What's Cropping Up?

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Understanding Soil Organic Matter Calculations

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Soil organic matter is usually included as part of a routine soil test. It is seldom used directly in making a nutrient recommendation. Soil organic matter is, however, an important component of the soil. The soil microbes digest the organic matter as their source of energy and nutrients. This releases nutrients into the soil. The organic matter contributes to the soil cation exchange capacity, adding about 2 meq/100 grams for each percent of organic matter present. This can be about the only source of cation exchange capacity in some sandy soils. Organic matter increases the soil water holding capacity since it may hold several times its own weight in water. Probably the most important function of the organic matter in most NY soils is its influence on the soil structure. The presence of large amounts of organic matter results in the soil being more aggregated, thus increasing its soil tilth making the soil easier to work, more easily penetrated by soil roots, and have a higher water infiltration rate. It is generally accepted that, up to a point, the greater the quantity of organic matter in a soil, the higher the soil quality and the greater is its nitrogen reserves. Thus, many growers and contractors want to increase the soil organic matter.

Determination of the soil organic matter

There are three common methods for estimating the soil organic matter: Loss-on-ignition, Walkley-Black reactions and carbon analysis. None of these are direct determinations of organic matter, but are measurements of the quantity of soil carbon. The soil organic matter is then assumed to be about 58% carbon. The Cornell Nutrient Analysis Laboratory uses the loss-on-ignition method. In this method the soil is dried, weighed then heated to 500 C and re-weighed. During heating the organic material present in the soil burns and the carbon is lost from the sample as carbon dioxide gas and water vapor. The weight loss is referred to as the loss-on-ignition and is related to the amount of carbon present. The conversion equation is **organic matter = (loss-on-ignition X 0.70) - 0.23.** The methods for estimating the amount of carbon in soils do not distuingush between soil organic matter and organic materials in the soil sample. For example, if there are fine roots or other organic material in the soil, this is determined as contributing to the soil organic matter even though only about 10% of freshly added organic material finally becomes part of the more stable soil organic matter.

Computing changes in soil organic matter

How much plant material must one add to increase the soil organic matter by 1%? The soil organic matter content is expressed as a percent of the soil dry weight. A 6 to 7 inch deep layer (acre furrow slice or plow layer) of a mineral soil (the usual type of soil) weighs about 2,000,000 pounds. There is more organic matter in the lower soil layers, but we will ignore that for now. If one wishes to increase the percent organic matter in each acre of land by 1%; i.e., from 3 to 4%, there would have to be 0.01 X 2,000,000 lbs or 20,000 lbs or 10 tons increase in soil organic matter for each acre-furrow slice of soil.

The most common method used to increase the soil organic matter is to grow cover crops or sod crops. So how much time does it take to get that 1% increase in soil organic matter? An excellent grass crop may produce 5 tons of dry matter per year in the harvested tops. The stubble returned to the soil and the roots may add the equivalent of 30% of the harvested yield or about 1.5 tons of organic matter added to the soil. With this yield level, it would take 6.7 years to add the 10 tons of organic matter. But, this isn't the whole story. Only about 10% of this easily decomposed organic material actually becomes incorporated into the more stable soil organic matter. As much as 70% of the added carbon may be used by the soil microbes, earthworms, etc. in the first few months after incorporation. Most of the remaining organic material is used during the next few years. Of the 1.5 tons of plant material deposited in the soil from the excellent grass yield, only about 0.15 to 0.2 tons is added to the stable soil organic matter pool. This means to get a 10 ton or 1% increase in soil organic matter, it would require about 50 or more years.

Some studies suggest that the increase in organic matter can be much faster than this and it may be the case.

(see SOIL, page 5)

Crop Management

Despite Low Prices, Keep Wheat in the Rotation

Bill Cox, Dept. of Soil, Crop & Atmospheric Sciences
Gary Bergstrom, Dept. of Plant Pathology

Wheat prices have plummeted to 7-year lows with July wheat selling for less than $2.50/bushel in New York. Additionally, New York wheat producers experienced some serious production challenges in 1998 with the widespread incidence of Barley Yellow Dwarf Virus (BYDV) and sprouting. Nevertheless, we believe that New York growers should adopt a long-term perspective, and continue to include wheat in their rotations. Wheat is not a major cash crop in New York, but rather a valuable rotation crop. Consequently, New York growers should not disrupt their long-term rotations, but rather plant wheat in the fall of 1998, despite the current low prices. This article discusses the value of wheat in the rotation and outlines some ideas on how to increase net returns of wheat in a time of low prices.

