CONSERVATION CROPPING SYSTEMS PROJECT

9th ANNUAL REPORT
2010

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Kelly Cooper Farm Manager

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PROJECT DESCRIPTION

The Conservation Cropping Systems Project (CCSP) is located on a 130-acre tract of farm land two miles south of Forman, ND along Highway 32. A 14 member Board of Directors composed of local producers in northeastern South Dakota and southeastern North Dakota advises the CCSP staff. Diverse crops are grown in 16 rotations that range from one to six years under no-till, strip till, shank and disk drill cropping systems. A total of 172 60x220 foot plots and several irregular shaped “bulk area” plots ranging from 1/10 acre to 8 acres are used for planting. Rotations are demonstrated to look at their effect on water and wind erosion, soil tilth, soil moisture retention, organic matter changes, and profitability. Each crop within a rotation is grown every year and replicated three

times. Other practices and demonstrations done include variety trials, livestock waste applications, carbon sequestration studies, weed control experiments, livestock grazing, saline cover crop and saline alfalfa trials, biological strip till, radish rooting depth, and equipment demos to name a few.

The project provides producers data and physical observations that allows them to see advantages and disadvantages of a range of crop rotations in no-till and conservation crop production. The effective use of crop rotations to break weed, disease, and insect cycles is demonstrated. The placement of legumes in rotations reduces dependence on fertilizer N. Recent work by Dr. Dave Franzen of NDSU has shown that long term no-till requires 50 lbs less nitrogen fertilizer to grow the same crop as conventional tillage. Dr. Franzen feels the increased amount of biology and organic matter in no-till effectively grabs the applied nitrogen and holds it much more efficiently than in conventional tillage. In other words, leaching and volatilization losses may be considerably less.

This project is a living classroom to demonstrate that agriculture can produce food, fuel and fiber in an environmentally favorable manner, preserving and enhancing soil, wildlife habitat and water quality, while providing producers with competitive to superior economic returns.

PROJECT PURPOSE

Our goal is to demonstrate profitable farming methods, machinery, and philosophies that promote soil and water conservation.

PROJECT SPONSORS

The Conservation Cropping System Project is funded through the sponsorship of governmental, corporate and private parties. The Wild Rice Soil Conservation District is the principle cooperating agency, supplying office space, facilities and administration of the project. Other cooperating agencies are the Natural Resources Conservation Service (NRCS), North Dakota State University (NDSU), South Dakota State University (SDSU). Sponsorship is either as a cash donation, in-kind or both. There are four levels of sponsorship: Platinum ($10,000 or greater), gold ($5,000 - $9,999), silver ($2,500 - $4,999) and bronze ($500 - $2,499). We wish to thank our sponsors listed on the next page for their support! Without them this project would not exist.

2010 PROJECT SPONSORS

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Special Thanks

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Walt Albus

Figure 1. 2010 overhead view of the Conservation Cropping Systems Project.

CROP ROTATIONS AT CCSP

Six crops are present in rotations: HRSW, HRWW, corn, soybean, alfalfa and flax. Switch grass, was seeded in bulk area 1 in 2007 and was the 7th crop to be grown on the farm. We want to look at switch grass as a possible energy crop that could be planted on existing CRP acres or any land coming out of CRP. The idea being that switch grass would offer wildlife and erosion control benefits without sacrificing the opportunity to participate in commodity markets. Cover crops were added in 2008. These can include a whole host of traditional and non-traditional crops that work to pull up and stabilize nutrients, manage salinity, and improve soil health. Three seeding techniques: disk drill, shank drill and strip till, are being studied within the HRSW-HRWW-corn-soybean rotation. New in 2010 was the planting of corn into what we are calling “bio-strip till”. Radish and peas were planted in rows in the fall of 2009 and then corn was planted directly into the radish rows in 2010 with very positive yield results. Another cover crop strategy we started investigating this year was interplanting cover crops into 30

inch corn rows in early season. Additional crops are added and subtracted as deemed desirable. Key considerations of rotations are their profitability, weed/insect control, moisture use or savings, and something we could call farm synergy. Rotations do a wonderful job of giving a farmer built-in opportunities to manage weed and insect resistance, spread manure, pick rocks, graze livestock, add recreational activities such as hunting, plant cover crops and so forth.

CCSP Rotation Key	
spring wheat/winter wheat/corn/soybeans - disk drill	A
spring wheat/winter wheat-st/corn/soybeans - shank drill	B
spring wheat/winter wheat-st/corn/soybeans	C
spring wheat-st/corn/soybeans	D
spring wheat/soybeans	E
corn/soybeans-st	F
spring wheat-st/corn/soybeans/corn/soybeans	G
continues corn since 2006-st	H6
continues corn since 2008-st	H8
spring wheat/winter wheat/flax-st/corn-st/corn/soybeans	I
winter wheat/soybeans/corn-st/corn/flax	J
winter wheat-bio-strip-cc/corn/soybeans	KH
spring wheat/winter wheat-st/corn-st/corn/soybeans/soybeans	***L***
spring wheat/winter wheat/soybeans/corn-st/corn/soybeans	M
spring wheat/winter wheat/alfalfa/alfalfa/corn/soybeans	N
corn/cover crop	**O**

note-st denotes strip till operation, cc-denotes cover crop

Figure 2. Crop rotations at the Cropping Systems Project at Forman, ND, 2010.

Each plot is 60 feet by 220 feet. Each crop within the rotation sequence is present each year. Each rotation sequence has 3 replications. For example in rotation F, corn is replicated three times as Fc1, Fc2 and Fc3.

