

❖ Dakota Dirt ❖

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A newsletter from the Soil Testing Laboratory at SDSU
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Lab Notes

We hope everyone's harvest has gone well and safely. It has been a good fall for harvest and soil sampling. There has been much interest in carryover nitrogen, especially in the drought areas (see article). There is no "average" that everyone can use. We see a range of carryover N in the drought areas as well as in the better yielding areas. That is why we test because we can't predict all the processes that happen with soils, plants and weather that influence soil N.

The other major happening in the last few months is the increase in corn prices. This has generated a tremendous interest in planting more corn and the questions of corn following corn. There has been a lot of work comparing different rotations especially under tillage. There has not been as much work under long term no-till with a continuous corn rotation. As the old saying goes "Manage your residue or it will manage you" (see the corn on corn article).

Rainfall has just been enough in August and September to get much of the winter wheat germinated. Since that time it has been extremely dry. Although many people may not like it, we really do need a good snowy winter. This would help not only winter crops, but provide needed soil moisture and runoff for dugouts, ponds, dams, and lakes. It has been awhile since we had to fight the white drifts of winter. Also we need something for Santa's Sleigh!

Merry Christmas and have a very good New Year ! From your Soil Testing Lab.

Prepared by Keri Skroch, Chris Morris, Carolyn Hoffmann, Lisa Ulvestad, Ron Gelderman

Timing of Nitrogen for Spring Wheat

The South Dakota Wheat Commission sponsored a nitrogen timing study on no-till wheat. Because of the drought only three spring wheat sites were harvested and two of these sites were very stressed (Table 1). However there was a yield increase to N at all three sites. The yields for the early spring application stand out for Gettysburg

Table 1. Influence of N source and N application time on spring wheat yields in South Dakota, 2006

Time of N application (50 lb N/a)	—Bath—			—Gettysburg—			—Cresbard—		
	AN ¹	Urea	mean	AN	Urea	mean	AN	Urea	mean
	— bu/a —			— bu/a —			— bu/a —		
Late Fall	39	37	38	18	16	17	22	18*	20
Early Spring	25	19*	22	18	12*	15	16	17	17
Planting	38	33	35	19	18	18	16	18	17
5th leaf	41	41	41	14	14	14	18	14*	16
LSD _{.05}	4.0			2.5			6.2		
Snow on ground at Early Spring	Yes			Yes			No		

¹ AN = ammonium nitrate

* = Significant difference between N source within a timing.

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and Bath. Both N sources at Gettysburg and the urea source at Bath had lower yields than other timings. Both of these sites had 2 - 4 inches of snow cover when the N was applied. These results confirm earlier findings that show inferior results when N is applied to snow covered fields. A similar winter wheat site at Gettysburg (data not shown) also had significant snow cover. However there was no yield depression at this site. The winter wheat sites followed small grain whereas the spring wheat sites followed sunflower. Perhaps the amount or type of residue has an influence here. Seven more sites have been established this fall and N timings will again be studied.

Prepared by Ron Gelderman

Corn on Corn

This is a topic on many producers minds. The immediate economics are driving the thoughts for more corn acres. Producers are asking can we do this? What problems may arise? What about residue, soil compaction, fertility, insects, disease, weed control, etc ? We will try to address the questions on soil fertility and residue/soil issues. Since residue is a large part of the equation and tillage practices control residue to a large amount we need to address both tilled and no-till systems.

Some possible consequences with continuous corn compared to corn after beans may include more residue, lower soil temperatures, wetter soil at planting, soil compaction, later planting, reduced stand, allelopathy, increased nutrient needs, more disease, more insects, and more nematodes. That is quite a list. Many of these possible problems have to do with the residue and the amount of residue. Most studies have shown that corn after soybean will yield more than a continuous corn rotation. The amount of yield decrease due to the cont. corn rotation is dependent on tillage. A long term study from Purdue (Table 2) shows that the % yield decrease for the cont. corn from the corn/soybeans was 5, 7, and 15 for plow, chisel and no-till, respectively. It is assumed that the physical covering of the residue was responsible for lessening some of the problems mentioned above.

The effect of rotation and residue is also seen in Table 3. Average yields (over all N rates) of continuous corn is 27 bu/a less than the corn after soybean on this tilled study. However when the corn

Table 2. Rotation and tillage influence on corn yield, 1975-2003, Indiana¹.

