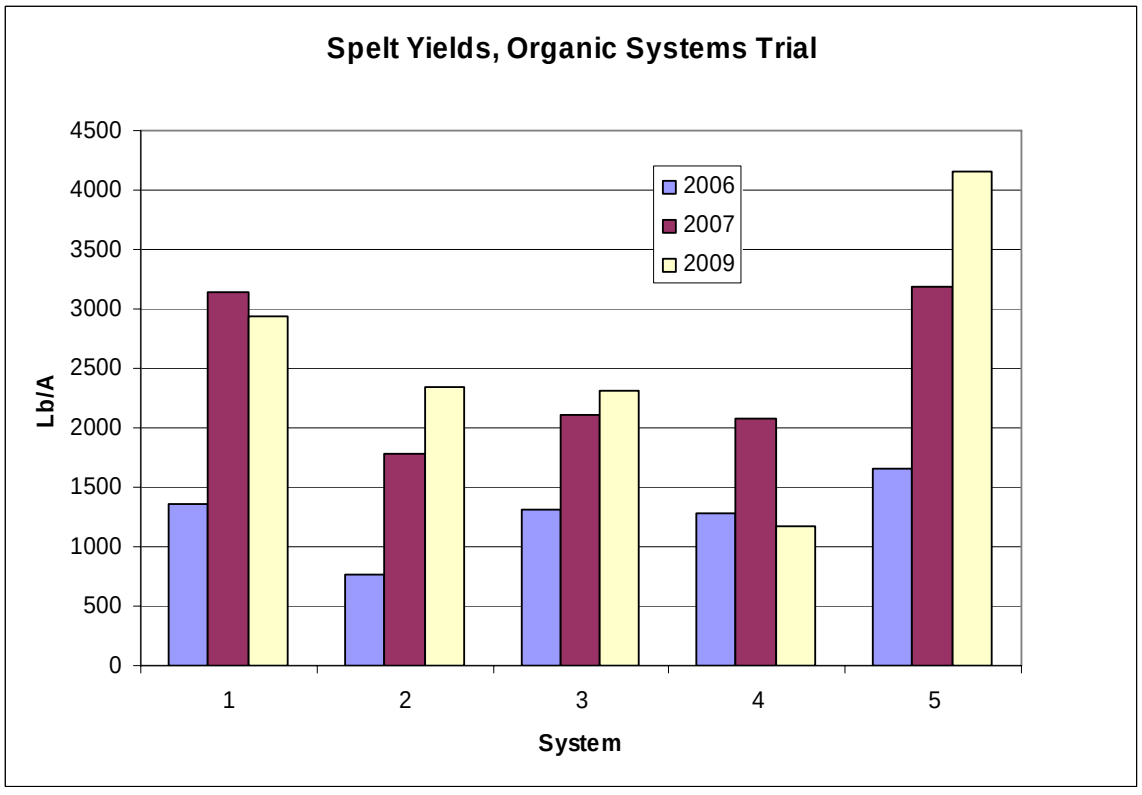
2009 Organic Grain Systems Trial Results

