Table 3. Influence of row configuration and nitrogen rate, averaged over seeding rates, on corn grain yield on Commerce silt loam at the Northeast Research Station, St. Joseph, LA, 2005 and 2006.

	2005			2006		
Nitrogen rate	Single row	Twin row	Average	Single row	Twin row	Average
	-----bu/a-----					
150	188.7	190.4	189.6	116.1	125.1	120.6
180	194.3	193.2	193.8	125.8	130.8	128.3
210	196.7	195.4	196.1	133.5	134.7	134.1
240	195.1	200.2	197.7	134.7	137.2	135.7
LSD (0.10):						
Nitrogen rate		2.7			3.2	

Table 4. Influence of row configuration, averaged over irrigation, seeding and nitrogen rate, on grain sorghum yield on Sharkey clay at the Northeast Research Station, St. Joseph, LA, 2005 and 2006.

Row configuration	2005	2006	Average
	-----lb/acre-----		
Single row	4,639	6,115	5,377
Twin row	4,947	6,474	5,711
LSD (0.10):	238	63	

Soil Quality And Crop Root Enhancements – Instigated By Strip-Tillage

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Strip-tillage is changing the way the Southern High Plains growers prepare their seedbeds for row crop production. With intensive irrigated cropping systems, growers are aware of climbing fuel prices, high fertilizer costs, increasing seed costs; and so on all are stimulating thoughts about how to stay in the business. To manage some sort of profit when all is said and done the grower has to cut inputs.

From the farmers shop and into the field, strip-till has changed the way and thinking of pre-plant tillage efforts. Offering 70% of the ground surface to be left no-till and 30% vertically tilled striptillage sets up an ideal seedbed for the young seedling to start and prosper. As part of this system approach, the narrow tilled zone, a better seedbed, precision placed fertilizers, disrupted tillage pans, and a warmer seedbed – growers are discovering enhanced soil quality characteristics. Those features are faster infiltration rates, soil aggregate stability improved, organic matter of the surface layer increases, deeper and more prolific root systems and higher soil porosity giving the farmer savings and gain in yields. Yields are 5 to 15% better than conventional tilled crops with inputs down by 15 to 33%.

What strip-till accomplishes

With strip-tillage the grower pulls a shank with a specific shaped knife through at depths of 4 to 12 inches, pulling soil fabric up and causing a wave effect up and outward at a 35 to 45 degree angle upward to the soil surface. The challenge is to minimize the boil effect and heave the soil and cause blowout of large chunks onto the soil surface. Strip-till tools vary in their disturbance directly proportional to width of the knife, shape of the shank, speed and depth to the tillage pan/layer. The remaining portion of the ground is left undisturbed for natural functions to continue soil development which is slow and steady.

Soil Quality Improvements

As soils are allowed to resume natural wetting and drying cycles with very minimal disturbance (strip-till) from inversion tillage tools, all three: physical, chemical and biological functions in the soil reform the soil fabric back to its more native state. What is that like? The soil surface layers are predominantly granular in shape – rounded globe like form which is teeming with microbes, mites, worms, small orbit beetles, fungi shaping, exuding glue-like polysaccharides that adhere and stick small aggregates together fairly resistant to disturbance unless inverted and crushed. Below the surface layer into the subsoil wetting and drying, gravitational forces, water draining downward moving humus, organic acids, these polysaccharides and clay particles to orientate in vertical forms. Roots following the pull of gravity, the seasonal warm-moisture front assist in shaping soil particles into vertical columns and prisms. Roots absorb nutrients and water to feed the above ground plant as they move downward. Gases of oxygen, carbon dioxide, nitrous gases, sulfur dioxide and others all move in and out of the soils through channels, shrink-swell cracks, pockets, old root holes, carbonate cavities from organic acid interactions by atmospheric pressure gradients helping shape soil structure. This is all part of the magnificent and intricate system that works well until the – plow.

Strip-till works to disturb the soil matrix in a vertical fashion to allow for natural soil physical functions to continue. In the bottom of the shank cavity the smear from the mole-knife is minimal so pores have a better chance to remain open, soil is stirred more than turned and tumbled, allowing for gases to move in and out. Strip-till keeps organic compounds from being fully exposed to the UV of the sun and heat which rapidly break it down as does inversion tillage across the entire soil surface. Soil infiltration rates improve due to minimized pore destruction, more vertical cracking allowed to continue, and less damage to earthworm populations and other burrowers who dig tunnels for water to move. The three charts below help explain this.

Due to improvements in soil quality the plants, corn in our case, demonstrate better crop responses. Those responses have been in the form of deeper and more extensive rooting systems, better tolerance to stress from drought and heat, access to water and nutrients, and improved grain yield.

