no recent history of manure or alfalfa. Can we use the plant as an indicator of soil N supply, either through the measurement of color or through estimates of

biomass and yield. The questions then become how quickly can the sensors differentiate N content/deficiency in the plant, how late can we apply the N and still get a good response, and can we rely on a rain to help get the N into the plant in July or August under our dry conditions?

Objectives

1. Determine the optimum combinations of preplant and midseason N fertilizer for the growth and yield potential of grain sorghum.

2. Determine how late N can be routinely applied to sorghum using comman application equipment.

3. Determine the optimum method for midseason N applications, dribble band on the surface, or coulter band into the soil under normally dry soil conditions.

4. Assess the potential of the GreenSeeker and Crop Circle active sensing systems to predict yield potential and mid-season fertilizer N needs.

Materials and Methods

A series of field experiments were established in 2006 at Manhattan, Belleville, Hutchinson and Tribune Kansas, to study the response of grain sorghum to preplant and midseason applications of N. Crop rotation, tillage practices and hybrids used were representative of the areas. A randomized complete block design with 3 or 4 replications was used. Nitrogen rates applied ranged from 0 to 150 pounds of N. Soil tests were taken by block prior to planting on the surface soil for pH, P, K, and to a depth of two foot for nitrate-and ammonium N, S and Cl. Weeds were controlled chemically with supplemental hand weeding as needed.

NDVI was measured on all plants from approximately the 6 leaf stage through heading at regular intervals, using both the GreenSeeker and Crop Circle sensors. Leaf samples were collected at half bloom, and yield was measured at all locations. Total N uptake in the above ground portions of the plant was also measured at Manhattan.

Results

Harvest was not completed at this writing, but will be summarized at the meeting.

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