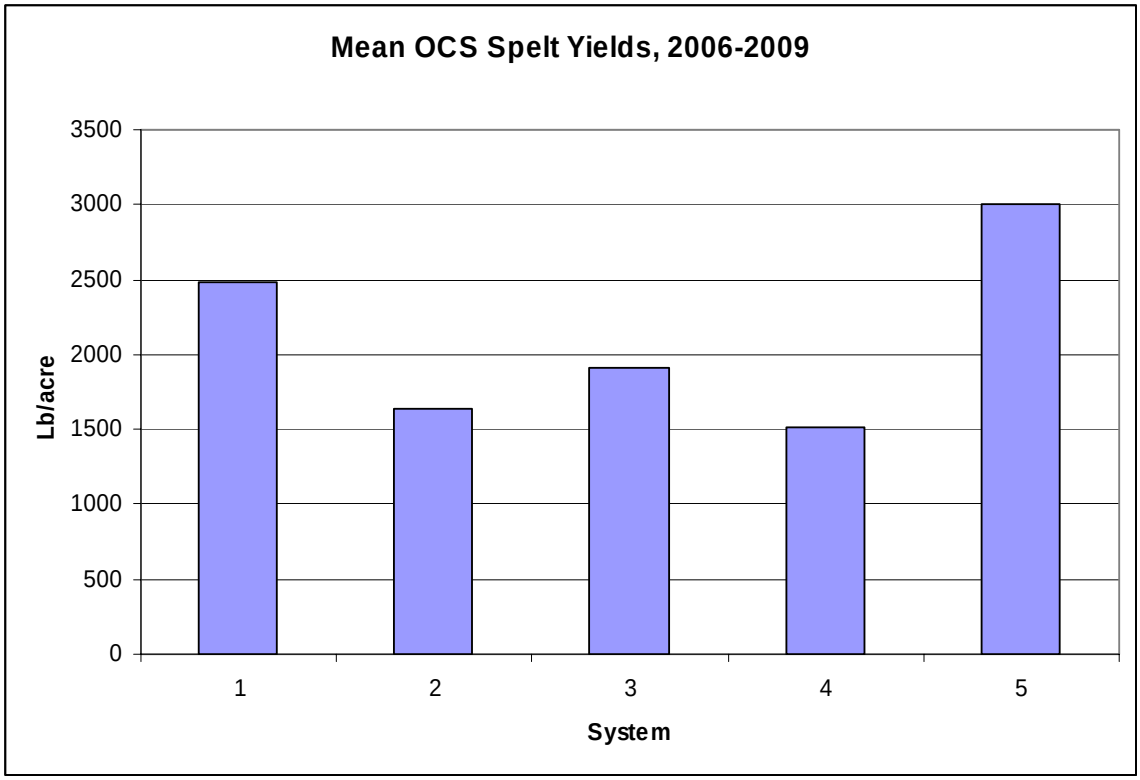
The 2009 growing season was cool and moist. Area soybeans were slow to grow in June and July because of low temperatures and soybean aphids were abundant. Overall area soybean yields were low. Winter wheat yields, however, were excellent in general.

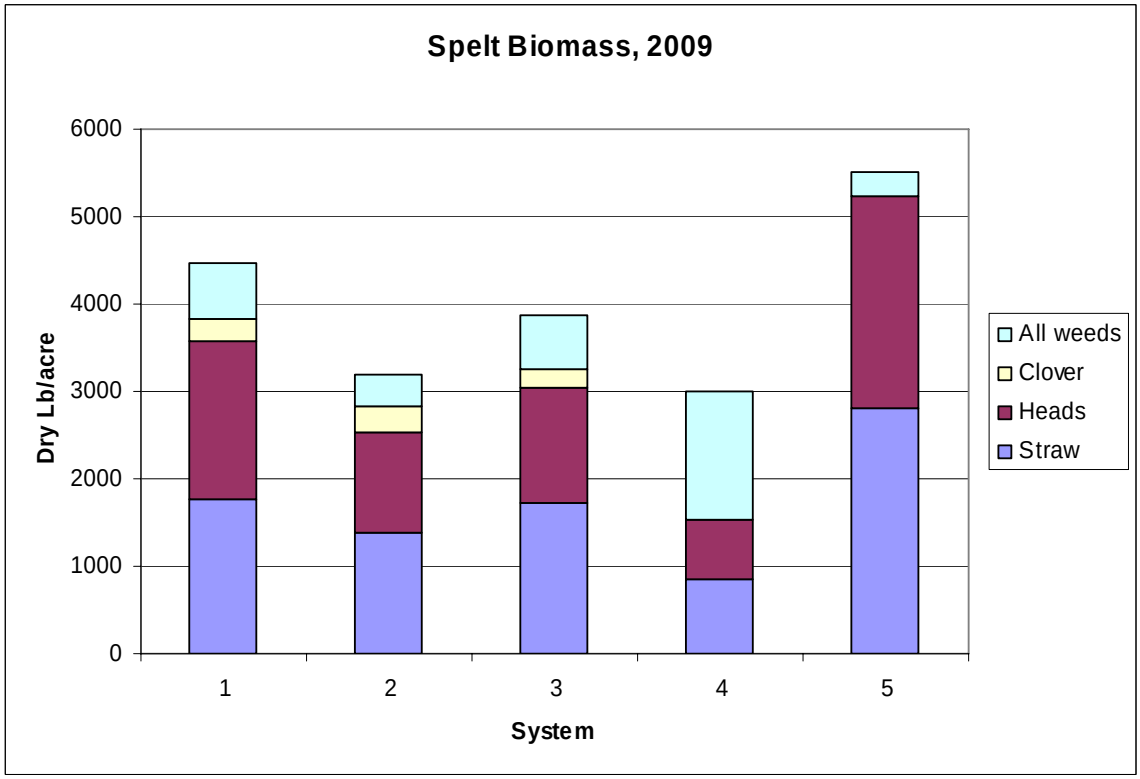
Spelt

Organic Cropping Systems Project (OCS) Oberkulmer spelt was planted on 10/13/08 and frost seeded with medium red clover @ 10 lb/acre on April 8, 2009 except for systems G4 (reduced tillage) and G5 (chemical input comparison). The spelt was harvested on August 12, its maturity and dry down having been delayed by cool, moist weather. Yields were good compared to past years and the typical state average organic yield of about 1 ton (65 bu) per acre.



