

Soil health assessment, management, and training: Vegetable production systems

Summary

This project was initiated by our Soil Health Work Team (consisting of vegetable growers, cooperative extension staff and multidisciplinary faculty) in order to address the progressive deterioration of vegetable soils and to develop appropriate solutions. During the project, the soil health status of 50 – 100 vegetable farms throughout the production areas in New York will be determined. Project impact on the awareness and knowledge of soil health issues and production practices of 100 – 250 growers will be monitored through mailed surveys, interviews and participatory activities. Demonstration trials on various soil management practices will be conducted in 5 commercial production regions and also on established long-term soil health sites. The established trials (including modification in crop rotations, cover crops, soil amendments, tillage systems, pest control, transition to organic production and others) will be intensively monitored for biological, chemical and physical soil quality factors as well as impact on farm profitability. The project will also develop and field-test various new measurements to be included in a soil health assessment protocol; a demonstration kit for educators, a website; and a package of outreach materials for soil health assessment and management.

Objectives/Performance Targets

Fifty growers will implement two or more promoted management practices to improve soil quality and health on their farms. The latter may include: using new soil health tests to determine appropriate management practices; incorporating a new main and/or cover crop into their rotation scheme, changing tillage practices employed, using a new compost or other soil amendments, and adopting sustainable pest management practices, including IPM strategies.

A “soil health assessment protocol” will be developed and field-tested to the stage where it is ready to be institutionalized (i.e., become a permanent feature of fee services) offered by Cornell University and/or commercial soil testing laboratories.

Accomplishments/Milestones

Outreach Activities and Promotion of Soil Health Issues: Our team members have collectively made a great contribution in increasing the awareness, concepts and needs in soil health and sustainable management practices to large and diverse audiences within and outside New York. In 2004, participating extension educators organized 10 field days, faculty and growers made >15 invited presentations at various national and international conferences, students and faculty presented 4 posters at national meetings, and our Soil health Program Work Team organized and presented sessions on soil health at the CCE In-service training and the Empire State fruit and Vegetable Expo. In addition, our team is planning to offer training and discussion sessions on soil health to an audience of private consultants within the region this winter and possibly to conduct hands-on training to national and international participants in the near future.

Maintenance of the Established Long-Term Research and Demonstration Soil Health Sites: Collaborating growers and extension educators of our team have continued the 10 demonstration sites around the state that are evaluating the impact of reduced tillage, crop rotation, cover crops and/or composts on soil health parameters and profitability. Involved faculty have continued the on-going research on the established 2 new replicated research sites (Gates Farm in Geneva and Organice Research Farm in Freeville) and also the 4 on-going and replicated research experiments (Geneva, Long Island, Chazy/Clinton Co. and Willsboro/Essex Co.) for an in-depth assessment of soil management practices on soil health, development of a cost-effective protocol for soil health

determination and providing living-laboratories for hands-on training.

Contribution to Increased Multi-Disciplinary and Collaborative Research and Outreach Efforts: All the outreach, research and training activities conducted and/or provided by our group have been truly a team effort. Our researchers in several academic departments have worked together on the same sites collecting data that range from the qualitative and applied nature to the most basic measurements including the molecular characterization of soil microbial communities. Growers, educators, faculty and private consultants are involved in the planning, data collection and presentation of information to various audiences at training sessions and formal meetings.

Development of a Cost-Effective Protocol for Assessing Soil Health Levels of NYS Soils: One of our team's objectives is developing and evaluating a soil health assessment protocol that is compatible with current soil testing services. To-date, we have accumulated large and useful data sets based on numerous physical, chemical and biological soil measurements that our team members have taken from the research and demonstration sites. The voluminous data sets are now being analyzed using a number of statistical programs in order to understand the multi-level interactions and correlations that exist among the parameters measured. It is hoped that the latter will make it possible to identify a few measurements for soil health assessment that could be conducted by the Cornell Soil Analysis Laboratories or other private laboratories for a modest fee. Currently deliverable and cost-effective measurements include aggregate stability, soil strength, pore size distribution, decomposition rate, N mineralization rate, particulate organic matter, disease suppressive capacity and nematode density and diversity. Other potential measurements that are being investigated by team members include glomalin content, fatty acid profiles, DNA fingerprinting patterns and others. The team is also working on developing simple soil health cards specifically for NYS soils and using growers modifications to proposed measurements including the use of simple rods and inexpensive penetrometers for determining the depth of compacted layers in the soil profile.

Documentation of the Effect of Various Soil Management Practices on Soil Health and Crop Productivity: Our team members are evaluating large number of soil management practices in the demonstration and research sites for their impact on soil health parameters and ability to improve yield and profitability. Such data will aid greatly in the promotion and adoption of sustainable soil management practices. In 2004 for example, yield of table beet and field corn were highest following a cover crop of hairy vetch at the Gates soil health site as compared to their yield after a cover crop of grain rye or fallow. Also, weed pressure was less on table beets and corn following a cover crop of hairy vetch. In addition, marketable yield of table beets was highest on the raised-ridge tillage plots as compared to the yield obtained on the zone-till (first cycle on this site) or conventionally plowed plots. We will need to involve an agricultural economist in analyzing the cost-effectiveness of the long-term effect of promoted soil health practices on crop profitability or ecosystem function.

Impacts and Contributions/Outcomes

More than 200 soil samples were analyzed for physical, chemical and biological soil health parameters and the results have been summarized and are being shared among the researchers and with extension and farmer audiences, as appropriate.

Within the coming year, a number of new soil health assessment procedures, including aggregate stability, porosity, permeability, penetrability, and soil suppressive capacity will become a fee-based service at Cornell University on a limited basis. Several other procedures such as parasitic : saprophytic nematode ratio, decomposition rate, N mineralization rate, and C and N in particulate

organic matter fractions are being fine-tuned and will be next in line for hand-over to the fee-for-service laboratory. The next step, after appropriate modification for handling large sample load on a profitable basis, will be education of other public and private laboratories on methods and interpretation of protocols.