Cover Your Acres Winter Conference

1st Annual

February 17, 2004

Gateway, Oberlin, KS

Discussing Conservation Crop Production Practices for the High Plains

K-STATE Kansas State University RESEARCH & EXTENSION

& NW KS Crop Residue Alliance

Schedule for the days events

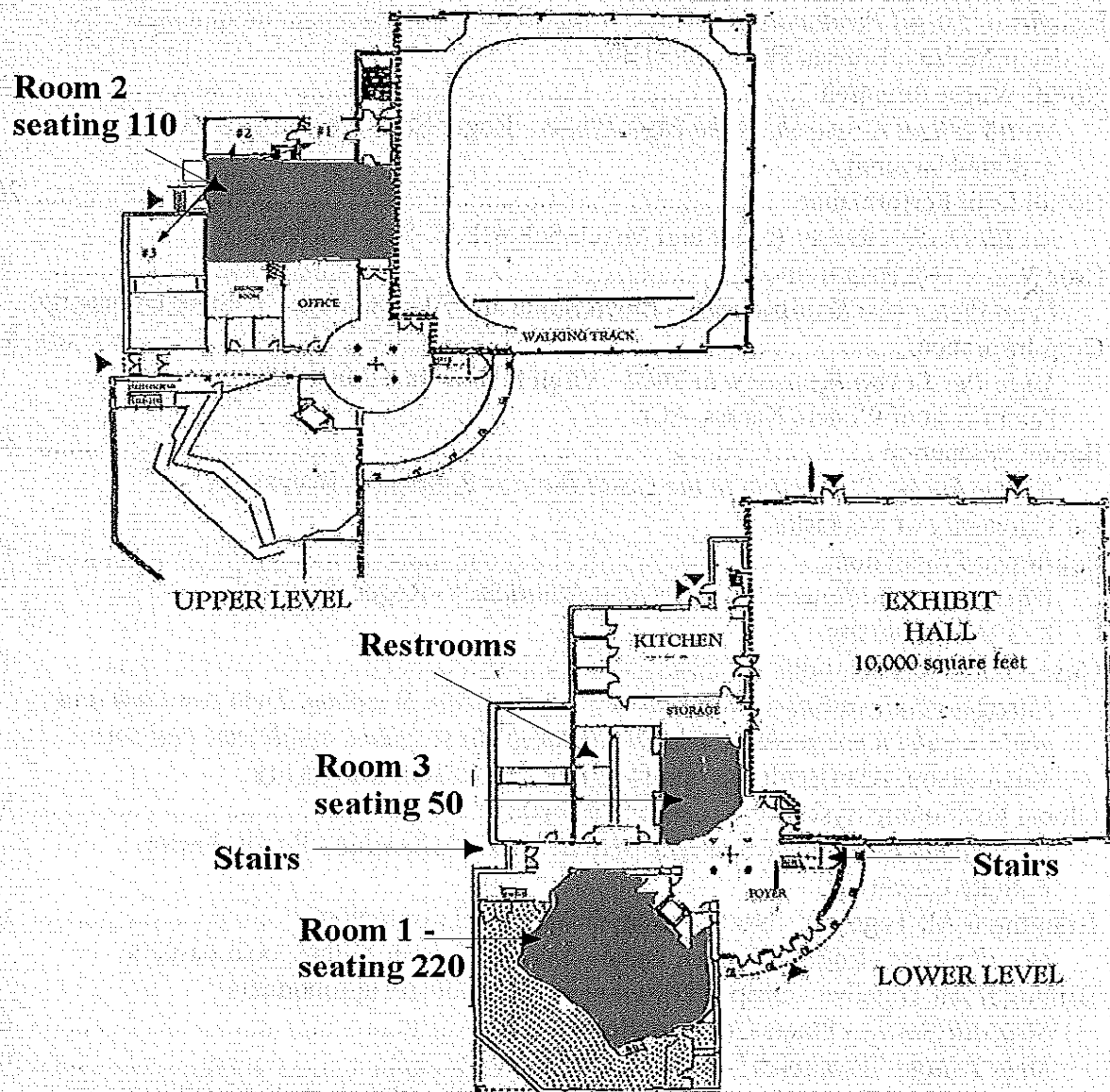
Time	Room 1	Room 2	Room 3
8:00 - 8:30 a.m.	Registration and coffee in sponsor displays (machinery, equipment, and information from industry)		
8:30 - 8:50	Welcome		
8:55 - 9:45	Irrigated Strip-till	Crop Water Use Requirements	Cover Your Acre Results
9:50 - 10:40	Dryland Strip-till	Crop Insurance	No-till wheat research
10:45 - 11:35	Stripe Rust Management in Wheat	Barley Production	Global Positioning System
11:40 - 1:10	Meal and view displays of sponsors (machinery, equipment, and information from industry)		
1:15 - 2:05	Benefits of No-till production for summer and winter crops	Irrigated Strip-till	Barley Production
2:10 - 3:00	No-till wheat research	Dryland Strip-till	Stripe Rust Management in Wheat
3:05 - 3:55	No-till drill performance	Sunflower Production	Crop Water Use Requirements
4:00 - 4:50	**Bringing It All Together** -No-till wheat farmer panel discussion	**Bringing It All Together** -Strip-till discussion with industry agronomists	Crop Insurance
5:00 - 7:00 p.m.	**Refreshment and Bull Session in equipment display area sponsored by private industry**		

Table of Contents

GATEWAY

Oberlin, Kansas

The Premiere Exhibition, Meeting & Conference Center for the Tri-State Area



#1 Morgan Drive, Oberlin, Kansas 67749 785.475.2400 Fax 785.475.2925

Strip-Tillage -- Getting to the Root of the Issue of Growing Irrigated Corn on the Great Plains

By: Jeff Tichota-Monsanto Co., Mike Petersen-USDA-NRCS
For: Cover Your Acres Winter Conference February 17, 2004

Introduction:

Growers in the semi-arid Great Plains have been struggling how to grow sustained profitable irrigated corn in dry, dry conditions and dealing with declining water tables in their Ogallala Aquifer wells. How can they raise 200+ bushel corn when wells surge and run out of water in late July and temperatures are above 100° F. day in and day out? Can they save water, keep erosion below tolerable levels, minimize traffic, get a good seedbed, control weeds, get every drop of rain and water into the soils, and make a decent living? The answer comes with a system approach – using the Strip-Till system which does a minimum amount of soil disturbance in a concentrated zone of 7-9 inches and vertically tills to 8-10 inches deep. Residues remain standing on 70% of the soil surface and little residue is incorporated into the soil. Fields are left in great shape see Figure 1.

Figure 1. Mark Myers, Mingo, KS grower (on left) demonstrates moisture management in early March with strip till after winter wheat (vertical tillage). Kevin Owen (right) points to penetration of moisture rod in the strip-tilled zone.——— PHOTO Courtesy Monsanto

This presentation offers a perspective of how the Strip Till System, a CORE 4 Advanced Production System can help growers make a profit and help sustain continued crop production under reduced irrigation. We will suggest the reasons why this agronomic system is a sound method to provide growers options and hope for a Better Future in Agriculture.

What you saw and heard:

Because plant roots are essential for the uptake of water and nutrients it is a vital concept for growers to have a better understanding of the roll they play in plant growth. Growers, agronomists, soil scientists, weed specialists, seed salesmen, and a host of others know that without roots any crop has a slim to none chance of yielding. So they are important.

The research that is being carried out on the Irrigation Research Foundation (IRF) Center of Excellence near Yuma, Colorado is looking intently at what is happening with roots in conventional tillage systems versus strip-tillage systems. Two scientists, Jeff Tichota – Technical Development Manager for Monsanto and Mike Petersen – Agronomist/Soil Scientist with USDA-Natural Resources Conservation Service are studying the viewpoint of roots below ground in irrigated corn and soybean production. They are examining soil penetration resistance, root depth, root volume by depth, root length, root length density, cubic volume of soils explored by roots, water transmission into soils, root to leaf area indices, worm populations, soil temperature, soil organic matter, fertility, water holding capacity and moisture depletion during the growing season, and yes – yields.

This all depends upon on water and the uptake of nutrients via roots for each individual plant seeded into the ground. Roots have several roles they play for the grower: 1) roots acquire soil based resources (water and dissolved ions; N. P, K, S, Zn etc), store photosynthates, 3) roots synthesize growth regulators, 4) regulate overall plant temperature and moisture content, 5) disperse toxic products, 6) grow more roots to gain water and nutrients, and 7) anchor the above ground plant. It is our desire that you have an understanding of three major ideas I. How the crop gets moisture and nutrients, II. What are the key growth phases for corn to utilize nutrients and water, III. Understand water movement, soil-temperature and the association of fungi on plant roots.

At the IRF, scientists have been carrying out the volume root growth patterns for several years. They have determined that Strip-Till can exceed root growth over conventional disk-chisel system 23 to 32%. Strip-Till also allows the root system to be more evenly distributed throughout the soil profile.

Figure 2. Common known chart of root development

Grass Crops Root Growth (by volumetric measurement)

Depth (inches)	% by vol. of total
0-12	40
12-24	30
24-36	20
36-48	10

Our studies at the IRF show root volumetric measurement based on quartiles.

Figure 3. Root studies by volumetric measurement at IRF-Yuma, Colorado 2001-2003

	Year - 2001		**Year - 2002**		**Year - 2003**	
Tillage Types	*Depth (in)*	*Pct. Roots by Vol.*	*Depth (in)*	*Pct. Roots by Vol.*	*Depth (in)*	*Pct. Roots by Vol.*
Conventional	0-8	55	0-7	65	0-7	55
	8-20	15	7-18	20	7-15	20
	20-36	20	18-29	10	15-31	15
	36-56	10	29-40	5	31-56	10
Strip Till	0-12	45	0-11	45	0-12	45
	12-21	25	11-20	25	12-26	20
	21-36	10	20-34	20	26-54	20
	36-70	20	34-52	10	54-74	15

***Benefits of Strip Till are measurable*:**

One of the first measurable characteristics of the soil system is soil organic matter. Strip till at the IRF has improved by 0.1% each year from 2000 to 2003. With the conventional tillage system the soils have held their own with no gains. Strip till has gone from 1.54% in 2000 to 1.74% in 2002 in the upper 8 inches. The earthworm population has increased dramatically. Our observations in the spring of 2003 counted an average of 15 worms per square foot in the strip till corn and only 6 per square foot under the conventional. That change is significant because with strip-till they have an abundance of food to eat and can propagate. Other items within the soil biota; roots continue to give off more glomalin which helps aggregate soil particles together when the soil it is not disrupted by tillage, organic matter breaks down into weak organic acid into the soil solution and buffers our calcareous soils, more centipedes, millipedes, larvae, digging insects live and inhabit the soil system. The residues on the soil surface act as an insulator from the hot sun. Crop residues release certain amounts of organic compounds – nutrients which can help feed roots and mycorrhizal hyphae. Mycorrhizae have a better opportunity to exists in harmony with the growing crop and symbiotically live for and off the plant.

Important soil characteristics such as; infiltration rate, subsurface and subsoil water movement, water holding capacity, nutrient carrying capacity (Cation Exchange Capacity), bulk density, Pore space, pH, soil aggregate stability, and soil structure are improving year after year with the Strip Till system.

One of the most observable conditions that a grower and advising scientist can measure is soil penetration resistance – a measurement of soil compaction. With the Strip-Till system growers can minimize compaction in a large portion of the field because it is a form of controlled traffic. Compaction restricts root growth and extension deep into the soil profile. Compaction can greatly limit yield potential and water uptake. Compaction is also one of the issues growers can control and compacted soils can be repaired.

Water infiltration with a strip till system increases dramatically when measured against the conventional disc-chisel-plant system. At the IRF we have studied this extensively with new tools available to us in the realm of soils research. As you look below you can see the differences as explained in the presentation.

Figure 4. Chart of near saturated moisture condition (standard methodology) on fine sandy loam textured soils at the IRF – Yuma, Colorado

System Type	2002	2003
	in/hr	in/hr
Strip-Till [guess row]	4.85	5.39
Soft row	2.29	2.65
Hard row	1.12	1.24
Mulch Till [guess row]	2.01	2.09
Soft row	1.47	1.33
Hard row	0.76	0.68
Conventional Till [guess row]	0.72	0.69
Soft row	0.52	0.49
Hard row	0.37	0.31

In the Strip-Till system we have measured three times more root development than conventionally tilled corn for two years running. The above ground plant portion is larger. Strip-Till corn has 100+ more square inches of leaf area compared to conventionally tilled two years in a row. That extra leaf area helps plants manufacture more sugars to store into the ear of corn.

***Root development*:**
Root studies are difficult but understanding root growth, measuring linear inches, volume of soil explored and how they grow is important. Research studies run in Iowa back in the early 1980's found that corn has three stages of root development; first phase is within the first 15 days of development after seedling emergence. Those roots only extend about six inches deep. During the next 15 – 20 days the corn grows another 6 or 7 inches deeper. After those two periods corn roots now grow vertically downward. During mid to late season roots grow in a shallow obtuse triangle-like fashion as demonstrated in the talk given at the Oberlin, Conference. In this second period the plant has reached the V6 leaf stage which is the stage where the plant is determining yields by the ability to access nutrients and water. We have done extensive research to determine what is the effective root zone for the predominate crops grown in the High Great Plains. Scientists in the Corn Belt have determined that the first 85% of the roots in the soil profile make up the effective root zone. Many if not all the roots below that level are not as efficient in uptake of nutrients and water. Over the 22+ years of Mike's 240+ root studies across eastern Colorado in corn fields he has observed an average 85 percent of the corn roots growing to 38 inches in sandy and medium textured soils. In clayey textured soils 85 percent of the roots extend to 33 inches. We have observed at the IRF, Strip-Till farming in irrigated corn production extends roots to an average of 44 to 54 inches. This increased rooting depth aids plant

development-offers growers more with increased soil moisture and more nutrients too which leads to better yields on the same or fewer inputs. It is important to remember that strip till can help the grower gain 15 to 40% more capacity out of his soil resources which then in turn could offer 15 to 40% improvement in yields when managed properly.

Some yield results to prove the points discussed:

The study at IRF has been going on for three years now; yields are depicted below:

Figure 5: Yield results from IRF, 110 day length corn, full irrigation to meet Consumptive Use

Corn Yields Bu. Per acre	2001	2002	2003
Strip-Till	204 12 bu advantage	237 11 bu advantage	233 24 bu advantage
Conventional Tillage	192	226	209

In summary and conclusion:

Under Strip-Till, soil quality improvements are dramatic. Water intake rates are improving both when dry and wet so when summer rainstorms drop 1 to 2.5 inches in an hour soils that are farmed with the strip till method will capture that liquid gold and get it into the soil with no or very little runoff. Soils will remain cooler with a blanket of past crop residues, soil biology changes for the better to furnish roots with digested organic compounds, worms bore holes in the ground to help next seasons crops and help the soil breathe, old roots are left which offers unrestricted deep root growth and some nutrients, little if any erosion and yields can increase, inputs are lessened and profit margins can put a smile on each growers face at the end of the year.

If these things can happen to you and your farming operation – why doesn't it seem like the way to go? We believe you can be a winner with the Strip-Till System approach.

DRYLAND STRIP-TILL

FERTILIZER MANAGEMENT FOR STRIP-TILL AND NO-TILL CORN PRODUCTION

Lorrie Ferdinand, Ray Lamond, Barney Gordon, Keith Janssen and Chad Godsey
Kansas State University, Manhattan, KS

Abstract

Strip-tillage for corn production can be advantageous over no-till, particularly in areas with heavy soils and high rainfall during spring months. Under these conditions in no-till systems, planting delays and/or slow, uneven emergence are common. Strip-tillage creates a narrow tilled area for the seedbed while maintaining the inter-row residue cover, allowing for erosion protection associated with no-till, yet providing an area in the row where the soil will dry out and warm up earlier in the season. Objectives for this study were to evaluate strip-till and no-till for early planted corn and to compare various fertilizer management options for these tillage systems, including time of fertilizer application and nitrogen rates. Field studies were conducted at three locations in Kansas in 2003. Nitrogen rates included 40, 80, and 120 lbs N/acre applied with 30 lbs P_2O_5/acre, 5 lbs K_20/acre and 5 lbs S/acre. Nutrients were applied either with fall strip-till, at planting after fall strip-till, or at planting with no-till. Soil temperature measurements were taken at two locations from selected treatments in each tillage system at 4 cm depth. Results to date from this research indicate that strip-till provides for warmer soil temperatures early in the season, resulting in better early season growth, and higher grain yields than no-till. Fertilizer applied during the fall strip-till performed similarly to fertilizer applied at planting where fall strip-tillage was done.

Introduction

Conservation tillage practices leave residue from the previous crops on the soil surface, reduce soil erosion, and decrease trips across the field with heavy tillage equipment. Although no-till provides soil and water conservation benefits to producers, the cooler, wetter soil conditions found in no-till systems result in potential problems for planting and establishing crops. Crop residues affect the soil surface energy balance by providing insulation and reflective properties. Thus, covered and bare surfaces have different energy balances with soil under a residue staying cooler and wetter in comparison to bare soil (Horton et al., 1996). The inherent residue layer associated with no-till contributes to cooler temperatures in the seed zone at spring planting (Al-Darby and Lowery, 1987). Lower soil temperatures negatively affect seedling emergence and early season growth, especially with early planting dates. Corn root growth increased five-fold when soil temperature increased from 18 C to 25 C (Mackay and Barber, 1984). If no-till systems are limited by crop residues on the soil surface, then seed-row residue removal should lead to corn growth similar to that of tilled systems (Kaspar et al., 1990). Strip-tillage provides an ideal combination of no-till with conventional tillage. Residue removal from within the row should allow for rates of development that are similar to that of conventional tillage. Maintaining a concentration of residue in the interrow will allow the no-till advantages of lower soil water evaporation and reduced runoff (Fortin, 1993) to be salvaged. Strip-till also offers the option of applying fertilizer nutrients during the fall strip-till operation. A second option is to apply nutrients in the spring at planting after creating the strip-till in the fall. The overall objective for this research is to compare strip-till and no-till as options for early planted corn in Kansas by evaluating i) seed row temperature differences between strip-till and no-till and effects on emergence, early season growth, and grain yield; and ii) management options for rates and timing of fertilizer application.

Methods and Materials

Field experiments were conducted in 2003 at three Kansas State University Research and Extension field sites in eastern Kansas (Belleville, Crete silty clay loam; Manhattan, Reading silt loam; Ottawa, Woodson silty clay loam). Tillage treatments were no-tillage and strip-tillage. A four-row strip-till rig was used in the fall at each site to disturb the soil to a depth of approximately 6 inches in the row with a 4-5" wide area of residue-free soil over the row. Interrow regions were left undisturbed. Previous crops included wheat (Belleville) and soybean (Manhattan and Ottawa). Fertilizer treatments included either 40, 80, or 120 lbs N/acre applied with 30 lbs P_2O_5/acre, 5 lbs K_2O/acre, and 5 lbs S/acre. No-fertilizer check plots were included for both strip-till and no-till at each site. Time of fertilizer application for the strip-till treatments occurred either in the fall during the strip-till operation or with the planter in the spring. One strip-till fertilizer treatment consisted of a split application with 2/3 applied during fall strip-till and the balance at planting time. No-tillage plots received fertilizer applications during the planting operation. Fertilizer was placed to approximately 5-6" depth with the strip-till operation or in a 2x2 placement with the planter on no-till plots and strip-till plots receiving spring application of nutrients. Fertilizer combinations were made using UAN, 10-34-0 and potassium thiosulfate. Corn was planted in early April. At the Manhattan site and the Belleville site Cu-constantan thermocouples were installed at the seeding depth in selected no-till plots and strip-till plots to measure soil temperature. Daily temperature data were taken at in-row positions in each of the selected plots from mid-April through May. At the V6 growth stage, plants were randomly selected from non-harvest rows in each plot to determine dry matter yield and analyzed for nutrient concentration. Ear leaf samples were collected for nutrient analysis at tasselling. Whole plot samples were taken at physiological maturity at the Manhattan site to determine total biomass and nutrient analysis. Grain yields were determined by either hand harvesting or machine harvest, depending on location.