G5 received 168#/acre of 10-20-20 and G1 749#/acre of 4-5.2-2.4 before planting. In the spring, G5 received a topdressing of 159#/acre of 34-0-0. So total additions of NPK in lb/acre were 71-34-34 to G5 and 30-39-18 to G1.


Mean OCS Spelt Yields, 2006-2009
Lb/acre
3500
3000
2500
2000
1500
1000
500
0
1
2
3
4
5
System


Spelt Biomass, 2009
Dry Lb/acre
6000
5000
4000
3000
2000
1000
0
1
2
3
4
5
System
All weeds
Clover
Heads
Straw

Weed presence was high, and G4 yields were reduced by heavy competition. Over the three OCS spelt crop years, trends have been consistent. Comparing G1 and G2, it is clear that added fertility results in a yield increase. G4 and G2 have been similar in yield, so reduced tillage has performed relatively well with this winter grain. While it also has no added fertility inputs, G3 has benefited from a 30-50% higher seeding rate (implemented to enhance weed suppression) which makes one wonder if our standard rate of 2 bu. (120 lb) per acre of hulled seed is perhaps too low. G5 yields have consistently been higher than G1, perhaps responding to higher fertility additions.

In general, weed pressure in spelt was high in 2009, after excellent control in the preceding soybeans. Oddly, weed biomass was higher in G3 than G2 in 2009. This may be because of moldboard plow tillage instead of discing before planting, which did not suppress perennial weeds as hoped but appeared to increase ragweed. One rep of G5 had heavy perennial sowthistle presence in spite of a spray of 2, 4 D.

Spelt plots were mowed with a rotary mower on 8/26, two weeks after harvest, to reduce ragweed seed production and general weed growth. Clover in G1-3 was mowed at about a 6" height, the other plots 2-4". Oats (75#/A) and Austrian winter peas (175 #/A) were seeded on 9/8 in G4 after two passes (8", then 12+" deep) with a chisel plow fitted with sweeps and a single discing, to disturb roots of perennial weeds.

Bushel weight, however, was low (24.5 lb/bu), but falling numbers and vomitoxin levels were within limits for spelt from all systems.

