

EVALUATION OF EIGHT FERTILITY LEVELS ON GRAIN SORGHUM YIELD AND PROFITABILITY BASED ON SOIL TESTS AND RESIDUAL SOIL NITROGEN LEVELS

John Smajstrla, Cooperator (2009)

**Joe D. Janak, Jr., Stephen Biles, Mark McFarland, Dennis Coker
Victoria County Extension Agent - Ag/NR; Calhoun, Refugio &
Victoria Extension IPM Agent, Professor and Soil Fertility Specialist, College
Station; Extension Program Specialist, College Station, respectively.
Victoria County, Texas**

SUMMARY:

Treatments included standard nitrogen (N) fertilizer rates and reduced rates where residual N measured by soil testing to depths of 6, 12, and 24 inches were credited. Across the study area, an average maximum of 78 lb N/A was detected to 24 inches. Grain yields varied from 2719 – 4575 pounds/acre. Crop yield was numerically and economically the highest when the credit from the 0 – 6 and 6 - 12 inch soil samples taken (based on a credit of 24 + 26 lbs/ac residual N) was used and only 50 lb/a N fertilizer that was recommended was applied. There was no additional grain yield response due to phosphorous used above the recommended amount.

OBJECTIVE:

To determine the amount of residual nitrogen found in the soil after 2008's soybean crop and to determine if this residual nitrogen is sufficient to assist with production goals of 5000 lbs/ac grain sorghum in 2009. To further evaluate several rates of phosphorus fertilizer applications.

MATERIALS and METHODS:

Composite soil samples were collected from three different depths (0 – 6; 6 – 12, and 12 – 24 inches) in January 2009 within the treatment area and sent to Texas AgriLife Extension Service Soil Testing Laboratory for analysis and fertility recommendations for producing 5000 lb/ac grain sorghum. From this analysis and recommendation, eight different treatments of soil applied nutrients were applied in a study replicated five times. Treatments were in a randomized complete block with six 38 inch row plots that were 85 feet long and 5 feet between replications. The fertilizer application listed in Table 1 and applicator was set up for 6 row application (one pass per plot). The only fertilizer applied to this crop was that with this demonstration.

Planting of NC+ 8R18 grain sorghum was accomplished on March 21, 2009 with the farmer owned John Deere 7100 MaxEmerge planter equipped with Kinze milo units. The previous crop was soybeans.

Insecticide applied at planting included 0.64 oz/ac Mustang Max on a band plus the seed company applied seed treatment. The sorghum planting rate was calibrated at 5 pounds per acre. Herbicide applied included 1 qt/ac of Atrazine banded over the row plus 0.5 pt/ac of Dual Magnum. The crop was cultivated twice and did not have a midge infestation so was not sprayed for midge during the mid-maturity stage.

RESULTS and DISCUSSIONS:

Soil test results revealed substantial nitrogen within the soil profiles (See Table 2) ranging from 16 – 30 lbs/ac within each strata and totally up to 78 lbs/ac of nitrogen detected averaged from both sites. From these results, eight different fertilizer levels were designed and applied. See Table 1 for plot layout and Table 3 for fertilizer levels. Tests revealed 28 lbs/ac of phosphorus was needed so it was added to all plots except one with double the recommendation.

The crop grew well in spite of the extended drought although there was some difference seen between and within treatments. Plant population was collected on June 18, 2009 with all populations being statistically equal. Plots were hand harvested on July 9, 2009 and grain was threshed and weighed.

Yields varied from 2719 – 4575 pounds/acre and at the 95 percent level of confidence there was statistical difference in several treatments. Additional differences may have been different, possible even greater, but were hampered due to two conditions: 1) Yield variance within some replications was high probably due to drier than normal conditions, and 2) the dry conditions did not allow the crop to reach its fertilized goal of 5000 pounds per acre.