Results and Discussion

Although there were no differences in final plant stands due to tillage, corn in the strip-till treatments emerged quicker and more uniformly than no-till (data not shown), likely due to higher soil temperatures. Average daily soil temperatures at both Manhattan and Belleville through April and May were higher in strip-till compared to no-till (Figures 1 and 2). The effect of higher soil temperatures in strip-till was reflected in the increased V6 dry matter production compared to no-till at all locations (Tables 1, 2, 3). In addition to the better early growth, the use of strip-till significantly increased corn yields in comparison to no-till at all locations in 2003 (Tables 1, 2, 3). Grain yields were excellent in 2003 at the Manhattan site for dryland corn due to early planting and timely rains through mid-July. Strip-till provided significantly increased early season growth over no-till and a 28 bu/ac grain yield advantage over no-till at the Manhattan site (Table 3). Grain yields at Belleville were reduced due to dry conditions, but even with lower yields, strip-till yields were 12 bu/ac higher than no-till yields at Belleville (Table 3). Advantages in early season dry matter production and grain yield were also observed for strip-till at the Ottawa field site. No significant difference existed between fertilizer applications made in the fall with the strip-till operation as compared to applying fertilizer in the spring after fall strip-till (Table 2). Results suggest that under similar conditions fertilizer can be applied during fall strip-till without concern of yield reduction. Nitrogen rate effects varied by location and previous crop, but increasing N rates generally increased grain yields.

Summary

Fall strip-till significantly increased corn grain yields over no-till corn yields in 2003. Application of nutrients during the fall strip-till operation resulted in similar yields to that of spring applied fertilizer, thus indicating that fall application of nutrients with strip-till is an effective way to implement a fertilizer program into the system. Additionally, soil temperatures were higher in strip-till over the course of the early season, providing an advantage to emergence and early season growth in strip-till. Overall, fall strip-till seems to be a viable option for producers who want to utilize conservation tillage practices while increasing yield.

References

Al-Darby, A.M., and B. Lowery. 1987. seed zone soil temperature and early corn growth with three conservation tillage systems. Soil Sci. Soc. Am. J. 51:768-774.

Fortin, M.-C. 1993. Soil temperature, soil water, and no-till corn development following in-row residue removal. Agron. J. 85:571-576.

Horton, R., K.L. Bristow, G.J. Kluitenberg, and T.J. Sauer. 1996. Crop residue effects on surface radiation and energy balane – Review. Theor. Appl. Climatol. 54, 27-37.

Mackay, A.D., and S.A. Barber. 1984. Soil temperature effects on root growth and phosphorus uptake by corn. Soil Sci. Soc. Am. J. 48:818-823.

Kaspar, T.C., D.C. Erbach, and R.M. Cruse. 1990. Corn response to seed-row residue removal. Soil Sci. Soc. Am. J. 54:1112-1117.

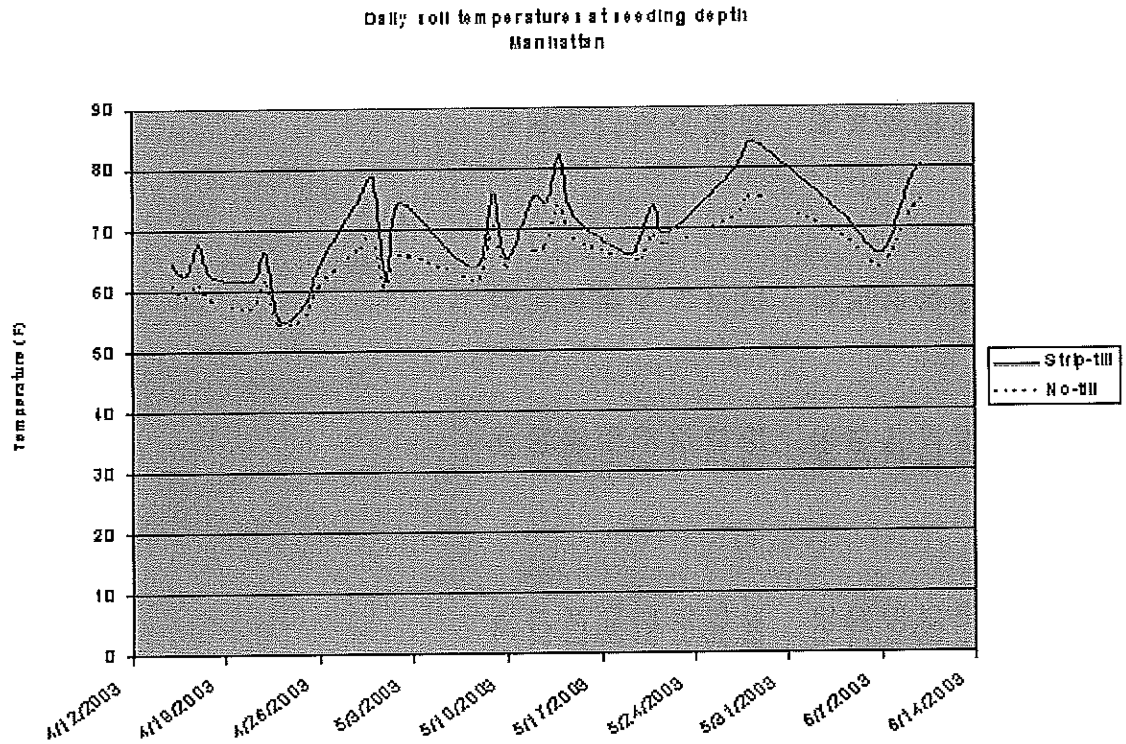

Daily soil temperatures at seeding depth
Manhattan
Temperature (F)
90
80
70
60
50
40
30
20
10
0
Strip-till
No-till

Figure 1.

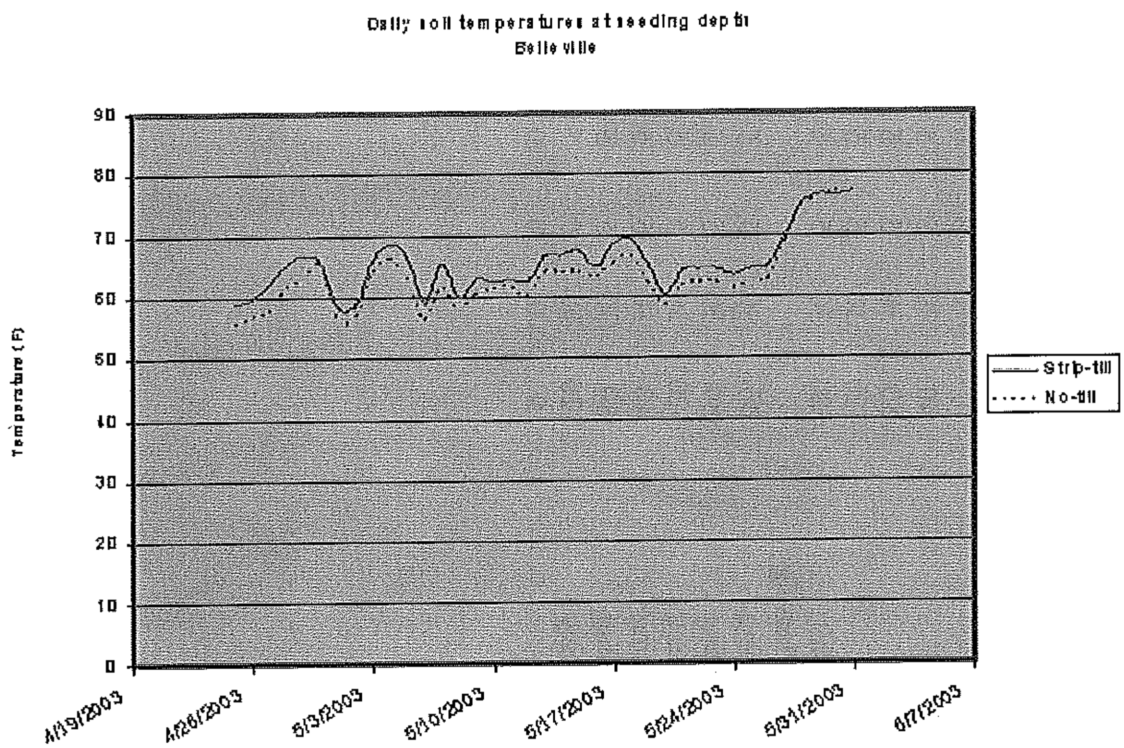

Daily soil temperatures at seeding depth
Belleville
Temperature (F)
90
80
70
60
50
40
30
20
10
0
Strip-till
No-till

Figure 2.

Table 1. Effects of tillage, time of fertilizer application and N rate on corn.

Tillage	Time of Fertilizer Application	Fertilizer Rate N	P	K	S	Manhattan V6 Dry weight	Manhattan Grain Yield	Belleville V6 Dry weight	Belleville Grain Yield	Ottawa V6 Dry weight	Ottawa Grain Yield
		------ lb/a ------				lb/a	bu/a	lb/a	bu/a	lb/a	bu/a
Strip-till	--	0	0	0	0	339	170	155	42	121	78
Strip-till	Fall	40	30	5	5	417	182	276	56	307	86
Strip-till	Fall	80	30	5	5	450	193	284	58	332	96
Strip-till	Fall	120	30	5	5	452	205	361	67	346	91
Strip-till	2/3 Fall 1/3 Planting	120	30	5	5	493	193	406	75	363	89
Strip-till	Planting	40	30	5	5	468	185	263	52	421	90
Strip-till	Planting	80	30	5	5	485	187	283	60	357	88
Strip-till	Planting	120	30	5	5	424	187	353	71	328	78
No-till	Planting	40	30	5	5	366	152	178	45	257	80
No-till	Planting	80	30	5	5	360	167	189	48	224	90
No-till	Planting	120	30	5	5	310	174	198	51	191	86
No-till	--	0	0	0	0	263	121	105	36	97	66
LSD (0.05)						76	25	34	12	77	9

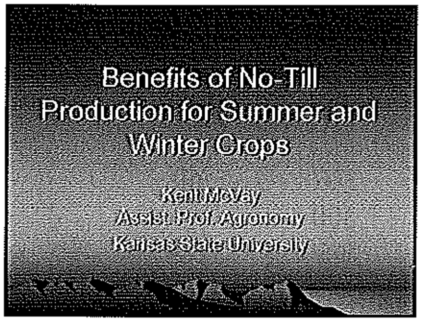
Table 2. Effects of time of fertilizer application and N rate on strip-till corn.

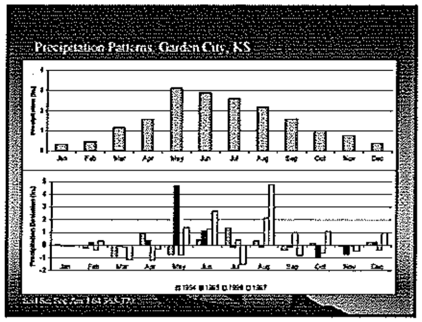
Variable		Manhattan V6 Dry Weight lb/a	Manhattan Grain Yield bu/a	Belleville V6 Dry Weight lb/a	Belleville Grain Yield bu/a
Time of fertilizer Application:	During strip-till (fall)	440	193	307	60
	Planting time	459	186	300	61
	LSD (0.05)	NS	NS	NS	NS
N Rate: lb/a	40	443	184	269	54
	80	468	190	283	59
	120	438	196	357	69
	LSD (0.05)	NS	NS	24	6

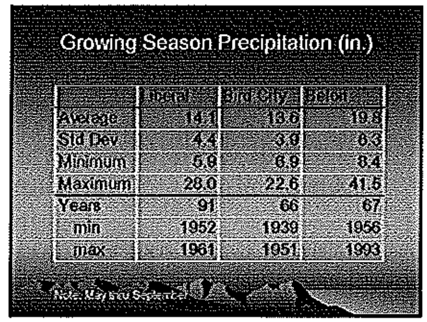
Table 3. Effects of tillage and N rate on corn[1].

Variable		Manhattan V6 Dry Weight lb/a	Manhattan Grain Yield bu/a	Belleville V6 Dry Weight lb/a	Belleville Grain Yield bu/a
Tillage:	Strip-till	429	182	264	57
	No-till	325	154	168	45
	LSD (0.05)	37	15	17	7
N Rate: lb/a	0	301	146	130	40
	40	417	169	221	49
	80	423	177	236	54
	120	367	181	276	61
	LSD (0.05)	52	21	25	10

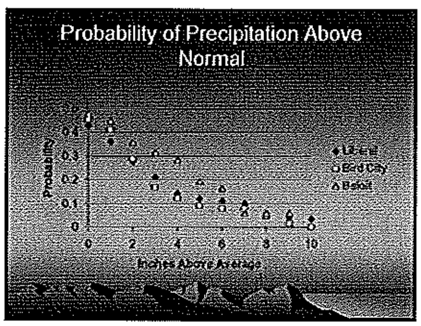
[1] Averaged across treatments receiving fertilizer at planting time.

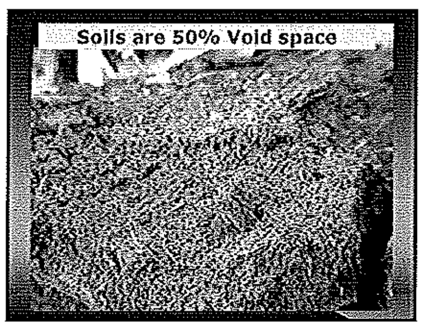


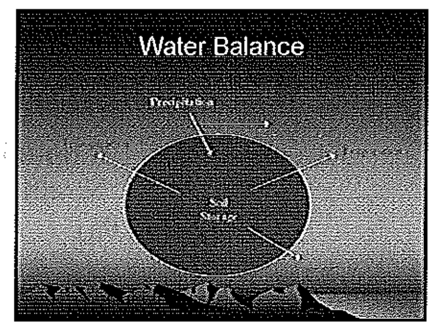


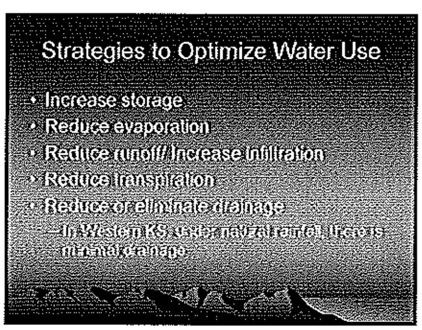


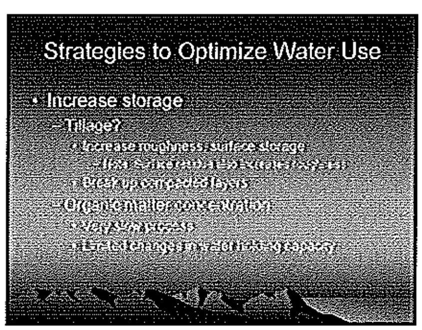
	Liberal	Bird City	Beloit
Average	14.1	18.6	19.8
Std Dev	4.4	3.9	6.3
Minimum	5.9	6.9	8.4
Maximum	28.0	22.6	41.5
Years	91	66	67
min	1952	1939	1956
max	1961	1951	1993

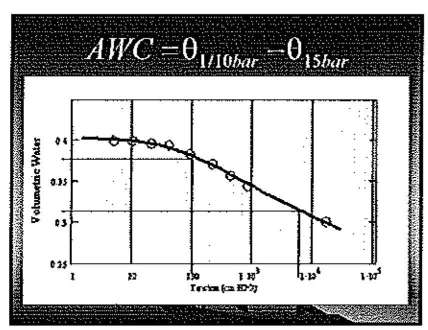


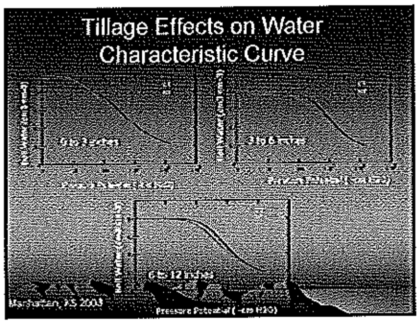


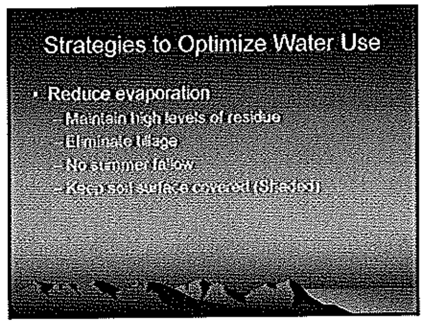




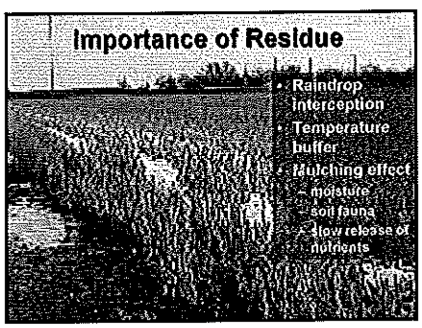


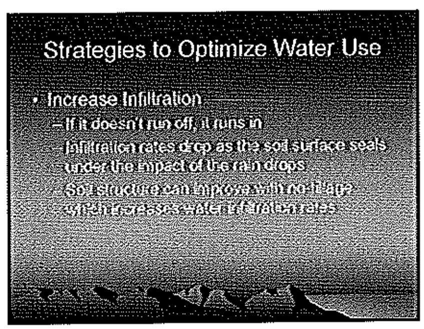


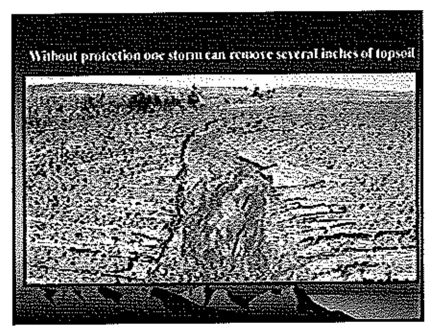

Tillage Effects on Water Characteristic Curve
0 to 3 inches
3 to 6 inches
6 to 12 inches
Manhattan, KS 2003

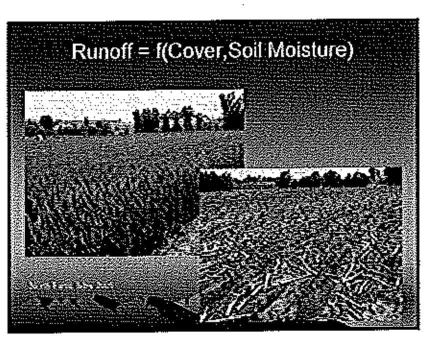

Strategies to Optimize Water Use
• Reduce evaporation
– Maintain high levels of residue
– Eliminate tillage
– No summer fallow
– Keep soil surface covered (Shaded)

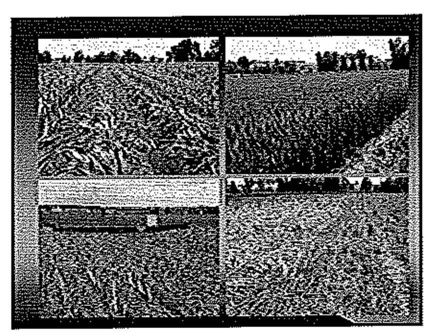

More is Better

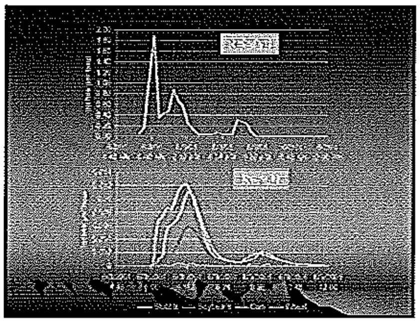

Importance of Residue
• Raindrop interception
• Temperature buffer
• Mulching effect
– moisture
– soil fauna
– slow release of nutrients

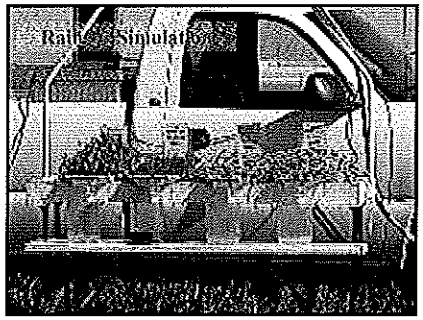

Strategies to Optimize Water Use
• Increase Infiltration
– If it doesn't run off, it runs in
– Infiltration rates drop as the soil surface seals under the impact of the rain drops
– Soil structure can improve with no-tillage which increases water infiltration rates

