Have you ever wondered how nitrogen rate and nitrogen placement affects no-till grain sorghum yields?

Two studies, a 4-year study at the North Agronomy Farm near Manhattan, KS (Riley County) and a 3-year study on a farmer's field in Greenwood County were established to address this question. Both research sites were in a continuous, no-till grain sorghum system. The three nitrogen rates were 0, 50, and 100 pounds N per acre and the three nitrogen placement treatments were broadcast, dribbled (dribbled on the surface on 20-inch centers), and knifed (knifed 6-7 inches below the surface on 20-inch centers). The nitrogen source was urea-ammonium nitrate (28% UAN solution).

At both locations grain sorghum yields increased as nitrogen rates increased from 0 N to 50 pounds N per acre and from 50 pounds N per acre to 100 pounds N per acre. At Riley County, the 0 N or check treatment yielded 63 bushels per acre, the 50 pounds N per acre rate yielded 108 bushels per acre and the 100 pounds N per acre rate yielded 131 bushels per acre. At Greenwood County, the 0 N or check treatment yielded 63 bushels per acre, the 50 pounds N per acre rate yielded 80 bushels per acre, and the 100 pounds N per acre rate yielded 85 bushels per acre. At Riley County, sorghum yields for the broadcast, dribble, and knifed applications were 110, 119, and 130 bushels per acre, respectively. The results at Greenwood County were not as dramatic; sorghum yields for the broadcast, dribble, and knifed applications were 79, 80, and 88 bushels per acre, respectively.

To obtain a better perspective of the importance of N placement, we need to see how placement responds within a given N rate. For example, at Riley County for the 50 pounds N per acre rate, sorghum yields for the broadcast, dribble, and knifed treatments were 98, 105, 122 bushels per acre, respectively. That's a 24 percent increase for the knifed N over the broadcast N application. At the 100 pounds N per acre rate, sorghum yields for the broadcast, dribble, and knifed treatments were 121, 133, and 138 bushels per acre, respectively. That's a 14 percent increase for the knifed N over the broadcast N application. And the knifed--50 pounds N per acre treatment (122 bu/a) yielded the same as the broadcast– 100 pounds N per acre treatment (121 bu/a). At Greenwood County for the 50 pounds N per acre rate, sorghum yields for the broadcast, dribble, and knifed treatments were 78, 77, and 85 bushels per acre, respectively. That's about a 9 percent increase for the knifed N over the broadcast N application. At the 100 pounds N per acre rate, sorghum yields for the broadcast, dribble, and knifed treatments were 80, 83, and 91 bushels per acre, respectively. That's about a 14 percent increase for the knifed N over the broadcast N application. At this location the knifed–50 pounds N per acre treatment (85 bu/a) yielded more than the broadcast–100 pounds N per acre treatment (80 bu/a).

What's the bottom line?
Farmers are concerned about placing nitrogen fertilizer on the soil surface in a no-till system because of nitrogen tie-up by crop residue and/ or volatilization loss of nitrogen– and for a good reason. This study shows that broadcast N applications result in the lowest yields, followed by dribble N applications, and the greatest yields were the knifed N applications. Why? You ask. With broadcast applications there are more chances the N fertilizer will come into contact with crop residues and it will be tied-up with the residue. That N will eventually become available after the residue is broken down, but it isn't readily available. Generally, the dribble application is better than the broadcast application because the nitrogen, albeit on the surface, is concentrated into a narrow band, which reduces contact with residues leaving more N available for the growing sorghum. The knifed N application is ideal because it places the N below the soil surface, so there's no contact with the surface residue and reduces volatilization losses.

For more details about this research see:
Kansas Fertilizer Research 1988-89. K-State Research and Extension. Report of Progress 561 (p.109) and 587 (p. 83)

Jim Shroyer
Extension Specialist
Crop Production