Results of Cornell Soil Health Testing on 13 NYS Farms – 2015
part of an NRCS Conservation Innovation Grant (CIG)
"Accelerating Adoption of Soil Health Practices by New York Farmers"

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This project involved sampling for Cornell Soil Health Assessments in 26 fields on 13 farms. A crop/soil management history of the fields was collected. A survey of 2015 cover crop use on the farms was also done, with results at the end of this article. In addition, assistance was provided to the WNY Soil Health Alliance during its start-up, and the Finger Lakes Soil Health Grower Discussion Group was organized.

Cornell Soil Health Assessments (CSHA)

Twenty-six fields were sampled, and compaction was tested, on 13 farms in Niagara, Monroe, Genesee, Wayne, Ontario and Yates Counties. Worm counts were also done at the 10 sampling sites in each field. Cropping, cover cropping, tillage, and manure application data were collected for 2013 – 2015 for all fields. All farms grew vegetables, or vegetables and field crops. Most cover cropped some to most of their fields. Farms ranged from 130 to a few thousand acres. Seven growers used some or all reduced/zone/no tillage. Four farms had manure. Four of the 13 growers produce some or all of their crops organically. Soil management on the farms varied from good to poor.

While many of the growers' fields had several serious constraints to good soil functioning and crop growth there were a handful of fields where soils tested better, either on the biological tests, or the aggregate stability test. These growers had been using reduced/zone tillage, intensive cover cropping, diverse crop rotations including soil building crops, and/or frequent manure applications, for many years. The growers with the best soils generally used two or more of these practices. Earthworms were more plentiful in these fields. Preliminary interpretation was sent to the growers. Individual interpretation of the CSHA results will be done with the growers through the winter.

Cornell Soil Health home page – Free access to the Cornell Soil Health Assessment Manual, with detailed descriptions of the tests, why they're important, and links to resources: http://soilhealth.cals.cornell.edu/index.htm

Cornell Soil Health test pages, with tests and test packages available, Soil Health Test Submission Form, and photo instructions on sampling, packaging and mailing samples: http://soilhealth.cals.cornell.edu/extension/test.htm
Sample/compaction test soil prior to spring tillage. Soil should have good, not excess, moisture when compaction is measured. To have compaction evaluated you need to measure compaction with a penetrometer and write down the data on the Soil Health Test Submission Form. Penetrometers are available on loan. Note that a penetrometer can't measure the effect of root channels and earthworm holes on drainage and ease of crop rooting.

Scroll down to find the **individual and add-on tests** that are available. If you want to order individual soil health tests (aggregate stability, active carbon, or bean root bioassay for soil-borne disease, etc.) use the form at this link:
http://cnal.cals.cornell.edu/forms/pdfs/CNAL_Form_S.pdf
Note: The test of Available Water Capacity does not indicate the water-holding capacity (pore space, etc.) of your soil as it exists in your field, but what it could be if soil health was excellent.

Select Cornell Soil Health Assessment Results and Soil Management – 2015

Soil management practices were summarized for the two years prior to sampling for the Cornell Soil Health Assessment. The order of test results from top to bottom ranges from better to worse. Active Carbon results order that table. Active C = Chemical measure of carbon-containing residues easily available for microbial decomposition and nutrient release. Resp = CO_2 released (mg/gram of soil) over a 4 day incubation; an indicator of current microbial activity. % Agg Stab = the % of stable soil aggregates which remain on a screen after a hard 1" rain.

0.77 Green = Good soil functioning; **531** Yellow = Medium –sub-optimal soil functioning; **176** Red = Low – Significant constraint to soil function.

Soil Management Practices vs. Active Carbon and Respiration

Farm	Soil	Active C	Resp	Management
6		531	0.37	mod till, manure+, small grain, clover, corn, mustard
4		509	0.49	Till, manure, veg, sm grain, clover
4		468	0.54	ZT/till, manure, sm grain, clover, veg, grass/leg cover
3		466	0.77	Till, 2 yrs legume/grass hay
12		466	0.66	Till, idle, grass cover, corn
5		466	0.71	ZT, manure, corn, corn
4		460	0.56	ZT/till, manure, corn, grass cover, veg, grass cover
4		445	0.47	Till, manure, sm grain, clover, veg, sm grain
11	sandy	444	0.25	ZT/till, veg, grass/clover cover
7		430	0.48	ZT/till, sm grain, corn
6		429	0.51	mod till, manure+, small grain, clover, corn, mustard
8		415	0.47	ZT, manure, corn, corn
6		410	0.52	mod till, manure+, small grain, clover, corn, mustard
3		406	0.67	Till, legume/grass hay, idle
2		397	0.47	Till, corn, corn
12		384	0.26	ZT, corn, corn
11	sandy	376	0.26	ZT/till, veg, grass/clover cover
6		372	0.42	mod till, legume/grass hay, legume hay
10		356	0.28	Till, corn, fallow, grass/legume cover
2		348	0.42	Till, corn, veg, sm grain
13		344	0.34	ZT/NT, sm grain, legume/grass/radish cover, corn
9	sandy	341	0.25	Till, 2 yrs veg, grass/crucifer cover
1		340	0.48	Till, veg, grass cover, veg, oat cover
13		313	0.34	ZT/NT, sm grain, legume/grass cover, corn
8		301	0.29	Till, soy, corn
1	sandy	176	0.41	ZT/till, 2 yrs veg, oat cover