Rotation Crop

Wheat preceding corn in the rotation results in a positive "rotation effect" to corn. In a 6-year study at the Aurora Research Farm, corn yielded 124 bu/acre in a continuous corn rotation, 139 bu/acre in a soybean-corn-corn rotation, 144 bu/acre in a soybean-corn rotation, and 147 bu/acre in a soybean-wheat/clover-corn rotation (Table 1). Of equal importance, corn yielded 139 bu/acre in a soybean-wheat/clover-corn rotation when corn received only 85 instead of 145 lb N/acre and no soil insecticide for corn rootworm control. Obviously, wheat/clover preceding corn in the rotation significantly increases corn yields while reducing corn inputs. We successfully demonstrated this with a 4-year study on four farms in New York. In that study, corn yielded 127 bu/acre in a continuous corn rotation, 139 bu/acre in a soybean-corn rotation, and 141 bu/acre in a soybean-wheat/clover-corn rotation, despite applying 35 less lbs N/acre to corn (*What's Cropping Up?*, Vol. 8, No. 1, p. 4-5).

Wheat in the rotation also provides a positive "rotation effect" to soybeans. In the same 6-year study at the Aurora Research Farm, soybeans yielded 36 bu/acre in a soybean-corn rotation, 38 bu/acre in a soybean-corn-corn rotation, and 38 bu/acre in a soybean-wheat-clover-corn rotation (Table 1). By including wheat/clover in the rotation in this study, both corn and soybeans yielded greater. In the soybean-corn-corn rotation, soybeans yielded greater but corn yielded 8 bu/acre less in this rotation than the soybean-wheat/clover-corn rotation because second-year corn yields were essentially the same as continuous corn yields.

Table 1. Average corn and soybean yields in different crop rotations from a 6-year study (1992-1997) at the Aurora Research Farm.

ROTATION	CORN		SOYBEAN
	Conventional†	Low Input‡	
	bu/acre		
continuous corn	124	95	-
soybean-corn	144	129	36
soybean-corn-corn*	139	101	38
soybean-corn-wheat	147	139	38
LSD 0.05	4	11	2

†Typical inputs for corn including 145 lb N/acre and corn rootworm insecticide.
‡Reduced inputs for corn including only 85 lb N/acre and no corn rootworm insecticide
*Average yield of first year and second year corn following soybeans

Wheat in the rotation not only results in a positive "rotation effect" to corn and soybean yields, but also reduces disease and insect incidence that can greatly reduce crop yields. The *1998 Cornell Pest Management Recommendations for Commercial Vegetable and Potato Production* lists rotation with small grains as a cultural practice to reduce carryover inoculum of several damaging vegetable diseases in New York. Yet, this management tool is underutilized by New York vegetable producers. Wheat in the rotation reduces populations of soil borne fungi that attack beets, crucifers, lettuce, sweet corn, peas, snap beans, and dry beans, and thus enhances the yield of each of those crops. Regular rotation of legumes and other vegetable crops with wheat is particularly useful in limiting the soil buildup of the white mold fungus, *Sclerotinia sclerotiorum*, that attacks over 400 dicot plants, but not monocots such as wheat. Having a crop like beans or peas precede wheat produces disease avoidance benefits for the wheat crop as well. Wheat is a positive addition to the crop sequence for New York cash grain, dairy-forage, and vegetable production systems.

Production Costs and Net Returns

Production costs for wheat typically average close to $220/acre if we use custom rates for machinery costs and include a land rental fee of $60/acre (Table 2). Consequently, New York growers, who did not harvest wheat straw and sold wheat at harvest in July this year, would have realized -$20/acre net return or less, even with 80

Table 2. Wheat Production costs in New York with different tillage systems.			
Costs	Moldboard Plow	*Chisel*	*No-Till*
Machinery†	---------- $/acre ----------		
Primary Tillage	12.10	11.30	-
Disk	-	10.90	-
Harow	7.60	-	-
Herbicide Application	-	-	7.00
Planting Wheat	11.30	11.30	11.30
Topdress N	6.00	6.00	6.00
Harvest	22.70	22.70	22.70
	59.70	62.20	40.00
Inputs			
Seed (2 1/4 bu/Acre)	22.50	22.50	22.50
Fertilizer (starter + 60 N)	45.00	45.00	45.00
Herbicide (Knockdown)	-	-	12.00
	67.50	67.50	79.50
Miscellaneous			
Hauling	8.00	8.00	8.00
Interest (8.5%)	18.00	18.00	19.00
Insurance	6.00	6.00	6.00
Land Rent	60.00	60.00	60.00
	92.00	92.00	93.00
TOTAL	**219.20**	**221.70**	**212.50**

†Machinery expenses calculated using custom rates

bu/acre yields (Table 3). Fortunately, most New York wheat growers harvest wheat straw and realize about $75/acre profit in selling the straw. Consequently, New York wheat growers, who averaged 60 bu/acre and sold the wheat at harvest, broke even on the 1998 wheat crop (Table 4).