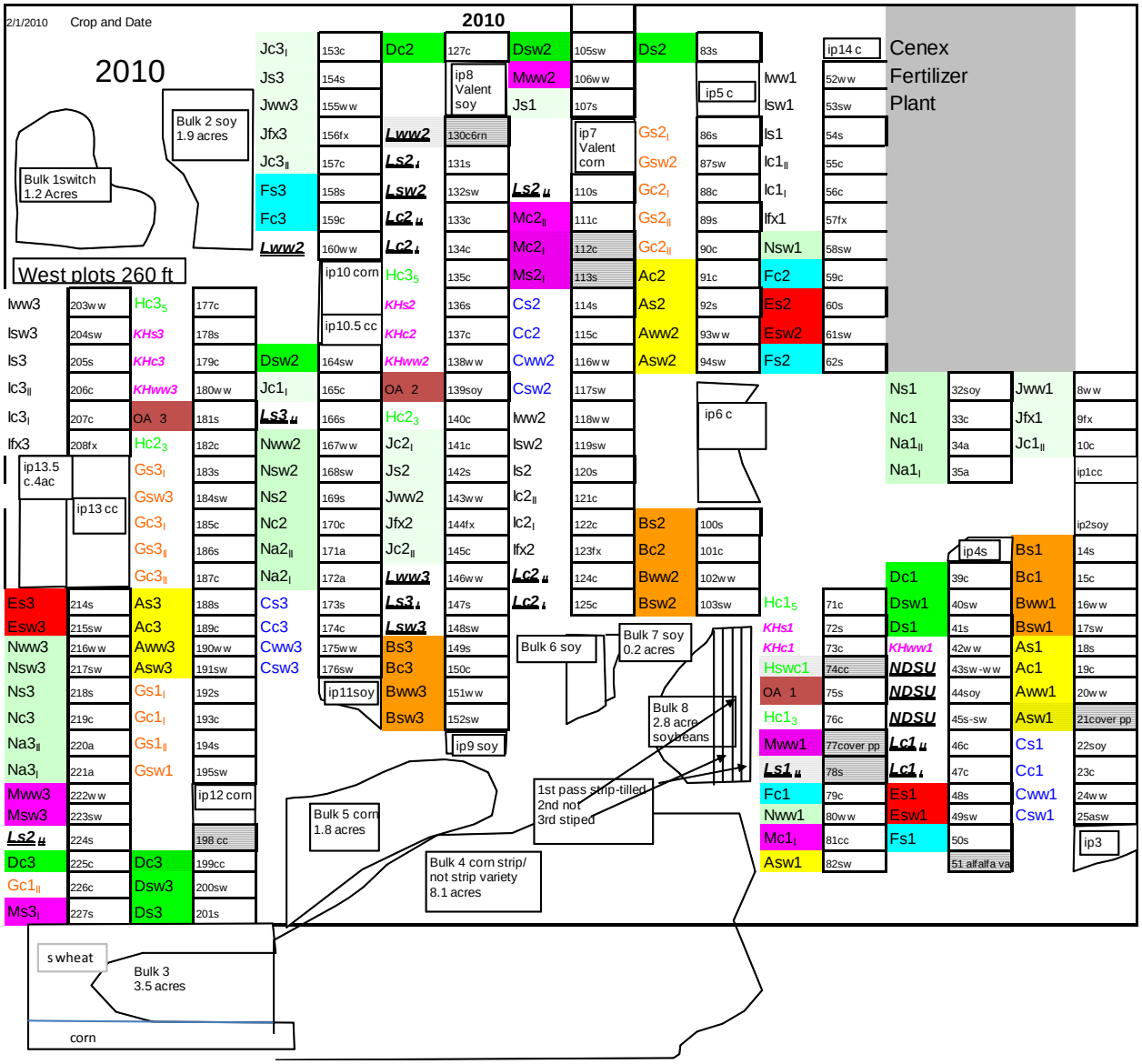

Figure 3. Plot map of rotations and their location in 2010.

Local Weather

In 2010 the weather did not become boring. Fall 2009 went late. The ground was so wet that I wanted a little frost to help with strip tilling and had to wait until the 1rst of December. Winter brought a uniform first snow which with the warm soil allowed many annual crops to survive until spring. A deep snow pack gave way to one of the most unusual thaws I have ever seen. Starting the first of March, temperatures moderated. From March 8-16, low temps did not fall below 32. In fact only 4 days in March had high temperatures below freezing. The combination of late fall, uniform snow and moderate spring temps kept many plants alive into spring such a volunteer spring wheat and cover crops that usually are killed out by cold temperatures. We had hopes the cold wet period might be behind us. April brought even nicer temperatures with little precipitation. The fall rains and heavy snows resulted in many flooded areas. Areas not flooded rapidly dried out and wheat and corn were planted by some area farmers in early to mid April. Late April and early May brought a temporary setback with rain and cold temperatures. Temperatures rebounded and monthly averages were above normal until September. May, July and September brought us above normal precipitation. See Figure 4 below. September put us right back to being "too wet" again. Growing degree days were slightly above normal this year with corn and beans maturing earlier than average, see Figure 5 below. Again the CCSP farm missed any significant hail and wind storms in 2010.

Calender year 2010 Weather

	Temperature (f)			Precipitation (in)		
	64 Yr	2010		64 Yr	2010	
Month	Mean	Mean	deviation	Mean	Total	deviation
January	7.6	9.0	1.4	0.50	0.74	0.24
February	11.9	10.0	-1.9	0.50	0.97	0.47
March	26.0	34.0	8.0	0.80	1.14	0.34
April	44.0	51.0	7.0	2.01	1.17	-0.84
May	55.7	57.0	1.3	2.95	3.81	0.86
June	65.0	67.0	2.0	3.60	2.81	-0.79
July	70.1	71.0	0.9	2.88	5.39	2.51
August	68.2	72.0	3.8	2.75	2.16	-0.59
Septembe	59.5	57.0	-2.5	2.07	6.79	4.72
October	46.0	49.0	3.0	1.35	1.93	0.58
November	28.6	29.0	0.4	0.60	0.30	-0.30
December	15.3	10.0	-5.3	0.60	1.27	0.67
mean total	41.5	43.0	1.5	20.61	28.48	7.87

note:Temps are from Oakes ndawn, growing season precip is CCSP farm
Non growing season precip from local NOAA coop observer se of Forman

Figure 4. Growing season temperature and precipitation 2010

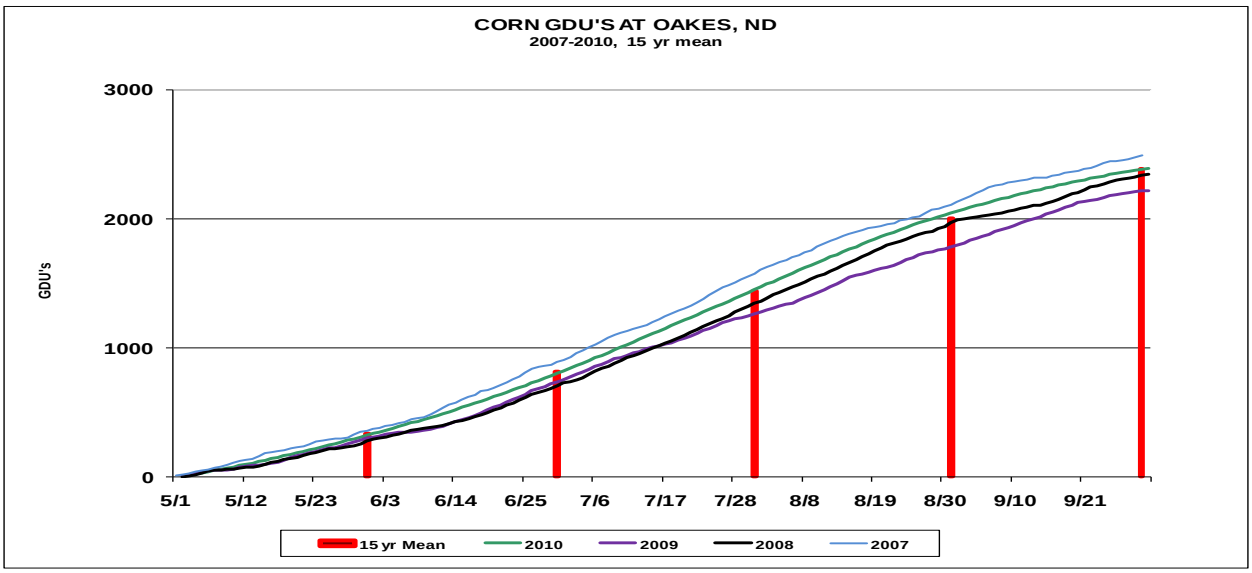

Figure 5. Growing degree units accumulated for corn at Forman, ND, 2387 in 2010 May 1- Sept 30 and the 15-yr mean of 2345.

AGRONOMIC PRACTICES AND YIELD

A detailed outline of agronomic practices used is listed in Figure 6.

Wheat: WestBred "Matlock" HRWW was planted September 25-28, 2009 with a John Deere (JD) 1560 single disk drill in the 3 disk drill plots (Rotation "A"), the 20 ft Amity twin disc drill in the 3 plots of the "N" rotation, and the balance of the plots seeded with a 10-foot Concord air drill with triple shot Anderson seed boots at a 10-inch spacing. Brick spring wheat was planted with the JD 1560 drill, Amity twin disc and the Concord drill on April 11, 2010. Starter fertilizer at a rate of 78 lb/ac of 11-55-0 was placed with the winter wheat seed in all non alfalfa winter wheat plots. The N rotation was seeded with the Amity drill and 120 lbs 11-55-0 was deep banded for alfalfa. Fertilizer nitrogen applications of 28-0-0 were applied with stream bars to HRWW on April 21, 75 lbs as N, and 60 lbs N again on May 9. A total application of 142 lbs N as 28-0-0 with stream bars was applied to HRSW with 70 lbs applied 4/21 and 72 lbs 5/9. Winter wheat was harvested on July 26 and spring wheat on August 5.