Each year we have measured length and volume of roots per quartile of the crops entire root zone in the strip-tilled plots versus conventionally tilled plots (620ft x 60ft). Below in table 4 is a summary of rooting profiles which depict what has occurred in this long term study in eastern Colorado.

Conclusions

Minimizing soil disturbance in a strip-till systems, farmers are improving their soil resource to take in more natural precipitation and irrigation water, providing an environment for the soil flora and microbes to function without a demolition derby wreck everything, and allow natural chemical and physical phenomena to occur.

Measured rooting depth is deeper by 8 to 37% and nearly 50% longer root systems in crops like corn and grain sorghum with strip-till systems compared to conventionally till systems. The first 85% of the plants root system is deeper which is where the largest proportion of the water and nutrient uptake occurs, see table 4. A healthier plant early in its life sets the pace for better conditions for higher yields when fertility is adequate and applied with best management practices. With improved soil infiltration rates, water storage and availability along with better carbon dioxide/oxygen exchange the root system works at its peak.

Growers are experiencing similar or better results to these all across the states where the High Plains Aquifer supplies irrigation water; Texas, Oklahoma, Kansas, Colorado, New Mexico, Nebraska and Wyoming. Strip-till system technology has improved growers bottom-line, their attitudes, and not least soil quality for years to come.

Table 1. Ocular measurements of soil pores in 1 decimeter blocks of soil at 4 to 2
Four sites observed per study, values of all four determine the range
Comparison of Strip-Till to Conventional Till 2003-2005

	Conv.Till			Strip-Till		
	<1mm	**1-2mm**	**2-5mm**	**<1mm**	**1-2mm**	**2-5mm**
2003	225-250	1-7	1-4	410-606	7-15	2-6
2004	198-265	3-12	1-3	350-625	10-20	4-7
2005	192-314	1-8	0-3	355-688	8-31	2-8

Average Numbers of Pores 2003-2005

	<1mm	**1-2mm**	**2-5mm**	**<1mm**	**1-2mm**	**2-5mm**
2003	238	4	3	508	11	4
2004	231	8	2	488	15	6
2005	253	5	2	520	19	5

Table 2. Infiltration of loam soils with
use of Cornell Sprinkle Infiltrometers -- 2002 - 2005
at Yuma COE-IRF

	2002	**2003**	**2004**	**2005**
Site Name	**in/hr**	**in/hr**	**in/hr**	**in/hr**
Strip-Till *	4.85	5.39	4.59	4.99
Strip-Till **	1.49	2.65	2.42	2.32
Strip-Till	1.14	1.24	0.85	1.11
Conventional *	0.72	0.69	1.81	0.87
Conventional **	0.50	0.49	0.38	0.71
Conventional	0.37	0.31	0.06	0.66

Table 3. Infiltration of loam soils with
use of 12" Rings with 1740ml water -- 2002 - 2005
at Yuma COE-IRF

	2002	**2003**	**2004**	**2005**
Site Name	**min/in**	**min/in**	**min/in**	**min/in**
Strip	10:03	7:45	3:44	8:12
Strip *	2:01	1:02	1:12	0:56
Strip **	1:11	0:59	0:58	0:57
Conv	16:44	20:45	1:56	15:15
Conv *	5:29	4:23	8:39	8:47
Conv **	6:08	10:16	14:46	2:20

Table 4. Six years of root study - Comparison of Strip-Till to Conventional Till in Eastern Colorado

	Year 2001		Year 2002		Year 2003		Year 2004		Year 2005		Year 2006	
Tillage Type	**Depth (in)**	**Pct. Roots by Vol.**	**Depth (in)**	**Pct. Roots by Vol.**	**Depth (in)**	**Pct. Roots by Vol.**	**Depth (in)**	**Pct Roots by Vol.**	**Depth (in)**	**Pct Roots by Vol.**	**Depth (in)**	**Pct Roots by Vol.**
Strip Tillage	0-12	45	0-11	45	0-12	45	0-10	40	0-12	45	0-11	45
	12-21	25	11-20	25	12-26	20	10-24	25	12-27	25	11-24	20
	21-36	10	20-34	20	26-54	20	24-45	25	27-43	20	24-43	25
	36-70	20	34-52	10	54-74	15	45-73	10	43-66	10	43-68	10
Conv Tillage	0-8	55	0-7	65	0-7	55	0-7	65	0-10	60	0-9	65
	8-20	15	7-18	20	7-15	20	7-18	20	10-23	20	9-19	20
	20-36	20	18-29	10	15-31	15	18-31	10	23-38	15	19-33	10
	36-56	10	29-40	5	31-56	10	31-54	5	38-56	5	33-56	5