Tillage	Corn/soy	Cont. Corn
corn yield, bu/a		
Moldboard	176	168
Chisel Plow	177	164
No-till	172	146

¹ Purdue Univ.

Table 3. Influence of N rate and rotation on corn yields, Beresford, SD, 2006.

N rate	Corn/soy.	Cont. corn	Cont. corn - residue baled
lb/a	bu/a		
0	96	73	53
30	96	96	73
60	119	101	93
90	122	104	92
120	112	105	95
150	134	105	108
180	128	115	108
mean	115	89	100

residue was baled the previous fall, continuous corn yield was only 15 bu/a less than the corn following soybean. Most of the residue was removed with the baling of the plant material from these studies.

There are larger differences (corn after soybeans compared to continuous corn) when environmental stresses (lower yields) are present (Table 4). Other studies indicate that when moisture stress is present,

Table 4. Corn yield Response to Rotation and Environment, U of M, Waseca , 4 year study.

Corn after Corn	Corn after Beans	difference
corn yield, bu/a		
110	142	32
120	137	17
140	164	24
155	180	25
165	177	12
180	185	5
200	205	5

200 lb N/a applied

cont. corn yields are proportionately much lower than corn after soybeans than if moisture conditions are good. Therefore root growth is assumed to be less with cont. corn compared to corn after soybean.

Nitrogen. Nitrogen need for corn after soybean generally averages about 40 lbs/a less than corn after corn. However this is when beginning nitrate-N carryover is the same for both rotations. This is usually not the case. Long term nitrate-N summary data from SDSU show 44 lb/a of nitrate-N in 2 feet after soybean vs. 80 lb/a carryover after corn. Therefore corn after corn will typically have more carryover N credit than corn after soybean. Actual N recommendations for corn in the two rotations often average very close to one another. Growers thinking of corn after corn need to be sampling to two feet to determine carryover nitrate-N.

Phosphorus. The need for P in a cont. corn rotation is slightly higher than for a corn/soybean rotation - assuming 150 bu/a corn and 50 bu/a soybean. With higher residue levels and in theory wetter/cooler soils with corn on corn rotations, a starter containing at least 15 to 20 lb/a P₂O₅ may be advantageous in many springs, especially for increasing early growth.

Other nutrient needs should not be substantially different from one rotation to another. However, corn response to added K at soil tests below 150 ppm is much greater than that for soybean. Therefore total K applications on cont. corn rotations will be higher than corn/soybean rotations with relatively lower K soil tests. Follow soil test guidelines.

Prepared by Jim Gerwing and Ron Gelderman

Drought and Nutrient needs for 2007

As our nitrate-N summary for fall of 2006 indicates (Table 5), significant carryover N is present in areas of South Dakota. These were the areas where rainfall was low, crop N uptake and soil N mineralization was low, resulting in relatively high carryover. This carryover is not as high as past average statewide nitrate-N levels such as following the 2002 drought (Table 6). However the average in 2006 is 18 and 12 lb/a higher than the 10 year average following corn and wheat, respectively.

We see statewide there are a number of fields that will need significant N applications (Table 7).

Table 5. Nitrate-N Soil Tests Following Different Crops in Areas of SD, SDSU Soil Testing Lab, Fall 2006

Crop	State	Part of State				WR
	Avg.	NE	SE	NC	SC	
		———— lb/a in 2 ft ————				
Corn	98	100	78	134	89	109
Wheat	78	56	81	101	91	130

Table 6. Previous Crop Influence on Fall Nitrate Soil Test, SDSU

Year	Corn	Sp. Wheat
	———— lb/a, 2 feet ————	
1997	60	69
1998	50	62
1999	62	50
2000	75	59
2001	70	53
2002	107	110
2003	105	75
2004	81	47
2005	87	53
2006	98	78
Average	80	66

Table 7. NO₃-N Soil Tests, SDSU Soil Testing Lab, Fall 2006

Crop	Avg Test	Soil test level, lb/a 2 ft				
		0 - 20	21- 60	61-100	101-200	> 200
	lb/a 2ft percent of samples				
Corn	98	1	28	32	33	6
Corn Silg	109	6	25	26	30	12
Wheat	78	9	38	25	24	4
Beans	47	8	72	15	5	1
Alfalfa	29	39	51	9	0	0
Grass	27	45	41	14	0	0
Fallow	153	0	0	29	57	14
All	68	7	52	22	16	3

Not all fields are high in carryover N.