Crop yield was numerically and economically the highest for the 50 lb/a N fertilizer level (treatment 3) that was recommended from the 0 - 12 inch soil sample taken (based on a credit of 24 + 26 lbs/ac residual N) although there was no statistical difference in yield between it and the higher levels of N fertility except where the phosphorus level was doubled (treatment 6). In treatment 6, there were some unexplainable situations with it having the highest yield in one of the 5 replications and having the lowest yield in another plus two additional lower yields.

Based on this demonstration, it can be shown that taking deep soil samples and using the 0 – 6 and the 6 – 12 inch level soil sample results (treatment 3) proved to be the most economical followed by using a standard level of 100 lbs/ac for N plus the soil recommendation for P and then using the standard 0 – 6 soil sample test recommendations (See Table 3).

Table 1. Layout of soil fertility/residual N demonstration. John Smajstrla, Cooperator.

	501 T1	502 T2	503 T3	504 T4	505 T8	506 T7	507 T6	508 T5	
	401 T3	402 T5	403 T4	404 T7	405 T6	406 T8	407 T2	408 T1	
	301 T2	302 T6	303 T7	304 T4	305 T8	306 T1	307 T5	308 T3	↑ E
↑ Row Direction	201 T4	202 T3	203 T6	204 T8	205 T5	206 T7	207 T1	208 T2	
	101 T7	102 T8	103 T3	104 T5	105 T4	106 T6	107 T2	108 T1	

Table 2. Residual soil nitrogen levels found at varying depths following a soybean cropping year. John Smajstrla, Cooperator, Victoria County, TX 2009.

Residual Soil Nitrogen (NO₃) at collected field sites; Lbs/ac			
Soil Depth (Inches)	Front of site	Rear of site	Average
0 – 6	16	32	24
6 – 12	22	30	26
12 - 24	28	28	28
Total	66	90	78

Table 3. Evaluation of eight fertility levels on sorghum yield and profitability based on soil tests and residual soil nitrogen. John Smajstrla, Cooperator, Victoria County, TX 2009.

Treatment	Fertilizer applied based on soil tests and recommendations (Lbs/ac)		Results of grain harvest and economics			
	Nitrogen	Phosphorus	Plant Pop. X 1000	Bushel Wt. Lbs/Bu. ^{7/}	Grain Yield Lbs/acre ^{7/}	Return Above Control \$/a ^{8/}
1 (Control)	0 (8) ^{6/}	28	44 a	58.5 ab	3399 b	-
2	22 ^{5/}	28	47 a	54.8 c	3491 b	\$ -1.20
3	50 ^{4/}	28	44 a	56.9 bc	4170 a	34.36
4	76 ^{3/}	28	48 a	56.2 bc	3870 ab	14.81
5	100 ^{1/}	28	45 a	60.8 a	4197 a	30.89
6	100 ^{1/}	56	46 a	58.7 ab	3442 b	-16.53
7	100 ^{1/}	0	48 a	54.9 c	3803 ab	8.63
8	100 ^{1/, 2/}	10 ^{2/}	48 a	57.1 bc	3762 ab	6.31
LSD (P=.05)			4.4	3.2	591.4	

^{1/} Nitrogen rate based on yield goal of 5000 lbs/ac sorghum without a soil test

^{2/} Pro Germinator 9-24-3 (Agro-Culture) at 4 gal./A (3.8 N - 10.2 P – 1.3 K)

^{3/} Nitrogen rate based on yield goal of 5000 lbs/ac sorghum and 0 - 6 inch soil test N credit

^{4/} Nitrogen rate based on yield goal of 5000 lbs/ac sorghum and 0 - 12 inch soil test N credit

^{5/} Nitrogen rate based on yield goal of 5000 lbs/ac sorghum and 0 - 24 inch soil test N credit

^{6/} Control plot with no nitrogen (actual N = 8 lb/ac which came premixed with phosphorus)

^{7/} Means followed by same letter do not significantly differ (P=.05, LSD)

^{8/} Based on fertilizer prices (N - \$0.10/lb; and P - \$0.20/lb) and \$5/acre application charge

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