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Drs. Wade Thomason, Mark Alley, and Bob Pitman

Starter Placement and Rate Effects Studied On Winter Wheat Production

Returns mixed at two Virginia sites in 2007 and 2008 studies.

Producers who seek to take advantage of labor and machinery savings possible with no-tillage (NT) small grain production have largely overcome seeding problems by using seeders capable of producing uniform crop stands, even planting into large amounts of residue, e.g., high-yield corn stover. However, experiences and research from Virginia and the Piedmont and Coastal Plain regions of North Carolina have shown that winter growth and tillering were lower with NT production. This same effect of lower tiller production has been found to exist in NT spring wheat. Planting up to one week earlier than the date recommended for conventional winter wheat is one common method to increase fall growth. However, this rarely results in tiller numbers equal to those in conventional plantings. Earlier planting also increases the likelihood of early maturity in spring and the chance for freeze damage. An additional management strategy to enhance NT small grain yields is to increase preplant nitrogen (N) rates by 10 to 15 lbs/A and apply 15 to 30 lbs/A in early winter. However, this increases the cost of production, especially with increased N fertilizer costs, and can also increase the likelihood of spring and winter freeze damage.

Research with NT corn in Virginia has shown a clear advantage to supplying N and phosphorus (P) in proximity to the seed and below the surface residue levels. For NT winter wheat, supplying fertilizer nutrients in proximity to the seed at planting, and below the surface residue, may increase fall tiller and root system development and lead to higher yields. While not directly measuring grain-forming tillers, increased total-season wheat forage yield due to seed-banded P has been found during research on acid soils with high soil test P levels. Wheat forage yields were increased due to banding P in Texas, especially in dry years. Other research has shown increased tillering, early growth, and P uptake when P was placed in-furrow at planting. Nitrogen placed in-furrow has also been shown to increase growth, tiller production, and grain yield in studies conducted in Arizona.

Finally, nutrient placement is the only process available with the potential to counter the problems of slow fall growth and limited tiller development on NT winter wheat. The surface residue needs to remain in place and will absorb heat that would be available in the soil for fall seedling growth and development. Increased nutrient supplied close to the seed may stimulate more efficient use of available heat units.

The objectives of this research were to:

1. Evaluate wheat tiller density and grain yield response to at-planting fertilizer placement method

2. Determine the effect of starter fertilizer rates, nutrients, and combinations placed with the seed at planting on wheat tiller density, grain yield, and yield components.

Placement methods

Middlesex. Plants ft-2 and tillers per unit area were highest for the Grower Standard at the Middlesex site (Table 1). This relationship did not continue late-season, as the number of heads ft-2 at harvest was less than for most other treatments. The number of kernels per head was proportionally higher and was similar to the effect of applying 33-17-8-5.5 behind the press wheels, which also produced relatively lower head numbers at harvest. Injecting 25-25-8-5.5 behind the cutting coulter produced the highest grain yield of 80.6 bu/A (Table 2). Application of 25-25-8-5.5 with a Keaton brand seed firmer (DD) or 33-17-6-5.5

Placement	Nutrients N-P-K-S	GS 15 Plants	GS 30 Tillers	Grain Yield	Grain Protein
	lbs/A	plants/ft²	tillers/ft²	bu/A	--%--
DD	25-25-8-5.5	17	43	77.8	10.30
IC	25-25-8-5.5	18	43	80.6	10.01
BP	25-25-8-5.5	18	46	77.5	10.63
Broadcast	25-25-8-5.5	16	44	74.0	10.59
DD	33-17-8-5.5	16	47	78.7	10.40
IC	33-17-8-5.5	18	40	77.2	10.55
BP	33-17-8-5.5	20	43	78.6	9.88
Broadcast	33-17-8-5.5	17	42	74.0	10.40
Check	0-0-0-0	17	49	77.6	10.76
Grower Standard	25-25-8.5-5.5 + 25 lbs N BC at planting	22	54	76.9	10.55

DD = Between double disc openers.
IC = With NT injection coulter in front of double disc openers.
BP = Behind press-wheel, over the row

Table 1. *Wheat vegetative, grain yield response to starter fertilizer placement in no-till wheat, Middlesex, 2007-2008*

behind the press wheel (BP) resulted in grain yields that were significantly higher than the check (Table 1). Grain test weight was not significantly affected by treatments.