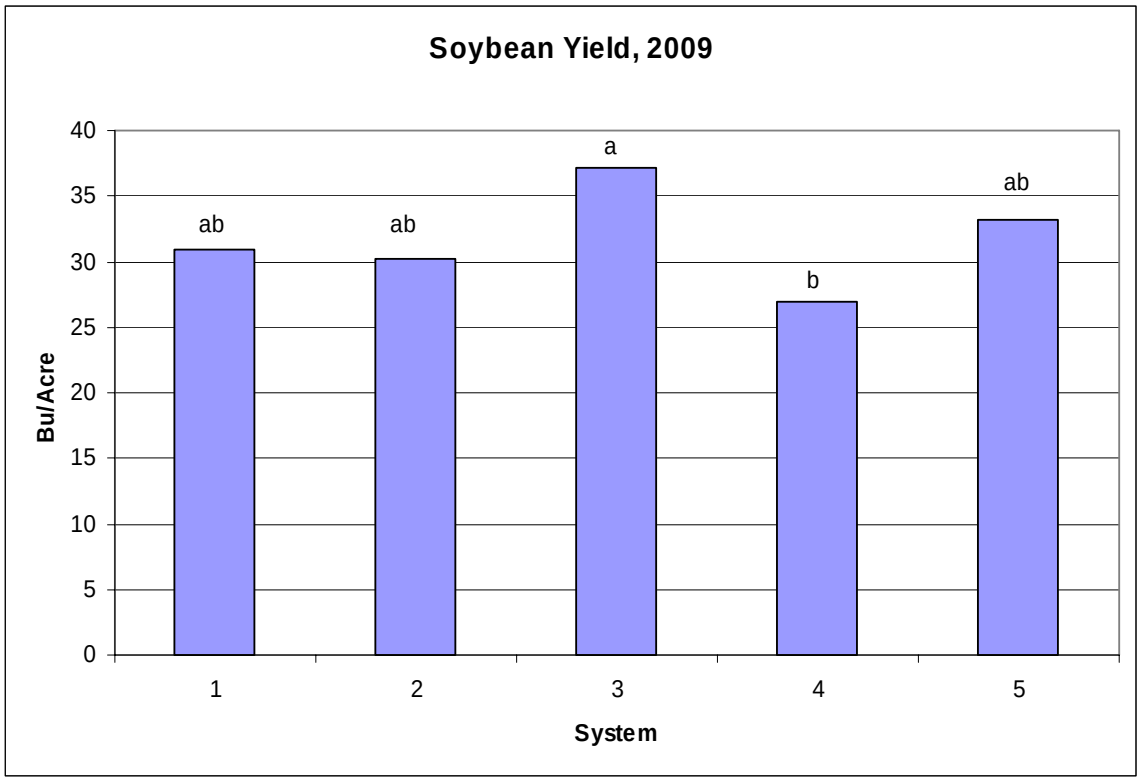
Soybeans

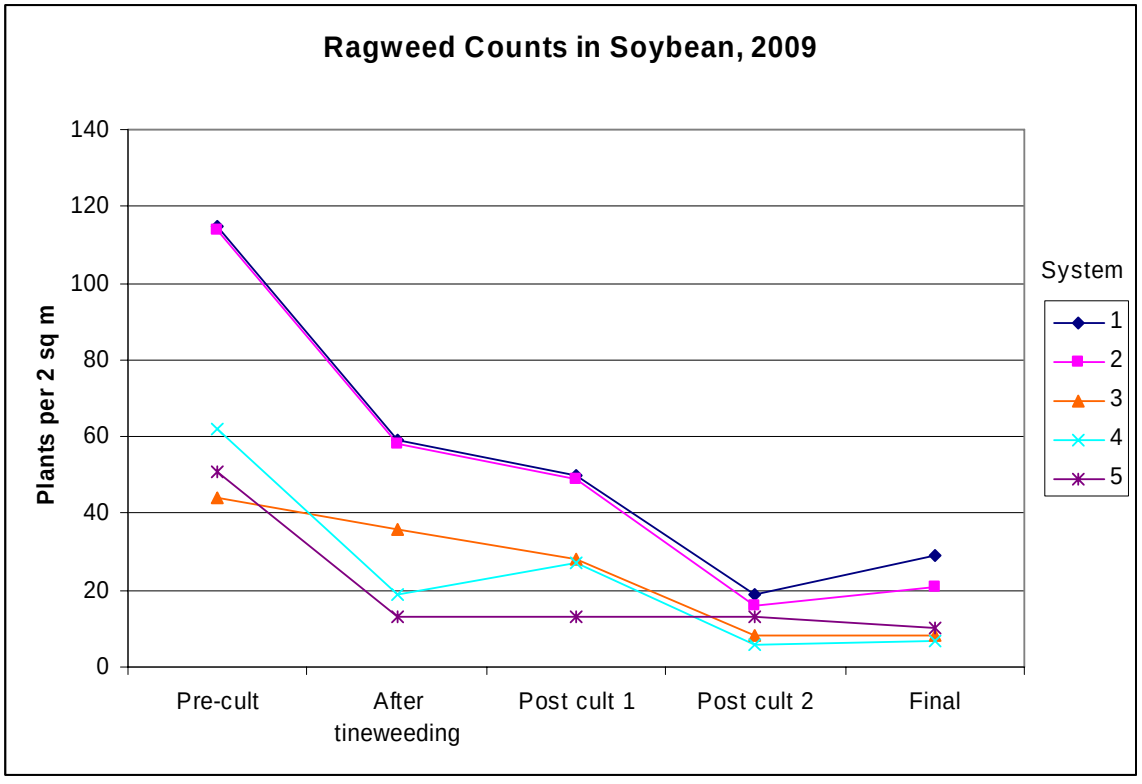
Inoculated Blue River 10F8 soybeans (group 1.0) were planted on 5/20-22. They were seeded at a rate of 197,000/acre and emergence was good.