Flax: Yellow flax was planted with the John Deere 1560 on April 22. Flax received a post application of 50 lbs/ac Nitrogen as 28-0-0. Callisto was applied on April 24 and Select Max on July 5.

Corn: Main variety planted was Croplan 2924 VT3. Syngenta N23K 3000GT was used for the long term continuous/nematode corn plots. Variety, strip till, corn on

corn, and corn nematode seed treatments were addressed. The rotation plot corn was planted April 28-May 5. The bulk areas and strip till/variety trial was done May 20-21. All corn planted at setting of 32,097. Fertilizer at planting was 139 lbs nitrogen and 48 lbs phosphorus including 5 gallons 10-34 infurrow. The corn on corn received 50 lbs extra nitrogen with a streambar application. The variety and strip till trial was planted 5/20/2010. Strip tilling was done on slightly frozen ground to the appropriate plots on December 1-2, 2009. Strip tilling on the variety trial was done in the spring prior to planting.

Soybeans: Pioneer 90M92 and 90M02 were planted May 28 at 180K population with 10 gallons 10-34-0 side-banded. The early maturing 90M01 soybeans were planted in the KH rotation where winter wheat is seeded in the fall.

Alfalfa: Dairyland Hybriforce-400 alfalfa was planted August 4, 2008 @20 lbs / acre. On 1rst year plots Dairyland Magnum Force V was planted August 11, 2009 @ 20 lbs.

Crop	Planting Date	Harvest Date	Planting Rate	Chemical	Rate	Date
Alfalfa 2nd Yr	**8/4/2008**	**June**	**20#**	**RU/24D/ (kill out)**	**32 oz+1.5pts**	**10/21/10**
Dairyland HybriForce 400		**July**		**Chataeu**	**4 oz**	**09/17/09**
Alfalfa(establish)	**8/11/2009**		**20#**	**Select Max**	**12 oz+NIS**	**08/30/09**
Dairyland Magnum V wet						
	Planting	**Harvest**				
HRSW	**4/11/2010**	**8/5/2010**	**120#**			
Brick				**RU-44/24D1.5/Valor3**		**11/17/09**
				Husky	**11 oz**	**05/17/10**
				Puma	**10.6 oz**	**05/17/10**
				Headline	**6 oz**	**05/17/10**
				Interlock	**4 oz**	**05/17/10**
				Prosario + NIS	**6.5 oz**	**06/19/10**
				Round Up Ultra Max	**22 oz**	**07/24/10**
	Planting	**Harvest**				
HRWW	**9/25-28/09**	**7/26/2010**	**120#**	**Husky**	**11 oz**	**05/17/10**
Westbred				**Puma**	**10.6 oz**	**05/17/10**
Matlock				**Headline**	**6 oz**	**05/17/10**
on Spr wht Flax and				**Interlock**	**4 oz**	**05/17/10**
Soybean				**Prosario + NIS**	**6.5 oz**	**06/19/10**
				Round Up Ultra Max	**22 oz**	**07/17/10**
	Planting	**Harvest**				
Corn	**4/28-5/6/2010**	**10/14-10/21**	**32,000**	**Roundup Ultra Max II**	**32 oz**	**05/31/10**
Croplan 2924				**Laudis**	**3 oz**	**05/31/10**
				Atrazine	**1/2 lb**	**05/31/10**
Syngenta N23K 3000	**long term corn plots**			**Interlock**	**6 oz**	**05/31/10**
				Destiny	**1qt/100**	**05/31/10**
				ams	**10lbs/100**	**05/31/10**
				Roundup Ultra Max II	**32 oz**	**06/28/10**
Strip tilling done 11/30-12/1/2009 on frozen ground				**Interlock**	**4 oz**	**06/28/10**
				Preference	**1 pint**	**06/28/10**
	Planting	**Harvest**				
Soybean	**5/28/2010**	**10/6/2010**	**180,000**	**32 ozRU+1.0 24-d+2oz valor**		**5/18/2010**
Pioneer 90M92				**Roundup Ultra Max II**	**32 oz**	**06/29/10**
Pioneer 90M02 on plots to be ww						
	Planting	**Harvest**				
Flax	**4/22/2010**	**8/21/2010**	**80#**	**Callisto**	**6 oz**	**04/24/10**
				Select Max	**16 oz**	**07/05/10**
				Roundup Ultra Max II	**32 oz**	**8/17/2010**

Fertilizer

Corn received 139 lbs nitrogen at planting, 2nd year corn had extra 50 lbs stream barred
All plot received 48.5 lbs P., 28.8 lbs sidedress, 19.7 lbs infurrow , both as 10-34 and 1 pint zinc chelate
Avipel powder was added to seed for bird protection

Winter Wheat at planting 78 lbs 11-52-0, 2 spring stream bar apps, 1rst 75 lbs 4/21, 2nd at 60 lbs 5/9.
Spring Wheat at planting 142 lbs 11-52-0, 2 stream bar app one at 1rst 70 lbs. 5/6.2nd at 72 lbs

Soybeans 10 gallons 10-34-0

Flax 50 lbs n stream bar

Figure 6. Crop Inputs and timing.

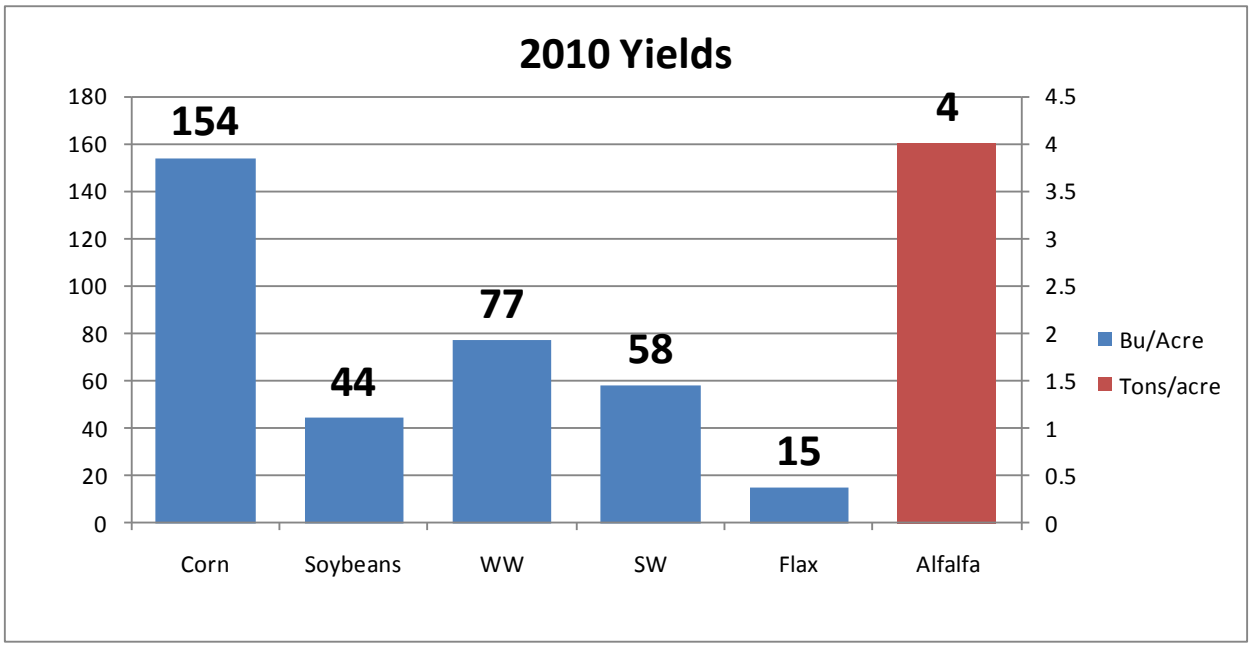

Figure 7. Crop yield averaged across all rotations at the Conservation Cropping Systems Project in 2010.

