WHEAT SEEDING RATE STUDY

Jim Herbek, John James and Dottie Call
Department of Agronomy

OBJECTIVE:

Evaluate the effect of different seeding rates and established stand on the yield potential of wheat.

METHODS:

The experiment was established in Caldwell County on a tract of land near the UKREC Center in the Fall of 1998. The wheat variety, Pioneer 2540, was planted on October 12, 1998 with a Lilliston 9670 no-till drill (7-inch row spacing) in both a conventionally tilled (chisel plow, 2 diskings, roterra) and no-till seedbed. The previous crop was corn and the corn residue was flail mowed prior to tillage and planting. Roundup Ultra (3 qts/A) was applied to the no-till area after planting on 10-12-98. All treatments received the following: Harmony Extra herbicide (0.5 oz/A) on 3-28-99; Warrior insecticide (3 oz/A) on 11-12-98 and 12-15-98; and Tilt fungicide (4 oz/A) at heading. Fertilizer (200 lbs. of 18-46-0 per acre and 100 lbs of 0-0-60 per acre) was applied to the study area on 10-1-98. A total of 100 lbs of N/acre as ammonium nitrate was applied in the spring in a split application (40 lbs on 2-22-99 and 60 lbs on 3-18-99).

Four wheat seeding rate treatment/goals were compared: 45, 35, 25 and 15 seeds/$ft^{2.}$ The drill was calibrated for each seeding rate treatment to insure seeding rate accuracy and to establish drill settings that would deliver the amount of seed needed in close proximity to the seeding rate treatment goals. Seeding rates were adjusted for germination so that wheat plant establishment would be numerically close to the seeding rate treatment goals. Seeding rate treatments were the same for both wheat tillage planting systems (conventional and no-till). Wheat data was collected on: fall stand counts (10-27-98), spring head counts (5-27-99), lodging (6-15-99), and yield (6-16-99).

RESULTS:

The wheat seeding rate study results are shown in Table 1. Excellent stand establishment was achieved at all seeding rates in both tillage systems. The % stand achieved (Column 3), based on the actual number of seeds drilled (Column 1) and fall plant stands achieved (Column 2), was over 80% for all seeding rate treatments which is considered good. The lowest seeding rate treatment (15 seeds/ft^2) achieved the highest % stand (>90%) and the highest seeding rate treatment (45 seeds/ft^2) achieved the lowest % stand. The actual plant stands achieved (Column 2) were numerically very close to the seeding rate treatment goals and is attributed to the adjustment of seeding rates for germination (Column 1) and also excellent planting conditions in the fall of 1998. The final plant stands achieved were very similar for both tillage systems at each seeding rate (Column 2). Because the final plant stands were very similar for both tillage systems within each seeding rate, this provided an excellent opportunity to compare the influence of tillage system on wheat yield potential when plant stands are equivalent. Normally, the no-till planting system results in a comparatively lower plant stand establishment of at least 2-3 plants/ft^2(or more) than the tillage planting system at equivalent seeding rates.

Total wheat head numbers (Column 4) were greater at the higher seeding rates. However, even at the lowest seeding rate, total heads/ft^2 were sufficient for optimum wheat yield potential (considered to be > 60 heads/ft^2). At the lower seeding rates, the wheat plant compensated for the thinner stands by developing more tillers and heads per plant (Column 5). Wheat heads per plant were calculated from heads/ft^2 (Column 4) and plants/ft^2 (Column 2) within each seeding rate treatment. The total number of heads (Column 4) were quite similar for both tillage systems within each seeding rate. However, there was a trend for more total heads in the no-till system at the higher seeding rates.

Severe wind and rain storms in late May caused the wheat to lodge (Column 6). The variety used, Pioneer 2540, also has a tendency to lodge. Lodging increased as seeding rate increased. The greatest lodging occurred at the highest seeding rate; however, some lodging occurred even at the lowest seeding rate. Tillage system did not seem to have an effect on lodging potential. There was no correlation between the amount of lodging and yield level which indicated that lodging occurred late enough so that it did not affect yield potential. Probably the greatest yield reducing factor of lodged wheat comes from harvest

loss. However, the wheat in this study was carefully harvested so that harvest loss was not a factor.

Excellent wheat yields were achieved at all seeding rates (Column 7). In the no-till system, there was no significant difference in yield among the four seeding rates. Similarly, yields were equivalent in the conventional tillage system for all four seeding rates except for a slight yield reduction at the highest seeding rate. The results were somewhat surprising since it was expected the lowest seeding rate (15 seeds/ft^2) would result in a yield reduction. However, it was apparent that more head bearing tillers were produced per plant to compensate for the thinner plant stands. There was also no difference in yield between the two tillage systems.

CONCLUSIONS:

The low seeding rate/final stand (15/ft^2) produced yields equal to higher seeding rate/final stands (25-45/ft^2). This does not imply that these low wheat seeding rates should be utilized and that similar results would be obtained. This is only one-year's results with one variety from one location. Two other factors need to be considered. The variety used in this study (Pioneer 2540) has excellent tillering capacity. Other varieties with low tillering capacity may not perform as well at low seeding rates. Also, the 1998-99 growing season was excellent for fall growth and tiller development, winter survival, and spring growth. Whereas, adverse growing seasons would hinder plant growth and development and thinner stands would not perform as well.

The no-till wheat system had the same yield level and potential as the conventional tillage wheat system when final plant stands were equivalent.

TABLE 1. EFFECT OF SEEDING RATE ON WHEAT STAND, HEAD NUMBER, LODGING AND GRAIN YIELD IN A CONVENTIONAL TILL AND NO-TILL PLANTING SYSTEM.

Seeding Rate Goal (Seeds/ft^2)	(1) Actual Seeds Drilled (#/ft^2)*	(2) Fall Plant Stand (#/ft^2)	(3) % Stand Achieved	(4) Head Counts (#/ft^2)	(5) Heads Per Plant	(6) Lodging (%)	(7) Grain Yield (Bu/Ac)

				Conventional Tillage			
15	**16.0**	**15.9 d**	**99**	**68.2 c**	**4.3**	**11**	**105.8 a**
25	**29.6**	**25.1 c**	**85**	**75.6 b**	**3.0**	**24**	**105.2 ab**
35	**38.8**	**33.5 b**	**86**	**79.8 a**	**2.4**	**25**	**104.0 ab**
45	**48.8**	**40.1 a**	**82**	**76.4 b**	**1.9**	**38**	**100.6 b**
				No-Tillage			
15	**16.0**	**14.9 d**	**93**	**68.6 d**	**4.6**	**11**	**104.3 a**
25	**29.6**	**25.1 c**	**85**	**75.6 c**	**3.0**	**29**	**107.7 a**
35	**38.8**	**34.7 b**	**89**	**81.4 b**	**2.3**	**30**	**103.9 a**
45	**48.8**	**40.6 a**	**83**	**84.6 a**	**2.1**	**40**	**103.6 a**

*Adjusted for 90% germination.
Means in a column (within each tillage system) followed by the same letter are not significantly different at the 10% level.