Tillage of the previous crop corn stubble was: moldboard plow (5/15), field cultivator (5/19), then roller harrow (5/21) for systems G1, G2, and G5. System G3 was plowed earlier (5/6) and had an extra field cultivation on 5/8. In G4, weeds and residue were rotary mowed on 5/15, then the ridges left over from hilled corn were scraped on 5/20. The planter stayed in the scraped area somewhat better than in previous years, but still tended to pull to one side.

Systems G1 (11-14-7 lb/A NPK) and G5 (7-36-36) received extra fertilizer at planting but appeared to benefit little from it.

Systems G1, G2, and G3 were tineweeded on 6/4, then cultivated on 6/11, 6/25, and 7/9. G4 was cultivated on 6/11, 6/16, 6/25, and 7/9. The 6/25 cultivation (and all G4 June cultivation) was done with a Brillion high residue cultivator with the discs cutting away from the row; and some row sections were damaged as the discs were set too closely. On 7/9, the discs were set to throw soil against the rows and smother small weeds. System 5 was sprayed with a tank mix of 1.5 pt/A of Dual II Magnum and 2/3 lb/A Sencor DF on May 22 (pre-emergence).


Soybean Yield, 2009
Bu/Acre
40
35
30
25
20
15
10
5
0
ab
ab
a
b
ab
1
2
3
4
5
System


Ragweed Counts in Soybean, 2009
Plants per 2 sq m
140
120
100
80
60
40
20
0
Pre-cult
After tineweeding
Post cult 1
Post cult 2
Final
System
1
2
3
4
5

It is not known how much soybean stands were reduced by tineweeding. However, G1 was planted a day later and ¼" deeper than the others, and may have had more damage. Subsequent cultivation reduced G1, G2, G3, and G4 by 9%, 16%, 8%, and 11% beyond the 7% stand reduction seen in G5. Final stands were below optimal for highest yields in G1 and G2.

System	Post Tineweeding Stand	Final Stand
G1	87651	73375
G2	101596	78355
G3	127493	108236
G4	134797	115208
G5	129485	120520

Soybean Stands, Plants per Acre

From ragweed counts, it looks as though tineweeding and the second cultivation were particularly effective in reducing weed numbers. Systems G3, G4, and G5 started with lower ragweed densities than G1 and G2. Because of the wet conditions, mechanical weed control was not as effective as in 2008.

While soybean aphids were over threshold and sprayed on almost all other fields on the research farm, they were under threshold in this trial and plants did not show any aphid-related damage or stress. Predator numbers were high in the plots, possibly due to relatively heavy weed pressure.

Soil fertility

Changes in soil nutrient levels from the baseline 2005 through spring 2009 were small in the 0-12" samples. Available P went up about 1 PPM in G1 and G4 in both entry points, down by about 0.15 in G2 and 0.38 in G3. It rose by about .5 in G5. Available K was down by an average of about 7 PPM in G2, G3, and G5, while staying steady or rising 3 PPM in G1. In G4, it stayed steady or fell 8 PPM.

Mg declined in all systems in both PE's, from 31-69 PPM, while Mn also declined by 5-10 PPM in all cases. Zn declined by 0.4-0.9 PPM. For other nutrients, values did not change much and there were no system-based trends.

pH had shown increases in the past 3 years but was back close to baseline levels in 2009. *Lab error probably explains this.*

The 0-8" samples, on which fertilizer recommendations are based, show areas of concern.

Available K has decreased in all systems, by 3-22 PPM. In EP A, G2 and G5 are in the "very low" category, while the others are "low" in K. In EP B, the same thing is true except that G1 is in "medium".

Available P increased in G1, G4, and G5 in both entry points by .2-.1.2 PPM, while decreasing in G2 and G3 by 1-1.3 PPM. This is enough to move G1 and G4 into the "high" P test range and G5 into "medium", while G2 and G3 are toward the bottom of the "medium" category. G4 values have increased both from extra compost applied before corn, and small nutrient exports due to low yields. At the same time, G2 and G3 were producing good yields but had little fertilizer input.

Zinc has also decreased in all systems and is in the "low" category in all systems.

pH in the 8" samples has increased since 2005 in all systems by .17-.28 points. This contrasts with the 12" samples which were closer to their 2005 baseline levels.