Warsaw. There was no effect of treatment on early-season plant stand, but the Grower Standard 25-25-8-5.5 applied broadcast, the 33-17-8-5.5 applied between the disc openers using seed firmers, and the check all had growth stage (GS) 30 tiller numbers higher than the other treatments (Table 2). Injecting 25-25-8-5.5 behind the cutting coulter produced the highest grain yield of 80.6 bu/A. Grain yields of the two broadcast treatments were significantly lower than the other treatments (Table 2). Grain test weight was highest for 33-17-8-5.5 applied either with a DD or a double-disk opener (IC).

Starter rates

Middlesex. There was a significant linear increase in plants ft-2, GS 30 tillers, and grain yield in response to increasing N rate (Table 3). There was also a concurrent linear decrease in individual kernel weight with increasing N rate. Application of potassium thiosulfate (KTS) resulted in significantly lower grain yield when compared only to plots also receiving 30 lbs/A of N and P_2O_5 (Table 2). However, grain yields for a number of other treatments also receiving KTS were not different from the highest yield. Yield components for plots receiving 30 lbs/A of N and P_2O_5 with and without KTS were not different.

Warsaw. There was a significant linear response to N for heads per unit

Placement	Nutrients N-P-K-S	GS 15 Plants	GS 30 Tillers	Grain Yield	Test Weight
	lbs/A	plants/ft²	tillers/ft²	bu/A	lbs/bu
DD	25-25-8-5.5	27	54	71.7	57.3
IC	25-25-8-5.5	26	52	73.3	58.4
BP	25-25-8-5.5	26	54	71.9	57.7
Broadcast	25-25-8-5.5	27	55	68.9	55.7
DD	33-17-8-5.5	27	58	72.7	59.0
IC	33-17-8-5.5	27	49	70.6	59.4
BP	33-17-8-5.5	28	51	72.6	58.2
Broadcast	33-17-8-5.5	28	54	64.8	58.7
Check	0-0-0-0	27	59	70.6	58.7
Grower Standard	25-25-8.5-5.5 + 28 kg N BC at planting Dec	26	58	72.0	58.1

DD = Between double disc openers.
IC = With NT injection coulter in front of double disc openers.
BP = Behind press-wheel, over the row.

Table 2. *Wheat vegetative, grain yield response to starter fertilizer in no-till wheat, Warsaw 2007-2008.*

Nutrients				GS 15 Plants	GS 30 Tillers	Grain Yield	Grain Protein
N	P	K	S				
kg/ha				plants/ft²	tillers/ft²	bu/A	--%--
0	0	0	0	17	50	77.2	10.35
15	30	8	5	18	53	77.3	9.85
30	30	8	5	19	53	75.1	10.07
45	30	8	5	20	52	81.2	10.84
60	30	8	5	20	51	83.2	10.19
30	0	8	5	19	56	78.1	10.60
30	15	8	5	17	53	76.7	10.76
30	30	0	0	18	57	80.5	10.27
30	45	8	5	20	51	78.9	10.84
30	60	8	5	19	51	79.4	10.96

Table 3. *Plant, tiller, grain yield, protein response to starter fertilizer rate in no-till wheat, Middlesex, 2007-2008. Nutrients were APP, UAN and KTS. All applications were placed between the doublediscк openers at planting, using seed firmers.*

area at harvest and grain yield. Grain yield increased at a rate of 0.1 bu/A per additional pound of N applied, up to 60 lbs/A (Table 4). There was also a linear decrease in grain protein with increasing P application. This effect is likely of little consequence, since values ranged only from 11.1 to 11.7, which is an acceptable range for soft red winter wheat. The addition of KTS resulted in greater heads at harvest but a lower number of kernels per head, which is the generally expected relationship among these yield components.

Dr. Thomason is extension grain specialist, and Dr. Alley is W. G. Wysor professor of agriculture, VA Tech; Dr. Pitman is Superintendent of the Eastern Virginia AREC.

Nutrients				GS 15 Plants	GS 30 Tillers	Grain Yield	Test Weight
N	P	K	S				
kg/ha				plants/ft²	tillers/ft²	bu/A	lbs/bu
0	0	0	0	25	58	68.6	56.1
15	30	8	5	26	60	71.4	57.2
30	30	8	5	25	59	68.6	58.9
45	30	8	5	22	54	71.3	56.1
60	30	8	5	25	56	77.7	59.4
30	0	8	5	24	61	69.6	57.9
30	15	8	5	24	60	70.4	59.0
30	30	0	0	24	63	66.9	56.4
30	45	8	5	25	57	71.8	56.4
30	60	8	5	24	56	71.9	58.6

Table 4. *Plant, tiller, grain yield, test weight response to starter fertilizer rate in no-till wheat, Warsaw, 2007-08. Nutrients were APP, UAN and KTS. All applications were placed between the double-disk openers at planting using seed firmers.*