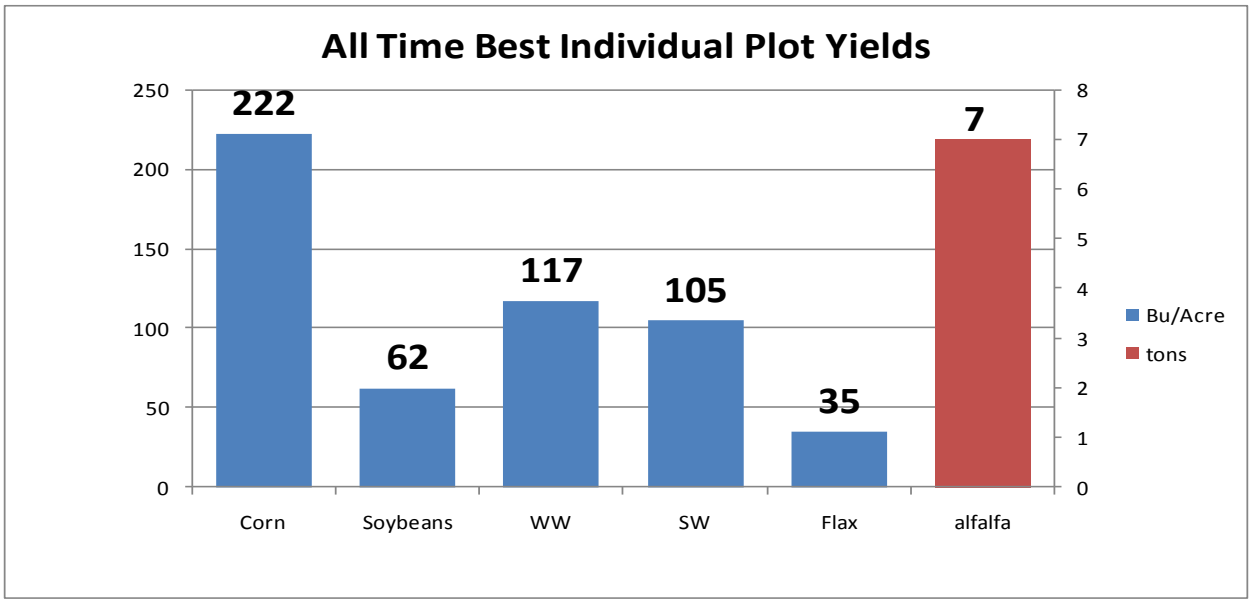

Figure 8. Best individual plot yields to date.

Crop observations

For rotation key see figure 2 on page 6.

Wheat

Matlock winter wheat, a WestBred variety, was planted on all plots. All plots except the KH rotation were planted September 25-28. The KH rotation was set up to look at planting winter wheat following early maturing soybeans. The KH rotation plots were planted September 30, immediately after combing the soybeans. Matlock is a very new variety, just receiving a name this year. We had previously planted this variety on the soybean plots and it has shown good winter hardiness. Some winter kill did occur 2 years ago. The fall of 2009 was warm, which pushed us to delay winter wheat seeding to avoid wheat curl mites that would still be active on green corn. October turned wet and cold which resulted in very little growth. Going into freeze up the plants only made it to 1 to 2 leaves. With the continuous wetness of October, the plant health was reduced. The best yielding rotations were KH and J, where winter wheat was planted on soybeans and flax ground respectively. A heavy blanket of snow which fell on warm ground extended throughout the winter. An unusually rapid transition from cold winter to moderate spring without cold setbacks resulted in no winter kill. In fact, spring wheat that emerged after fall pre-plant Roundup applications survived unscathed. Scab incidence varied from plot to plot but no significant amounts were reported in the samples. It seems that most years the scab affected kernels are light and just blow out of the combine which reduce yield but are not an influence to quality. Yellow headed blackbirds continue to be a problem as the wheat enters soft dough at the same time the young blackbirds are first leaving their nests. We will work with some bird repellants rates to see if this problem can be reduced.

New in 2010 was the addition of the NDSU winter wheat and spring wheat variety trials. Extension Agronomist, Joel Ransom, and his crew, evaluated 19 HRSW and 19 HRWW varieties with and without a foliar fungicide regimen. The fungicide program consisted of a half rate of Stratego at the 4 leaf stage followed by a full rate of Prosaro at early flower. The winter wheat varieties as a group averaged an 18% yield response to the fungicide treatments whereas the spring wheats as a group were only benefited by an average response of 6.5%. The average yield for the fungicide-treated HRSW varieties was 45.9 bu/A. The average yield for the fungicide-treated HRWW varieties was 57.5 bu/A (a 25% yield advantage over the spring wheat varieties).

Another NDSU project at the CCSP farm involves Dr. Larry Cihacek and one of his grad students. Dr. Cihacek has begun the evaluation of several of the crop rotations with regard to their effects on soil quality and greenhouse gas emissions.

Brick spring wheat was planted April 11, 2011. As I have observed before, getting across notill ground that was previously soybeans harvested with a good and properly adjusted residue spreading system is no problem even in very wet conditions. This year

however I may have pushed things a little too far. Dual tracks were clearly evident for quite some time after the crop emerged. Weed control with Husky/Puma did a good job in both the winter and spring wheat. An early season application of Headline along with an early anthesis application of Prosaro provided good control of foliar diseases and reduced head scab severity.

Yields of winter wheat were rather exceptional in the flax and soybean plots, J and KH rotations respectively, were 94 and 92 bushels. These yields are often achieved in winter wheat in moderately good years. It may be a testament to the new varieties that both winter and spring wheat did so well this year with all the late moisture.

Flax

This year I did not do so well with the flax. Planting was done on April 22. The wet weather in early May apparently caused much of the seed to rot especially in the wheat stubble requiring reseeding in 2 of them. The flax planted in corn plots were somewhat better but yields were poor. Even the reseeded crop was poor. Yields were in the 15 bushel range. Weed control with a fall application of valor and the 6 oz of Callisto held until the end of June. An application of Select Max was used for control of late grasses. For next year I need to look at seed treatment options which I would hope would help in a wet spring.

Corn

Corn planting could have started as early as the 2nd week in April this year. Soil temperatures rose quickly with the nice weather and many people did start. I have heard mixed reports on the success of the early planting. For the most part I think it worked. When it comes to seed ”cold shock”, the most critical time is when the kernel is taking on moisture. During this period it is important to have soil temps above 50 degrees and we did have that for quite a long time in April. During the normal best time to plant corn, the first week in May, conditions were not so great. Night time temps got below freezing and day time temps were below 50. Some corn planted during this time period did suffer some ill effects including seed rot, slow germination. Some corn planted at this time did perfectly well. It is common to hear the experts say you have to wait for good conditions to plant corn. In this part of the county that might mean waiting until June, so we have to pick our challenges. At CCSP I started planting April 28. Then the weather turned colder and wetter. I had the most problems with emergence in the expected places such as flat areas and dips that held water.