Prepared by Jim Gerwing and Ron Gelderman

Long term Phosphorus Management

Recently we have finished two long term (11 yr) studies on no-till P management for a corn - soybean rotation. We have reported on these studies over the years. We have begun to summarize these results and will be reporting the conclusions over the next year or so. We initially applied large amounts of phosphorus on some plots in these two studies to build P to provide a range of soil test levels. This P was worked in before the no-till system was established. Figures 1 and 2 show the decline in soil test P over 10 years. The

initial Olsen P test is indicated on the left side at '0' years and declines over years as P is removed with the grain and no fertilizer was applied on these particular plots.

The lines represents the average decline over the years for that beginning soil test level. The rate of decline over years (slope) is steeper when the original Olsen P test level is higher. The slopes of each line for both sites was plotted against the original soil test level (Figure 3). There is a good relationship between the original Olsen P level and the rate of soil test P decline over the years. The

higher the soil test P level the faster it declines over time.

What does this mean? If a producer wants to build soil test P with manure or fertilizer, this graph will tell us when P soil tests approach the level when added P would again be needed. For example if levels

were raised to about the 20 ppm level, tests would fall about 1.2 ppm each year or to about 10 ppm in about 8 years. Of course this is assuming yearly average yields of 140 -150 bu corn and 40 to 50 bu soybean.

Prepared by Ron Gelderman

Figure 1. Decrease in soil test P after 10 years of no-till corn and soybean, Beresford, 1995 - 2004.

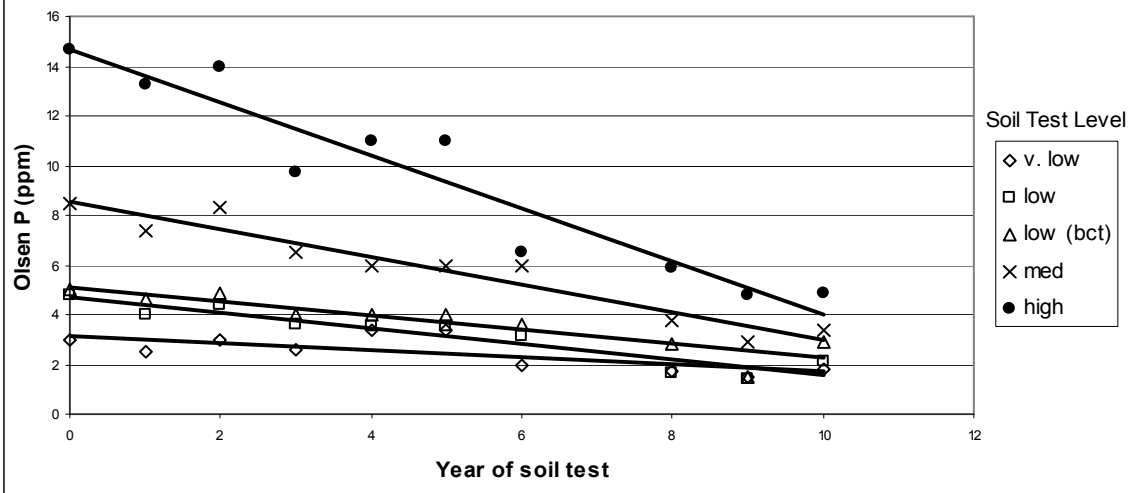


Figure 2. Decrease in soil test P after 10 years of no-till corn and soybean at Brookings, 1996 - 2005.

