

***First In a Series of Four:* Orthman Strip-Till vs. Direct Seeding Corn Research – 2009 Results**
February 22, 2010 by: Michael Petersen, Precision Tillage Agronomist

Introduction:

Being a smart economic based grower, it is mandatory to have a bottom-line that stays in the black. To be farming high sustainable yields – growers have to employ a systems approach from harvest to harvest. We at Orthman Manufacturing are advocating in any row crop (and future crops) the right soil preparation for seeds start to finish is imperative.

At our facility near Lexington, Nebraska in the heart of corn country, we use what we preach, the Orthman 1tRIPr Strip-Till implement. We are also making the effort to compare the Strip-Till System to the Direct Seeding approach in the very common soybean-corn rotation.

In this first part of four part series from our 2009 field trials I will present what we did to grow the corn crop. These side-by-side studies are irrigated scenarios but as wet as 2009 was for so many of us this last year, our irrigation was to apply liquid N in small watering amounts.

Methods and Methodology:

In 2008 our plots were Direct Seeded soybeans, that yielded 32-35 bushels per acre (bpa) and we spring strip-tilled with the 1tRIPr 32 days in advance of the planting operation, approximately March 28, 2009. Our fertilizer pass: During that tillage pass we applied our pre-plant N-P-K quantity according to soil tests values



Fig. 1 Orthman Case-IH Planter 12row-30”

from samples taken in late fall 2008. In the Direct Seeded plot areas we applied N & P via a dribble method with a spray rig with a RTK guided trip. The 1tRIPr applied with the shank the product in the strip-till. We were concerned for the amount we applied we could have root burn with UAN so we adjusted the sprayer to be over 6 inches off the center where we would plant with RTK.

Planting was then accomplished on May 1, 2009 with a 12 row – 30 inch center Case-IH 1200 planter on a three-point Orthman stack fold bar. We planted 31,000 seeds per acre (spa) in all plots. We planted hybrids from Hoegemeyer, Pioneer, Dekalb and Midwest Seed. In the

seeding pass for both Strip-Till and Direct Seeded we applied a liquid Kugler Fertilizer Co.- (McCook, Nebraska) product KQ1515 at the rate of 4 gpa, that went InFurrow. This product is a low salt derivative liquid fertilizer and has had great results with hundreds of growers in the Western Corn Belt.

To control weeds we used a 40oz/acre rate of PowerMax™ RoundUp with BASF® Status at 4oz/acre with a very good burn-down at V7 stage.

Our field studies in this side-by-side trial was to observe roots three times during the growing season at 25DAE (days after emergence), 55DAE and 110DAE. First emergence was May 8th, full emergence was by May 11th so we could ascertain differences below ground surface as to what was happening with corn in these two tillage systems that are popular in Nebraska.

Results:

Table 1. Root Development at 25-30DAE at Lexington, NE

Root Observations at Lexington OMI Farm June 12, 2009

N-S Direction Component Study ... Midwest Hybrids completed observations 6/12/2009

Plant 1	Plant 2	Plant 3	Plant 1	Plant 2	Plant 3	Plant 1	Plant 2	Plant 3	Plant 1	Plant 2	Plant 3	
210-57VT3 - No-Till			208-72VT3 - No-Till			210-72VT3 - Strip-Till			208-57VT3 - Strip-Till			
10	8	6	10	8	10	10	10	10	12	10	12	Primary Roots
6	4	6	4	6	6	6	8	8	6	6	6	2nd Nodal Roots
0	0	0	0	0	0	3	4	5	0	2	0	3rd Nodal Roots
11.5	10	10	10.5	10	11	14	13.5	14	13	12	13	Plant Height (inches)
12	10	10	12	10.5	12.5	16	16	17.5	15	13.5	13	Root Depth(inches)
6	6	6	6	6	6	7	7	7	7	7	7	Leaf Stage(no.)

NOTES: All planted May 1st, 2009

N-S Direction Component Study ... Competitor Hybrids completed observations 6/12/2009

Plant 1	Plant 2	Plant 3	Plant 1	Plant 2	Plant 3	Plant 1	Plant 2	Plant 3	Plant 1	Plant 2	Plant 3	
Pioneer 33P83 Strip-Till			Pioneer 33P83 No-Till			Dekalb 63-42 Strip-Till			Dekalb 63-42 No-Till			
10	10	10	10	10	10	12	10	10	10	10	12	Primary Roots
8	6	8	6	8	6	8	8	8	8	8	6	2nd Nodal Roots
2	6	3	0	0	0	6	6	6	4	6	5	3rd Nodal Roots
16	15.5	15	10	12	12	14	15.5	17	14	15	15.5	Plant Height (inches)
17	16	16	12	13	11	16	16	17.5	15	16	14	Root Depth(inches)
7-8	7-8	7-8	7	7	7	7	7	7	6-7	7	6-7	Leaf Stage(no.)