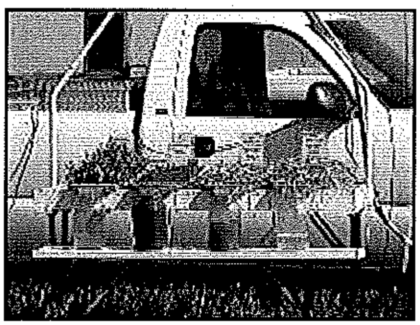

Without protection one storm can remove several inches of topsoil

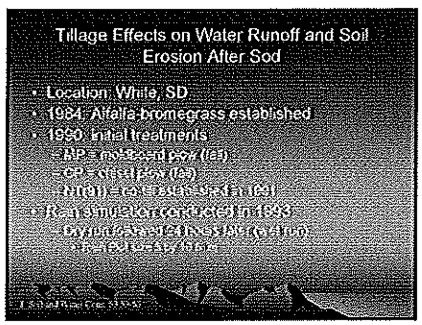

Runoff = f(Cover,Soil Moisture)

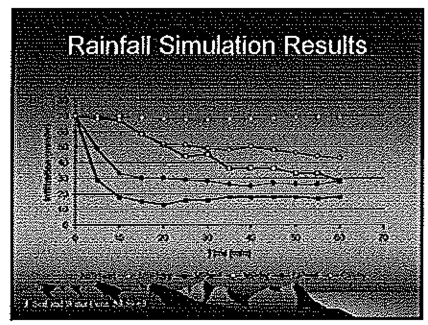


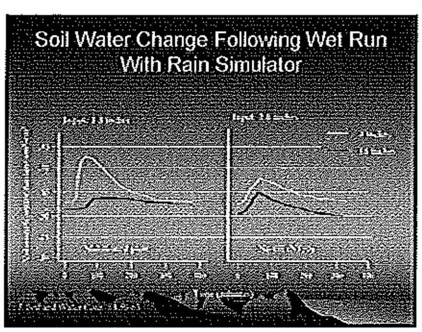


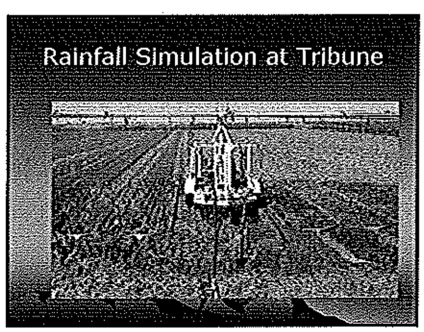


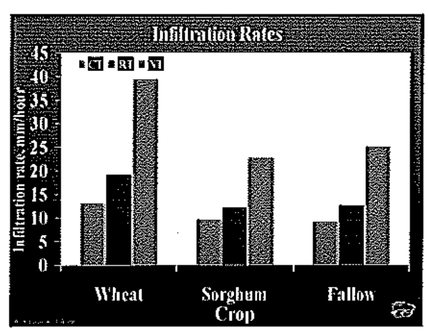


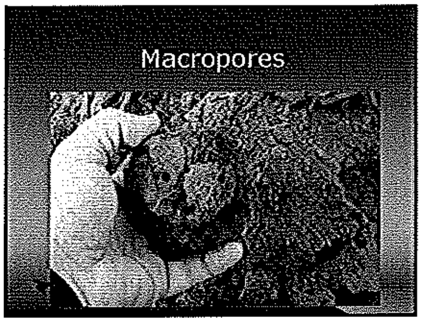

Tillage Effects on Water Runoff and Soil Erosion After Sod
• Location: White, SD
• 1984: Alfalfa-bromegrass established
• 1990: Initial treatments

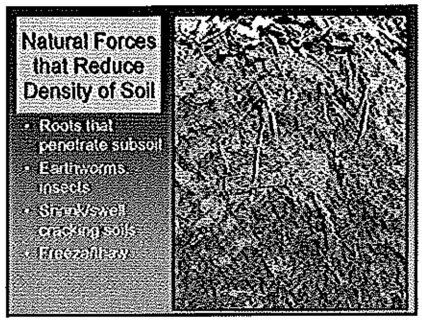

Rainfall Simulation Results

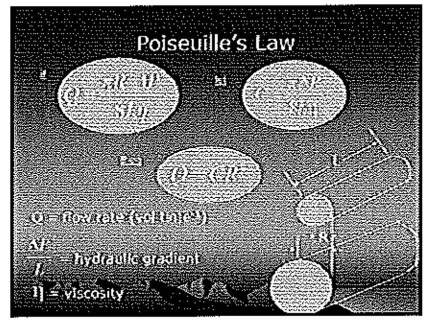

Soil Water Change Following Wet Run With Rain Simulator

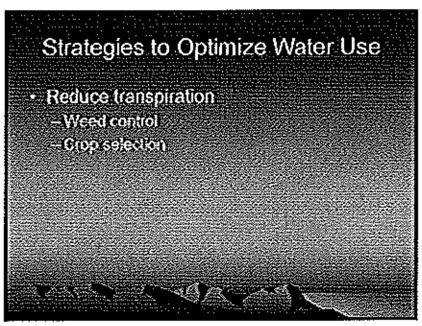

Rainfall Simulation at Tribune

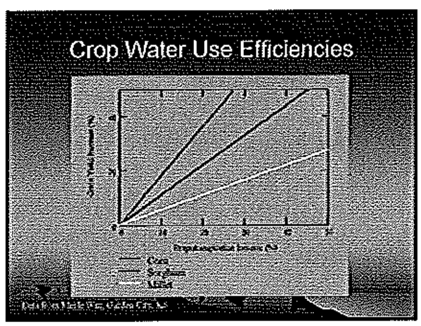

Infiltration Rates
CT
RT
NT
Infiltration rate, mm/hour
0
5
10
15
20
25
30
35
40
45
Wheat
Sorghum Crop
Fallow

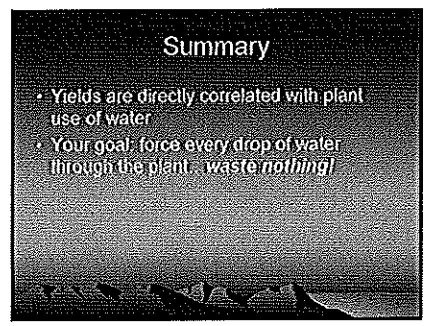

Macropores

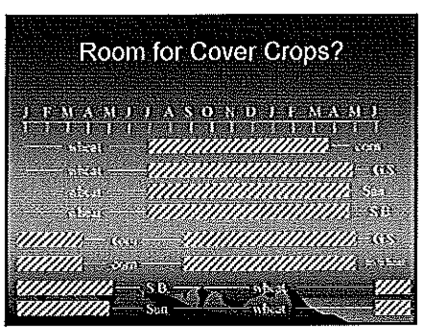

Natural Forces that Reduce Density of Soil
Roots that penetrate subsoil
Earthworms, insects
Shrink/swell cracking soils
Freeze/thaw

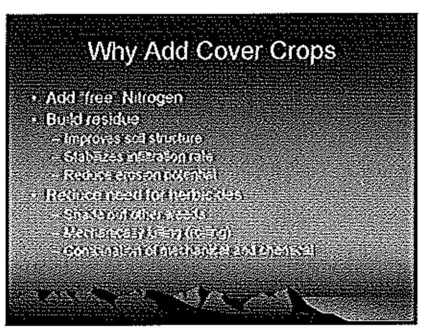

Poiseuille's Law
Q = flow rate
hydraulic gradient
η = viscosity

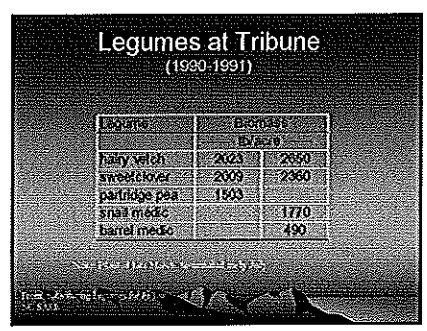

Strategies to Optimize Water Use
Reduce transpiration
–Weed control
–Crop selection

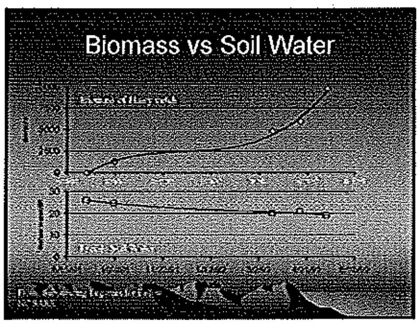

Crop Water Use Efficiencies

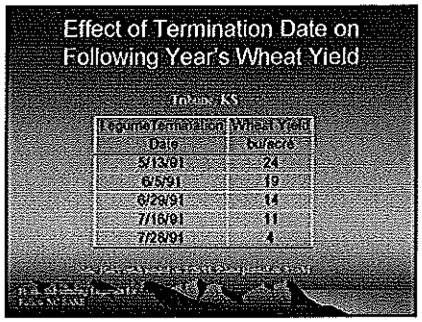

Summary
Yields are directly correlated with plant use of water
Your goal: force every drop of water through the plant.. waste nothing!

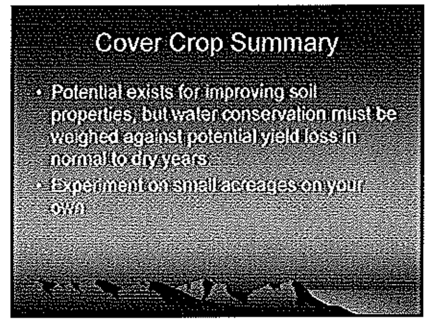

Room for Cover Crops?
J F M A M J J A S O N D J F M A M J
wheat
corn
wheat
GS
wheat
Sun
wheat
SB
corn
GS
corn
wheat
SB
wheat
Sun
wheat

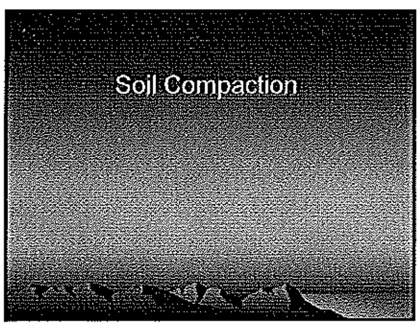

Why Add Cover Crops
Add "free" Nitrogen
Build residue
– Improves soil structure
Reduce need for herbicides

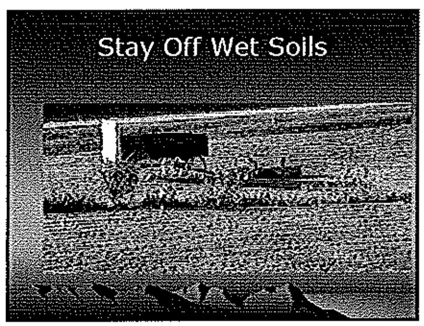

Legumes at Tribune
(1990-1991)
hairy vetch 2023 2650
sweetclover 2009 2360
partridge pea 1503
snail medic 1770
barrel medic 490

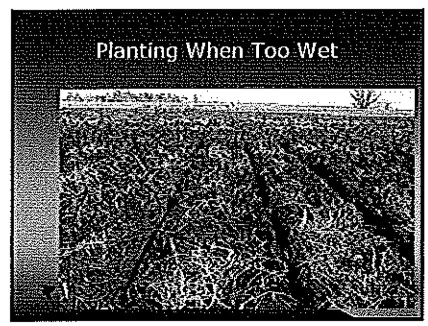

Biomass vs Soil Water

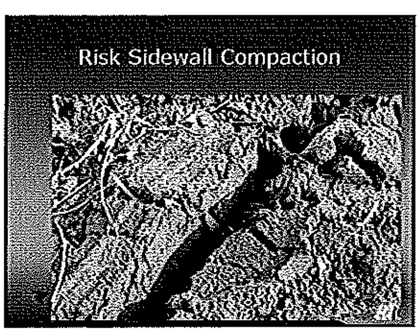

Effect of Termination Date on Following Year's Wheat Yield
Legume Termination Date
Wheat Yield bu/acre
5/13/91
24
6/5/91
19
6/28/91
14
7/16/91
11
7/28/91
4

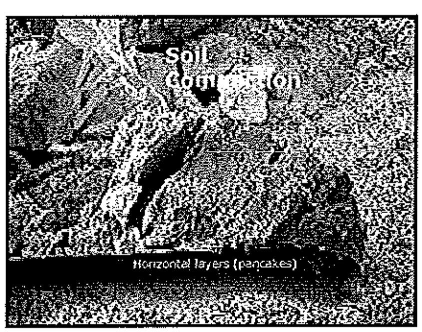

Cover Crop Summary
• Potential exists for improving soil properties, but water conservation must be weighed against potential yield loss in normal to dry years.
• Experiment on small acreages on your own

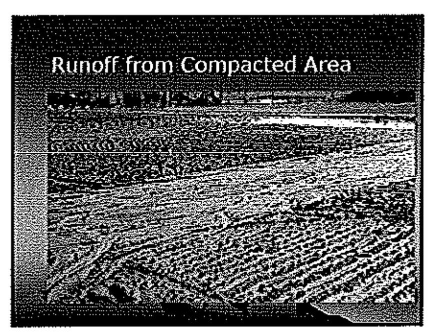

Soil Compaction

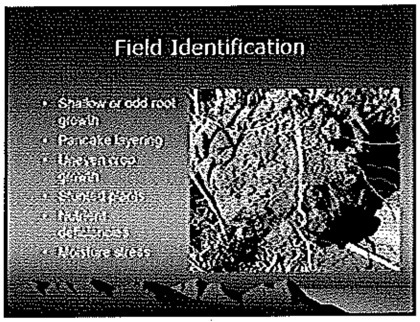

Stay Off Wet Soils

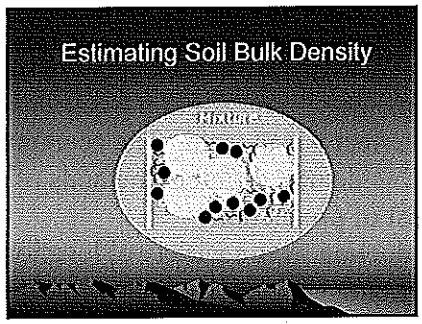

Planting When Too Wet

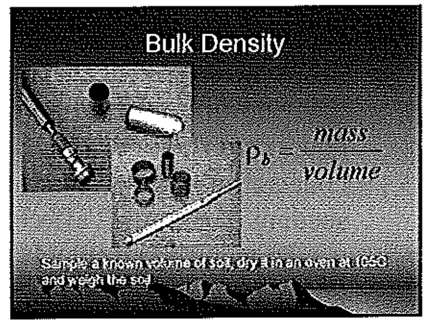

Risk Sidewall Compaction

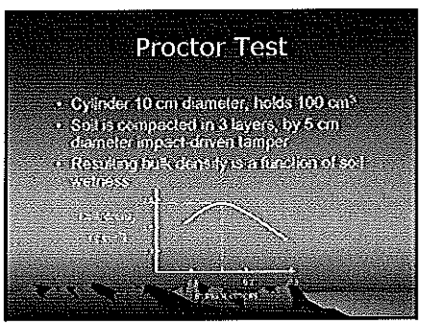

Horizontal layers (pancakes)

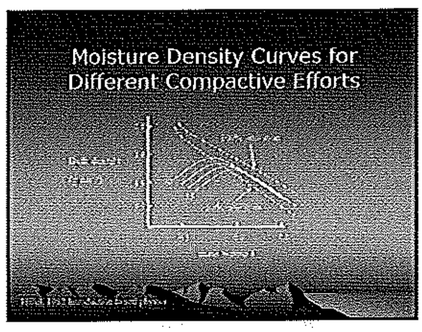

Runoff from Compacted Area

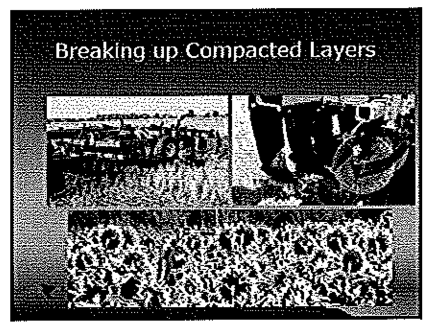


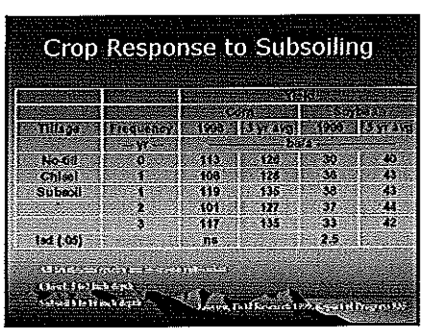




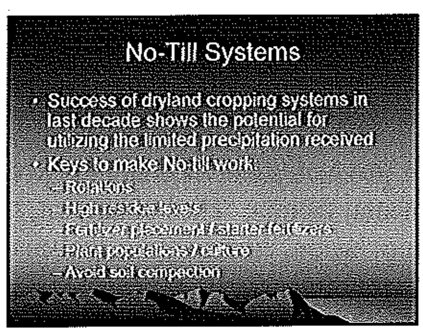


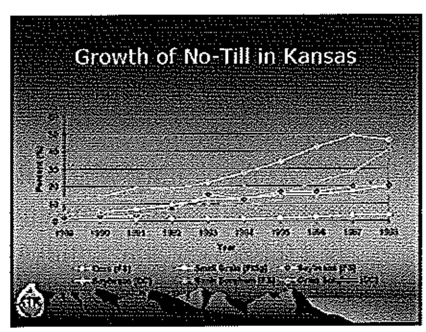






		[illegible]			
		Corn		[illegible]	
Tillage	Frequency	1998	3 yr Avg	[illegible]	3 yr Avg
	yr	bu/a			
No-till	0	113	126	30	40
Chisel	1	108	126	36	43
Subsoil	1	119	136	38	43
	2	101	127	37	44
	3	117	135	33	42
lsd (.05)		ns		2.5	





No-till Wheat Research on the High Plains

Roger Stockton and Brian Olson, Kansas State University

With the advent of more no-till production in the summer crops, producers are looking at using no-till for wheat production. However, adoption has been slow as many producers are concerned about how no-till will affect wheat yield. The economics of production are also a concern because of increased herbicide use, different methods of applying fertilizer, or increased seeding rates can all affect the cost of production.

To evaluate no-till wheat production over a variety of locations, no-till to conventional-till planted wheat plots are currently being evaluated in side-by-side comparisons in county wheat trials across multiple locations in Northwest Kansas. These comparisons are made possible through a grant from the Kansas Wheat Commission for which we are very appreciative.

All comparison have been coordinated on local producers fields. The cooperating producers are contacted in May before the field where wheat will be planted next fall is worked. A segment of ground is marked off for no-till and another for conventional-till, and these segments are maintained through the summer. At planting, K-State faculty provide wheat seed and plant the comparison study using the machinery in the below picture.

At the county wheat plot tour, producers can evaluate the two production systems as influenced by the same environmental factors. Then at harvest, the plots are cut for yield. This is a three year study, and at the conclusion, an economic analysis will be conducted to evaluate the cost of production of the two systems.

The wheat harvest of 2003 was the first results from these comparisons. Unfortunately, four sites worth of data were lost due to hail, Tordon damage, or other factors. In the Decatur, Norton, Gove, and Trego comparisons, each tillage system had fifteen varieties planted, and these same varieties were used across the locations. The conventional-till yielded on average better at two locations, while no-till was better at the other two. However, there was no statistical difference between the two systems when combined across sites. The results area listed in Table 1.

Possible reasons why no-till was better at two of the sites could be the following. At Norton, a three inch rain after planting caused significant crusting in the conventional-till which hindered stand establishment while the no-till had little soil crusting. At Trego, the fertilizer was injected, so it was placed below the residue. The injection did not allow the residue to tie-up the fertilizer. Therefore, the wheat in the no-till plot was not deficient in nitrogen. At Decatur and Gove, the fertilizer was applied broadcast to the surface which allowed for the nitrogen to become bound to the residue. This binding of nitrogen likely caused the wheat to be deficient in nitrogen in the no-till system and to yield less than wheat in the conventional-till system.

The following is some background information of each site. Trego - The site was continually no-tilled for a number of years before the test. The previous crop was grain sorghum. Norton - The site was no-tilled for the summer crops and tilled for planting wheat. The previous crop was corn. Gove - The site was no-tilled for the summer crops and tilled for planting wheat. The previous crop was corn. Decatur- The site was conventional-tilled for the summer crops and tilled for planting wheat. The previous crop was corn.

