2006 Northeast SARE Farmer/Grower Grants

Evaluating Farm Feasible Microbiological Applications and Soil Health Response

FNE06-580

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Project Goals:

The project team is proposing to explore three different application types; Compost, Inoculated Wood Chips/High Carbon Compost, and Compost Tea will be applied across four replicated blocks for a total of 16 plots in a uniform trial area (including Control plots).

The effort is to determine which would result in the most marked improvement in subsequent Soil Health Assessment Scores as determined by the Cornell Soil Health Program Work Team (CSHPWT) assessment methodologies. Furthermore we will subsequently assess which of these improvements is the most cost effective and agriculturally sustainable.

Cover Crop yields will be taken from the sampled plots to correlate soil treatment effects on yield response. The development of best management practices will be based upon assessing which treatment improved Soil Health Assessment Scores in the most cost effective and agriculturally sustainable way.

Farm Background:

Stones Throw Farm was established in 2005 as a complimentary and collaborative enterprise that is synergistic with the Guptill family's 4th generation farm. Neighboring Guptill Farms is a 250 acre farm that rotationally grazes 60 dairy cows as well as young stock and steers. Guptill Farms also produces and markets Toad Hollow Farms Natural Compost. Diversification of the farm entity is extremely important for its continued sustainability.

Stones Throw Farm is a Northeast Organic Farmers Association – Farmers Pledge producer that grows specialty vegetables, small fruits, herbs, flowers, log grown mushrooms and pasturage on 7 - 10 acres of Palmyra Gravel Loam. Our

pastures are rotationally grazed by laying hens and summer run ducks and geese. The pasture is also a key component in our long-term soil building program and vegetable rotation. Our produce is marketed at the Central New York Regional Market, and to local restaurants, in 2007 Stones Throw Farm is establishing a Growers Season CSA Program. The Guptill Family farm ships milk via Farmland and steers are pre-sold directly to consumers. Farm generated compost is sold in bagged form at region wide retail and garden centers. Compost is also sold bulk to area nursery professionals, and small farm enterprises such as Stones Throw Farm.

Project Cooperators:

The primary cooperators on this project include; Waste Not Resource Solutions (WNRS), Guptill Farms, the Cornell Soil Health Program Work Team (CSHPWT), and Matt DaRin an independently contracted microbiologist with experience in fungal propagation.

WNRS is primarily responsible for assistance with general project management and implementation and will be involved with project outreach during 2007.

Guptill Farms has assisted with field work and compost applications in 2006 and will do so again in 2007.

CSHPWT has assisted in the development of a research approach and is responsible for soil health sampling and analysis. Additionally CSHPWT has contributed by drying and weighing farm collected forage samples.

Matt DaRin has been responsible for assisting with the procurement and propagation of fungal species utilized in the Inoculated Wood Chips / High Carbon Compost.

Progress in 2006:

During 2006 a project implementation area was defined and marked. Sixteen randomly assigned treatment blocks were developed and a map delineating these areas was developed. In May of 2006 the CSHPWT took pre-application base sampling in order to develop a benchmark for comparison of subsequent soil sampling.

Applications were prepared and applied as specified by the methodology developed in the grant application. Manure compost from Toad Hollow Farms Natural Compost was applied during the spring of 2006, fungal inoculum was propagated and introduced to high-carbon compost and applied in spring of 2006 and an improved compost tea production unit was developed and utilized in the production and application of compost tea applied monthly during the 2006 growing season.

During the summer and fall of 2006 forage samples were cut from the stand of mixed legume and grass sod that is currently grown on the trial area. Two representative samples each containing two forage squares of material were cut, dried and weighed to determine yield correlations across the treatment areas.

Throughout the growing season the trial area was observationally monitored and field notes and photographs were taken as needed.

Progress Slated for 2007:

In early 2007 CSHPWT will again gather soil samples. These samples will provide insight into soil health improvements based upon applications and treatments. After early spring sampling, compost applications will again be made to the treatment blocks and the area will be seeded with an annual cover crop. Field preparation and exact crop species will be determined based upon the weather and hence the timing of establishment. Soil Health and forage sampling will proceed accordingly.

