2010

Report of Orthman Manufacturing Research Farm Strip-Till Comparison with No-Till Corn.

Under irrigation, corn has the best chance for high production. A proper fertilization and tillage system to help get the seed off to a good start is of prime importance. Orthman Manufacturing is dedicated to make that happen like many of you growing corn.

In Nebraska, the state with the most irrigated acres of cropland (source 2009 UNL Economics Report) in the United States where Orthman Research Farm sits, we are actively engaged in growing corn with an advanced agronomic systems approach. From 2008 on, we have challenged ourselves to grow corn using the Direct Seeding method against Precision Tillage method we sell via the 1tRIPr™ Strip-Till machine.

In the winter of 2009 we planned plots to compare Precision Tillage vs. Direct Seeding while also planning comparisons after the 2009 crop of soybeans, Direct Seeded compared to Strip-Till. This report offers a breakdown of both methods and our observations of the 2010 growing season.

Figure 1. Image during 2010 Planting of plots for Strip-Till Dekalb comparisons

Timeline:

2009 Harvest to April 2010 – the aftermath of 220 – 240 bu/ac corn harvested left nearly 6 tons per acre of residue (approx. 50 lbs of residue per bushel of corn harvested) to catch snow and minimize evaporation over the winter. The last 10 days of April we were able to strip-till and fertilize for the 2010 season. We completed the tilling process on April 24th. John Deere Greenstar RTK provided sub-inch accuracy for the Strip-Till and fertilizer application.

May to Mid-June 2010 – planting began on May 1st with No-Till vs. Strip-Till plots being some of the first to be planted among the 122 corn and soybean plots. Soil temperature was not favorable for soybean planting in early May, thus beans were planted May 15 - 18. While planting we placed a Kugler 1515™ product "in-furrow" at a 4 gal/acre rate. Tillage treatments for corn received the same rate.

We experienced difficulty in getting the proper seed depth in No-Till plots without increasing airbag down pressure on our John Deere Max-Emerge planter units. The soil condition where we had two years of No-Till back-to-back was very dense even with soybeans in rotation. Strip-Till plots had much less of a density problem and were planted with much less down pressure.

Emergence in the Strip-Till plots was a quick 7 days with the No-Till/Direct Seeded corn emerging 3 to 7 days later. Between rain events, bulk beans were all in the ground by the 18th of May. Eight inches of rain was received in the month of May and the first half of June.

Mid-June to August 1 – corn was growing very slowly. Soil temperature at 15 inches on June 20th was 53° F and the plants appeared stagnated, yellow and stunted. We made a judgment call to cancel our summer field day due to water logged soils, erratic growth, yellow-green corn and a high water table which made it impossible to dig observation root pits. In late July the rains abated and corn responded tremendously. Nitrogen was applied twice UAN through the pivot. First time root studies were completed in mid-June between rain showers. During this time we received over 10 inches of rainfall.

August 1 to September 20 – the corn continued to impress as it grew out of the doldrums and we had a positive outlook on the harvest to come. A third dose of UAN in early August finished our 90 lbs of Nitrogen post-seeding. The second of root digs were completed and reported. Corn was using 4.75 to 7 lbs of N/ac/day from July 30 to August 20th. Obviously, there was concerned as to the heavy rains and the possible loss of N due to leaching and de-nitrification. Time would only tell.

September 20 to October 5 - the corn was mature and drying down rapidly. Corn harvest began on October 5th, finished three days later. The growing season finished with 2580 heat units which was adequate for nearly all of the corn varieties planted which was pleasing considering the abundance of rainfall.

Specifics to the Strip-Till vs. No-Till Corn Plots:

Root observations changed very little from 25 days after emergence [DAE] to 55 DAE due to lack of heat, wet conditions and the water table being within 30 inches of the soil surface. See in Table 1 below.