Soil Health Practices vs. % Water-stable Soil Aggregates

Farm	%Agg Stab	Management
3	39	Till, 2 yrs legume/grass hay
12	38	Till, idle, grass cover, corn
6	32	mod till, legume/grass hay, legume hay
10	31	Till, corn, fallow, grass/legume cover
6	30	mod till, manure+, small grain, clover, corn, mustard
5	30	ZT, manure, corn, corn
3	29	Till, legume/grass hay, idle
13	27	ZT/NT, sm grain, legume/grass/radish cover, corn
9	27	Till, 2 yrs veg, grass/crucifer cover
11	26	ZT/till, veg, grass/clover cover
13	25	ZT/NT, sm grain, legume/grass cover, corn
11	24	ZT/till, veg, grass/clover cover
12	22	ZT, corn, corn
6	20	mod till, manure+, small grain, clover, corn, mustard
6	18	mod till, manure+, small grain, clover, corn, mustard
8	18	ZT, manure, corn, corn
4	17	Till, manure, veg, sm grain, clover
2	15	Till, corn, veg, sm grain
4	15	ZT/till, manure, corn, grass cover, veg, grass cover
7	12	ZT/till, sm grain, corn
2	10	Till, corn, corn
4	9	Till, manure, sm grain, clover, veg, sm grain
1	9	ZT/till, 2 yrs veg, oat cover
1	8	Till, veg, grass cover, veg, oat cover
8	6	Till, soy, corn
4	6	ZT/till, manure, sm grain, clover, veg, grass/leg cover

-Cover Crop Survey below-

Cover Crop Acreage Survey, 2015

Twelve of the 13 growers who participated in the Cornell Soil Health Assessment replied to a survey on the cover crops planted in 2015. They reported planting a total of 6,519 acres of cover crops, beginning with frost-seedings, to summer plantings after early crops, through fall plantings. One grower had no cover crops but includes small grains in his rotation. A wide range of grasses, legumes, crucifers and other cover crops were planted. Cereal rye and red clover, alone or in a mix, were the most common cover crops. There were 733 acres of 2, 3, and even 9-way mixes planted on several farms. This is relatively new, but it has benefits. Some cover crops establish rapidly and prevent weed growth while a companion cover crop is taking time to get established (oats and a legume). Some cover crops over-winter so their nutrients aren't released until crops need them (rye, wheat, winter barley, many legumes). Grasses soak up nitrogen from the soil, inducing legumes planted with them to produce even more nitrogen. Legumes produce the nitrogen that crucifers need to make maximum growth. Over-wintering grasses soak up the nitrogen that crucifers release when they die in mid-winter. *Note: Most of these growers have legume and/or crucifer cash crops, so the acreage of legume and/or crucifer cash crops is less than it might be due to disease concerns.*

Total acreage of each cover crop being grown alone by 11 of the growers:

Grasses:

Cereal rye – 1,918
Annual ryegrass – 570
Wheat cover crop – 650
Winter barley - 200
Oats – 495
Sorghum sudan – 218

Legumes:

Red clover – 1,161 (much with small grain volunteers)
Austrian winter pea – 271

Crucifers:

Tillage radish – 101
Mustard – 120

Other:

Buckwheat – 82

Total acreage of 2-way cover crop mixes being grown:

Rye and vetch – 60
Rye and radish – 90
Rye and winter pea – 20
Red clover and ryegrass – 210
Red clover and radish – 80

3-way combinations (acres) -
Annual ryegrass, Crimson clover and radish – 48
Annual ryegrass, hairy vetch and radish – 59

4-way combination (acres) - Winter barley, Austrian winter pea, buckwheat and sunflower – 20
5-way combination (acres) - (recommended by Ray Archuleta before grain corn) -
Cereal rye, triticale, oats, Austrian winter peas, fixation clover (Balsana) – 61

6-way combination (acres) -
Cereal rye, oats, sorghum sudangrass, Mr clover, soybeans, radish – 45

9-way combination (acres) -
Cereal rye, sorgum sudan, soybeans, Sweet clover, Mr clover, sunnhemp (a non-hardy legume), vetch, radish, sunflower - 40