Table 1. Wheat variety plot results for 2003 across tillage systems for Norton, Decatur, Gove, and Trego

Rank	Variety	Average test weight	Average Bu/A
1	NuFrontier	58.0	62.5**
2	Jagalene	58.3	60.8
3	Alliance	58.0	59.5
4	Trego	58.5	58.8
5	Vista	56.8	57.2
6	Jagger	57.4	56.8
7	T81	58.0	56.7
8	2137/Jagger/Thunderbolt	57.4	56.1
9	502CL	56.9	56.1
10	Stanton	57.6	54.6
11	2137	57.7	54.0
12	Thunderbolt	58.5	53.5
13	Venango	57.6	51.5
14	Lakin	56.8	50.3
15	Ogallala	58.6	48.3

**NuFrontier was not in the wheat plot at Decatur County

No-till versus Conventional Tillage Systems - There was no difference between tillage systems

No-till was 6.2 and 8 bu/A better at Trego and Norton

Conventional-till 7.7 and 8.3 bu/A better at Gove and Decatur

For this next summer, there are local comparisons in Norton, Decatur, Sheridan, Gove, Trego, Rawlins, Cheyenne, Wallace, Thomas, Graham, and Lincoln counties. Visual inspection of the plots are showing differences between the two systems with less wheat stand establishment occurring in the no-till. This decreased establishment was caused by the lack of moisture the area received from September 1 to December 1. At many of the comparison sites, the no-till wheat has much less of a wheat stand than the conventional-till wheat. The ground was very hard at planting which did not allow the wheat to be planted deeper than an inch in the no-till. In the conventional-till, the seed could be planted deeper, thus coming in contact with more moisture and causing better stand establishment.

Preliminary results from these comparison suggest that fertilizer placement is critical. If the fertilizer is broadcast in no-till, it will become tied-up with the residue and not be available for use by the wheat. The new K-State Nutrient Recommendations suggest increasing applied nitrogen by 20 lbs/A to compensate. In addition, the nitrogen producers apply to fields before planting should be injected into the soil. The second important point has to do with moisture at planting. Moisture is needed sometime from September 1 to December 1 if no-till is going to compete with the conventional-till. However, I am unaware of anytime in the past besides this past fall where this did not happen.

To follow up, Roger Stockton has developed the list of "Things to Expect in Conversion to No-till Wheat Production":

Things to Expect in Conversion to No-Till Wheat Production.

Foundational concepts:

1. If a plow-pan i.e. a compacted soil layer with characteristic horizontal platy structure, is restricting root growth, water infiltration or limiting yield, it should be broken by chisel tillage 2 inches deeper than the layer, when soil is dry enough to fracture.
2. No-till management cannot manufacture rainfall, but it can help increase water capture and water use efficiency when precipitation does occur.
3. At some point, precipitation and management must produce enough residue to adequately cover the soil surface. Drought severely impacts no-till production by decreasing the amount of residue necessary to cover the surface. Not only is less residue produced, but longer fallow periods between crops result in more oxidation and decomposition of existing residue per year.
4. No-Till is not a silver bullet. It depends on each crop producing enough residue to protect the soil. During drought cycles it may be necessary to grow wheat two years in a row to produce enough residue to last through a winter fallow before moving into a summer crop. Alternately it may be beneficial to grow a winter legume cover crop, i.e. Austrian winter peas or hairy vetch, to add residue prior to a summer crop, especially a later summer crop such as milo or sunflowers. Evaporative losses from bare soil can be as much as the ET demand of a winter legume.
5. If it is too dry to establish a winter legume in the fall, the next best alternative to increase residue levels in drought years is to allow the first flush of spring weeds to grow to a height of about one foot before applying burn-down herbicide. This should provide extra residue, but stop weed growth before their water use impacts the following crop.
6. In drought cycles, it is advisable to use full label rates of systemic herbicides for weed control. The labels direct the applicator to apply to *actively growing weeds* for best control. Drought stressed weeds are seldom growing as actively as non-stressed weeds and if the first application does not kill them, it will harden them to the extent that it will be difficult to control them with chemicals.

7. In drought cycles, residual herbicides last longer, especially in high pH soils. If you have doubts whether the previous crop herbicide has decomposed or dissipated sufficiently to allow rotation, perform a bio-assay or "can test".
8. Crop rotations should be planned and used so that herbicides with different modes of action are used to minimize the potential for development of resistance in weed species, i.e. don't use glyphosate too much.
9. Many small weed seeds need brief light exposure, after being buried in the soil, to break dormancy. Also, weed seed viability in the soil seed bank sharply declines after two years. Therefore, pressure from traditional weed species should decrease with each successive year of no-till, but some different species may appear.
10. About 1/3 of the crop residue is below the soil surface after harvest. Allowing the previous year's roots to decompose without tillage is what creates the macro-pores that improve water infiltration and decrease runoff. Surface residue reduces evaporation loss and absorbs the energy of raindrops, which reduces soil crusting and water erosion.
11. Crop residue insulates soil temperatures by as much as 5 °F., i.e. warmer lows and cooler highs. Wetter soil requires more energy (heat) to change temperature than dry soil. The combination of these forces could result in 5 to 10 °F cooler soils in the spring compared to bare ground. Wheat is a cool season annual and needs cooler temperatures during grain fill to achieve maximum yield. Duration of grainfill and leaf photosynthetic activity are increased to a greater extent by cooler root temperatures than by cooler shoot temperatures (G.M. Paulsen, et.al., KSU).
12. You should expect to save about 500 tractor hours per tractor per year. Use that time to improve your management and marketing skills.
13. No-Till management cannot be accurately evaluated until the soil has had sufficient time to respond to the change, usually 4 to 6 years, depending upon soil type and climate.
14. Herbicide application must be timely to be effective. Most "no-tillers" purchase a sprayer to insure timeliness.

First year changes:

- At wheat planting time, hard soil surface, if dry.
- Favorable planting conditions achieved with less planting season rainfall than tilled soil. Three fourths inch rainfall will produce favorable planting conditions.
- Soil moisture content equal to slightly better than tilled soil.
- Excessive runoff from high intensity thunderstorms due to lack of macro-pores.
- Tie-up of 20 to 30 % of surface applied nitrogen by residue-decomposing microbes. A portion of the "tied-up" N will become available in one to two years as the N cycle comes into balance with the slower decomposition rate.
- Better emergence than tilled soil if rain comes between planting and emergence.
- Slower fall and winter-growth than tilled soil due to cooler soil temperatures.
- Potentially more soil moisture available for spring growth than tilled soil.
- Need to increase seeding rate by 25 to 50%, depending upon planter efficiency, because not all seed will get good seed-to-soil contact and slower fall growth may result in fewer tillers

per plant.

- Less probability of winter kill in dry cold winters than tilled soil.
- Dramatically reduced wind erosion potential due to residue cover, can plant later in the fall.
- Greater snow capture than tilled soil.
- Wheat yields may be slightly worse to slightly better than tilled soil.

Second year changes:

- Soil surface should be slightly more mellow than 1st year, even if dry.
- Soil moisture content should be better and closer to the surface than tilled soil.
- Runoff from high intensity thunderstorms should be less than 1st year, but more than long-term no-till due to incomplete macro-pore development.
- Runoff leaving the field should be relatively clear and free of eroded soil.
- May need to increase rates of soil-applied herbicides due to increased amounts of residue, but weed pressure should decrease each year.
- Higher disease incidence, especially tan spot, if planting wheat on wheat.
- May see decreased crop emergence or spotty emergence due to higher populations of rodents or insects resulting from better habitat (residue).
- Wheat varieties may respond differently in no-till than in tillage (research currently underway).
- Positive effects of no-till (reduced erosion potential, increased snow and rain capture, etc.) will continue to improve with successive years.

Third year changes:

- Soil surface continues to become more mellow with each successive year, as decaying residue and organic matter increases in the upper 1 to 2 inches.
- Soil macro-pore system (decayed root channels) becoming more functional resulting in greater water infiltration and less runoff.
- May start to see some "**weed species shift**", usually pasture type weeds encroach no-till fields that are bordered by grass. May need to spot treat these weeds or possibly change rotation to include a crop that will allow effective herbicidal control.
- Traditional weed pressure should decrease.
- Yields should be noticeably better than tilled fields.

Fourth year changes:

- Management becomes easier as the producer gains understanding of the system and the system has been in place long enough for many of the benefits to become evident.
- Soil pH in the upper two inches may start to decrease as a result of release of hydrogen ions from ammonia based fertilizers, if so, this will affect the availability of nutrients and the activity of soil-applied herbicides.

First year no-till wheat results are available on the Northwest Area extension office web page at www.oznet.ksu.edu/nwao . If you do not have internet connectivity, your local extension office can print results for you. Eighteen locations of no-till wheat variety trails were planted in the fall of 2003 and those results will be available after harvest. This work is supported in part by the Kansas Wheat Commission.

No-Till Drills

Randy Taylor and Mark Schrock

No-till planting of wheat and other drilled crops differs from conventional till in many ways. More residue must be cut or moved out of the path of the opener. This is a challenge for the narrow 6-12" row spacing used for grain drills, and some of the solutions used for row crop planters are simply too expensive or too large to be used on drills. On the positive side, soil moisture is usually closer to the surface in no-till than in conventional till. This means that seeding depths can often be shallower with no-till. Also, high residue slows the rate of soil drying and reduces the tendency of the soil to crust before the plant emerges.

Spacing

Row spacing of wheat tends to be much wider than the theoretically ideal square plant zone. A bushel of wheat typically contains between 800,000 and 1,000,000 seeds, so achieving the square plant zone would require approximately 2" row spacing at a 1.5 bu/ac rate. The concept of ultra-narrow row openers has been investigated at several locations, most of which were more humid than Kansas. However, an Oklahoma study compared 9", 6", and 3" drills for two years at several locations. The study predicted a yield increase of about 8% and 9% for 6" and 3" rows compared with 9" rows. The yield response to the narrower rows occurred in both cheat-free and cheat-infested fields. The study concluded that the optimum row spacing for seeding rates commonly used in Oklahoma was about 6.6" (Solie, et al. 1991). Thus, 6" and 7.5" row widths appear to be appropriate for wheat in the Eastern two-thirds of Kansas.

For producers whose primary use of a no-till drill is soybeans and grain sorghum, a 10" spacing may be the most economical compromise, if wheat acreage is low. Grain sorghum growers who use seeding rates in the range of 30,000 to 60,000 seeds/acre can block half of the openers in the raised position to achieve satisfactory (12-20") row spacing while eliminating unnecessary opener wear. The same technique is often used on soybeans.

Types

The type of seed slot openers typically categorizes drills. There are three primary types of openers used in Kansas. They are the single-disk, double-disk, and hoe.

Single Disk

For conventional tillage, single-disk openers were the standard grain drill in central and eastern Kansas for over 50 years. These openers usually consisted of a single concave 13" disk suspended by a simple swing-arm. Depth control was acceptable in conventional tillage seedbeds without using an attached press wheel for depth control. Although they are still available, the market for conventional till to reduced till drills has been largely captured by double disk openers during the last two decades.

No-till single-disk openers are available from several manufacturers. Designed for no-till, these openers are equipped with large (16-18"), heavy, flat disks and a heavy duty disk hub and bearing. These openers use a swing arm suspension, with depth controlled by side wheel and a press wheel located behind the opener. Although the single disk is subject to hairpinning when planting in tough residue, these openers can place seed at the desired depth with minimal disturbance of crop residues. They may be equipped with hydraulic down force adjustment (sometimes called "active" down force) to allow the openers to maintain more consistent depth control over rolling terrain.

Double Disk

Double-disk openers usually have a press wheel attached directly behind the opener for depth control. Double disk openers move less soil laterally than the concave single disk drill, allowing them to operate at higher speeds than the concave single disk. Double-disk openers may be suspended by a swing-arm, parallel arms, or a strut and swing arm combination. Down-force may be applied by springs, hydraulics, or a combination of the two. Most double-disk openers that are intended for no-till have the disks offset slightly (0.5" to 1.5") so that only the leading disk edge cuts residue. In some cases, the trailing disk is a smaller diameter than the leading disk.

Coulter/double-disk combinations are a popular style of no-till drill, sometimes known as the "fluff-and-plant" system. These machines use coulters (usually rippled or wavy) aligned to run directly in the path of the double-disk openers. The coulters cut the residue and till the soil in front of the opener. Depth of the coulters and speed of operation have a major impact on the function of this concept. In the 15-20'-wide units, the coulter-cart can be used with either a drill or a row-crop planter to cut operating costs. Wider no-till drills have both coulters and openers integrated on a folding frame.

Hoe

Hoe openers generally require much less down-force to penetrate firm soil, and they usually move more soil laterally than disk openers. Whereas disk openers tend to push residue into the soil as they cut it, a hoe tends to lift the residue and allow it to fall to the side. These features have made hoe more popular in western Kansas than in the east. The challenge of planting into dry conditions is to place the seed into moist soil without covering it too deeply. The hoe opener, operated on relatively wide spacing (10-14"), can move a layer of dry soil into a ridge between the rows. This can allow the seed to be placed 4" below the original soil surface, while covering the seed with about 2.5" of soil. Hoe openers are usually used with gangs of "full press" wheels, which carry much of the drill or air seeder frame weight. Full press wheels can apply heavy down force, forming well-defined furrows and ridges on the soil surface.

The greater lateral soil movement created by hoe openers tends to limit the maximum speed of operation. At high speeds, the second (and third) ranks of openers tends to cover the front rank with additional soil. This may produce a noticeable reduction in the stand produced by the front rank. Attachments have been marketed to limit lateral soil movement from the rear rank.

On hoe drills, the openers are usually attached to the frame via a swing arm. There are a few examples of hoe openers having depth control/press wheels. With hoe-type air seeders, the opener is often rigidly attached to the seeder frame (the opener may be equipped with a spring linkage for shank protection). Such seeders rely on good frame flexibility to allow the machine to comply with lateral terrain features.

"Floating" hitches, used with support wheels in front of the main frame, allow the frame to follow the ground independently from the tractor.

Adjustments

Depth control is a concern with any seeding system. A survey of conventional grain drills conducted in 1994 by Oklahoma State University indicated a strong tendency for farmers to plant wheat much deeper than they intended. Only about 20% of producers were at or near the intended depth, and 68% of the fields were planted too deep. Excessive depth delayed emergence and reduced stands. In over 50% of the fields, emergence was less than 60%. KSU research in no-till wheat indicated that each half-inch of excess depth reduced stand by 6 to 22%, depending on location. The OSU survey also found that producers are much more accurate with planting rate than with depth.

It is critical that depth be checked especially when changing fields or planting conditions. This can be time consuming, especially in grain sorghum, where the seeds are small and more widely spaced than wheat. The objective is to place the seed in contact with moist soil, with an acceptably shallow covering depth. Because soil moisture varies with both location in a field and the time of planting, depth is usually a compromise between the need to place the seed into moisture and the need to plant shallow to reduce soil crusting.

With most disk-type openers, the two primary adjustments affecting depth are a) the down-force applied to the opener, and b) the relative position of the disk and the depth-control wheel. Understanding how these two adjustments affect depth control is important. The down-force applied to the opener is balanced by the up-force of the soil on the disk itself and on the depth control wheel. In some cases, a seed firming wheel or runner also applies force to the soil.

As the opener moves through the field, the force on the disk changes in response to soil hardness and residue conditions. Any down-force not used to make the disk penetrate to the desired depth is fed into the depth control wheel. Reduced or no-till seedbeds usually require more down-force for disk penetration. If an opener is planting too shallow, check to see if the depth control wheel (in some cases the press wheel) is carrying a load. If the depth control wheel is not supporting down-force, depth will not be increased by raising the wheel...the solution is more down-force. Conversely, when moving a drill from firm soil to looser conditions, down-force should be reduced to prolong the life of the opener suspension, the depth control tire, and the bearing. In general, use just enough down-force to consistently force the disk to the desired depth, with enough left over to let the press wheel do its job. Depending on the drill, down-force may be adjusted by changing spring pre-load, hydraulic pressure, or even the operating height of the drill frame. Check the operator's manual for specific instructions on depth and down-force adjustment. Also, many disk openers have more than one style of down-force spring available. Heavier springs are used for reduced or no-till seedbeds.

Air Seeders

Air Seeders are now available with both disk and hoe openers, plus sweep and paired-row openers. Using air to convey the seed (and fertilizer) from a central tank offers at least three basic advantages over conventional grain drills. First, the central hopper of an air seeder eases filling. It also allows wings to be folded vertically for road transport like a tillage tool. These two advantages become more important as the width of the drill increases. The third major advantage is the ability of the air seeder to transport seed horizontally under the soil. This allows one opener, such as a small sweep, to seed multiple rows of seed. It also facilitates the concept of the paired row.

A wide variety of openers are available for air seeders. Knife-type openers cut a narrow slot for seed placement with minimal soil disturbance, while sweep-type openers accomplish some mechanical weed control at seeding time. "Double-shoot" openers use separate tubes for seed and fertilizer, allowing a heavy rate of nitrogen to be placed a safe distance from the seed. Openers are available to place dry, liquid, and even anhydrous ammonia fertilizer. Some air seeder openers split the seed stream into two rows, 3-7" apart, and place the fertilizer between the seed rows. The paired row concept is intended to give the crop preferential access to the fertilizer.

Topographical Conditions

Tillage tends to even out or "level" a field. Conversely, for reduced and no-till farming, unevenness is often more extreme and may increase with time. Erosion may be a major cause, especially for steep slopes, but terraces and contour farming are also causes of topography variations. With larger machinery and farming of more marginal land, there is a greater requirement for machine flexibility. Most new planters have flex linkages that allows each row to move up and down independently of other rows. This feature allows the planters to accommodate the soil unevenness. Flexing of the frame will be required for wide planters or uneven topography.

Planting on the contour often requires sharp turns. The distance from front to back (coulters to opener and press wheels) determines how well the planter will follow the row. The shorter front to back distance the better the planter will stay on the row. Pull type planters will follow curves better than mounted planters, but keeping spacing on steep side slopes may be a greater challenge.

CROP WATER USE REQUIREMENTS

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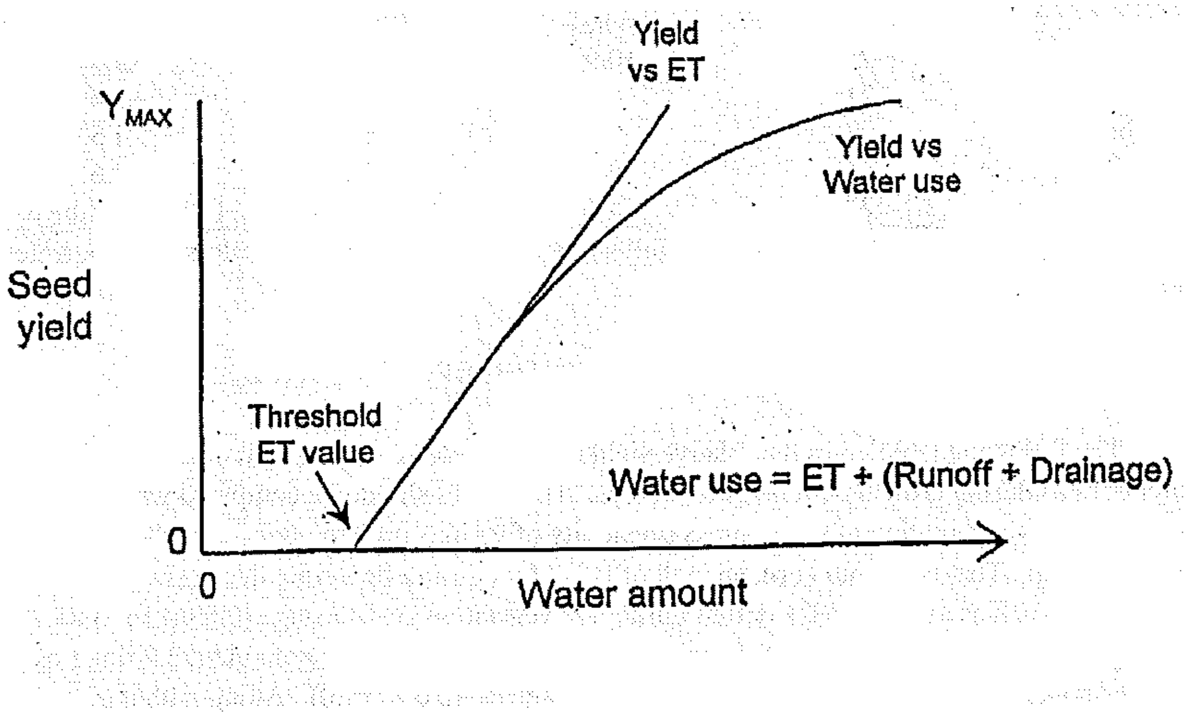
ESTIMATED CROP YIELDS AND ET RELATIONSHIPS

The diagram below illustrates the general relationships between seed yield and water amount (ET or water use). As used here, ET refers to evapotranspiration while water use refers to ET plus losses by runoff and internal drainage from the soil profile. Seed yield vs. ET is a linear relationship, although variability can and does exist. Seed yield vs. water use (ET + Runoff +Drainage) is typically a curvilinear relationship. The seed yield vs. ET relationship is more transferable among geographic locations than is the seed yield vs. water use relationship that is more influenced by soil and landform characteristics that influence runoff and drainage.