In addition during 2007 an open house will be conducted on farm. This open house will allow visitors an opportunity to learn about the project and soil building methods utilized on farm. During the fall and winter of 2007-2008 as additional project data becomes available the primary outreach component of the project will take place. Observational and Analytical reports will be developed that will explore the efficacy of each treatment on the soil health response. These treatments will be assessed for their economic and farm feasibility. Fact sheets on the projects findings will be developed and distributed to industry professionals. Additionally it is intended that the information will be presented in industry literature and at/during industry events.

Results and Accomplishments:

We feel that the timely initiation and implementation of the primary phases of this project during a very difficult 2006 growing season, in which weather fluctuations and phenomena continue to astound us, is an accomplishment in and of itself. That said the project is proceeding on schedule and has met the milestones it established for 2006. Due to the nature of seasonal applications and prescribed sampling methodology we don't at this time have hard data to substantiate the applications and treatments made during 2006. Some of this data will become available during the spring of 2007 and additional data will continue to become available into the spring of 2008. We look forward to reporting on this data as it becomes available. We have included as attachments a summary document containing the baseline soil information gathered during the Spring of 2006 and additionally it includes average forage yields based upon the 2006 sampling.

Observational analysis during the 2006 growing season was quite promising. All forage stands appeared healthy and yielded well. Upon closer observation of the soil surface across the various treatment blocks we were very pleased to note improved textural quality in the soil surface (1"-2"). The blocks receiving compost or high-carbon compost both displayed increased aggregation, increased incidence of worm castings and holes as compared to the "control" blocks. Additionally it was noted that the compost tea blocks also seemed to display some improvement in the soil surface over the "control" blocks.

Site and/or Farm Conditions:

It is difficult to determine what if any effect the 2006 growing season may have had on the results of this project. It can unequivocally be stated that the 2006 growing season was one for the record books. We started the year with an early dry period; our "wettest" ground was bone dry by early-May when we endured close to a week of record breaking temperatures in the upper 90's with heat indexes well over 100. We had frost the following week. The season then proceeded to become cool and wet. It was the wettest summer on record in this area and we experienced not just one but a handful of torrential rain events that flooded much of Central and Upstate New York and dumped rain measured in inches. Fall and Winter have been quite mild, we didn't experience ground-freeze until Mid-January and our precipitation averages are still on the high-side.

From a production standpoint the year was really a mixed bag. Depending on their period of establishment some early and mid crops did very well others didn't do well at all. Most of our soils are quite well drained and some certainly benefited from the regular rainfall throughout much of the season. Cultivation and planting schedules became increasingly befuddled as the season wore on. We were very fortunate to have not lost our potato crop to field rot due to an extended period of wet and cold in late-May and early-June. We defiantly attribute some of this to a soil that is healthy and microbiologically active. For the most part heat-loving crops had a difficult year. Tomatoes were especially trying this season. Our tomato season began almost a full month behind schedule and ended very early due to foliar blight exacerbated by cold and wet weather. To a large degree long season fall crops which are typically established on our "wettest" ground in order to provide them with ample moisture in July and August didn't even get planted. With the exception of a stretch of about three days in late-August that ground was unworkable. We sent our entire first and most of our second planting of fall transplants straight to the compost pile. A "desperation" third planting was put in during a brief window of "dryish" soil in late-August. Most of these crops were established to late to mature during our market season.

All in all 2006 was plainly a mixed bag of crops and weather. It really depended on soils and locations. Hay ground and some forages yielded at record levels on some local farms with the ample rainfall, others were completely washed out, lost entire plantings and in some instances barns and boundary fences were washed

away or damaged by flooding. We had it better than some and worse than others. It is what it is and unfortunately we can't change the weather. We're looking forward to 2007 and whatever it might bring.

Economic Findings:

At this stage of the project it is difficult to determine the exact economic implications of the various applications and treatments. As data becomes available in 2007 and early 2008 we look forward to performing an economic analysis of each treatment related to its farm feasibility and the subsequent intended effect on soil health.

New Ideas and Next Steps:

Again it is probably too early to gain much insight into the exact nature of the relationship between this project, the applications, and the issue of soil microbiology and soil health response. The more we consider soil health and the positive and/or negative implications that our farm processes and procedures have upon it, the more we realize that this is truly a diverse and integrated system that warrants full process planning and implementation. For instance we feel it is beneficial to apply compost to crop and forage fields as a means to increase microbial diversity and abundance, increase soil organic matter and provide nutrients to the growing or intended crops. Simultaneously we also recognize that efficiently and economically spreading compost and soil amendments on a "large scale" requires increased field traffic by heavy machinery. When it comes to soil health the two could be inversely related and an analysis of the implications of each is warranted. Based upon our initial observations of soil health in the plots we perceive that the applications are beneficial in spite of increased field traffic however the remainder of the project and the quantitative as well as additional qualitative findings will help to better elucidate these beliefs.