I also suspect the corn suffered for lack of nitrogen at times, even though there was not a lot of yellowing. The N rotation where corn is planted into alfalfa ground did very well, as it always does on a wet year. We continue to ponder this and wonder if we can get similar results with proper cover crops. What is the magic of alfalfa? The slow release nitrogen certainly could have been of benefit this year. The decaying deep roots of alfalfa could be allowing the corn roots to follow and pickup nutrients. In looking at Figures 10,11, and 12 you can see for the past three years alfalfa is the best in 2009

and 2010 which were wet, and 2008 was poor when in season rain was short. Contrast that with the corn planted into wheat which was best in 2008 and poor in the wet years.

Our experiment with bio-strip till was intriguing and looks promising. I go into detail about that in the cover crop section of this report. We continue to look at mechanical strip till and corn varieties. This year showed a positive response to strip till. See figures 13 and 14. With such variations in weather, one must always qualify results of any trial in reference to the possibilities of other likely weather scenarios. This year the strip till trial was planted into warm soil May 20. Rapid germination and emergence ensued as opposed to 2009 when cold wet conditions prevailed. The results of the trials showed corresponding differences with much less response to strip till in 2010 than 2009. However, varietal responses vary. In 2010 we had one variety showing over a 14 bushel response with another showing a yield reduction. Seeding directly into wheat stubble did not fare well this year. It must be noted the strip till trial was planted after the cold period in May, and the rotation plots were planted before the cold period. The bio strip plots were planted early and did quite well, and did not have any mechanical disturbance save the action of the 7200 planter seeding the radish.

Soybeans

Soybean planting went well again this year. Pioneer 90M92 was seeded in the majority of the plots with Pioneer 90M02 seeded in the early harvest plots. The early harvest plots were taken of with a straight head so there was considerable loss. Our focus at this point is to see how winter wheat will work on the soybean ground and without having our own flex head we use our straight head to get the beans off as soon as possible. All seed was treated and inoculated. As with all other soybeans in the area, growth was slow and color did not look good until after the first of July. The above normal precipitation in May quickly saturated the soil in spite of the nice April. This seems to confirm the old saying about soybeans and wet feet. The beans did turn around and yields were in the low to mid 40s. No-till and rotation seems to suppress white mold as we have not had any incidence of it. Aphids did not become a significant factor but were present in low numbers. We have noticed that strip tilling for soybean improves growth on headlands or other areas where increased traffic has compact the soil. Bigger soybean plants don’t always mean bigger yields.

Alfalfa

2010 was a good year for alfalfa with the abundant rain and moderate temperatures. Planting into wheat stubble in the fall continues work very well resulting in great stands. Alfalfa weevil has become a persistent problem will need some attention on the plots. In reading through extension information it looks as if treatment with insecticides, resistant varieties, and biological controls offers ways to deal with the pest.

I am particularly interested in alfalfa for its ability to root deep and use up water as long as we are dealing with excess moisture which I will discuss in the cover crop section.

Cover Crops

Bio-Strip Till

Bio-strip till 10/2/2009

We found the bio-strip till to be a pleasant surprise as we got into those plots with the combine. The summary of these plots are as follows. Bio-strip till was added in the KH rotation where we are planting soybeans followed by winter wheat followed by corn. The focus on this rotation is planting winter wheat following soybean as we feel this is an opportunity to introduce winter cereals into the predominant corn soybean rotation in the area. Winter wheat's benefits would be several including planting in the fall thereby reducing spring workloads, utilizing more moisture in fall and early spring, nesting habitat, yield advantage over spring wheat, and earlier combining. The late fall growth and early spring green up would especially help manage salinity if a winter cereal were flown on standing corn in early September or late August. The challenge to planting after soybeans would be winter hardiness. We feel that planting a cover crop after any winter wheat crop is essential to use up moisture in what appears to be a new normal of having excess soil moisture.

The idea of bio strip till would be that you would concentrate the cover crop in rows where corn would be planted the following year. Theories and idea are many. What we did was to plant radish in 30 inch rows in 2009 following the winter wheat where the corn would be planted in 2010. We also planted peas in between the radish rows also on 30 in centers. Both cover crops were seeded with our 7200 John Deere row crop planter using Kinze brush meters. The radishes were planted heavy and developed a thick stand. Large roots did not develop as expected with planting high population in

rows. The peas germinated well and grew nicely. The corn was planted into the radish rows easily in the spring of 2010. The radishes had completely decomposed by planting time. Some of the pea plants did remain but did not interfere with planting. The ground was a little firmer from the increased traffic of the cover crop planting but planting and germination was fine. The yield results proved positive. Of 53 plots of corn planted the bio strip till plots ranked 5th, 6th and 42nd. See figure 9. The low yielding plot had water ponding and stand loss.

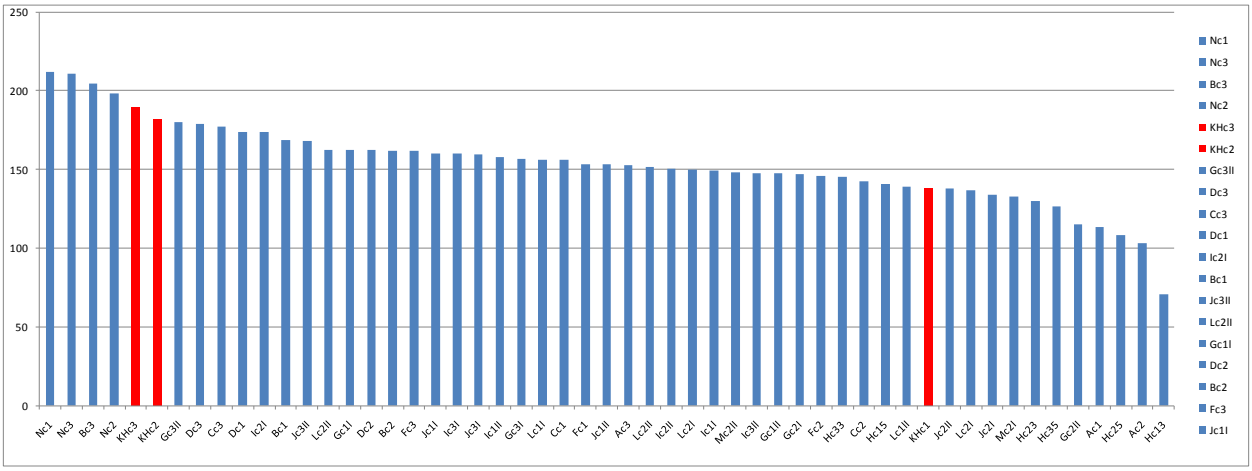

Figure 9. Bio-Strip Till plots ranking of 53 corn plots.

We planted cover crops in various other scenarios including prevent plant, saline areas, interplant in corn, grazing, and following wheat. Potential salt tolerant alfalfa varieties were evaluated by Dairyland Seed with some promising results. Alfalfa has many advantages for preventing salinity since it uses a lot of water. The main disadvantage of using alfalfa is that it does not tolerate standing water. In a managed grazing system, a deep rooted full season crop like alfalfa has the capability to use 30 inches of water a year. This would be almost 10 inches more than corn or soybeans would use. If our excess precipitation keeps occurring, systems that use more moisture will need to be utilized if other means of removing water cannot be used.