Table 1. Strip-Till vs. No-Till Root Comparisons during the 2010 Growing Season

Corn Hybrid	Tillage Practice	Root Profile Width@6"	Root Profile Width@12"	Root Profile Width@18"	Water Table Depth (in.)@55dae	Vol. 1st 85% of roots-depth	25DAE Rooting Depth (max.)	55DAE Rooting Depth (max.)	Total # Roots
Studies to Examine hybrid root strength									
Excell 54-37	NT	20	14	13	32	15	13	26	31
Excell 55-31	NT	20	22	10	32	13	14	29	33
Excell 58-57	NT	20	20	8	32	12	14	22	33
Excell 59-56	NT	20	21	12	32	13	15	26	34
Excell 54-37	ST	21	22	0	29	11	15	15	42
Excell 55-31	ST	16	19	8	29	12	14	20	42
Excell 58-57	ST	17	19	4	29	12	15	16	43
Excell 59-56	ST	12	11	4	29	10	13	16	38
DKC58-16	ST	17	15	8	32	15	18	31	43
DKC58-16	NT	18	16	8	33	14	13	30	38
Hoegemeyer 5353	ST	24	6	0	22	8	15	15	40
Hoegemeyer 5353	NT	23	3	0	24	7	16	14	41
Hoegemeyer 8042	ST	17	16	6	22	12	14	21	45
Hoegemeyer 8042	NT	20	21	9	26	11	14	19	33

2010 Summer Climatic and Soil Conditions….

As mentioned before, rainfall in the summer of 2010 was abundant throughout Central Nebraska. From April through September reporting stations in and around Dawson County reported from 23.7 up to 26.3 inches of rain (data from NeRAIN website) causing waterlogged soils.

Soil remained cold and nearly saturated from May 10th to July 25th which did not allow soil temperatures to increase for root extension both vertically and laterally. Corn showed stress during this time due to Hypoxia (severe lack of O_2). As Hypoxia occurs, soils and specific soil bacteria denitrify the supply of N in the soil. Most all growers in the area were experiencing these conditions.

The Research Farm soils are clay loam in the surface layer, clay loam sub-soils with loam to sandy loam to 60 inches or more. Soil organic matter varies slightly from 2.2 to 3.1% in the surface 4 inches. Cation exchange capacity in the subsoil ranges from 13meq/L to 18meq/L. Residual nitrates range from 5ppm to 11ppm in the sub-soils. Surface soil pH values range from 7.6 to 8.2.

Strip-Till and No-Till/Direct Seeding Plots….

All of the Hoegemeyer, Excell Hybrid and Dekalb plots were triplicate to offer a better study as to how the two tillage systems. Plots were located in very deep, clay loam soils with poorly draining soil conditions. Plot length ranged from 200 ft. to 350 ft., dependent upon location. Plots were 8 rows wide on 30 inch centers. Planting a population of 32K yielded an emergence of 29.9 to 31.4K and all seed was either 107 or 108 day variety.

Discussion…

All of us who grow irrigated corn want higher potential yields but the 200 bu/ac has always been a benchmark and we all understand it as a good and practical goal.

The Strip-Till corn emerged 3 to 7 days before the Direct Seeded corn and I was so full of hope.

Water in excess is detrimental. Rule of thumb says that for every inch after the first 10 inches of water supplied to the crop can yield an additional 18-22 bu/acre of corn. That is only the case if the soil drains well, the soil warms adequately, the plant receives adequate sun and heat units for photosynthesis. As mentioned before, hypoxia was prevalent in late May until mid-July. Plants were slowed to a near standstill, photosynthesis struggled and cold soils during the time when the plants genetics were trying to determine ear size and leaf number, reduced overall plant potential. July 20th brought excellent growing conditions and the corn began to respond positively however, it was difficult to determine the end result of early plant stress.

In Table 1 we observe where the first 85% of corn roots reside to gain a real look below the soil surface corn development. We can then gage the capacity of the plant to absorb water and nutrients for best yields. In the columns 25DAE depth and 55DAE depth you may observe minimal change from the earlier root digs to the latter. Genetic potential for row count of kernels is set at 45 days after emergence. The long, cold, wet spring left saturated conditions, near hypoxia concern and an obvious stress on the corn. Research is always a learning experience and gives rise to eliminating what does not work adopting what does work.