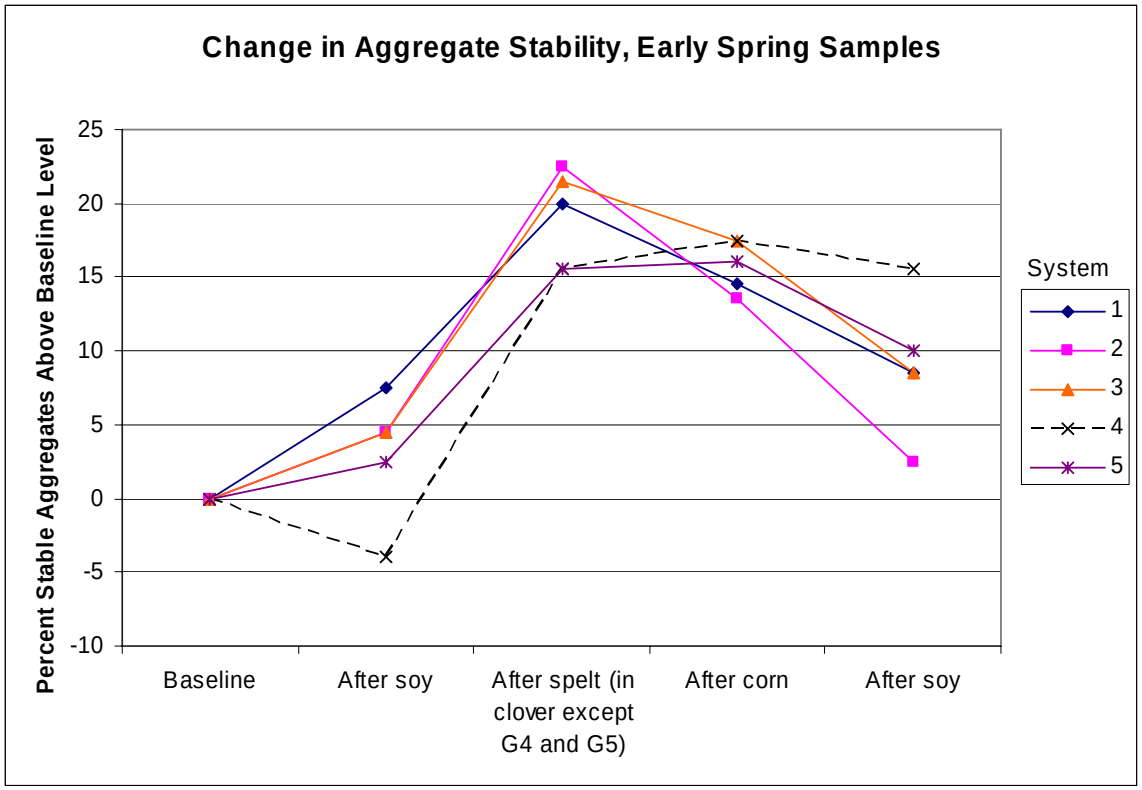
Soil OM levels increased in all systems from 2005-2009, from .2-.37%. This contrasts with soil test results from 2008, which were the same or slightly lower compared to 2005. *Changes in lab procedures may account for this.*