The following table lists values of "Threshold ET", "Maximum ET for a typical full-season variety", "Slope of seed yield vs ET", and "Slope of long-term seed yield vs. ET" for five crops from research in western Kansas by Stone et al. (1995) and Khan (1996). "Threshold ET" is the amount of ET necessary to move into the seed producing segment of the yield vs. ET relationship. That is, at the "Threshold ET" value and below, seed yield is zero. "Maximum ET" gives the upper value of ET expected for full-season varieties with good water conditions (no water stress). The "Slope of yield vs. ET" gives the seed yield increase per inch of ET in the seed producing segment of yield vs. ET. This would be the expected yield increase due to water (ET) in a year with no out-of-the-ordinary yield reducing factor such as hail, frost, insects, etc. Because out-of-the-ordinary yield reducing events do occur, the "Slope of long term yield vs. ET" is less than the yield vs. ET slope for an individual good year.

The "Threshold ET" value is of critical importance in assessing if seed yield will likely be obtained in drier crop environments. Within the four summer row crops of the following table, "Threshold ET" is 5.4 inches for sunflowers, 6.9 inches for sorghum, 9.0 inches for soybean, and 10.9 inches for corn. The water stress sensitivity of growth stages of various crops is also important in assessing their suitability for drier environments. The "Slope of yield vs. ET" is important is assessing the response of crops to irrigation that is converted into ET. Within the four summer row crops of the table below, yield response per inch of ET is 218 lb/acre-inch for sunflower, 330 lb/acre-inch for soybean (5.5 bu/acre-inch), 683 lb/acre-inch for sorghum (12.2 bu/acre-inch), and 946 lb/acre-inch for corn (16.9 bu/acre-inch).

Crop	Max. ET for Full-season Variety	Threshold ET	Slope of yield vs. ET	Slope of long-term yield vs. ET
	inches	Inches	bu/acre-inch	bu/acre-inch
Corn	25	10.9	16.9	13.3
Grain Sorghum	21	6.9	12.2	9.4
Soybean	24	9.0	5.5	4.5
Winter Wheat	24	10.0	6.0	4.6
Sunflower	22	5.4	218 lb/acre-inch	150 lb/acre-inch

* Long term (multi-year) slope is less than full slope due to yield reducing factors such as water stress, hail, frost, insects.

YIELD RESPONSE TO WATER STRESS FACTORS

The following table gives the relative yield response (decrease) per unit of ET deficit (water deficit) during growth periods of five crops. The values should be compared within a crop to get the relative weighting of water stress sensitivity of various growth periods for the individual crop. That is, within corn, an inch of ET deficit during flowering decreases grain yield 3.8 times as much as an inch of ET deficit during the vegetative growth stage (0.53/0.14=3.8). Within grain sorghum, an inch of ET deficit during flowering decreases grain yield 2.0 times as much as an inch of ET deficit during the vegetative stage (0.42/0.21=2.0). Along with the sensitivity to water stress in corn being greatest during flowering, daily water use is greatest during flowering through about the milky-fluid growth stage. These two factors working together produce the need for water in corn during flowering.

Relative yield response per unit of ET (within a crop) to water deficit during selected growth periods

	Growth Period			
Crop	Vegetative	Flowering	Yield Formation	Ripening
Corn	0.14	0.53	0.19	0.14
Grain Sorghum	0.21	0.42	0.21	0.16
Sunflower	0.25	0.42	0.27	0.06
Winter Wheat	0.19	0.51	0.25	0.05
Soybean	0.10	0.40	0.50	--------

The relative weighting of water stress sensitivity within a crop is illustrated in the previous table. These relative weightings of water sensitivity give insight into the growth periods of most critical water needs for these five crops. On average, rainfall during the most sensitive growth periods will give the greatest yield benefit. Also, limited irrigation should be timed to avoid water stress at the most sensitive growth stages. On average, that will give the greatest yield benefit from a limited water resource. The timing of limited irrigation for maximum seed yield (on average) is given in the table below.

Timing of limited irrigation for maximum seed yield benefit.

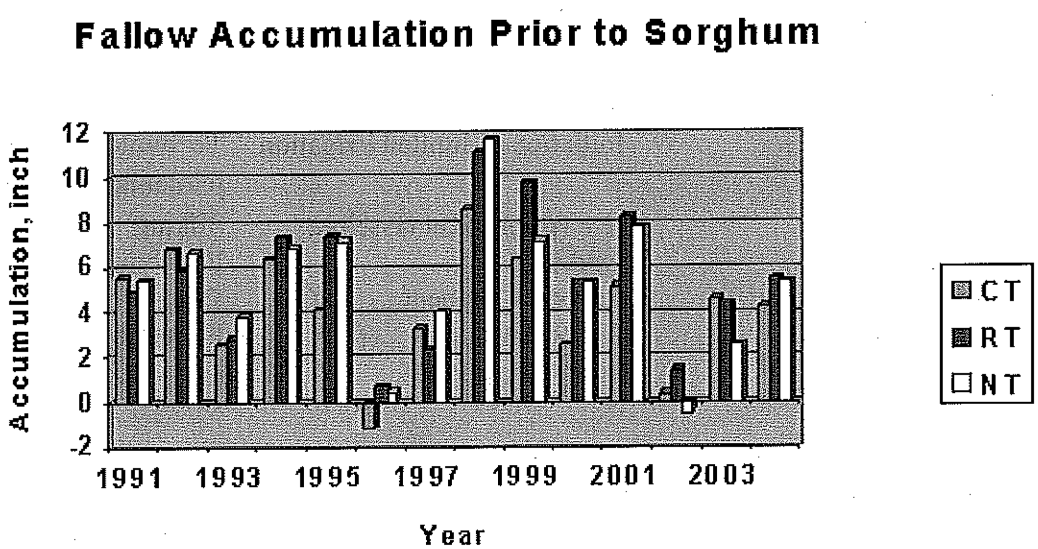
Crop	Initiation of limited irrigation	To avoid (lessen) water stress particularly during
Corn	Near (prior) or at tasseling	Silking
Grain Sorghum	Head extension	Flowering
Sunflower	Head development	Disk Flowering
Winter Wheat	Head extension	Flowering
Soybean	Mid to late pod set	Early to mid bean fill

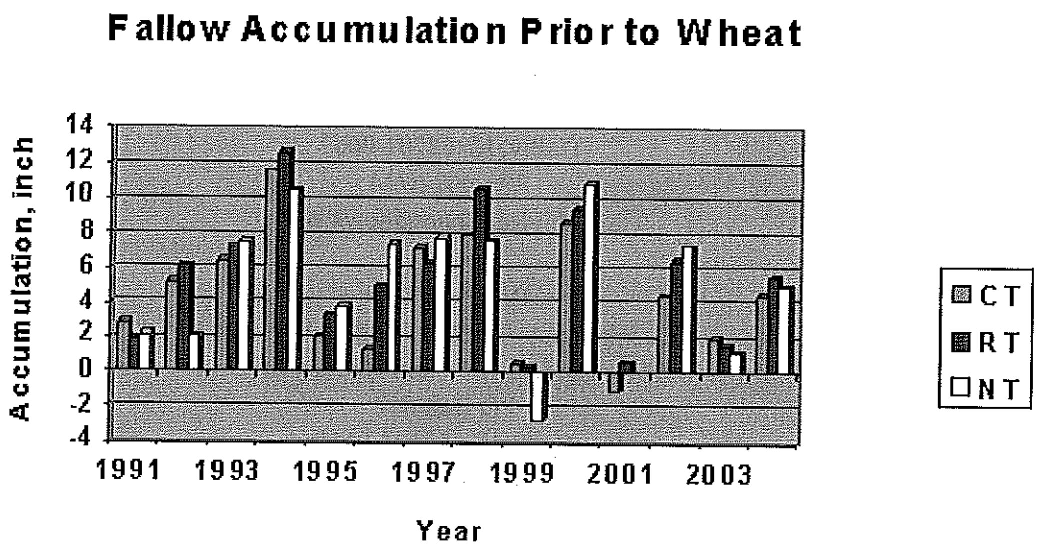
A consideration of the suitability of crops for rainfed-only management in drier environments starts with an examination of the "Threshold ET" and water stress sensitivity values. The suitability of crops for limited irrigation management in drier environments is influenced by the factors of "Threshold ET", water stress sensitivity, and crop response to added water ("Slope of yield vs. ET"). The suitability of crops for full irrigation management in drier environments is primarily driven by the crop yield response to water ("Slope of yield vs. ET").

SOIL WATER STORAGE PRIOR TO PLANTING

Water available for dryland crop use comes from in-season rainfall plus water available in the soil profile at planting. Several factors influence the amount of available soil water at planting including climatic conditions (e.g. precipitation, evaporative potential, etc.) and crop management practices (e.g. previous crop, length of fallow, tillage practices, residue management, etc.). Although there is little control of climatic factors, producers can influence soil water at planting through crop management practices. In general, fallow accumulation of soil water increases with fallow length (as long as the soil profile still has capacity to store additional water) although fallow efficiency generally decreases with longer fallow periods. Fallow efficiency is generally greater from precipitation received during the cooler portions of the year instead of during the summer (slower evaporation allowing for more time for infiltration). Tillage practices that leave residue on the soil surface can improve fallow accumulation. The increased amount of residue on the soil surface can reduce runoff, improve infiltration, and reduce evaporation.

Research in western Kansas near Tribune evaluated the effect of tillage practices on soil water storage during fallow and fallow efficiency in a wheat-sorghum-fallow rotation. Three tillage practices were evaluated. Conventional tillage (CT) used a sweep plow for weed control during fallow, no-till (NT) used only chemicals for weed control, and reduced tillage (RT) used a combination of chemical and tillage for weed control. The following two figures show the amount of water accumulation in the soil profile during the fallow period prior to sorghum and wheat planting. The last group of bars in each figure is the average across the 13 years.





The amount of fallow accumulation varied widely among years for both crops. In some years, there was a loss of stored soil water from harvest to planting while, in other years, fallow accumulation exceeded 10 inches. On average, CT was the least effective in accumulating soil water for both crops. Prior to sorghum, fallow accumulation averaged 4.27 inches for CT compared to 5.55 inches for RT and 5.29 inches for NT. Although the differences were not great, an inch of additional water available for sorghum ET would be worth about 10 bu/a of yield. Similarly, prior to wheat, fallow accumulation averaged 4.57 inches for CT compared with 5.55 inches for RT and 5.07 inches for NT. Fallow efficiency (amount of water accumulated during fallow divided by precipitation during fallow) ranged from less than 0 to more than 50% and averaged 29% (24, 30, and 33% for CT, NT, and RT, respectively) prior to sorghum and 28% (25, 27, and 31% for CT, NT, and RT, respectively) prior to wheat.

REFERENCES

Khan, A.H. 1996. KS water Budget: EWducational software for illustration of drainage, ET, and crop yield. Ph.D. diss. Kansas State Univ., Manhattan (Diss. Abstr. 96-29047).

Stone, L.R., O.H. Buller, A.J. Schlegel, M.C. Knapp, J-I. Perng, A.H.Khan, H.L. Manges, and D.H. Rogers. 1995. Description and use of KS Water Budget v. T1 software. Resource Manual, Dep. Of Agronomy, Kansas State University.

Multi Peril Crop Insurance in 2004

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Multi peril crop insurance is a significant factor in risk management strategies used by producers. Within the states of Kansas, Colorado and Nebraska, the annual number of policies in force has increased by over 20 percent since 1999, with over 400,000 policies having been sold in crop year 2003. During this 5 year period nearly 2.3 billion dollars in indemnities were paid to producers in this 3 state area, resulting in an overall loss ratio of 1.22. Due to the subsidy provided, the total producer paid premium for this coverage amounted to slightly less than 944 million dollars, thereby showing an average indemnity of nearly $2.43 for each dollar producers spent for coverage. (Source: FCIC Crop Year Statistics for 1999-2003)

Losses, however, were not limited to just our immediate region and not all claims were the result of weather phenomena. Major efforts have been made in recent years to stem fraud and abuse of the program. Requirements of the "Agricultural Risk Protection Act of 2000" and the results of an Office of Inspector General audit on program vulnerability led the Risk Management Agency to issue a new Common Policy for 2004. Changes to the Common Policy will directly impact policyholders in a multitude of ways.

Multi Peril Crop Insurance is an extremely complex program that undergoes continuous change and modification. The following material represents our understanding of the program at this point in time but does not reflect any official sanction. Policy holders are advised to consult with their agents to determine the specifics of how their coverage will be impacted.

Definitions: Changes in 2004 include 24 definitions that are either new to the policy or revised. The following selected definitions have particular importance to our region. Review your common crop policy for complete details.

- Good Farming Practices – "The production methods utilized to produce the insured crop and allow it to make normal progress towards maturity and produce at least the yield used to determine the production guarantee or amount of insurance, . . . which are . . . those generally recognized by **agricultural experts** for the area . . ."

- Agricultural Experts – "Persons who are employed by the Cooperative State Research, Education and Extension Service or the agricultural departments of universities, or other persons approved by FCIC, whose research or occupation is related to the specific crop or practice for which such expertise is sought."

- First Insured Crop – "With respect to a single crop year and any specific crop acreage, the first instance that an agricultural commodity is planted for harvest or prevented from being planted and is insured under the authority of the Act."

- Second Crop – "With respect to a single crop year, the next occurrence of planting any agricultural commodity for harvest <u>following a first insured crop</u> on the same acreage. . . ." The insurability of a second crop is governed by such factors as does it qualify under double cropping regulations, planting date, producer choice, etc.

- Double Crop – "Producing two or more crops for harvest on the same acreage in the same crop year." To be an insurable practice, the producer will be required to provide acceptable records that show double cropping history in at least 2 of the last 4 years and that the number of acres being double cropped in the current crop year does not exceed the historical record provided.

☻ Cover Crop – "A crop generally recognized by agricultural experts as agronomically sound for the area for erosion control or other purposes related to conservation or soil improvement. A cover crop may be considered to be a second crop." This is of significant importance should a cover crop be hayed, grazed or otherwise harvested in prevented planting situations.

Limits to Multiple Indemnity Payments: The most significant impact of the new Common Policy in our general area is likely to be how insurance benefits are handled for multiple crops grown on the same acreage during the same crop year. The possibility of a full indemnity payment on each successive crop planted on the same land within a given crop year will no longer be available unless that land meets the new double cropping requirements. Limits will be imposed on indemnity payments associated with land that does not meet these requirements. The maximum total indemnity payable will be 35% of the loss due on the first insured crop and 100% of the loss due on a second insured crop. When the first claim is worked, the insured will have to choose 1 of the 3 options addressed below.

Assumption: In the fall of 2003 the policy holder planted 80 ac of insured summerfallow (SF) wheat on the north half of a dryland quarter. In the spring of 2004 a notice of loss was filed and the wheat was appraised at 1.0 bu/ac. To complete the claim the insured must pick and certify to 1 of 3 options as to how the 80 ac on which the adjusted wheat was located will be farmed during the remainder of crop year 2004.

Option 1: The producer certifies that no second crop will be planted on acres where the first insured crop failed. Planting wheat in the fall of 2004 on the same acres will not impact 2004 coverage as this would be a 2005 crop. (Note! If the failed 2004 wheat was continuous crop (CC) wheat, any wheat planted on the same acres for 2005 will also be CC wheat. If the failed wheat was SF wheat, and any residual stand was destroyed prior to 01 June and other SF requirements were met, then wheat planted in the fall of 2004 would again qualify as SF wheat.)

Result: 100% of the indemnity due will be paid, 100% of premium due collected.

Option 2: A second crop is planted on the acres where the first insured crop failed, but this crop is either uninsurable or the producer certifies that it will not be insured. (Starting in 2004 a policy holder can elect to not insure a second crop planted after a failed first insured crop even though the second crop is covered by his policy and may be planted and insured on other land in the county.)

Result: 100% of the indemnity due will be paid, 100% of premium due collected.

Option 3: A second crop is planted and insured on acres where the first insured crop failed.

Result: 35% of the indemnity due on the first insured crop is paid and 35% of the premium on the first insured crop is collected. 100% of the premium earned on the second insured crop is charged to the policy and a waiting period is started.

Should the second insured crop not experience a loss (or no claim of loss is completed), the balance of the first insured crop's indemnity is paid and the balance of that crop's original premium is collected. If an indemnity is claimed on the second insured crop, the reduced indemnity and premium on the first insured crop will not change.

Question: Would it matter if the land in question was irrigated?

Answer: No, proof of double cropping history would still be required.

Prevented Planting: To file a prevented planting claim successfully, notice of the claim must be given your agent within "72 hours after (1) the final planting date, if you do not intend to plant the insured crop during the late planting period or if a late planting period is not applicable; or (2) you determine you will not be able to plant the insured crop within any applicable late planting period." Notice can be made by phone if followed by written confirmation within 15 days. Standard prevented planting coverage on buy-up policies can be increased by an additional 5% or 10% prior to sales closing <u>but</u> only if the cause of loss is not already evident.

If the land under prevented planting claim does <u>not</u> meet double cropping requirements, a reduction in indemnity to 35% of the full claim will occur if a second crop is planted <u>for harvest</u> **by anyone**, or if <u>any benefit is gained</u> from a volunteer or cover crop, or if <u>any cash rent</u> is received on land under claim. (Note - a cover crop may be utilized without penalty after the end of the insurance period for the prevented planted crop.) The APH history for the prevented planted crop will also be impacted, as 60% of the crops approved yield will be assigned to the database and used in calculating average yield in the future.

SELECTED 2004 ACTUARIAL CHANGES

Kansas:

Millet....... Coverage available in Cheyenne, Sherman and Wallace Counties
Sunflowers. . .RA Coverage now available, oil and confectionary sunflowers
Sunflowers insurable on acreage planted to soybeans the prior year
Cotton ...... Dryland practice now available in 8 SW Kansas Counties

Colorado:

Barley ...... RA Coverage now available
Sunflowers . . RA Coverage now available, oil and confectionary sunflowers
Sunflowers insurable on acreage planted to soybeans the prior year

Nebraska:

Corn .... RA Coverage available in all counties
Soybeans. . . . RA Coverage available in all counties
Sunflowers insurable on acreage planted to soybeans the prior year

OTHER ITEMS OF INTEREST

Grain Sorghum Base Price: Starting in 2004 the price relationship between grain sorghum and corn with regard to CRC base price will be set by RMA based on January USDA estimates of prices. Grain Sorghum base price will no longer be automatically set at 95% of corn.

Substantial Beneficial Interest (SBI): Insurance companies are required to collect Social Security or Employer Identification Numbers associated with a given policy for any individual or entity having a 10% or more share in that policy. Failure to comply will result in a denial of benefits.

Added Land: The 50% acreage limitation no longer applies. Should 2,000 or more cropland acres be added within the crop year, the appropriate variable T-Yield will be assigned with no RMA RO review being allowed.

Pivot Irrigation: When a pivot and its non-irrigated corners are planted at the same time, cultivation, disking, mowing, etc., can be used to create a break between the practices. This break must be established before the acreage reporting date and must be clearly discernable if inspection is required later in the year.

Combining and Dividing Units: The ability to combine and divide optional and basic unit databases will come under additional restrictions in 2004. To combine adjacent optional units the insured will be require to sign a binding agreement to maintain the combined unit in subsequent crop years. Dividing basic units into optional units or further dividing optional units will require approval of the insurance company.

Organic Farming Practices: Special provisions have been updated to allow insurance coverage for an insured crop grown under an organic farming practice. Coverage must be obtained by sales closing date.

Deadlines: Significant funds are invested in multi peril insurance coverage. This initial investment plus any potential indemnity can be reduced or lost if deadlines are not met. Ignoring deadlines for signup, acreage reports, production reports, notice of loss, etc. can lead to loss of coverage. Know what deadlines you are facing and work with your agent.