With current prices at 7-year lows, New York wheat producers should consider reducing production costs to make wheat a more profitable crop. For example, wheat does not require excellent seedbed conditions to get an adequate stand. In fact, some growers have very acceptable stands by broadcasting wheat and lightly harrowing in the seed. A simple way to reduce production costs is to reduce tillage operations. Excellent wheat stands can be achieved by no-tilling wheat (provided slugs are not a problem) or by just disking in the previous crop

(see LOW PRICES, page 5)

Table 3. Net return/acre for wheat under different yields and prices.									
	YIELD (bu/acre)								
Wheat Price	40	45	50	55	60	65	70	75	80
($)	---------- $220/acre production costs ----------								
2.00	-140	-130	-120	-110	-100	-90	-80	-70	-60
2.50	-120	-107.50	-95	-82.50	-70	-57.50	-45	-32.50	-20
3.00	-100	-85	-70	-55	-40	-25	-10	5	20
3.50	-80	-62.50	-45	-27.50	-10	7.50	25	42.50	60
4.00	-60	-40	-20	-	20	40	60	80	100
4.50	-40	-17.50	5	27.50	50	72.50	95	117.50	140
5.00	-20	5	30	55	80	105	130	155	180
5.50	-	27.50	55	82.50	110	137.50	165	192.50	220
6.00	20	50	80	110	140	170	200	230	260
	$75/acre wheat straw profit								
2.00	-65	-55	-45	-35	-25	-15	-5	5	15
2.50	-45	-32.50	-20	-7.50	5	17.50	30	42.50	55
3.00	-25	-10	5	20	35	50	65	80	95
3.50	-5	12.50	30	47.50	65	82.50	100	117.50	135
4.00	15	35	55	75	95	115	135	155	175
4.50	35	57.50	80	102.50	125	147.50	170	192.50	215
5.00	55	80	105	130	155	180	205	230	255
5.50	75	102.50	130	157.50	185	212.50	240	267.50	295
6.00	95	125	155	185	215	245	275	305	335
1988-97 Wheat Price = $3.33									

Weed Management

Wirestem Muhly Control with Herbicide-Resistant Corn Hybrids

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Wirestem muhly is a warm-season perennial grass for which there have been no good control recommendations in corn. The development and introduction of corn hybrids that are resistant to nonselective herbicides like Roundup Ultra (glyphosate) and Liberty (glufosinate) or to grass herbicides like Poast Plus (sethoxydim) has changed this situation.

In an effort to demonstrate this new technology, an experiment was established at the Valatie Research Farm (Columbia County) in 1997 to evaluate wirestem muhly control using Roundup Ready, glufosinate resistant (GR) and Poast Protected or sethoxydim resistant (SR) corn hybrids. Corn was planted on May 28, 1997 and a preemergence herbicide was applied to the entire plot area to control annual grass and broadleaf weeds. Wirestem treatments were applied 30 days after planting when corn was in the V5 stage of growth and the wirestem was about 14 inches tall.

Early Control Ratings

Control ratings (Table 1) made 10 days after treatment (DAT) showed that Roundup Ultra and Liberty both had significant burndown of the wirestem. Control with 1.5 or 2 pt/A of Roundup Ultra was 90 and 95% respectively while control with 1.75 pt/A of Liberty was 92%. Poast Plus (2.25 pt/A) provided about 60% control at this early date while 0.67 oz/A of Accent or 0.76 oz/A of Beacon provided only 20 and 26% wirestem control respectively. Ratings made 70 DAT on September 4, showed that both Roundup Ultra treatments were still providing better than 95% control. New shoots appeared in Liberty-treated plots within 14 DAT and by 70 DAT the control rating had declined to 60%. Late-season control with Poast Plus stayed at about 60% while control with Accent and Beacon was 53 and 14% respectively 70 DAT.

Residual Control in 1998

Since wirestem muhly is a perennial that spreads by short scaly rhizomes (underground stems), the residual control observed this summer is critical to the overall evaluation of these programs for long-term control. Observations made on July 8, 1998 at the Valatie Weed Science Field Day showed Roundup Ultra treatments providing excellent residual control and seemed to indicate that some changes had occurred over winter for the Poast Plus and Liberty treatments. Control ratings made July 13 reinforced this observation for Poast Plus which now received a rating of 88%. Although control with Liberty was 90 and 80% in replications one and two respectively, the control in the third replication was only 20% (average 63%). It is not clear why there was so much variability among the replications for this treatment, however, there is some indication that Liberty may have more residual effect than anticipated even though there is little or no translocation of Liberty into the rhizomes. The level of wirestem control with Accent and Beacon did not change significantly between last fall and this summer. Accent plots averaged 57% control and Beacon plots averaged only 11% control one year after treatment.