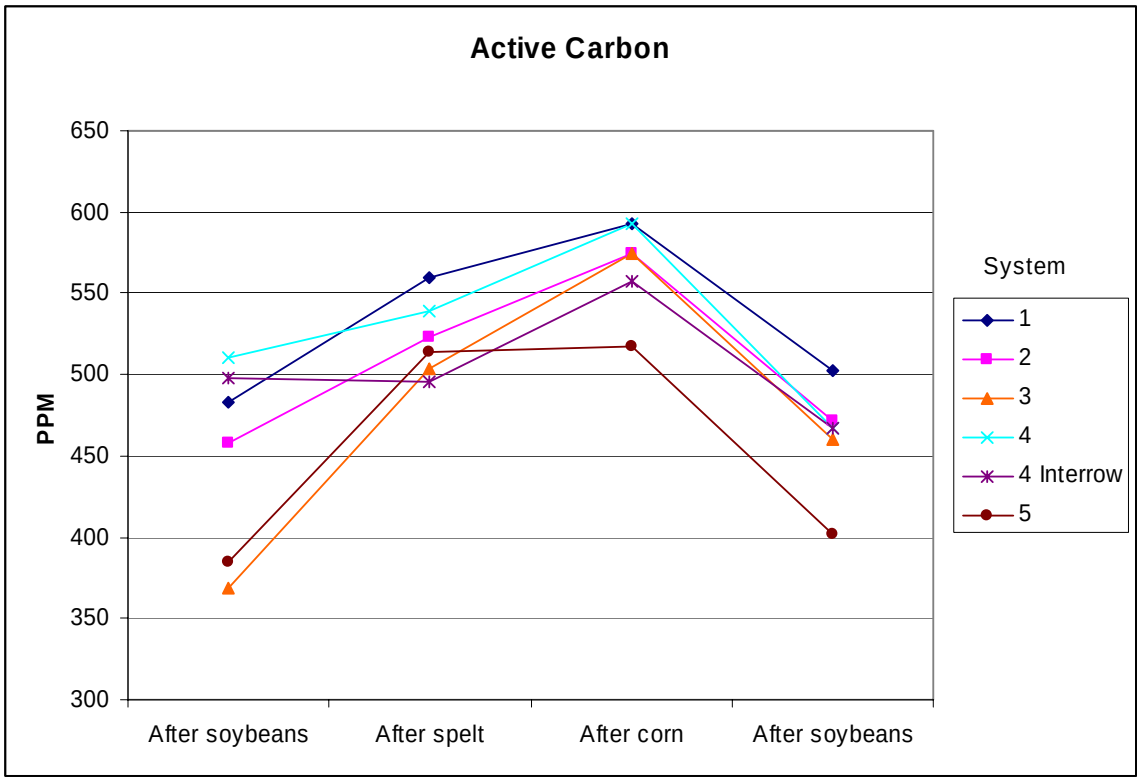
Soil health

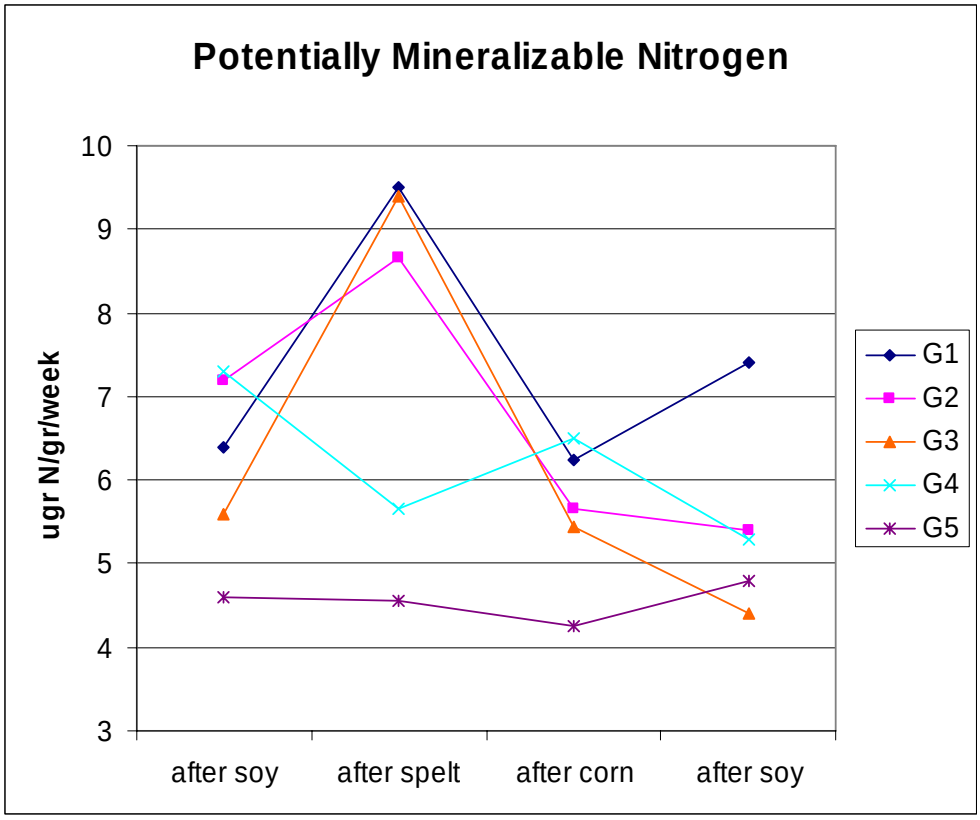
Aggregate stability is one of the fastest soil health indicators to respond to management. From the chart below, it appears that aggregate stability tends to increase sharply after spelt (during the time that clover is in the field), then drops somewhat after corn and soybeans. G5 has also followed this trend. Since red clover is not in G5's rotation, the effect would seem to be due mostly to the spelt, and the fact that the soil had not been tilled in 18 months. The future will show whether aggregate stability levels continue higher than baseline levels in all systems.

