

No-Till Cropping Sequence Studies Under Dryland Agriculture at Ayr, North Dakota

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A no-till cropping system study was initiated at Ayr, North Dakota, in the spring of 2007. Three crop rotations are being studied: corn-corn, corn-soybean and corn-soybean-spring wheat. A fertilizer N-rate calibration component is a part of the corn treatment in each rotation. Each N rate study is arranged in a randomized complete block design with four replications.

Materials and Methods

- Previous crops: Block 1: 2008 – field corn; 2007 – wheat; 2006 – soybean.
Block 2: 2008 – soybean; 2007 – corn; 2006 – soybean.
Block 3: 2008 – soybean; 2007 – corn; 2006 – soybean.
Block 4: 2008 – wheat; 2007 – soybean; 2006 – field corn (north border – soybean).
Block 5: 2008 – field corn; 2007 – soybean; 2006 – field corn.
Block 6: 2008 – field corn; 2007 – field corn; 2006 – field corn.
- Seedbed preparation: Strip-tilled (except Block 4, (wheat ground for 2008)) about 5 inches deep on November 15, 2007.
- Planting: All corn and soybean were planted with a Monosem planter; the wheat was planted with a Horsch Anderson plot drill.
Block 1: Planted DKC38-89(VT3) May 7 in 30-inch rows at 28,800 seeds/acre.
Block 2: Planted W2064RR® May 7 in 30-inch rows at 194,000 seeds/acre.
Block 3: Planted W2064RR May 7 in 30-inch rows at 194,000 seeds/acre.
Block 4: Planted Blade on May 7 at 1.6 million seeds/acre.
Block 5: Planted DKC38-89(VT3) May 7 in 30-inch rows at 28,800 seeds/acre.
Block 6: Planted DKC38-89(VT3) May 7 in 30-inch rows at 28,800 seeds/acre.
- Fertilizer: All Blocks received 11 lbs. N/acre, and 36 lbs. P₂O₅/acre as 10-34-0. Blocks 1, 2, 3, 5 and 6 on November 15, 2007 and Block 4 on May 7, 2008.
Blocks 2 and 3 received no further fertilizer treatments.
Blocks 1, 5 and 6: Stream-bar applied N treatments of 39, 89 and 139 lbs. N/acre as 32-0-0 on May 22.
Block 4: Stream-bar applied 88 lbs. N/acre as 32-0-0 on June 7.
- Pest Control: Block 1 on June 7 and blocks 5 and 6 on June 9, received Lumax (3 pt/acre) + Buccaneer Plus (40 oz/acre) + AMS (10 lb/100 gal) + NIS (0.25% v/v).
Blocks 2 and 3: Resource (6 oz/acre) + Buccaneer Plus (40 oz/acre) + AMS (10 lb/100 gal) + NIS (0.5% v/v) on June 9, Select (8 oz/acre) on August 4, and Cornerstone Plus (32 oz/acre) + AMS (1 lb/10 gal) + Interlock (4 oz/acre) on August 14.
Block 4: Wolfpack (1.35 oz/acre) on June 9, Headline (6 oz/acre) on June 20, Tilt (4 oz/acre) on July 3 and Folicur (2 oz/acre) + Proline (2 oz/acre) on July 9.
- Harvest: Block 4: Combined Blade HRSW August 27.
Block 2 and 3: Combined soybean October 17.
Block 1, 5 and 6: Hand-harvested a 20 ft. section from rows 3 and 4 each plot November 4, combined remainder with 4400 JD on November 19.



No-till cropping study at Ayr, ND.

Results

Intensively managed HRSW yielded 71.2 bu/ac at 13.5% moisture, had a 14.1% protein content, a moisture content of 17.2% and a test weight of 59.4 lb/ac. Soybean yielded 21.3 bu/ac at 13% moisture. Adjacent soybean fields were adjusted at hail damage levels of 40-50%.

Table 1 of the corn on corn study shows that increasing rates of N increased yield, ears/plant, chlorophyll meter readings and grain protein. For the second consecutive year the 10 lbs. N/ac rate plots (low N rate) yielded more than the 100 lbs. N/ac plots. Either there is more residual N in these plots or more N is being mineralized. Fall soil tests showed 36 lbs. nitrate-N/ac in the low N plots compared to 37 lbs. nitrate-N in the high N plots. It is somewhat puzzling that the low N-rate plots would have the highest stalk nitrate-N test, the second highest grain protein and the lowest chlorophyll meter reading.

When corn was grown on soybean ground, increasing N rates increased yield, test weight fall soil nitrate-N, chlorophyll meter readings, grain protein and stalk nitrate-N. The chlorophyll meter readings and the stalk test would suggest that yield was maximized at the 100 lb/ac N rate.