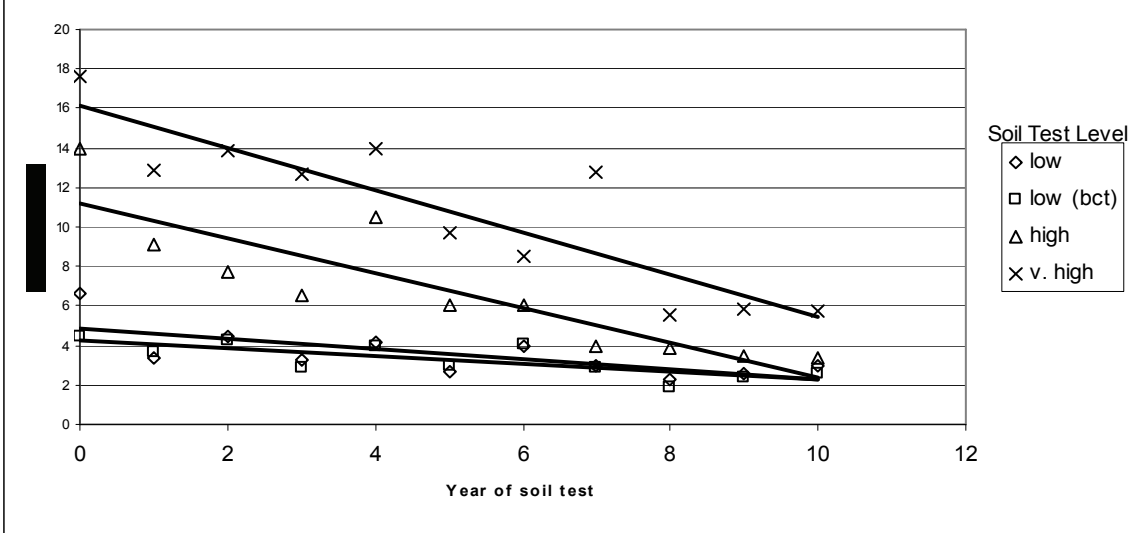
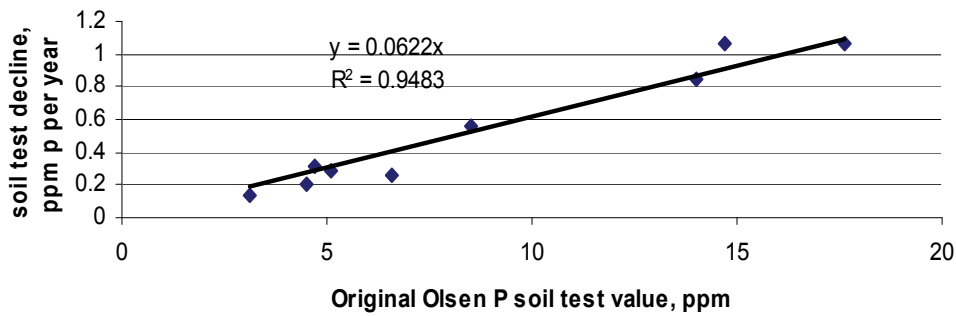


Figure 3. Influence of original soil test on rate of P decline, Long term P studies, Beresford and Brookings 1994 - 2005.



Zinc Coating for Corn seed.

A new idea for applying zinc has been tested. A very fine powder of zinc oxide is applied as a corn seed coating. In the past, zinc oxide fertilizers have shown lower zinc availability when compared to zinc sulfate. Manufacturers claim that the finely ground zinc oxide enables the zinc to be

Table 8. Influence of Zinc oxide coated seed on corn grain yield at Aurora and Brookings SD in 2006.

Zinc Treatment ^A	Aurora	Brookings
oz/a	----- bu/a -----	
0	99	107
4	104	107
6	106	108
8	113	103
Pr>F	0.23	0.84
LSD _(.05)	14.1	12.2
CV	8.3	7.1
Zinc Soil test (ppm, 0-6")	0.63	0.81

^A Zinc oxide applied to the seed.

more available. We tested this new zinc seed coating at two sites near Brookings in 2006. Corn grain yield was not statistically influenced by zinc seed coating at either site (Table 8). However, a trend for higher yield with increased zinc coating rate was measured at the Aurora site which had the lowest soil test zinc. Further research needs to be conducted to verify the value of this product on soils that require zinc application.

Prepared by Anthony Bly



What's Happening

<u>Date</u>	<u>Event</u>	<u>Location</u>
¹ Jan. 2- Murdo, 3-Winner, 4-Aberdeen, 9-Chester, 9-Watertown, 10-Scotland, 11-Beresford, 19-Brookings, 25-Sioux Falls, 26-Redfield, Feb. 6-Bristol, 8-Watertown, 13-Howard, 14-White, 15-Parker, 16-Renner.		
Jan 18	Manure Management Training	605 688-5144 Huron - Crossroads
Jan. 30 - 31	Conservation Tillage Conference	605 722-5334 Sioux Falls - Ramkota
Jan. 31 - Feb. 1	SD No-Till Association Conference	605 222-6238 Huron - Crossroads/Events Center

¹ County Extension Sponsored events with soil fertility topics - contact local County Extension Educator for time and location.

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