Winter Barley Production in the Great Plains

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Winter barley (*Hodeum vulgare* L.) is a crop with a long history in the Great Plains and in world agriculture. It originated in Mesopotamia, the current Iraq, and it was widely grown throughout the Old World as a feed and food grain. It was brought to the New World by immigrants and continues to be widely grown in the U.S., though the production of barley in many states has declined from its historic highs. Barley is related to wheat (durum and bread) and to rye and triticale. Barley, wheat, rye and triticale are all believed to have a common ancestor thousands of years ago.

Types of Barley:

Barley can be classified in different ways. Like wheat it is a diverse crop that can be grown everywhere wheat is grown except in areas requiring the highest levels of winter hardiness. The growth habit of barley can be spring and winter. Winter barley tends to have greater yield potential. In addition, there are feed (for animal and human consumption) and malting barleys (for making beer). Feed barley is used as a cereal to feed animals, particularly cattle where the hull can be digested and is valued by dairy and cattle operations. Barley can also be used as part of feed ration for swine and poultry. It is process and used in many pet foods. As a feed grain barley usually competes with other feed grains such as corn and sorghum. Barley does not have the high oil content of corn, hence does not have the energy value of corn. Barley does not have the tannins (an anti-quality component) of sorghum. Malting barley quality is highly controlled and has very strict standards. In the market place, malting barley is more highly valued than feed barley. Malting barley historically is produced near to malt houses, which were many in the upper Midwest; hence the demand for malting barley has tended to be small in the Great Plains. Feed barley can be hulled or hulless (also known as naked barley). Hulless barley is used in many human foods and potentially in the ethanol industry.

Like wheat, in regions where the growing season is long and there is ample spring growth potential, barley can be used for pasture or hay. Barley is well known for it lush fall growth, hence is often used as a fall pasture. Barley for pasture or dual purpose (pasture early, remove the cattle, and then harvest the grain) could be done in southern Kansas, Oklahoma, and Texas.

Barley Production:

According to the most recent USDA Agricultural Statistics 2003 (http://www.usda.gov/nass/pubs/agr03/03_ch1.pdf, verified January 17, 2004) approximately

14,000 acres of barley were planted in Kansas and Nebraska in 2002. The average yield was 39 bu/a. Barley has a test weight of 48 lbs/bu, so for comparison purposes, all yields will be reported in lbs/a. Hence the average yield for 2002 was 1850 lbs/a. As both winter and spring barley are grown in Kansas and Nebraska and spring grains tend to yield less than winter cereals, one should expect the winter barley yields to be higher than the average and the spring barley yields to be lower than the average. However, winter barley can yield much higher than the state average. For example, data from yield trails grown in Kansas and Nebraska using modern varieties are:

VARIETY	H.Date	Height	Linc.	McCook	Mead	Sidney	Colby, KS**	TWT03	Average	Rank
	after Jan.1	in	lbs/a	lbs/a	lbs/a	lbs/a	lbs/a	lbs/bu	lbs/a	
	6*	6*	6*	2*	1*	2*	6*	6*	17*	
P-954***	134.0	30.5	4471	2871	4293	2490	4162	47.4	3930	2
P-713***	133.3	32.5	4837	2989	4502	3160	4512	46.2	4288	1
Weskan	135.1	29.9	3565	2729	3188	2104	4371	45.2	3557	5
P-721***	133.9	29.5	4296	2721	3171	2644	4251	45.8	3834	3
Kanby	135.6	34.3	3673	2414	3161	2005	3687	44.4	3303	6
Perkins	135.9	32.5	4156	3021	4130	2353	3824	47.3	3692	4

* Number of years or environments used for the average

** Data from Colby, Kansas was taken by Mr. Pat Evans whose efforts are gratefully acknowledged as being invaluable for barley research.

*** Commercial feed barleys developed by the University of Nebraska and marketed through Paramount Seed Farms. Additional data on these lines can be found at: (http://www.paramountseedfarms.com/testplot.htm or http://agronomy.unl.edu/grain/rleas.htm , verified January 18, 2004).

The grain yields are twice the state averages. In addition, many well-maintained commercial fields can achieve grain yields in excess of 4800 lbs/a.

How is Winter Barley Grown:

Because barley is a small grain like wheat, oats, and triticale, much of the same equipment can be used for planting, field maintenance, and harvesting. Often a seeding rate of 60 to 90 lbs/a is used in the Great Plains. Higher seeding rates are used when there is a great concern about winterkilling or in high rainfall areas. It is best to consult your extension educator or seed producer on fertility requirements. A general rule of thumb would be to have 1.5 lbs of N available for each bu of expected grain yield. The winterhardiness of winter barley tends to be less than the most winter hardy winter wheats, but can be comparable to winter wheats developed in the southern Great Plains. The normal planting date for winter barley would be slightly ahead of winter wheat so that barley can develop a crown with excellent reserves. Barley should not be planted too early as early planting increases the risk of barley yellow dwarf virus (BYDV) infection. Barley yellow dwarf infection is transmitted by aphids, so later planting tends to decrease the number of aphids that can transmit the disease. The normal barley seeding rate (lbs/a)would be similar to higher than that used for wheat. Winter hardiness will also be increased by planting the seed in to stubble. It is highly recommended that treated barley seed be planted because barley is more susceptible to smut pathogens than wheat and the chemical costs for treatment are very effective and inexpensive. It would not be unusual to have 5 to 10% of the heads in a field that was planted using untreated seed to be infected with smut. During the winter, barley will appear to be dead in severe climates. Basically all the above ground leaves will die. If a grower is concerned about the survival of their barley crop, they can dig up a few plants, bring them into the house, keep them watered, and see if the green up. Normally in the spring, it takes barley a little longer to "green-up" than wheat if above ground plant has been killed. However, once barley does green-up, barley will grow faster than winter wheat and normally flower and be harvested before wheat. Barley is often harvested one week before winter wheat. Barley needs to be harvested on time. Its straw strength, though greatly improved over previous varieties, would be considered as slightly less than the strongest strawed wheat varieties. Barley seems to put more of its reserves into the grain than wheat, hence at maturity it has a heavy head on a thin stem. Heavy rains and wind just before harvest will lead to lodging.

Some of the Advantages and Disadvantages of Winter Barley

Barley is one of the most stress tolerant cereal grain crops. When compared to wheat, because it matures earlier, barley is generally considered as avoiding heat during grainfill and being more tolerant of drought. This drought tolerance also helps barley grow in areas with poor or saline soils. In the Old World, much of the cereal production was irrigated. With continued irrigation, many of the soils became increasingly saline. As the soils became more saline, wheat would be replaced with barley because barley was more stress tolerant.

In the Great Plains, our climate usually has most of the rainfall between September-October to June, the growing season for winter barley. As the summer gets hotter and drier (June to August), barley avoids the heat and drought. Remarkably, even the week of early maturity often give barley an advantage over winter wheat when there is a late season drought or heat stress at grain finish. This heat and drought avoidance is particularly useful in dry years like we have had in the early 2000s where summer annual feed grains (corn and sorghum) have been severely damaged by heat and drought stress.

The main potential disadvantages of winter barley would be: 1. Because the above ground part of the plant is often dead during the cold of winter, it is as susceptible as wheat to the adverse effects of "blowing". Where "blowing" is a concern, planting into stubble or being prepared to use cultural practices to reduce blowing should be considered. 2. In Nebraska with its harsher winters, winter barley is not as winter hardy as winter wheat, hence is more susceptible to winter killing. In Kansas and more southern states, winter killing is rare. Winter barley grows very quickly after green-up, hence the winter killing may not be due to "cold temperatures", but rather due to hard killing freezes when its growing point is above ground.

Diseases and Insects of Barley:

In the northern Great Plains, the main diseases of barley are barley yellow dwarf virus (BYDV), seed borne smuts, and occasionally some of the foliar blotches and rusts. Barley varieties differ in their tolerance of BYDV, hence variety selection can be very helpful is lessening the risk to this disease. The major insect pests are aphids, which transmit BYDV, and the Russian wheat aphid. Control measures include planting barley at the correct time to avoid aphid infestation and BYDV and inexpensive seed treatments, which will control smuts and if an insecticide is added, will control aphids. Grazing can also control aphids. Currently none of the winter barley varieties are resistant to the Russian wheat aphid, so the only recommended control measure is insecticide spraying when economic losses are predicted.

Barley does have some important disease resistances when compared to wheat. First, it is immune to karnal bunt. Hence any region that succumbs to karnal bunt infection, small grains producers could produce barley and market their grain. In general, barley does better in drier climates, so it tends to have much lower rust disease incidence and severity.

Barley Varieties and Improvement:

In general, barley research and development in the Great Plains has greatly been reduced in the late twentieth century. At one time, there were active winter barley breeding efforts in Texas, Kansas, Oklahoma, Nebraska, South Dakota, and Colorado. Of these, only the winter barley program at Nebraska remains. The Nebraska program remains dedicated to providing small grains producers in the Great Plains with choice. Barley is crop of worldwide importance that is an alternative crop in this region. As such, it has the benefits of a global research enterprise and market, but the disadvantage of an alternative crop market locally. Until two years ago, Texas had an active barley program and its recent releases, such as TAMBAR 501, are excellent varieties for the southern Great Plains.

As can be seen above, the modern barley varieties (P-954, P-721, and P-713) are great improvements over the historical variety Kanby and even the last release from the Kansas breeding program, Weskan (an excellent variety when it was released). Anyone interested in producing barley should first talk to their seed provider, because he or she has the best knowledge of how the line does under "field" situations. Most research plots are small, often only 4' x 8'. Similarly, usually only seed producers can comment how a commercial field should be planted, treated, and harvested. However, a few brief comments about the new lines can be made. P-954 and P-713 have excellent straw strength for a winter barley and would be equal or better than the straw strength of an average wheat. P-954, P-721, and P-713 all have much better straw strength than Kanby and Weskan. While P-954, P-721, and P-713 all have good winterhardiness, P-954 and P-713 excel in this area, thus reduce the chance for winter killing. P-721 and P-713 are more tolerant to BYDV than would be P-954. All the barley lines are susceptible to smut and Russian wheat aphid. A new experimental line worth watching is NE98919 that has excellent forage and grain yield potential. NE98919 is also beardless (awnless) which is an advantage for hay and forage because it reduces "lump jaw" in cattle.

Where Does Sunflower Fit in Dryland Rotations?

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Sunflowers have grown in the Great Plains region of the United States for at least 10,000 years. They are as well acclimated to the climate as anything that grows here. The breeding and selection process for the cultivated species began in the 1500's when Coronado found them growing here. He took seed back to Spain, where 300 years of selection for large seed size yielded plants similar to the current non-oil types. In the 1800's, sunflowers were taken to Russia, where they were grown and selected for oil content as well as confection uses. In the early 1900's cultivated sunflowers were brought from Russia to the U.S. Early accounts indicate that cultivated sunflowers were used for a silage crop in the '30's. Breeding efforts in the U.S. concentrated on shorter plant stature than the silage types to enhance lodging resistance and seed yield

These early efforts led to modern oil types with oil content similar to cotton seed, but with a more desirable balance of fatty acids and modern confection types with seed size approaching that of small peanuts. The National Sunflower Association began a directed breeding program in 1995 to develop the mid-oleic or NuSun oil type sunflower. By selecting for higher oleic fatty acid content than standard sun oil, the balance of fatty acids in the resulting seeds yielded oil did not require hydrogenation to enhance storage or cooking use life. Thus NuSun oil does not add trans-fatty acids to any food cooked or prepared with the oil. Everything now known about trans-fats indicates they are a much worse health risk than the animal fats that were replaced by hydrogenated vegetable oil. Additionally, NuSun oil has a high smoke point (450°F.) and does not transfer flavors. That's right, the french fries won't taste like fish sticks. A recent human nutrition study at Pennsylvania State University showed that NuSun oil reduced cholesterol significantly better than olive oil. Food processors would use ten times the amount of NuSun oil currently being produced if it was available. On the confection side, Sunbutter is a new product with the protein, consistency, and convenience of peanut butter, but with more vitamin E, very palatable flavor and without peanut allergens. Approximately 3 million people in the U.S. are allergic to peanuts, with the most severe cases resulting in respiratory failure in minutes. Demand for these products is steadily increasing which means that producer prices should be steady to stronger for the foreseeable future.

Sunflowers are a deep-rooted summer annual broadleaf crop. Sunflowers are quite drought tolerant due to their deep aggressive root system and the fact that they can extract more water per unit of soil than other crops. However, sunflowers can't manufacture rain, and dryland sunflower crops have failed in some locations in the recent drought years. But, even in failure, the sunflowers persisted about two to three weeks longer than other summer crops in the same area. Stated another way, sunflowers offer the best opportunity for economic return, but there are no guarantees. Many producers have the mistaken idea that sunflowers will break up a "plow pan" or compacted zone in the soil. The reason compacted soil zones are called plow pans is that they are usually created by a tillage operation when the soil is slightly too wet and tillage is required to break up the compaction.. The best position for sunflowers in a crop rotation may be different in a drought cycle compared to average or above average rainfall years. Since this area is in the fourth or fifth year of drought, the rest of this paper will assume drought conditions first.

Preparation for sunflower production begins with the preceding crop. Good weed control in the preceding crop will limit weed seed production and make control in the sunflower crop easier. Care should be taken that residual herbicide carry over from the preceding crop doesn't interfere with sunflower growth. Remember that many herbicides persist longer in drought conditions and in high pH soils and that many herbicides refer to sunflowers in the "weeds controlled" section. If there is any doubt about residual herbicides, perform a bio-assay or "can test".

As is true of other summer crops in the high plains, sunflowers benefit from no-till residue management. Since sunflowers are a low residue producing crop, it is desirable to plant them in wheat, corn or grain sorghum stubble for improved moisture conservation during the growing season and improved soil conservation during the fallow season. In the current drought, it would be advisable to have two high residue crops in the two years preceding sunflowers. Standing sunflower stubble should be sufficient for snow catch and soil protection if crop growth is near normal, but stubble from a drought related crop failure may not be sufficient by itself.

Weed control during the sunflower growing season can be accomplished by several labeled herbicides and the most cost effective combination will be dependent upon the weeds species anticipated. A listing of those herbicides can be found in the 2004 Chemical Weed Control publication from K State. One herbicide not listed there is Spartan, which has received registration approval but the label was not available at printing time. Spartan works well in no-till situations on small seeded broadleaf weeds, including ALS resistant pigweed and kochia. Spartan should be applied two to four weeks prior to planting, but may be applied two months prior to planting in drought years to allow plenty of time to receive rainfall to activate the chemical before planting. Spartan is much more active in high pH (> 7.7) or low organic matter (< 1%) soils and lowest label rates should be used.

Sunflowers can be planted as early as corn to as late as July 5th to 10th in northwestern Kansas. Sunflowers require higher soil moisture to germinate than other crops due to the dry woody hull surrounding the seed. Seed should be placed 1.5 to 3 inches deep at planting with at least one inch of moist soil above the seed to insure that winds don't dry the soil down to the seed. Wire worms and many other soil pests can reduce sunflower stands, so it is advisable to use seed insecticide. Cruiser has recently been labeled for sunflowers and is very effective against early seedling pests. Cruiser will be dealer applied and is projected to cost about $5/a. Plant populations during drought years should be about 16,000 for oil seed and 12,000 for confection. Sunflower has remarkable head size flex capacity and should be able to respond to wetter than expected conditions. However, if conditions are drier, fewer plants per acre result in less vegetative water use and possibly higher percentage of available water going to seed production. The downside to lower plant populations is that it takes longer to get canopy closure, but if good amounts of no-till residue are present and there is sufficient rainfall to activate herbicides, this should be of minimal consequence. If short stature hybrids are planted, population may be increased by 1000 to 2000 plants per acre. Inter-row cultivation is discouraged due to root pruning by cultivator shears.

Sunflower seed has about 5 lb. of nitrogen per 100 lb of seed, and this nitrogen must come from native soil fertility or added fertilizer. However in drought years, dryland sunflowers seldom respond to added fertilizer with water being the limiting factor. If the soil is nitrogen or phosphorus deficient, fertilizer is recommended. Thirty lb/a phosphorus is sufficient for season long growth. Sunflowers are not sensitive to high pH iron chlorosis, seldom respond to micronutrients, but may need potassium on eroded or sandy soils.

Sunflowers are a native plant and have native insect pests, but insect management need not be burdensome. The spotted stem weevil is a very small (1/8") insect and thus quite difficult to scout. The larvae over-winter in sunflower stalks and one generation per year of adults emerge between mid-June and early July and seek the largest sunflower plants within a few miles of the old sunflower field to lay eggs. The eggs hatch into larvae and feed up and down the interior sunflower stem, often damaging the plants' vascular system and almost always introducing Phoma stem rot into the plant. Phoma causes pre-mature death of the plant, lower seed weight, and oil content. The stem weevil makes a winter chamber in the stem cortex, which weakens the stem and leads to lodging. The insect's life cycle forces it to lay eggs shortly after emerging and thus planting after June 20 delays plant growth enough that stem weevils rarely lay eggs in these plants. If planting before June 20, one pint/a of Furdan applied by air at the 10 leaf stage has increased yields by 600 to 1200 lb/a under irrigation. Whether yield prospects justify the expense in dryland conditions is a judgment call.

The other insects of concern are sunflower moth and seed weevils. Both should be scouted for at R-4 growth stage, i.e. flower bud about three inches across and green bracts at the edge of the bud starting to pull back to reveal yellow ray flowers inside. Moth are nocturnal and scouting should occur about thirty minutes after sunset or later. Moth adults are about 5/8 inch long, grayish-white in color and cigar-shaped when at rest. Moth larvae damage about 4 seeds per larva, but the wound made by the larva is the entry point for rhizopus head rot. Rhizopus usually results in the entire head shredding and total seed loss, so the more important reason to control moth is to prevent rhizopus. Two adults per five plants is economic threshold for spraying. If a spray is needed, the plane should be in the field when 5 to 10% of flowers are showing yellow ray petals open and easily visible. Re-scout the field as soon as the pesticide label allows field re-entry to assess if a second spray will be needed. See the K State Sunflower Insect management guide for labeled pesticides and rates. If growing confection sunflowers, the red and gray seed weevil need to be controlled and usually will be controlled by the same insecticide used for moth control. The processor which has contracted the confection seeds will supply treatment recommendations for seed weevil control. Seed weevil is rarely present in high enough numbers to require treatment in oil type sunflowers.

Bloom is complete at growth stage R-6, when the yellow ray flowers start to dry up. Seed development continues up to growth stage R-9, physiological maturity, when the back of the head is lemon yellow and the green leafy bracts at the edge of the head are turning brown. At this point, the plant has put everything into the seed that it can, similar to black layer development in corn or grain sorghum. If the crop was planted early enough that defoliation is desired, R-9 is the correct time and will speed harvest by one to two weeks, unless rainfall is received shortly after defoliation. Any rainfall or supplemental water that is received during reproductive growth stages, especially near bloom, will dramatically increase yield.

Sunflowers can be harvested with almost any kind of combine platform, with necessary modifications. Cylinder speed should be slow (300 – 500 rpm), concaves should be fairly open

(1" front to ¾" back) with sieves adjusted to seed size. Sunflowers should be harvested just as soon as seed moisture content is at 10 to 12%. Delaying harvest results in more head breakage in the machine and more trash in the grain sample. The weight loss incurred in harvesting drier seed can amount to 111 lb/ton (5% vs 10% moisture). The vast majority of combine fires associated with sunflower harvest occur when seed moisture is less than 8% and relative humidity is less than 25%. Seed moisture can go from too wet to too dry in two days in the high plains. If you find yourself in these conditions, harvest at night and in the early morning when relative humidity is higher and some dew may be present on the plant, let the combine stand still from lunch until after dark. Harvesting as soon as possible will also lessen the likelihood of excessive lodging from high winds and insect damage.

Wheat is the low risk crop to follow sunflowers in dryland rotations. If there is sufficient rainfall in late summer/early fall to germinate wheat after harvest and support it through the winter, average spring precipitation should make a crop. Wheat gets about 80% of its yield potential from precipitation during the growing season. Wheat would not have to be fertilized until early spring when the producer has a better perspective of whether crop potential justifies the expense. If crop potential is not sufficient, the crop could be burnt down with herbicide in early May and treated as a cover crop. The drawback to this is that it moves insurance coverage to continuous crop versus fallow. The upside is that at the least, residue coverage will be improved, and one or two timely rains could produce a near-normal wheat crop. Remember that sunflowers remove more water from soil than other crops and moisture recharge will be critical.