At our field day this year we dug the soil pit where radishes were planted July 17, 2009. The rooting depth was observed to go at least 40 inches, which we found rather amazing. We have planted various cocktail mixes in different landscapes on the CCSP farm. With so many different species and combinations it is difficult say which mix would be best in any one given situation. Cover crops such as radish look to be excellent for using up excess moisture, rapid establishment, high nitrogen to carbon ratio, and nutrient capture. Permanent cover crops may be an option in marginal areas around wetlands that are subject to salinity. Next year we hope to try planting a cool season crop such as peas into our established warm season switch grass plot. This may be an option where you are having wet soil problems, and have been denied prevent plant.

We carried out a small but interesting trial of grazing one of our salt tolerant cover crop plots in the “mob grazing” protocol. We had to cut the trial short since it was started late and cold weather set in but it showed that we could do it on our site. Care is required when turning animals into crop species that are not routinely grazed. With all commodities at or near record highs much value could be extracted from wet or prevent plant acres if we could plant cover crops and background graze. Currently one must wait until November 1 to hay or graze, but the last few years have had late falls so this could be a viable option. In summary my suggestions when considering cover crops based on the last two years of observations are as follows.

-They need to be seeded properly. Broadcast without incorporating did not produce a desirable stand. Only the small seeded species grew adequately.
-Be thinking about weeds and herbicides. Always spray prior to seeding. If the area you want to plant cover crops in has weed problems, plan a kill down spray late in the fall. Consider your goals for the cover crop and when the weeds will have to be killed. For instance if you want to kill volunteer grains, Selectmax or like products could be used that would not hurt most broadleaf cover crops.
-Plan a herbicide that will not carry over into the cover crop in the preceding crop.
-Get rapid establishment for best results and weed suppression. Take advantage of approaching weather systems.
-Consider application of nitrogen fertilizer or mixes with legumes. We saw improved growth and more frost tolerance with adding nitrogen on radishes, rape, and turnips. Legumes planted after wheat may need nitrogen as well as residual n levels can be very low after large yields
-Earlier seeding is better. In 2009, a cold year, late planted cover crops did not get good growth. In our northern climate time will always be short.
-Salinity management is not as simple as planting salt tolerant crops. Many salt tolerant crops do poorly as seedlings and just never really get going in adverse conditions. Timing is important. If possible pick a time to seed after the soil has dried some and then some light rain. The idea is to get some downward movement of salt out of the germination zone. This will give you a better chance of getting the plant through the critical germination and seedling stage. After that, many plants can grow.
-Bio-strip till looks promising. We will continue to experiment with this and report results.
-Excellent grazing potential exists. Be careful what you plant is safe and palatable to the animals you graze or feed. I have been told that cattle do not like purple flowers of some pea varieties.
-Peas must be planted deep (2-3 inches) to get good growth. If peas are put into a mix that is seeded shallow you will get you some peas but I suspect the percent of success if looking at only the peas would be low. We need to verify this. At present I feel much better about utilizing a planter or drill with capabilities of seeding at multiple depths such as seeding peas with the fertilizer banders.

Rotation effects Charts

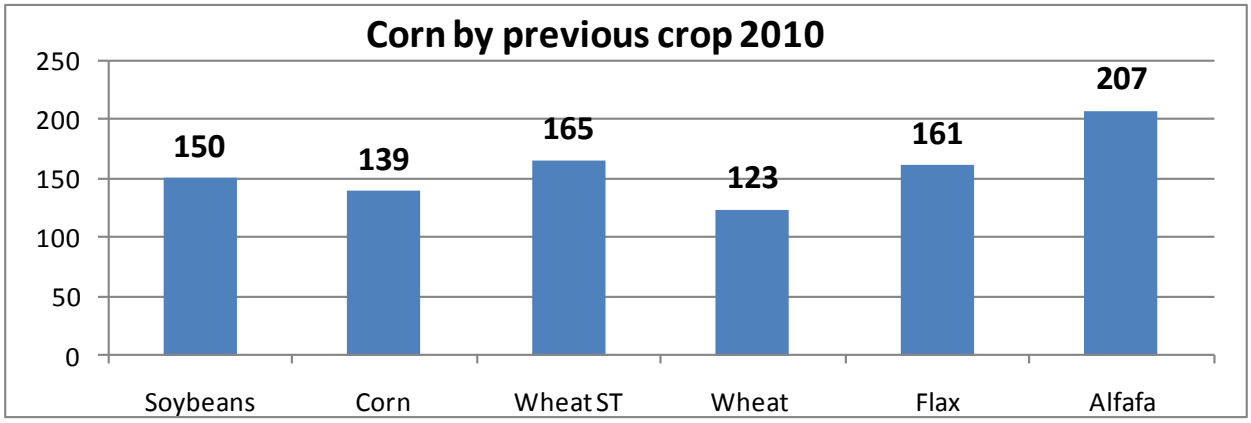

Figure 10.

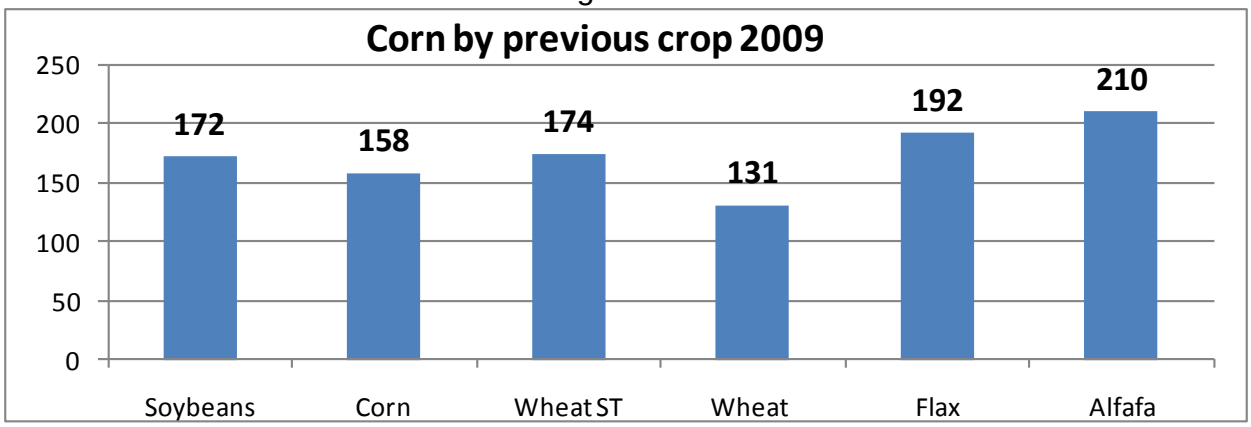

Figure 11.

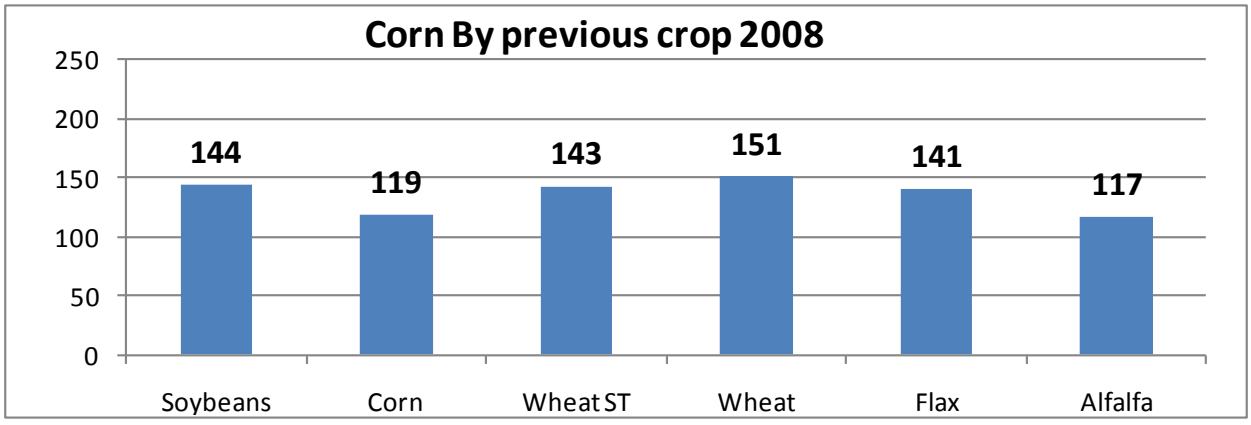

Figure 12.