Table 2. Yield results of three hybrid varieties: Strip-Till and No-Till for 2010 at Lexington, NE

Hybrid	St-Till Yield	No-Till Yield	Plot # ST	NT
Hoegemeyer5353	192.79	154.68	16	17
	176.28	163.04	18	19
	191.53	146.95	20	21
Avg Yield bpa	186.87	154.89		
Hoegemeyer8042	150.50	145.47	22	23
	149.01	90.36	24	25
	157.25	126.98	26	27
Avg Yield bpa	152.25	120.94		
Dekalb 58-16	135.72	103.46	2	3
	153.49	114.64	4	5
	145.40	138.67	6	7
	148.47	154.44	8	9
	131.24	120.11	10	11
	133.21	107.23	12	13
Avg Yield bpa	141.26	123.09		

Table 3. 2010 Yields Strip-Till plots with Excell Hybrids

Plot	Moisture	Tstwght	Weight	Avg Yield(bpa)
Excell 104r1	11.65	60.67	384.85	135.29
Excell 105r1	11.65	60.8	347.2	124.76
Excell 108r1	14.23	59.55	379.51	132.39
Excell 109r1	11.72	60.8	422.23	151.60
Ex104r2	12.42	60.33	344.25	122.62
Ex105r2	10.82	61.71	526.36	186.77
Ex108r2	14.42	59.81	444.88	154.85
Ex109r2	10.28	61.59	636.36	213.26
EX104r3	11.75	60.62	282.19	101.29
Ex105r3	14.15	59.9	322.5	112.61
Ex108r3	17.97	58.15	345.53	115.28
Ex109r3	11.48	61.43	429.26	154.55

Table 4. 2010 Yields No-Till plots with Excell Hybrids

Excell Hybrid	% moist	Wt./bushel	Yield(bpa)
54-37 rep1	14.37	59.55	96.16
55-31 rep1	12.61	60.70	178.05
58-57 rep1	17.97	58.33	147.11
59-56 rep1	12.52	60.62	147.50
54-37 rep2	13.89	59.69	114.16
55-31 rep2	12.90	60.55	124.57
58-57 rep2	16.19	58.98	161.07
59-56 rep2	11.72	61.12	122.44
54-37 rep3	14.57	59.43	126.41
55-31 rep3	16.63	58.84	146.94
58-57 rep3	18.62	58.13	160.96
59-56 rep3	12.73	60.65	167.94

Excell Hybrid yields better illuminate the results of rain, cold, near hypoxia and slowed development. The start was looking good for Strip-Tilled corn. In early June, water stood in the field for the duration of 8 days and the effects were nearly devastating ranging from 26 to 37% yield loss in the strip-till plots. The No-Till was more fortunate with better internal drainage and was not so negatively affected.

In Table 1 soils are better drained and the results give a bit of a different picture. Generally speaking, we observed all season that the Strip-Tilled was taller, greener and more robust and of good color. Hoegemeyer selections used in this study; 5353, a shallow rooted corn hybrid and variety 8042, a deeper rooted hybrid showed the following results. The 5353 hybrid handled the water table and compensated to raise some decent bushels per acre in Strip-Till. The nearby No-Till yielded 31 bushels less. The deeper rooted 8042 performed better in the Strip-Till vs. No-Till, again a 32 bu/ac average margin. In Table 1, the Dekalb 58-16 Strip-Till yielded and average of 18 bu/ac better than No-Till.

Last season Dekalb 58-16 yielded 212 bu/ac. It is Orthman's strong contention that wet, cold soils do not promote top yields regardless of tillage practice.

Conclusions:

After studying this data thoroughly, I grimace that excess water can diminish yields so much after such a wonderful year in 2009. Knowing roots are slowed at cold temperatures and water logging of all the pore space in the soils, we can say with confidence that we believe this was the case on the Research Farm this summer.

First, knowing root types/architectures, when corn varieties take up nitrogen, and varietal cold tolerance; we could select corn hybrids to fit the condition. We were on the mark with our choice of 107 and 108 day corn this year being able to harvest in October 2010 vs. December of 2009. Regarding root architecture and hybrids from the 3 year Colorado Corn Growers Association study in eastern Colorado depicted below, we could in higher water table soils make better selections of seed corn and manage the crop better to soil condition. Orthman plays a large role in an eastern Colorado study involving corn companies representing all three types of root structures aimed to give growers better choices and higher potential yields.