Recommendations

Clearly, the use of Roundup Ready corn hybrids with Roundup Ultra can provide excellent wirestem control and is recommended for control of this perennial grass in field corn. For now, it is recommended that a minimal preemergence herbicide application be made to control the bulk of the annual grass and broadleaf weeds and that Roundup Ultra at 1.5 to 2 pt/A be applied mid- to late postemergence when the wirestem is 8 to 12 inches tall. Further research may reveal that the use of GR or Liberty Link hybrids with Liberty herbicide or the use of SR or Poast Protected hybrids with Poast Plus may also have potential for control of wirestem muhly.

Table 1. Wirestem muhly control in Roundup Ready, GR (glufosinate resistant), and SR (sethoxydim resistant) corn following herbicide applications made June 27, 1997 at Valatie.

	Rate	Wirestem Muhly Control %		
Herbicides	Amt/A	7/8/97	9/4/97	7/13/98
Roundup Ultra	1.50 pt	90	96	99
Roundup Ultra	2.00 pt	95	98	98
Liberty*	1.75 pt	92	60	63
Poast Plus**	2.25 pt	60	60	88
Accent**	0.67 oz	20	53	57
Beacon**	0.76 oz	26	14	11

* Applied with 3 lb/A AMS (ammonium sulfate)
** Applied with 1% (v/v) COC and 2% (v/v) 28% UAN.

RESIDUE

(SOIL, from page 1)

Plant materials more resistant to decay than well fertilized grass may leave 30 to 40 percent of their organic materials in the soil. The yield of the grass crop may be higher or entire crop, tops and roots, may be incorporated into the soil as with a green manure crop. The organic material may be incorporated into less than the entire soil plow layer and the samples taken from this more shallow zone as may be the case with no tillage management. However, the final result is that it requires many years to replace the organic matter lost from the soil by soil erosion and/or continuous row crop cultivation.

(Low Prices, from page 3)

residue of soybeans, dry beans, peas, etc. Another opportunity to reduce production costs is through seeding rates. Too many growers seed at 2½ to 3 bu/acre instead of the recommended 2 bu/acre. With good quality seed, New York wheat producers should seed at 2 bu/acre up until early October. Only if planting is delayed until mid or late-October should wheat producers seed at 2½ bu/acre or greater. Another opportunity for reducing production costs is to include only P in the starter fertilizer provided soil K levels are adequate. Research at Cornell has shown that no N is required in the starter fertilizer, especially if wheat follows soybeans, dry beans, or peas in the rotation. One management input not to skip on is seed quality. Certified seed treated with protectant fungicides (such as Vitavax200, Raxil-Thiram, or Bividend) is a profitable investment even when the wheat price is depressed.

Conclusion

Despite current low wheat prices, we recommend that New York growers keep wheat in their rotations. Wheat can have a direct positive "rotation effect" on corn yields, and break insect and disease cycles for many of our cash crops in New York. New York growers should look for opportunities to reduce production costs to maximize net returns on wheat in 1999.

Field Crop Dealer Meetings

October 27 - Tuesday:
Clifton Park, NY - Chaucers Restaurant, Rt. 9 South

October 28 - Wednesday:
New Hartford, NY - Ramada Inn, 141 New Hartford Street

October 29 - Thursday:
Batavia, NY - Holdiay Inn, 8250 Park Road (formerly Sheraton)

October 30 - Friday:
Waterloo, NY - Holiday Inn, 2468 NYS Route 414

Calendar of Events

October 18-22	ASA, CSSA, SSSA Annual Meetings, Baltimore, MD
October 27	Field Crop Dealer Meeting, Clifton Park, NY
October 28	Field Crop Dealer Meeting, New Hartford, NY
October 29	Field Crop Dealer Meeting, Batavia, NY
October 30	Field Crop Dealer Meeting, Waterloo, NY
November 8-12	Joint Meeting of American Phytopathological Society and Entomology Society of America Las Vegas, NV
January 4-7	Northeastern Weed Science Society Annual Meeting, Cambridge, MA

What's Cropping Up? is a bimonthly newsletter distributed by the Department of Soil, Crop and Atmospheric Sciences at Cornell University. The purpose of the newsletter is to provide timely information on field crop production and environmental issues as it relates to New York agriculture. Articles are regularly contributed by the following Departments at Cornell University: Soil, Crop and Atmospheric Sciences, Plant Breeding, Plant Pathology, and Entomology. **To subscribe, send a check for $8.00 along with the form at the right.**

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