

# Development of Nitrogen Rate Recommendations for No-till Dryland Grain Sorghum in Virginia

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## ABSTRACT

Grain sorghum (*Sorghum bicolor* L. Moench) has been a relatively small acreage crop in Virginia. Little research has been done in the humid mid-Atlantic region to develop full-season N fertilizer recommendations for dryland grain sorghum grown in no-tillage production systems. The objectives of this study were: (i) to determine the optimum rate of band-placed starter N fertilizer needed in combination with side-dress N applications to achieve economic grain yields, (ii) to investigate if pre-plant broadcast N applications are as efficient as band-placed plus side-dress N applications, (iii) to evaluate the response of grain sorghum yield to partitioned side-dress N applications, and (iv) to study the influence of residual soil profile mineral-N ( $\text{NO}_3\text{-N}$  and  $\text{NH}_4\text{-N}$ ) on sorghum response to applied N fertilization. Multi-location field studies were conducted over a period of three years (1995, 1996, and 1997). A range of N treatments consisting of factorial combinations of various starter-band and side-dress N rates were applied. Grain sorghum yield response was determined by harvesting the four middle rows of each experimental plot with a plot combine. The experimental data indicate that an optimum rate of N fertilization depends on residual soil mineral-N. Little or zero starter-band-N in conjunction with side-dress-N applications of  $130 \text{ kg N ha}^{-1}$  for soils testing high in mineral-N ( $\geq 50 \text{ kg N ha}^{-1}$  in the top 0.3m of surface soil) at planting, and a starter-band-N supplement of  $40 \text{ kg N ha}^{-1}$  in conjunction with  $130 \text{ kg N ha}^{-1}$  side-dress N for soils testing low in mineral-N at planting, optimized the grain sorghum yields in these experiments. Broadcast N applications were observed to be as efficient as band placed N applications when followed by rainfall soon after application. Grain sorghum yields did respond to the partitioned side-dress N applications. However, partitioning of side-dress N application again depends on the residual mineral-N level present in the soil. The grain yield increase due to applied N was inversely correlated with residual soil mineral-N measured to a soil depth of 0.9 m at planting. In order to consider residual soil mineral-N in making N fertilizer recommendations "Associated Nitrogen Fertilizer Equivalency" (ANFE) values were calculated. ANFE is the amount of applied N that has potential to produce the same yield as that produced by the residual soil mineral-N. The N fertilizer recommendations based on ANFE values were quite close for two out of four sites as compared to the N rates at which the maximum yields were obtained in this study. The ANFE system over and under predicted the required N rates for one site each. These experiments indicates that soil mineral-N is not as transient as is generally assumed in the humid mid-Atlantic region; and that the ANFE concept has potential for including soil mineral-N as an integral part of the fertilizer N recommendation system.