Active carbon was measured since 2007. Its levels are highest after corn, following red clover plowdown in systems G 1-3. In this case, G5 does not follow the other trends as closely. G5 has a lower biomass contribution after spelt because it has no red clover. Above and below ground residues of both spelt and red clover undoubtedly contribute to active C levels. Active C levels do not appear to be rising over time.

Soil surface hardness as measured by a penetrometer showed that in early 2009 G4 had significantly higher values than all others in rotation starting point B, and than G2 and G3 in point A. In B, this was after corn which was harvested early as silage, since it was so weedy, while in A, it was after soybeans harvested normally. The higher surface hardness of G4 is perhaps to be expected, since it is a reduced tillage system and the surface soil is not loosened as it is with a moldboard plow. It is a bit surprising, though, that the deeper soil layer from 6-18" shows the same trend, though not as strongly.


Change in Aggregate Stability, Early Spring Samples
Percent Stable Aggregates Above Baseline Level
25
20
15
10
5
0
-5
-10
Baseline
After soy
After spelt (in clover except G4 and G5)
After corn
After soy
System
1
2
3
4
5


Active Carbon
PPM
650
600
550
500
450
400
350
300
After soybeans
After spelt
After corn
After soybeans
System
1
2
3
4
4 Interrow
5



Potentially mineralizable N has reverted quickly to low levels in G1-3, after the relatively high inputs of clover residues plowed down before corn in those systems.

Pests and Disease

Spelt had little pest or disease problems. In the soybeans, soybean aphids were present but below the threshold of 250/plant when sampled near the peak of the area infestation on 7/27.

System	aphids per plant		lady beetles per plant		aphids per lady beetle
G1	**86**	**ab**	**0.53**	**ab**	162
G2	**118**	**a**	**0.60**	**a**	197
G3	**108**	**a**	**0.55**	**a**	197
G4	**84**	**ab**	**0.14**	**b**	598
G5	**39**	**b**	**0.29**	**ab**	135

Visually, the soybean plants did not show stunting or discoloring the way those in other fields did nearby. It is unlikely that yield was reduced in any systems by soybean aphids. Other soybean arthropod pests and diseases were minimal.

Economics

Preliminary figures show that organic soybeans (@ $17/bu) were more profitable than non-organic beans ($10/bu). This is true even with the low yields of G4. In this example, labor is figured at $15/hour. If the farmer does half the labor, that is the amount added back in to the net income below to get the total net income to the farmer. Note that extra inputs were costly on G1.

SOYBEANS	**System 1**	**System 2**	**System 3**	**System 4**	**System 5**
YIELD (BU)	**30.9**	**30.2**	**37.2**	**26.9**	**33.2**
TOTAL INCOME	**$525**	**$513**	**$632**	**$457**	**$332**
TOTAL COSTS	**$427**	**$341**	**$362**	**$311**	**$374**
GROWING THE CROP	$251	$166	$182	$138	$197
HARVEST	$76	$76	$80	$74	$77
OVERHEAD	$100	$100	$100	$100	$100
NET INCOME	**$98**	**$172**	**$271**	**$146**	**-$42**
PLUS OPERATOR LABOR	**$29**	**$29**	**$32**	**$26**	**$23**
TOTAL	**$128**	**$201**	**$302**	**$172**	**-$19**

Spelt can also be a lucrative crop for the organic farmers, especially with good yields as in 2009. In this case the conventional yield was outstanding, and resulted in similar net returns to the higher-priced organic systems (since there is little non-organic spelt market, conventional winter wheat prices were used, assuming a 2500 lb/acre spelt yield was equivalent to 50 bu. of winter wheat). In the case of spelt, higher yields in G1 more than made up for extra fertility expenses.

SPELT	**System G1**	**System G2**	**System G3**	**System G4**	**System G5**
YIELD (LB)	**2940**	**2338**	**2320**	**1175**	**4152**
TOTAL INCOME	**$588**	**$468**	**$464**	**$235**	**$623**
COSTS					
GROWING THE CROP	$184	$142	$183	$193	$282
HARVEST	$67	$61	$61	$50	$100
OVERHEAD	$100	$100	$100	$100	$100
TOTAL	$352	$303	$344	$342	$482
NET INCOME	**$236**	**$164**	**$120**	**-$107**	**$141**
INCLUDING OPERATOR LABOR	**$18**	**$17**	**$20**	**$23**	**$20**
TOTAL NET INCOME	**$254**	**$181**	**$139**	**-$84**	**$161**