All planted May 1st, 2009

To our surprise, we observed much more as to what is happening with production of below ground biomass and what is happening with ear development at this period of root digs. We knew from reading and conversations with crop physiologists in the corn breeding world that 45-55 DAE is a period of rapid development. What we observed proved that out, but to gain data sets as to how the plants can have a better rooting profile and greater number of roots due to tillage and fertilizer placement really inspired me, as we hope it does you. As the Direct Seeded and Strip-Tilled plots matured the root systems were somewhat the same in total depth achieved and total cubic inches of soil volume explored was close – but the yield bore out a different story. Please look at the number of roots in the differing varieties, Dekalb and Pioneer had quite a large root number in Strip-Till compared to the Direct Seeded (No-Till) seen in Table 2. Hoegemeyer was similar but the yield spreads were not quite as wide. Midwest had the smaller total root numbers differences at the 55DAE time frame.

Discussion of the results will follow after Table 3.

Table 2. Root development with Direct Seeded vs. Strip-Till at 55 DAE.

Strip-Till vs.. Direct Seeding (No-Till) Root Studies at Orthman Research Farm

55DAE Root Observations made on July 10, 2009

Tillage Type	Seed Co.	Day Length	Max Rooting Depth(inches)	#Primary Roots	#1st Node Roots	#2nd Node Roots	#3rd Node Roots	#4th Node Roots	#5th Node Roots	Total No. Roots
No-Till	Midwest	110	36	8	8	8	6	8	6	44
No-Till	Midwest	108	31	8	8	8	10	8	4	46
No-Till	Hoegemeyer	108	32	8	8	6	7	10	--	39
No-Till	Dekalb	113	35	10	8	6	8	8	10	50
No-Till	Pioneer	113	27	10	8	6	8	6	6	44
Strip-Till	Midwest	110	30	10	8	8	10	10	6	52
Strip-Till	Midwest	108	37	12	8	8	8	10	6	52
Strip-Till	Hoegemeyer	108	33	10	8	8	8	10	7	51
Strip-Till	Dekalb	113	39	12	10	10	8	10	10	60
Strip-Till	Pioneer	113	33	12	10	8	8	8	8	54

Table 3. Late Root Observations in Direct Seeded compared to Strip-Till at Lexington, NE

2009 Final Root Report (110DAE) - OMI Research Farm Lexington, NE-- Corn Plots

Corn Hybrid	Tillage Practice	RMD	Total N Inputs	Root Width@12"	Root Width@24"	Root Width@36"	Root profile Dimension cubic inches	Vol. 1st 85% of roots- depth	Mature Rooting Depth (max.)
Midwest 208-72	StripTill/N-Srows	108	164.0	19"	20"	16"	4445	22"	50
Midwest 210-57	StripTill/N-Srows	109	164.0	21"	18"	12"	4475	18"	59
Midwest 210-57	NoTill/N-S rows	109	164.0	19"	14"	13"	4330	17"	50
Midwest 208-72	NoTill/N-S rows	108	164.0	23"	18"	13"	4285	15"	58
Pioneer 33P83	StripTill/N-Srows	113	164.0	27"	20"	15"	5210	26"	64
Pioneer 33P83	NoTill/N-S rows	113	164.0	28"	14"	10"	4345	20"	51
Dekalb 63-42VT3	NoTill/N-S rows	113	164.0	21"	18"	11"	5010	24"	57
Dekalb 63-42VT3	S.Till N-S rows	113	164.0	20"	16"	13"	5510	30"	56
Hoegemeyer 5143	NoTill/N-S rows	108	164.0	20"	16"	15"	4400	19"	64
Hoegemeyer 5143	STill N-S rows	108	164.0	24"	16"	11"	5025	25"	57

Discussion:

Our weed control was top notch when we applied in the V7 stage. The weather conditions were conducive to getting the kill we were after with 77-80°F air temperatures and bright sunny conditions for five days straight. Prior years with the intense grass seed bank in the soil we battled getting a handle on knocking back the foxtail, barnyardgrass and Texas tumblegrass. In 2009 we are claiming one in the win category.

Rainfall and Irrigation - Nebraska's climatic conditions have ways of changing what we want and what does truly happen. At the end of August 2009, Growing Degree Days (GDD) from April 15th to August 31st had accumulated to 2255. In September we saw another 238 accumulate totaling 2493 days, adding up to be short by 157 days for the 108 day corn. We were over 300 GDD for the 113 RMD corns. From April 15 to the end of September we were very wet with 17.6 inches of rain officially recorded in the Lexington area. Via our center pivot we applied 1.9 inches over 4 applications, three of the applications we applied 10.5 gpa of 32% UAN each time with 0.3 inch water.

Roots and Root Development:

Our root studies are for several reasons; 1) gain knowledge of what the VT3 hybrids can do for depth of rooting to achieve a deeper penetration of the overall plant root because of past work with Jeff Tichota-Monsanto in Colorado knowledge of excellent root worm control, 2) access more water in the soil profile, 3) observe the rooting profile of the selected corn varieties in the Platte River Valley where water tables do reach up to the 2 to 2.5 foot level below the soil surface keeping the soils cool for a longer period which could be detrimental to growth and grain yield, 4) observe rooting differences during these three periods as mentioned in the outline (25DAE, 55DAE and 105DAE), 5) observe rooting differences between tillage types of Direct Seeding (No-Till) and Strip-Till.