In terms of "Next Steps" that extend beyond this project proposal we are certainly very interested in determining the effect that these applications and their soil health response have on the yield and quality of subsequent crops. This project was designed based upon the explicit need to develop a better understanding of appropriate means to improve soil health and subsequently yield and quality of high value mixed vegetables. Integrating these treatments into the forage and cover cropping regime seemed the most appropriate entry point but the goal is not to simply improve those forage stands but the overall soil health and thus soil quality for high-value mixed vegetable crops.

Additionally with respect to our concerns over the effect of field traffic, even in-lieu of proper timing and management, become more clear we are interested in exploring alternative means of applying additional amendments; nutrients, organic matter, etc. to our cover-crops and fallow fields throughout our vegetable

rotation. A more explicit understanding of compost spreading and/or compost tea application technology and/or a more explicit understanding of managed grazing being integrated into mixed vegetable production may be warranted.

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1/2/07

2006 Hay Yields (dry Tons/A)

Treatment	august	sept.
control	2.10 a	0.85 a
composted dairy	2.40 a	1.02 a
inoculated woodchips	2.43 a	0.94 a
compost tea	2.52 a	0.82 a

2006 Soil Parameters 5.30.06

	Biological					
	(μgN/g/week) Pot. Min. N	(ppm) Carbon	%	1-9	%	g/cm^3
Treatment	**PMN**	**activeC**	**organic matter**	**Root Health Rating**	**aggregate stability %**	**Bulk density**
control	5.18	525	4.95	3.3	40	1.50
composted dairy	5.04	509	4.82	3.1	41	1.45
inoculated woodchips	9.55	504	4.91	3.3	36	1.41
compost tea	9.61	436	4.86	3.9	32	1.38

Physical							
% total porosity %	% macro porosity	% meso porosity	% soil strength	% Avail. Water Capacity AWC	pH in water	P, availabl mg/Kg	K, availabl mg/Kg
0.46	0.01	0.11	1.43	0.18	6.28	3.3	46
0.49	0.01	0.14	1.35	0.20	6.1	2.8	42
0.49	0.01	0.15	1.04	0.19	6.01	3.4	42
0.50	0.02	0.16	1.12	0.22	6.01	2.9	40

Chemical						
Mg, availa	Ca, availal	Fe, availat	Al, availab	Mn, availa	Zn, availat	CU, available
mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
221.7	1995	2	19.3	64.4	0.8	0.5
178	1705	2.3	21.5	63.8	0.79	0.5
180.7	1826	2.5	22.4	77	0.59	0.3
168.5	1664	2.5	25.1	73.4	0.53	0.7

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2006 august sampling

Plot	Rep	TRT	drywt.(g)/2 ft^2	dry T/A	
1	1	A	67	1.61	
1	2	A	78	1.87	
7	1	A	83	1.99	
7	2	A	102	2.45	
10	1	A	103	2.47	
10	2	A	92	2.21	2.10
2	1	B	107	2.57	
2	2	B	92	2.21	
5	1	B	77	1.85	
5	2	B	94	2.25	
11	1	B	143	3.43	
11	2	B	88	2.11	2.40
3	1	C	104	2.49	
3	2	C	96	2.30	
6	1	C	100	2.40	
6	2	C	107	2.57	
9	1	C	89	2.13	
9	2	C	111	2.66	2.43
4	1	D	92	2.21	
4	2	D	95	2.28	
8	1	D	93	2.23	
8	2	D	111	2.66	
12	1	D	126	3.02	
12	2	D	113	2.71	2.52

late Sept. 2006 sampling

1	1	A	36	0.85	
1	2	A	36	0.86	
7	1	A	31	0.75	
7	2	A	34	0.80	
10	1	A	36	0.87	
10	2	A	40	0.97	0.85
2	1	B	36	0.87	
2	2	B	41	0.97	
5	1	B	37	0.89	
5	2	B	47	1.14	
11	1	B	41	0.97	
11	2	B	54	1.29	1.02
3	1	C	45	1.07	
3	2	C	31	0.74	
6	1	C	42	1.00	
6	2	C	43	1.02	
9	1	C	40	0.96	
9	2	C	36	0.86	0.94
4	1	D	35	0.83	
4	2	D	36	0.86	
8	1	D	25	0.60	
8	2	D	32	0.76	