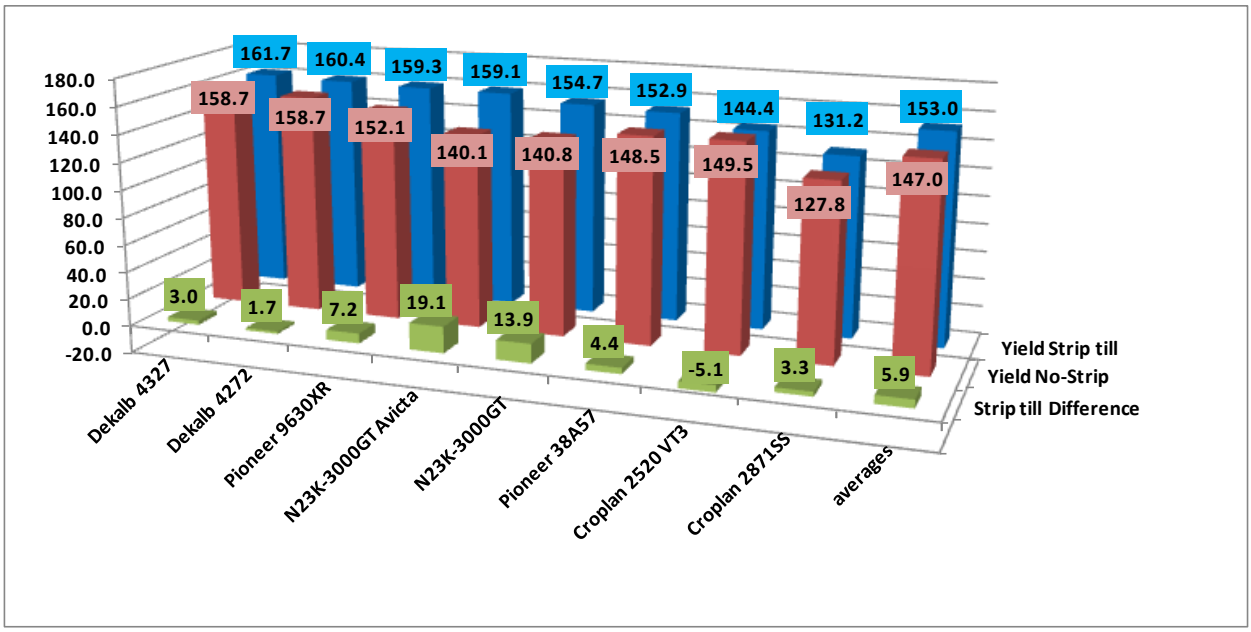

Figure 13. 2010 Strip till and Variety
Previous crop was soybeans

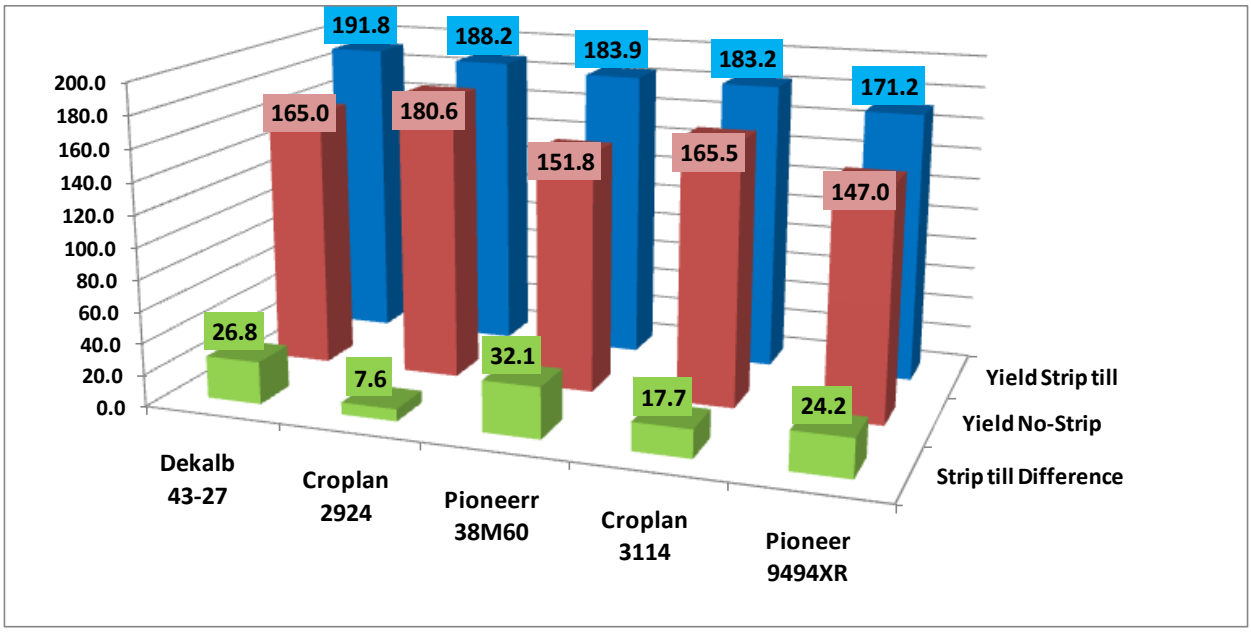

Figure 14. 2009 Strip Till and Variety
Previous crop was soybeans

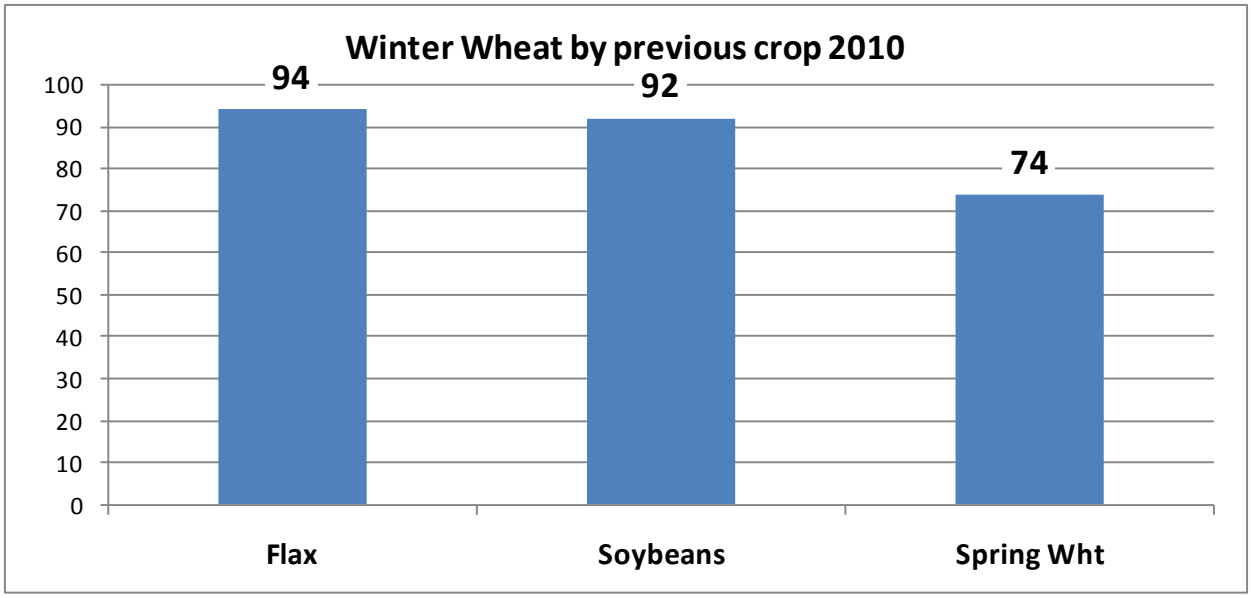

Figure 15.