At 25DAE we observed a healthier rooted crop in the strip-tilled corn. The soils were warmed earlier from the get-go similar to the scene to the right in Figure 2. The corn plants we dug up and washed the roots were more robust, and more in number as you can see in Table 1. Strip-Till plants were generally exposing more leaves, a larger diameter stalk and taller compared to the Direct Seeded plants.



Fig. 3 Strips made with Orthman 1tRIPr

At 55-60DAE, look in Table 2. The total number of roots we examined were more in quantity with the strip-till compared to Direct Seeded corn and the numbers of roots at 4th and 5th nodes have significance for later in the life of the corn crop. The water table was observed at this root dig 44 to 48 inches below the soil surface on July 10th, 2009.

In Table 3, the information offers you a more pronounced set of observations such as width of the root system perpendicular to the row direction so we can tell how far to the left and to the right the roots extend in the first 12 inches, at 24 inches, and at 36 inches. To provide you the reader more information as to how large the root to soil interface is in cubic inches of volume within the 50 to 64 inches we measured roots one is able to capture the thoughts of well developed roots gain more water and nutrients and expect more yield. Then in the final table (Table 4. See next page) of this report is the yield information. Let me draw your attention to the Pioneer variety we grew; strip-till system had 5210 cubic inches of root/soil volume and yielded 258+bpa – the Direct Seeded Pioneer had a root zone of 4345 cubic inches and a yield of 213+bpa. The Hoegemeyer variety used in these trials; with strip-till had a root zone of 5025 cu. in. and a yield of 198bpa and the Direct Seeded 4400 cu.in. with a yield of 184 bpa. From Table 3 the Dekalb variety was 500 cu. in. larger in the strip-till plots compared to the Direct Seeded with a yield of Strip-Till coming in at 244 bpa versus 219 with Direct Seed

methods.

It is interesting to note that the Pioneer variety had 13 inches of deeper root extension in the strip-till over its Direct Seeded comparison, the Hoegemeyer was 7 inches deeper, the Midwest varieties for the 208-72 was 8 inches deeper in the Direct Seeded compared to its counterpart of strip-till, and the Midwest 210-57 strip-tilled corn was 9 inches deeper than its Direct Seeded counterpart, last the Dekalb variety was 1 inch shorter in the Strip-Till compared to the Direct Seeded – essentially the same.

Root volume has been consistent a bright indicator of a healthier plant and more productive corn plant. I have been looking at roots since (I have written in other reports) 1981.

Table 4. Tillage Comparison Plots on N-S Row Direction at OMI Research Farm - Corn Yield

Plot #	Corn Hybrid	RMD	Tillage Type	# Rows	Plot Length	Corn Wt.	Acreage	Bushels /plot	Yield - bpa
No-Till Plots									
54	Midwest Seed 210-57	110	No-Till	6	440	1578	0.152	28.179	185.39
55	Midwest Seed 208-72	108	No-Till	6	444	1738	0.154	31.036	201.53
56	Pioneer 33P83	113	No-Till	8	440	2420	0.202	43.214	213.93
57	Dekalb 63-42 VT3	113	No-Till	8	450	2582	0.210	46.107	219.56
58	Hoegemeyer 5143VT3	108	No-Till	8	450	2145	0.208	38.304	184.15
Strip-Till Plots									
59	Pioneer 33P83	113	Strip-Till	8	440	2922	0.202	52.179	258.31
60	Midwest Seed 210-57	110	Strip-Till	6	440	2050	0.152	36.607	240.84
61	Midwest Seed 208-72	108	Strip-Till	6	440	2130	0.152	38.036	250.23
62	Hoegemeyer 5143VT3	108	Strip-Till	8	440	2244	0.202	40.071	198.37
63	Dekalb 63-42 VT3	113	Strip-Till	8	440	2766	0.202	49.4	244.55

Conclusions:

Root numbers, root volume, rooting depth, and root health is enhanced with a better start all the way to senescence. Gaining more water, more nutrients from the soil from the root point of view is important to remember. Some say well the crop will catch up after a slow start as what we see in Direct Seeded crops into heavy residue cover. I have not seen that happen unless the years are much like that of 2002 and 2003 where we had some 65 days above 90°F each summer and very low rainfall. In 2002 the area of Eastern Colorado received only 3.45 inches of rain from April to September 15 and barely 5.7 inches in 2003 same timeframe. No-Till (Direct Seeded) environments in these very dry years were not able to extend roots deep enough early on to keep up with the strip-tilled corn and yield drop-off was significant.

With strip-till the root system has the potential to reach depth quicker and extend to take up water and nutrients all the way down. In 2009 the Strip-Till corn did just that, as was the same case in 2008 at the Orthman Research Farm. We feel confident that is the case 9 times out of 10. The more nutrient uptake with a larger root package is a plus to sustain and obtain higher yielding crops.