If there is not sufficient soil moisture to germinate wheat immediately following sunflower harvest, grain sorghum seeded the next spring could be a relatively low risk crop sequence. The critical points to balance are: 1) dry crop residue does not persist very long in semi-arid environments, 2) no-till works best when the soil surface is entirely covered with residue; so increasing the frequency of crops increases the amount of residue, and 3) will there be enough moisture to produce an economic yield from the crop sequence. Please note crop sequence rather than individual crop. Sunflowers may decrease wheat income slightly, but the net income from the entire rotation sequence may be higher than a similar rotation without sunflowers.

Where do sunflowers fit in a dryland rotation? At least during this drought cycle, they fit after two high residue crops and before another high residue crop. The best option is probably wheat-grain sorghum-sunflowers-wheat. The next best option is probably wheat-grain sorghum-sunflowers-grain sorghum-wheat. If it is drier still the best option may be wheat-grain sorghum-sunflowers-fallow-wheat. As always, the best rotation is a blend of the producers' capabilities, the capabilities of the farm in question and the constraints of mother-nature.

Cover Your Acres Results

NITROGEN MANAGEMENT FOR NO-TILL DRYLAND CORN IN THE CENTRAL GREAT PLAINS

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ABSTRACT

Dryland corn acreage in the central Great Plains (western Kansas and Nebraska and eastern Colorado) has increased more than 1 million acres during the past decade (1991 to 2000). The majority of dryland corn is grown using no-tillage practices to optimize water conservation. However, there is limited information available on N management for no-till dryland corn. The objectives of this research are to determine the impact of N fertilizer placement and time of application on N utilization by no-till dryland corn in western Kansas. The N treatments were a factorial of applications methods, time of application, and N rates. The methods of application were surface broadcast, surface dribble, and sub-surface inject. The times of application were early pre-plant and pre-emergence after planting. The N rates were 0, 30, 60, 90, and 120 lb N/acre using 28% UAN solution. Increasing N rates increased early season growth and N uptake. Early pre-plant application of N produced greater early growth at 50% of the sites, with a trend towards greater growth at the other sites. Time of N application had little effect on N uptake. Broadcast N applications produced greater early season growth than inject N at two sites, while at the other sites there was no difference in plant growth due to application method. Placement of UAN had no consistent effect on N uptake. Dry conditions during July and August severely restricted grain yield with no significant yield differences due to N treatment at any site.

INTRODUCTION

Dryland corn acreage in the central Great Plains rapidly increased during the past decade. The majority of dryland corn is grown using no-tillage practices to optimize water conservation. However, there is limited information available on N management for no-till crop production in western Kansas, with no current information for dryland corn. Increased surface residue cover in no-till systems has been shown to impact N utilization from surface N fertilizer applications. Therefore, N fertilizer recommendations may need to be adjusted to optimize no-till dryland corn production. Injection of N fertilizer below the residue layer is one means for avoiding the problems with plant residue reducing N utilization. However, this requires a separate operation and precludes applying fluid N fertilizer with herbicides in a surface broadcast application. A one-pass application reduces application costs and labor requirements, but may also reduce N fertilizer effectiveness. The overall objectives of this project are to determine the impact of N fertilizer placement and time of application on N utilization by no-till dryland corn in western Kansas.

MATERIALS AND METHODS

Study sites were established in the spring of 2003 at five locations (data shown from four sites) in west-central and northwest Kansas. The Greeley county site is at the Tribune Unit, SWREC and the Thomas county location is at the NWREC near Colby. The other three sites are on farmer cooperator fields in Wallace, Rawlins, and Norton counties. At all sites, dryland corn was no-till planted into standing wheat stubble. The N treatments were a factorial of applications methods, time of application, and N rates with four replications at each site. The three methods of application were surface broadcast, surface dribble, and sub-surface inject. The times of application were early pre-plant (March 31 to April 3) and pre-emergence after planting (May 8 to May 27). The N rates were 0, 30, 60, 90, and 120 lb N/acre. Fluid N [28% N as UAN solution] was the N source. A coulter injection fertilizer unit was used to place the N fertilizer below the soil surface on 15" centers for the inject treatments. The dribble applications were made using the same coulter applicator operated with the coulters about 11 inches above the soil surface. A 10 ft spray boom with 4 spray tips at 30 inch spacing was mounted on the back of the coulter injection unit to apply the broadcast treatments. Plot size was 10 (4-30" rows) by 40 ft (35 ft at the Thomas County location because of space limitations).

Site selection was based on cooperator interest and residual soil N levels. Sites with the potential for yield response from N fertilizer were selected. Surface soil samples (0 to 6 in.) were taken after planting and analyzed for pH, soil test P, and organic matter content (Table 1). Residual soil inorganic N was determined for the surface 2 ft. Surface residue amounts were determined after planting. Whole plant samples at about the 6-leaf stage were collected, dried, weighed, and analyzed for N content. Dry conditions during July and August severely reduced grain production with no significant yield differences due to N treatment at any site (data not shown).

Table 1. Selected soil chemical properties and surface residue at planting at 5 sites in western Kansas.

Site	Soil (0-6") pH	Soil (0-6") OM	Soil P (0-6") Bray-1	Soil P (0-6") Olsen P	Soil P (0-6") Mehlich P	Soil N (0-24") NO_3	Soil N (0-24") NH_4	Soil N (0-24") Total	Residue at planting
		%	ppm	ppm	ppm	ppm	ppm	ppm	lb/acre
Atwood	6.5	2.3	36	36	19	3.90	4.35	8.25	3376
Colby	7.1	1.8	28	54	24	5.70	4.25	9.95	2287
Norcatur	6.7	1.9	24	22	14	1.70	4.25	5.95	4356
Sharon Springs	8.3	1.8	3	9	13	4.40	3.95	8.35	4465
Tribune	7.8	1.5	30	36	16	7.90	5.55	13.45	2940

The early preplant N applications were made in late March or early April. Corn was planted in May at all sites with N applications made shortly after planting. Hybrid selection and seeding rate were determined by the cooperator and varied among sites.

RESULTS

Early season growth of no-till dryland corn was increased 18 to 41% by increasing N rates compared to the control (Table 2). Nitrogen uptake was increased by 40 to 133% by increased N rates.

Table 2. Effect of N rate on early growth and N uptake of dryland corn in western Kansas, 2003.

N rate	Biomass Greeley	Biomass Norton	Biomass Thomas	Biomass Wallace	N uptake Greeley	N uptake Norton	N uptake Thomas	N uptake Wallace
Lb/a	lb/a	lb/a	lb/a	lb/a	lb/a	lb/a	lb/a	lb/a
0	338	636	341	131	10	12	11	3
30	349	787	374	159	11	17	14	5
60	381	795	431	183	13	20	17	6
90	369	831	427	178	13	25	17	6
120	400	894	435	182	14	28	17	6
$LSD_{0.05}$	Ns	*	*	*	*	**	*	*

Early pre-plant application of N produced greater early growth than pre-emerge applications at 50% of the sites, with a trend towards greater growth at the other sites (Table 3). Time of N application had little effect on N uptake, with only one site showing greater uptake (~13%) from early preplant application vs. at planting.

Table 3. Effect of time of application on early growth and N uptake of dryland corn in western Kansas, 2003.

Time of Application	Biomass Greeley	Biomass Norton	Biomass Thomas	Biomass Wallace	N uptake Greeley	N uptake Norton	N uptake Thomas	N uptake Wallace
	lb/a	lb/a	lb/a	lb/a	lb/a	lb/a	lb/a	lb/a
Early preplant	387	897	439	180	13	23	17	6
Pre-emerge	363	757	394	170	13	21	15	6
$LSD_{0.05}$	Ns	**	*	Ns	ns	ns	*	Ns

Broadcast N applications produced greater early season growth than inject N at two sites, while at the other sites there was no difference in plant growth due to application method (Table 4). The effect of placement on N uptake was inconsistent, with one site showing greater uptake from inject than broadcast and two sites showing better uptake from broadcast than inject. Although in all cases, the difference in N uptake between application methods was less than 20%.

Table 4. Effect of method of application on early growth and N uptake of dryland corn in western Kansas, 2003.

Method of Application	Biomass				N uptake			
	Greeley	Norton	Thomas	Wallace	Greeley	Norton	Thomas	Wallace
	----------lb/a---------				----------lb/a----------			
Broadcast	383	826	441	190	13	21	17	6
Dribble	388	786	418	181	13	21	16	6
Inject	355	868	391	156	12	25	15	5
$LSD_{0.05}$	ns	ns	*	*	ns	*	*	*

ACKNOWLEDGEMENTS

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Phosphorus Study in Grain Sorghum

Revising KSU Grain Sorghum Phosphorus and Potassium Recommendations

Dale Leikam, Kansas State University

Introduction: Soil testing is recognized as the cornerstone of profitable grain sorghum production fertility programs. Extensive and ongoing correlation research is required to determine the relationship between crop response (nutrient uptake and/or yield) with the amount of nutrient extracted by the soil test method. Likewise, ongoing research is also needed to calibrate the soil test method with the amount of supplemental crop nutrient required for optimum crop production. Current KSU grain sorghum nutrient recommendations are largely based on decades old research data. Over this time period, production systems have changed, yield levels have increased markedly and residue management systems have been adopted. Additionally, large amounts of crop nutrients have been removed in harvested crops.

Methodology: Study sites were established in spring of 2003 at six Kansas locations (Figure 1). The Decatur, Saline, Clay and Ford county sites are in farmer cooperator fields. The Ellis county location is on the Fort Hays State University (FHSU) farm and the Brown county locations are at the Powhattan Agronomy field. Phosphorus treatments are included at all locations, while potassium applications are included in the Brown county location. Phosphorus rates include 0, 20, 40, 80 and 120 lbs P2O5/A and potassium rates include 0, 40 and 120 lbs K2O/A. Randomized replications are employed at the FHSU, Decatur county, Saline county and Powhattan sites. Treatment strips across the field are used at the Ford and Clay county sites. From 4 to 16 replications were used at each site. Soil samples (0-6") were collected this spring from each individual plot in order to evaluate change in soil test level as a result of crop removal and fertilizer application. Individual treatments strips are generally 25 feet wide and, where randomized, 40 ft. long so that the same locations can be monitored in future years. All locations have been located/referenced with a GPS system.

2003 Results: The FHSU, Offerle and Saline county locations were lost to this summers drought. Grain yields were obtained at Decatur (P), Brown (2 P, K) and Clay county (P) sites – although harvest was rather late. Grain P and K concentrations are being run for the and residual soil test values will be determined for each remaining plot. All of the studies were under drought stress late in the season, which resulted in rather high levels of variability.

Grain yields were very good at the no-till Decatur county site. Interestingly, a grain yield response to applied P was obtained even though the soil test was in the mid 20's and the broadcast application was not incorporated at this no-till site.

Two side-by-side P studies were conducted near Powhattan – one with sorghum following grain sorghum and the other following soybeans. Responses to the broadcast /incorporated P applications were obtained in both studies, although only the differences in the soybean/sorghum study were significant (10% or less). If both studies were combined, the responses to applied P were highly significant. While there was a numerical positive response of grain sorghum yield to applied potassium, the differences were not statistically different.

Powhattan Grain Sorghum - P Study
(following sorghum)

P Application Rate (lbs P2O5/a)	Grain Sorghum Yield (bu/a)
0	61.4
20	63.5
40	73.7
80	71.3
120	81.2
Significance Level	0.04

Powhattan Grain Sorghum - P Study
(following soybeans)

P Application Rate (lbs P2O5/a)	Grain Sorghum Yield (bu/a)
0	66.1
20	63.5
40	70.7
80	74.4
120	76.4
Significance Level	0.43

Powhattan Grain Sorghum - P Study (combined following soybeans and grain sorghum)

P application rate (lbs P2O5/A)	Grain Sorghum Yield (bu/A)
0	63.8
20	63.6
40	72.3
80	72.9
120	78.8
Significance level (0.01)	

Decatur County Grain Sorghum - 2003

P application rate (lbs P2O5/A)	Grain Sorghum Yield (bu/A)
0	68.0
20	77.4
40	86.9
80	80.6
120	80.4
Significance level (0.07)	LSD (0.1) 9.1

Twin Row Corn and Grain Sorghum Comparison

Brian Olson, Kansas State University

Many of you may have seen a new twin row planting system developed by Great Plains in farm press magazines. The implement is a drill that has a singulation unit that is supposed to enhance the dispersion of the seed so as to allow the unit to accurately plant crops like corn. Therefore, this implement would allow a producer to buy one piece of equipment to plant both winter and summer crops. The idea is very appealing, and there may be some other benefits such as better plant spacing and quicker canopy closure.

To evaluate this in our area, large dryland field studies were conducted evaluating the twin row system from Great Plains to a 30 inch conventional planted crops planted to the same population per acre. Sponsoring companies with this project have been Hoxie Implement who supplied the twin row planter with additional sponsorship from Pioneer with corn in 2002 and DeKalb with corn and Fontanelle with grain sorghum in 2003. Even though weather conditions have been bad these past two summers, there was some useable information collected.

In 2002, the twin row system failed to plant a consistent population at two locations. Corn stands were extremely erratic with stands ranging from 8,000 to 17,500 plants/A. The desired stand was 18,000 plants/A which was achieved with a 30-inch conventional planter. These plots were not harvested due to the drought. Needless to say, everyone was disappointed, but there was a consistent thought that low seed to soil contact was to blame for the poor performance of the twin row planter.

In 2003, Hoxie Implement replaced the springs on the twin row planter with stronger ones to increase down pressure on each row unit which would hopefully translate into increased seed to soil contact. This development improved performance. The desired population was achieved for the corn and grain sorghum with an exception. When the twin row planter was traveling over a terrace there did appear to be more skips in the row when planting either corn or grain sorghum than when comparing to a row planted with a conventional planter. The twin row system also took more area to prime the singulator system to plant seeds at the desired rate than a conventional planter.

Fortunately, plots at Norcatur were able to be harvested this past summer. For corn although yields were low, there was no significant difference between corn planted on conventional 30 inch rows, 31.5 bu/A, when compared to corn planted with the twin row planter, 27.4 bu/A. The same is true for the grain sorghum. There was no difference between the twin row system at 54.6 bu/A and the conventional system at 52.3 bu/A.

The drought has impaired the evaluation of the twin row system the past two summers. However, due to the improved operation exhibited by the twin row system this past year, preliminary results would indicate this system has adequate performance for producers to consider the twin row planter for their operation. More field trials, however, will be conducted in the future to obtain more information on the performance of this system.

The below grain sorghum, sunflower, and corn results are from unreplicated plots located near Norcatur, KS. These results should be used with results from other locations for farmers to determine which hybrids are best for their operation.

Dryland Grain Sorghum Hybrid Results

K-State Multi-County Agronomist - Brian Olson

Yields adjusted to 14% moisture

Cooperator - Dennis Leichliter

Rank	Hybrid	Company	% moisture	test weight	Bu/A	% of
1	5616	Garst	12.8	60.3	87.4	144.7
2	5B89	NC+ Hybrids	11.0	61.0	79.8	132.1
3	Pulsar	Asgrow	11.2	59.9	77.6	128.5
4	TR438	Triumph Seed Company	10.2	59.5	76.2	126.2
5	DKS 36-00	DeKalb	10.7	59.1	75.1	124.4
6	5615	Fontanelle	13.2	60.6	74.0	122.5
7	AV 330	Agventure	10.0	58.6	71.1	117.6
8	Channel G567	Midwest Seed Genetics	13.1	59.6	67.6	111.9
9	3245	Fontanelle	10.5	58.5	67.4	111.6
10	Channel G530	Midwest Seed Genetics	10.5	61.8	67.1	111.0
11	5040	Fontanelle	11.2	60.1	63.1	104.5
12	Channel G462	Midwest Seed Genetics	10.5	58.0	62.4	103.4
13	7R83	NC+ Hybrids	17.2	56.4	61.9	102.5
14	Reward	Asgrow	10.5	58.4	60.9	100.8
15	9135	Garst	10.2	59.2	60.4	100.0
16	DKS 42-20	DeKalb	11.8	59.9	60.3	99.9
17	484	Croplan Genetics	12.3	59.6	59.3	98.2
18	AV 377	Agventure	10.9	60.6	57.9	95.8
19	5750	Garst	10.8	61.0	57.4	95.1
20	AV 372	Agventure	12.3	58.0	56.1	92.9
21	DKS 44-41	DeKalb	11.8	61.2	51.0	84.5
22	DGX-1738	Dyna-Gro - UAP Pueblo	12.6	60.3	50.2	83.2
23	6B50	NC+ Hybrids	12.4	60.5	42.5	70.3
24	A459	Asgrow	11.6	60.9	42.0	69.6
25	TR459	Triumph Seed Company	12.6	61.2	40.7	67.4
26	DGX-1753	Dyna-Gro - UAP Pueblo	14.3	58.9	32.0	53.0
27	DGX-1754	Dyna-Gro - UAP Pueblo	13.4	59.1	28.9	47.8
				AVG.	**60.4**	

Tester - Croplan Genetics 414 = average - 50 bu/A std. dev. - 9.2 bu/A, Plot size - 8 rows by 472 feet, harvested October 23, 2003. Site description - This was a no-till site with the previous crop having been wheat. There were a few showers at this site in July and August which allowed some hybrids to produce decent yields.

Dryland Sunflower Hybrid Results

K-State Multi-County Agronomist - Brian Olson

Yields adjusted to 10% moisture

Cooperator - Dennis Leichliter

Rank	Hybrid	Company	% moisture	test weight	lbs/A	% of avg
1	DKF EXP38-30	DeKalb	6.9	31.2	2520.3	127.5
2	902NS	Fontanelle	9.8	28.5	2491.2	126.1
3	665	Triumph Seed Company	12	28.8	2165.7	109.6
4	IS-521 (HYSUN)	NC+ Hybrids	10.3	30.1	2035.8	103.0
5	CL347	Croplan Genetics	7.3	30.8	1977.2	100.1
6	567	Triumph Seed Company	7.8	29.6	1941.3	98.2
7	521	Garst	7.5	31	1922.3	97.3
8	450	Garst	8.6	31	1674.5	84.7
9	DKF 33-33	DeKalb	7.3	32.2	1546.3	78.2
10	IS-450 (HYSUN)	NC+ Hybrids	10.9	31.4	1486.2	75.2
				AVG.	**1976.1**	

Tester - Triumph 665 avg - 1873 lbs/A, std dev. - 351 lbs/A

Plot size - 4 rows by 354 feet, harvested October 23, 2003

Site description - This was a no-till site with the previous crop having been wheat. There were a few showers at this site in July and August. Even though the sunflowers had to be replanted on July 3, the yields were excellent.

Dryland Corn Hybrid Results Yields adjusted to 15.5% moisture
K-State Multi-County Agronomist - Brian Olson Cooperator - Dennis Leichliter

Rank	Hybrid	Company	% moisture	test weight	Bu/A	% of AVG
1	4491C	NC+ Hybrids	15.8	56.2	41.6	245
2	RX 601 RR/YG	Asgrow	13.5	58.2	31.0	182
3	AV 812CB	Agventure	16.4	56.8	29.6	174
4	DKC 53-34	DeKalb	13.4	55.6	26.0	153
5	5800	Fontanelle	19.2	56.3	25.1	147
6	HC7764RR	Fontanelle	14.1	58.5	23.9	141
7	RX 718 RR/YG	Asgrow	14.9	59.8	23.0	135
8	G7716 B	Midwest Seed Genetics	16.6	57	22.5	133
9	1120BTRR	Triumph Seed	17.5	56.1	20.0	118
10	N65-M7	Syngenta - NK	16.1	58	19.0	112
11	AV 832	Agventure	16.9	57	18.3	108
12	AV 852	Agventure	17.9	56.8	18.2	107
13	5306	Fontanelle	14.2	58.1	17.3	102
14	8553RR	Garst	15.2	57.1	17.3	102
15	DG-5352RRBT	Dyna-Gro - UAP Pueblo	15.4	56.8	17.1	101
16	4992RB	NC+ Hybrids	15.6	56.7	16.9	99
17	610RR	Croplan Genetics	14.1	58.1	15.1	89
18	DG-56P24	Dyna-Gro - UAP Pueblo	13.3	57.6	14.7	87
19	8544	Garst	16.9	55.9	13.0	76
20	DKC 58-24	DeKalb	14.7	58.4	12.6	74
21	4573B	NC+ Hybrids	19.1	55.8	11.0	65
22	Channel 7704 R	Midwest Seed Genetics	15.2	57.5	9.3	55
23	8787	Garst	15.4	58.6	9.3	55
24	DKC 60-09	DeKalb	13.7	57.3	9.0	53
25	CS-6699	Circle Seed Hybrids	16.3	56.9	8.7	51
26	CS-7199RR	Circle Seed Hybrids	15.4	57.9	7.6	45
27	RX 730 RR/YG	Asgrow	16.6	56.1	7.0	41
28	Channel 8065 RB	Midwest Seed Genetics	14.9	57.3	4.6	27
29	NX6931	Syngenta - NK	.	.	3.4	20
				AVG	17.0	

Tester - Garst 8543 average bu/A - 17.9, std. dev. - 12.8
Plot size - 8 rows by 460 feet, harvested October 13, 2003
Site description - This was a no-till site with the previous crop having been wheat. Even though there were a few showers at this site in July and August, the corn did not receive enough moisture to cope with the heat. There was a lot of variability within the test with hybrids planted in or around terrace channels usually having higher yields. However, the data for the corn still has some value since some of the top hybrids from this test also did well in the test from 2002.