A copy of all our annual reports, more detailed yield graphs and tables, periodic crop updates and comments can be found on our website, www.notillfarm.org.

Education

Our goal at CCSP is to promote conservation practices that are economically feasible for producers to utilize. Our main field day was held on July 15, 2010 with a crowd of around 175 people attending. “Farm Talk with Mick Kjar” was broadcast live from the tour where many of the board members, guests and members of the CCSP staff were able to visit live on the radio about their interests in conservation farming. During the tour we had John Lundgren, Brookings ARS give an in-field presentation on predatory insects and their role in keeping the bad guys out of your field. Jeff Hemenway, South Dakota NRCS state agronomist brought a rainfall simulator to demonstrate and discuss the effect of residue on preventing soil erosion and also showing how tillage reduces water infiltration and increases runoff. Seeing was believing as we watched how rain soaked through the non-tilled ground and ran off the tilled ground. Dry soil was observed after the simulated rain just fractions of an inch below the worked soil surface after a simulated 2 inch rainfall. Joel Ransom discussed the NDSU spring wheat and winter wheat variety trials which are a new addition to the farm this year. Lee Briese and Peder Gulleson showed off our interplant cover crops in corn and talked about cover crops and soil salinity. A great meal was served afterward. This fall we sponsored a cover crop tour that went through the cover

crops at the CCSP farm and we also toured some local farmer's cover crop planting. Later this fall we once again had the opportunity to host the Wahpeton Science school ag production class for a tour of the plots with some special work done in our corn plots. We take the yields of the corn plots, combining 6 of the 24 rows in each plot. With test results in hand we take the student through the plots and look at the remaining corn and talk about what difference we see. So far this winter 5 CCSP based PowerPoint talks have been presented by myself and Steve Dvorak, Ducks Unlimited Field Agronomist, covering subjects from cover crops, soybeans in rotations, farming wet ground, and no-till in general.

Impromptu small tours with sponsors, producers, or any interested group are always welcome. We look forward to the open exchange of ideas. Our next field day is scheduled for Thursday July 14, 2011.

Students looking at corn plots this fall.

Final comments from the Farm Manager.

Sponsors keep this project going so I want to thank all who have given their time, money, equipment, products, and talents in an effort to keep soil productive and available to feed a future world.

After working with these plots for several years, I am starting to draw some conclusions. We all know that when we think we have all the answers, the questions all get changed. I know that any of us over 50 years old are starting to sound like a broken record about it getting dry again like it used to be, but I have just decided we have to plan for more of

the same as far as heavy rains and just learn to deal with it. In looking through weather records the last 10 years, I was surprised to see that in spite of what it looks like driving down the road at all the big bodies of water, we are not receiving much more rain that in theory we could use up. Since I have many years of experience managing irrigation, I decided to look at water use rates of corn, soybeans and alfalfa to see how they compare to rainfall amounts. We all know the rainfall amounts can vary from neighbor to neighbor, but overall it appears that we are in a range of 18- 30 inches for the last decade. Under ideal conditions, soybeans and corn would use 18 and 20 inches respectively on average years. Alfalfa however could possibly use close to 30 in a managed grazing system. If alfalfa is cut water use declines until growth has recovered so water use under a haying system would be in the lower 20s.

The point is that if we could use up more moisture we could in some cases prevent water table build up. The problem is if we get excess precipitation EVERY year, and if much of it comes as snow melt or large events which goes directly to the water table or slough we need either deep rooted crops that are drown out resistant, or tile drainage. On the other side of this is prevent plant. I don't have any direct measurements, but I can assure you that water use in "a work it twice spray with round up" would in most cases be less than 10 inches. What really makes this bad is 1 inch of rain raises water tables anywhere from 5 to 10 inches. Trying filling a water glass with soil and try dumping a glass full of water into it and see how much goes in. Think about how prevent plant ground is already wet in the first place. If you kill the vegetation on it, things get bad really fast if it keeps raining. I haven't talked about salinity yet either, which comes along for the ride, literally. If the only way water can come out of the soil is to rise to the surface, it leaves the salts behind at the soil surface where the water evaporates. It is just a nasty cycle. I don't think one can emphasize enough how important using cover crops is on this land, and getting them planted as early as possible. Moisture use drops dramatically in late summer. When running irrigators we always said that after mid-August, you could pretty much take life easy. Instead of running irrigators continuously as we always did in July when it did not rain, we could easily keep up with one pass a week the end of August because nights start getting longer. Having something green with good roots in July will take up to 3 tenths of an inch of moisture a day when days are long and temps are in the 90's.

As I write this, markets, although very high, are jittery with recent world events. Will commodities stay high, or will they as they have always done before, drop down to substantially lower levels. I know there is a lot of good farmland in the world that is not developed. Getting proper infrastructure in these areas will take huge sums of money and political stability. Only 7% of the earth's surface is suitable for growing crops, but that is only part of feeding a hungry world. Modern efficient agriculture will be put to the test because the increase in the world's population is not slowing down. Oxcarts and bicycles that have provided transportation systems in many of the third world countries are rapidly being replaced with western technologies. Farmland that is not serviced by modern infrastructure will be of little value in servicing large population centers. Even though market prices are high, production cost are high as well. Efficiency and long

term stability of agriculture systems will be of highest priority in any successful cultural system. Soil and water resources must be maintained to prevent collapse.

Every year as I go to the winter meetings, I wonder what new challenge we will have to deal with. I have noticed that over the years we very seldom get rid of problems, but just seem to keep accumulating new ones and have to maintain and develop strategies to deal with them. Back in the early 80's I recall a noted entomologist chewing out a fellow consultant friend of mine out for making a recommendation to spray for corn borers. The entomologist told my friend in no uncertain term that corn borers are not a problem in North Dakota and did not for see that they ever would be. In a period of a few days that same entomologist was on the radio proclaiming the invasion of corn borers into the state and that farmers needed to check their fields. 30 years latter we might think that corn borers are gone as a result of Bt corn. My late planted sweet corn that I did not spray had nearly a 100% infestation rate. Corn borers have only been controlled, not eradicated, and threaten to return as soon as they develop resistance to Bt. Other things on the horizon include glyphosate resistance, soybean cyst nematode, (if you don't have it already), and ug99 rust on wheat. So far, mankind has stayed ahead of impending catastrophe, but not without the tireless effort of many people who work in the trenches, who never get the recognition they deserve.

All in all, we do live in a wonderful place in a great time. Working together we have solved many problems and will solve many more. It really is a blessing to have a little more water than we need. We just need to work out plans to get it through the system a little more efficiently and orderly. If we can make more of it go up in the air, that's even better. We have a huge coal and oil supply close to home, wind power, fertile soil, lot's of space to work and play and a world that needs our products. You could not ask for much more.

Tour stop at 2010 summer field day.