12	1	D	44	1.05	
12	2	D	35	0.83	0.82

2006 Hay Yields (dry Tons

Treatment	august
control	2.10 a
composted dairy	2.40 a
inoculated woodchips	2.43 a
compost tea	2.52 a

/A)

sept.
0.85 a
1.02 a
0.94 a
0.82 a

PMN	Root Healt	activeC	SARE ID	core id	number	year	OM
5.18	3.3	525	d287	dd287	1	2006	4.95
5.18	3.3	525	d287	dd287	2	2006	4.95
5.18	3.3	525	d287	dd287	3	2006	4.95
5.04	3.1	509	d288	dd288	1	2006	4.82
5.04	3.1	509	d288	dd288	2	2006	4.82
5.04	3.1	509	d288	dd288	3	2006	4.82
9.55	3.3	504	d289	dd289	1	2006	4.91
9.55	3.3	504	d289	dd289	2	2006	4.91
9.55	3.3	504	d289	dd289	3	2006	4.91
9.61	3.9	436	d290	dd290	1	2006	4.86
9.61	3.9	436	d290	dd290	2	2006	4.86
9.61	3.9	436	d290	dd290	3	2006	4.86

5.18	3.3	525					4.95
5.04	3.1	509					4.82
9.55	3.3	504					4.91
9.61	3.9	436					4.86

2006 Soil Parameters **5.30.06**

	Biological						
Treatment	**PMN**	**activeC**	**organic matter %**	**Root Health Rating**	**aggregate stability %**	**Bulk density**	**total porosity %**
control	5.18	525	4.95	3.3	40	1.50	0.46
composted dairy	5.04	509	4.82	3.1	41	1.45	0.49
inoculated woodchips	9.55	504	4.91	3.3	36	1.41	0.49
compost tea	9.61	436	4.86	3.9	32	1.38	0.50

texture	ag stability	coreBD	saturated theta V	0.3kPa theta V	10kPa theta V	15 bar theta V	van genuchten 30kPa	Strength@ 10kPa Mpa
CLAY	40	1.62	0.42	0.42	0.37	0.23	0.34	1.98
CLAY	40	1.51	0.46	0.45	0.38	0.21	0.34	1.32
CLAY	40	1.36	0.51	0.50	0.42	0.19	0.36	0.99
CLAY	41	1.59	0.45	0.44	0.37	0.21	0.33	1.83
CLAY	41	1.37	0.50	0.50	0.40	0.18	0.34	1.16
CLAY	41	1.38	0.52	0.50	0.41	0.18	0.35	1.05
CLAY	36	1.55	0.44	0.43	0.36	0.21	0.32	1.16
CLAY	36	1.33	0.53	0.52	0.40	0.18	0.34	0.99
CLAY	36	1.35	0.51	0.49	0.38	0.19	0.33	0.95
CLAY	32	1.49	0.47	0.45	0.37	0.18	0.32	1.34
CLAY	32	1.31	0.52	0.50	0.40	0.16	0.33	1.08
CLAY	32	1.33	0.51	0.50	0.39	0.16	0.33	0.94
	40	1.50	0.46	0.46	0.39	0.21	0.35	1.43
	41	1.45	0.49	0.48	0.39	0.19	0.34	1.35
	36	1.41	0.49	0.48	0.38	0.19	0.33	1.04
	32	1.38	0.50	0.48	0.39	0.17	0.33	1.12

Physical

macro porosity	meso porosity	soil strength	AWC	pH in wate	P, availabl mg/Kg	K, availabl mg/Kg	Mg, availa mg/Kg	Ca, availal mg/Kg
0.01	0.11	1.43	0.18	6.28	3.3	46	221.7	1995
0.01	0.14	1.35	0.20	6.1	2.8	42	178	1705
0.01	0.15	1.04	0.19	6.01	3.4	42	180.7	1826
0.02	0.16	1.12	0.22	6.01	2.9	40	168.5	1664