Site location - 2.5 miles west of Norcatur

Site information - pH - 7.3, OM - 1.6%, Nitrogen 30lbs/A, P-bray - 18 ppm, K - 529 ppm

Rainfall - 6 foot profile May 14 - May 15 - 0.45, 19 - 0.25,23 - 0.07, 31 - 0.03, June 1 - 0.55, 3 - 0.15, 7 - 0.16, 12 -1.1, 13 - 0.08, 17 - 0.42, 18 - 0.08, 19 -0.09, 23 - 0.16, 24 -0.12, 28 - 1.75, July 3 - 0.11, 7 - 0.45, 20 - 0.97, August 5 - 0.27, 7 - 1.42, 9 - 0.24 inches

Weed control - Corn and grain sorghum = Bicep Lite II Magnum - donated by Syngenta; Sunflower = Spartan - donated by FMC

CORN - 5-14-03, 1.75 inch depth, seeding 17,700 seeds/A
TWIN ROW CORN - DEKALB 58-24, PLANTED 5-22-03, 1.5 INCH DEPTH, POPULATION - 18,200 seeds/A
TWIN ROW GS - FONTANELLE 5040, PLANTED 5-22-03, 1.5 INCH DEPTH, POPULATION - 40,200 seeds/A
GRAIN SORGHUM, planted 5-27-03, 1.0 inch deep population - 40,200 seeds/A
SUNFLOWERS, planted 7-02-03, 2 inch depth, population - 18,900 seeds/A

GPS Navigation - The Good, The Better, The Unbelievable

Randy Taylor
Biological and Agricultural Engineering
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Navigation of agricultural vehicles using the global positioning system (GPS) is becoming more popular due to the increasing availability of GPS receivers and changes in farming practices. The availability of free differential correction over a wider area has increased the number of lower priced DGPS receivers. As well, the increase in reduced and no-till acres has increased the importance of crop protection application and created challenges for producers attempting to follow their desired path in the field. Crop stubble creates an environment where seeing the previous pass can be difficult and traditional markers have had limited success. Several manufacturers have introduced GPS guidance systems to address these problems and several more will enter the market soon. Systems range from those that indicate a desired path to the operator via a display of lights or image to ones that automatically steer the vehicle. Automatic steering systems for tractors and self propelled sprayers are available today and more manufacturers are starting to produce them. Furthermore we are making progress toward autonomous or operatorless vehicles for agriculture.

The Good – Operator Steered

The basic starting point for GPS navigation is some type of a light-bar or visual method of giving the operator some steering advice. These items come in many shapes and designs with varying levels of accuracy and features. Important items to consider are accuracy, flexibility or openness of the system, and features.

First of all the system must provide sufficient pass-to-pass accuracy, or precision, to provide the driver with adequate feedback. However, extremely accurate GPS systems are not required since the operator is likely to make slight steering errors anyway. Also the system must present the 'steering advice' in a manner that the operator can interpret and make the appropriate steering correction. In general, most of the systems that are currently being sold can provide a GPS signal that is more precise than most operators' can drive. Several recent studies have attempted to evaluate dynamic accuracy of current GPS technology. Though there is some variability in the results, DGPS receivers commonly used for guidance have pass-to-pass errors less than 10 inches. Some receivers have pass-to-pass errors less than 6 inches.

Probably the most important item to consider with respect to accuracy is the operator interface. Everyone has personal preferences and the system that fits one person's needs may be unacceptable to someone else. Operator feedback provided with some sort of light array seems acceptable for most operators, but probably takes a little longer to learn. The 'moving highway' type displays are probably easier to learn, but often drivers will spend too much time watching the display. Because personal preference plays such an important role in the operator interface of a guidance system, research into which system is better is not feasible.

System flexibility is an important aspect of all guidance systems. Though the initial purchase decision may be based entirely upon guidance, future uses may be much more diverse. The GPS receiver from a guidance system could be used for other functions such as yield mapping or variable rate application. The ability to easily move the components from one application to another is beneficial.

Most GPS guidance systems offer at least two path modes, straight line and contour. The most common, and simplest, feature of most guidance systems is straight line guidance. The operator drives and logs a reference pass and the parallel passes of a preset swath width are created. The operator logs the reference pass by recording an A point at the beginning of the pass and a B point at the end. Each time the operator turns, the guidance system finds a new pass and indicates a steering pattern to follow this pass. In the straight guidance mode, all subsequent passes are typically referenced to the initial A-B line. The reference pass is typically place in a location that is easily driven in a straight line. This could be along a fence line or road. Straight line guidance can be conducted in back and forth or racetrack patterns. Contour guidance is a feature of some systems. This feature allows the operator to drive a curved pass. At the end of the first pass, the guidance system creates a new pass parallel to the initial pass. Each subsequent pass is typically created parallel to the previous pass and not the initial pass.

The Better – Automatically Steered

As we start to consider automatically steered vehicles, GPS accuracy becomes more important. We now must consider the benefits of precision (good pass-to-pass accuracy) and absolute accuracy. Absolute accuracy allows you to drive the same path at a later time with little deviation. To obtain high absolute accuracy and pass-to-pass precision, you will likely need a Real-Time-Kinematic (RTK) GPS system. The RTK systems require a separate, user-owned base station to provide additional differential correction.

High quality dual frequency receivers have been introduced that have the necessary precision for auto steering. However they are typically not as accurate as RTK systems. The pass-to-pass precision is sufficient, but they may not be able to return to the same exact spot at some point in the future. With continued advances in GPS technology, we will see improved pass-to-pass precision and absolute accuracy without the need for a separate base station.

The multiple patterns and paths that are available for user steered GPS guidance systems are typically not available to automatically steered systems. The influence of vehicle roll has been a problem for auto steer systems when receivers are mounted on the top of cabs. The rapid lateral movement of the GPS receiver leads to erroneous information for the steering system. However the inclusion of inertial sensors has helped alleviate this problem for RTK and DGPS auto steer systems.

The Unbelievable – Autonomous Vehicles

It may seem like some space age dream, but realistically autonomous vehicles are on the horizon. In fact, with some agricultural vehicles the components necessary for autonomous operation are already in place. All we need is the control system. Naturally the first component is an automatic steering system. As previously described, these systems are currently available and improving. Tractors are being marketed that are capable of memorizing a series of control commands and repeating them with one touch. Integrating this with position information from DGPS and control command prescription map makes the task no more challenging than variable rate application that is currently being implemented. The marketplace will ultimately determine when they become available.

No-till Wheat
Farmer Panel Discussion

Eugene Ziegler, Dennis Leichliter, Stan Miller, local farmers

Eugene Ziegler - Eugene farms 1500 acres around Grainfield, KS. He has been no-tilling wheat for 12 years with no fallow crop. The rotation is two years wheat, two years feed grains (corn or milo), and one year sunflower. The acreage split is approximately 40% wheat, 40% feed grains, and 20% sunflowers. He currently uses a homemade 15 foot drill and is building a 20 foot drill for 2004. Eugene always puts phosphorous down with the seed at planting. (785-673-4670)

Dennis Leichliter - Dennis farms 2000 acres around Clayton, KS. He has been no-tilling wheat for 13 years and no-tilling is summer crops for 20 years. Dennis does not chemical fallow any ground except for two rented quarters. His crop rotation is two years wheat, one year corn, one year soybeans. He currently is using a 30 foot Flex King air seeder with Accra plant openers and puts down a starter with the seed at planting. Dennis also does all of his own spraying and routinely will run cattle on crop residue over the winter. (785-693-4481)

Stan Miller - Stan farms 4500 acres around Norcatur, KS. He has been no-tilling wheat for 8 years and no-tilling his summer crops for 23 years. His crop rotation consists of no chemical fallow; instead, there is a crop rotation of wheat, corn, and soybeans. Stan currently is using a 45 foot Crustbuster no-till drill, and he puts down fertilizer with a homemade fertilizer machine on 15 inch centers. In addition, Stan does all of his own spraying and routinely will run cattle on crop residue over the winter.. (785-693-4561)

Do's

-Plant a minimum of 90 lbs of seed/A
-Planting should be done in a timely manner after the summer crop has been harvested.
-Band fertilizer below ground
- Plant cleaned seed
-Plant wheat into weed free field

Dont's

- Don't get to excited over a few weeds in a field, but get the weeds sprayed before they go to seed
- Don't skimp on chemical when spraying for weeds or applying fertilizer

Good wheat varieties to use - Jagger, Thunderbolt, Millenium, Stanton

Poor wheat varieties would be those that are short, or wheats that are slow to green-up in the spring as the ground usually stays cooler longer in no-till.

STRIP TILL/RO-TILL
Stacie Cochran – Servi-Tech

ADVANTAGES

1. REDUCED LABOR, FUEL AND MACHINE HOURS. PLANT AND PICK!! (EXAMPLE: FARMED 3500 ACRES AND USED TWO LESS TANKER LOADS OF FUEL THAN TYPICALLY TOOK TO FARM 2500 ACRES AND CULTIVATED)

2. MORE TIME TO GRAZE CATTLE WHILE PASTURES GREEN UP. CAN CHASE CATTLE OFF WITH PLANTER, LITERALLY.

3. MAINTAINS MAXIMUM RESIDUE ON SURFACE TO LIMIT WIND AND WATER EROSION.

4. ENHANCES WATER INFILTRATION IN ROW AND BETWEEN

5. WATER MOVES TO THE ROW INSTEAD OF TO FURROW IN INTER-ROW RIPPED SCENARIOS.

6. SEEDLINGS BENEFIT FROM PROTECTION OF STANDING RESIDUE FROM PREVIOUS CROP.

7. MULCH/RESIDUE/FLUFF BETWEEN ROWS SEEMS TO INHIBIT WEED ESTABLISHMENT AND WEED SEED IS REMOVED FROM ROW BY ROW CLEANERS.

8. TILLAGE IS COMPLETED AND NEVER RUN OVER WITH EQUIPMENT RIGHT IN ROOT ZONE.

9. SAVES MOISTURE LOST IN TRADITIONAL TILLAGE OPERATIONS. ½" PER OPERATION? 3-4 PASSES EQUALS 1.5-2". MULCH ALSO HELPS HOLD MOISTURE AND REDUCE EVAPORATION OFF SOIL SURFACE.

10. WILL ALWAYS PLANT IN A MELLOW MOIST SEED BED WITH EXCELLENT SEED PLACEMENT AND SEED TO SOIL CONTACT. NO CLODS OR DRY SOIL IN SEED SLICE!!

11. WILL HAVE SOME TWO YEAR OLD RESIDUE ON SOIL SURFACE AT PLANTING. HAVE NOTICED BLACK/CHARCOAL LIKE HUMUS MATERIAL IN SOIL THAT I HAVE NEVER SEEN IN CONVENTIONAL TILL SYSTEMS.

DISADVANTAGES

1. SLOWS PLANTING PROCESS

2. HEAVY AWKWARD MACHINE.

3. CAN HAVE SIDEWALL COMPACTION IN WET CONDITIONS AND HEAVIER SOILS. REDUCE DOWN PRESSURE; CONVERT DEPTH GAUGE WHEELS TO CASE-IH, FINGER CLOSING WHEELS MAY HELP AS WELL.

4. WILL REQUIRE SCRAPERS ON DEPTH GAUGE AND CLOSING WHEELS.

5. SOME RISK OF LOSING SEEDS DOWN SLOT IF HEAVY RAINS OCCUR PRIOR TO SUBSTANTIAL ROOTING. HAVE NEVER SEEN A REDUCED STAND ONLY A SEED HERE AND THERE.

6. APPEARANCE IS NOT AS NEAT AS CONVENTIONAL TILL BUT WILL GET ATTENTION FROM 4-5 LEAF ON!

7. HAVE HAD DIFFICULTY WITH TRUE-V FERTILIZER OPENERS PUSHING AND DIGGING A TRENCH IN LOOSE WET SOIL. HAVE RUN ONE DISC OR CONVERTED TO A COULTER INJECTION TYPE OPENER.

8. STALKS WILL BE HARD ON GREEN TRACTOR TIRES AND PUSH CHAINS OFF OF ROW UNITS. NEED A SEASONED SET OF TIRES ON TRACTOR AND A SHIELD ON UNDERSIDE OF PLANTER TO PROTECT DRIVES.

9. POST-EMERGE SPRAYING IS MORE CHALLENGING AS SPRAYER WILL SEEK RIPPER SLOT. HAVE NOTICED AN ADVANTAGE TO HARDI OVER BESTWAY PULL TYPES IN HOW WELL THEY FOLLOW THE TRACTOR. WILL SLOW CUSTOM ROW CROP RIG DOWN AS WELL.

10. NEIGHBORS WILL GIVE YOU A HARD TIME EVEN AFTER THEY SEE IT WORK.

11. ALL THE SKILLS DEVELOPED PACKING WHEEL BEARINGS, CHANGING CHISEL POINTS, FINISHER SWEEPS, AND SERVICING TRACTORS ARE NOT AS USEFUL AS THEY WERE ONCE.

NOTES TO KEEP IN MIND

MAY COMPLICATE NITROGEN APPLICATION

WILL HAVE POTENTIALLY ONE MORE APPLICATION THAN USUAL

CHEMICAL BILL WILL OFFSET EQUIPMENT COST SAVINGS

STILL SAVED THE TIME

AGRONOMICS MAKE SENSE

CONSERVATION AND WATER EFFICIENCE A HUGE PLUS, ESPECIALLY IN LIMITED WATER OR ALLOCATED SCENARIOS.

LOGISTICS FOR INTENSIVE LIVESTOCK OPERATIONS ATTRACTIVE

HAVE INTERSEEDED RYE/TRITICALE AERIALLY IN AUG/SEPT FOR A GREEN CONSTITUENT IN LATE STALK GRAZING. WORKS WELL IF DONE 3-5 IRRIGATIONS PRIOR TO FINAL. RUN MORE FREQUENT LIGHTER IRRIGATIONS TO GERMINATE SEED ON SURFACE OF SOIL.

Strip Tillage 'Watchouts'

John Mick, Pioneer

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Watchout #1:
Poor Seed Bed

•Do not leave a rough seed bed after stripping.

–Expecting moisture to correct it can be a big mistake. ***Control the controllable***.

–Rigs differ significantly in their ability to leave a good strip planting zone.

•Rolling basket vs. wavy coulter. Mole knife vs. other, etc.

–"An inch of rain makes everyone look like a good farmer."

•Pre-watering is highly suggested when strip is left rough, cloddy.

•Fall stripping is much better than spring because it leaves time for weather to correct your mistakes.

•Running on old rows, between old rows, at angle to old rows.

–Splitting old rows is best from a seed bed perspective.

Watchout #2:
Fertilizer Injury

•High Potential exists to burn seed and seedling roots.

•NH_3 rate, application depth, timing, strip closure, knife selection, moisture, soil type / pH all impact this.

Watchout #3:
Dried Out Seed Bed

•***Control the controllable***; Equipment and adjustment.

–Knife choice can leave strip rough, open to air movement and drying out; Mole knife vs. other designs.

–Closure mechanism can leave soil loose and prone to drying out; rolling basket vs. wavy coulters.

–Stripping on dryland can be risky when winter remains dry.

Watchout #4:
Managing Residue

•Shredding stalks increases wear on tires, esp. when spitting row.

•Don't leave long / tall stalks in the field after harvest.

•Don't flatten out stalks with wide tires Pull type strip till rigs generally will have better clearance than 3 point.

We've Got You Covered.....From Start to Finish

We're Your No-Till Farming Headquarters!!

SPRAYERS...Self-Propelled and Pull-Type

- Case IH SPX3200 Self-Propelled
- Bestway Pull-Type Sprayer
- Schaben Pull-Type Sprayer
- Wylie Pull-Type sprayer

Case IH Tractors...... Get The Job Done!!

Rated #1 in University of Nebraska Tractor Tests

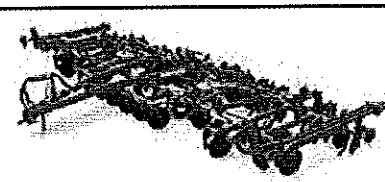
- **Magnum's** **160 hp—285 hp.**
- **STX 4WD** **275 hp—500 hp.**

- **Case IH**
- **Kinze**
- **Sunflower**
- **Great Plains**
- **Crustbuster**

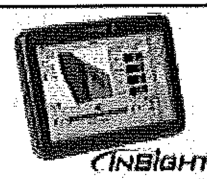
No-Till Planters & Drills for depth control in planting, and a uniform stand

- **DMI**
- **Quinstar**
- **Orthman**
- **Yetter**

Precision Fertilizer Placement In No-Till Fields



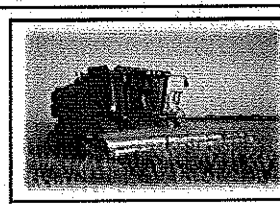
Easy to Operate And Reliable



Cost Effective Precision Farming System

And The Most Important Step..

Harvest every bushel with a Case IH Axial Flow Combine and leave your field ready for next year with a Shelbourne Stripper Header



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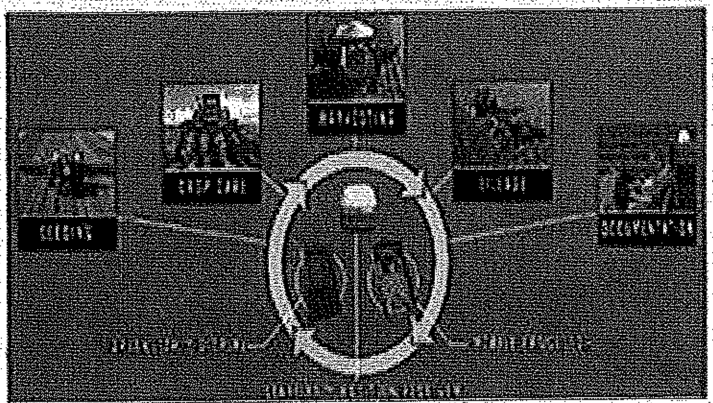
Southwest Implement Inc.

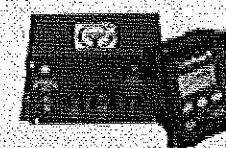
Your GPS Headquarters for All Brands of Machines



- GreenStar Common Components (StarFire Receiver, Mobile Processor, Display
- Field Doc. (Harvest Doc, Sprayer Doc., Field Doc. Air Cart, *Field Doc Connect*, Field Doc Planter w/SeedStar, Map Base Seeding)
  Note; *Connect* works with Raven, Rawson, New Leader and Dickjohn
- Parallel/Curve trac Guidance
- Auto-Trac, Automatic Steering
- Terrain Compensation Module (TCM)
- JD-Office Software w/AgLeader & Quick-Books Pro plugins
- JDLink (Fleet Management)
- 3 Tiered Customer Support (Dealer, DTAC, AMS Support)
- Differential Correction Signal Choice's (WAAS, SF1, SF2, RTK) Pricing Package Options; 3-6-12-24 or 36 month

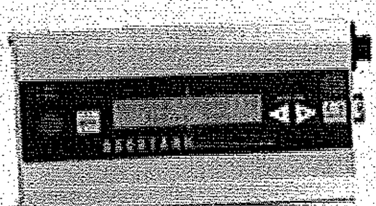
Ag Management Solutions

Inexpensive Auto-Steering



Smucker/Satloc Auto-Steering for Most Brands Of Equipment (Case-Ford-Agco-Deere), Works with Parallel & Curve Lines.

THE CHAUFFEUR



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