Interestingly, corn on spring wheat ground averaged within 5 bu/ac of corn on soybean ground. Although corn yielded 23 bu/ac more at the 150 lbs. N/ac than at the 10 lb/ac rate in the corn on spring wheat, the difference was not significant. Increased rates of N increased test weight, chlorophyll meter readings, grain protein and stalk nitrate-N. The big jump in stalk N from 100 lbs. N/ac to 150 lbs. N/ac and the very small difference in chlorophyll meter reading at these rates shows that the corn N requirement was met at the 100 lbs. N/ac rate.

Table 1. Impact of nitrogen fertilization on corn performance when corn is strip-tilled onto previous corn ground, Ayr, North Dakota, 2008.

Fertilizer N Rate lb/ac	Grain Yield bu/ac	Harvest Moisture %	Test Weight lb/bu	Ears/ Plant	Fall Nitrate-N		8/14/2008 Chlorophyll Reading	Population plants/ac
					2007 0-24"	2008 0-24"		
11	120.1	30.5	50.7	0.97	84	36	46	27552
50	96.9	31.6	49.4	0.97	36	14	52	28097
100	112.9	29.9	51.6	1.02	40	21	56	25591
150	139.3	29.9	52.0	1.00	41	37	57	27661
Mean	117.3	30.5	50.9	0.99	50	27	53	27225
LSD 0.05	17.4	NS	NS	0.03	NS	NS	4	1541
C.V. (%)	11.5	5.8	2.7	1.8	85.5	71.4	4.2	3.5

Fertilizer N Rate lb/ac	Grain Oil %	Grain Protein %	Grain Starch %	Stalk Nitrate-N ppm
11	3.4	7.5	72.5	806
50	3.6	7.2	72.5	568
100	3.4	7.4	71.3	444
150	3.2	7.9	72.0	747
Mean	3.4	7.5	72.1	642
LSD 0.05	0.3	NS	NS	950
C.V. (%)	4.8	7.6	1.3	92

Table 2. Impact of nitrogen fertilization on corn performance when corn is strip-tilled onto previous soybean ground, Ayr, North Dakota, 2008.

Fertilizer N Rate lb/ac	Grain Yield bu/ac	Harvest Moisture %	Test Weight lb/bu	Ears/ Plant	Fall Nitrate-N (0-24")		8/14/2008	Population plants/ac
					2007 ¹ lb/ac	2008 lb/ac	Chlorophyll Reading	
11	157.6	28.7	52.8	1.00	37	16	56.0	29512
50	174.6	27.9	53.5	0.99	37	13	59.0	29730
100	185.4	27.7	54.4	1.00	37	33	60.6	28968
150	189.6	27.8	53.9	1.00	37	38	61.2	30492
Mean	176.8	28.0	53.7	1.00	--	25	59.2	29675
LSD 0.05	9.6	NS	0.7	NS	--	15	3	NS
C.V. (%)	3.4	1.9	0.8	2.18	--	37	3	3

Fertilizer N Rate lb/ac	Grain Oil %	Grain Protein %	Grain Starch %	Stalk Nitrate-N ppm
11	3.2	6.9	72.1	341
50	3.2	7.3	71.7	203
100	3.2	7.8	71.5	1026
150	3.3	8.1	71.1	1823
Mean	3.2	7.5	71.6	848
LSD 0.05	NS	0.2	0.6	755
C.V. (%)	4.2	2.1	0.5	56.0

¹ Composite soil sample from entire soybean plot.

Table 3. Impact of nitrogen fertilization on corn performance when corn is strip-tilled onto previous spring wheat ground, Ayr, North Dakota, 2008.

Fertilizer N Rate lb/ac	Grain Yield bu/ac	Harvest Moisture %	Test Weight lb/bu	Ears/ Plant	Fall Nitrate-N (0-24")		8/14/2008 Chlorophyll	Population plants/ac
					2007 ¹ lb/ac	2008 lb/ac	Reading	
10	160.0	28.7	54.1	1.00	26	7.0	55.3	28205
50	171.1	26.7	54.6	1.01	26	9.0	58.6	26789
100	174.3	26.2	55.4	1.00	26	14.0	60.2	26136
150	182.6	26.3	55.6	1.00	26	21.0	60.6	27770
Mean	172.0	27.0	54.9	1.00	--	12.8	58.7	27225
LSD 0.05	NS	1.8	0.8	NS	--	6.1	3.8	NS
C.V. (%)	6.6	4.3	0.9	1.59	--	29.7	4.1	6.0

Fertilizer N Rate lb/ac	Grain Oil %	Grain Protein %	Grain Starch %	Stalk Nitrate-N ppm
10	3.3	7.0	71.1	271
50	3.3	7.2	70.8	394
100	3.2	7.7	70.9	966
150	3.1	7.9	70.7	2142
Mean	3.2	7.4	70.9	943
LSD 0.05	NS	0.6	NS	1175
C.V. (%)	6.0	5.1	0.6	78

¹ Composite soil sample from entire wheat plot.