We also believe that we can be better at the Orthman Research Farm in choosing which root type is to our best benefit. With our highly publicized high water table throughout this document, which root structure do you think would thrive and which may have more restricted development? As you look at Figure 3 (below) we are betting that the far right root structure would probably react better to a water table that can be as shallow as 24 inches – yes?

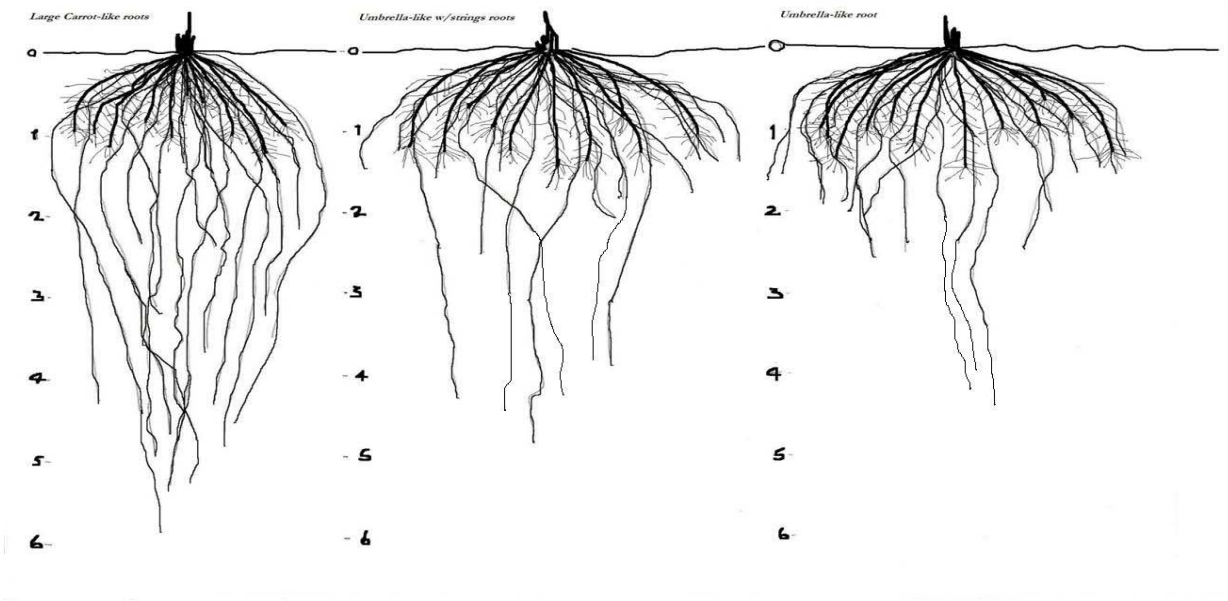

Figure 2. Three modern day Corn root types from Colorado Corn Growers Association field research after 3 years
[*I have excavated over 1220+ root pits since 1981 to corroborate this evidence*]

In the wet and cold soils that we experienced this year, we observed that No-Till/Direct Seeding yields are less when compared to Strip-Till in the same conditions. Starting the crop off with warmer soils, less soil compaction and crusting issues in the Strip-Till along with having the advantage of precisely placing fertilizer proved to be big plusses on the Strip-Till vs. No-Till study this summer.

Lastly, it appears that we have some different choices to make as we continue to study the effects of Strip-Till in well drained soils, moderately well drained soils or our Research Farm's somewhat poorly drained sites. The choices we made to gain an earlier harvest did come to fruition and that was positive.

Acknowledgements:

I do want to first thank our dedicated farm team, Mark Griffith, Brent Kliments, BJ Margritz and Warren Coulter who all were fully engaged in this project and committed to making it work. Second, my thanks go to our partners with Excell, Hoegemeyer and Dekalb who helped us walk through hybrids for disease protection and provided the seed for this study. The Orthman Agricultural Division is very appreciative of the cooperation and involvement of these future thinking companies. The genetics are an incredibly important facet of raising top yielding corn. Orthman foundationally believes that the right tillage and fertilization system, match with the right genetics, will provide our customers with better production opportunities.

I encourage you to contact myself or any Orthman Market Development Representative to discuss how we can help you with any production concerns. This is what Orthman Manufacturing is here for!

Sincerely,

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