Improve Crop Yields and Get on Your Fields Quicker with Good Soil Management

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Poor management of soils contributes to gradual degradation of soil quality and health, resulting in lower quality and quantity of marketable crop yields. Also, it is well known that root diseases and their damage are most severe in poor quality/unhealthy soils. Thus, the recent interest in the concept of soil health and the implementation of sustainable soil health management practices. Maintaining or improving the health status of soil involve a holistic approach to integrate and optimize the physical, chemical and biological properties of soil for improved crop health and productivity in a sustainable manner. Available soil health management practices include reduced tillage systems, cropping sequences, cover cropping, and adding various amendments. It is known that all of these production practices have direct and/or indirect effects on all soil properties, but only limited information is available on the impact of their numerous combinations on crop productivity and health. Accordingly, several collaborative projects are on-going in experimental fields to assess the impact of soil health management practices employed singly and in various combinations on crop yield, root health and measured soil health quality indicators. Below are brief summaries of results obtained from two collaborative, long-term experiments in 2011, but they will be more fully illustrated and discussed in the presentation at the meeting.

In collaboration with the Cornell soil health team, the combined effects of tillage practices (No-till/ridge-till, Zone-till, Plow-till), cover crops (Rye grain, Vetch, Fallow), and crop rotation (Vegetables vs. Grain/Forage/Vegetable) have been evaluated at the long-term soil health site at the Gates Farm, NYS Ag Experiment Station since 2003. In 2011, all the 72 plots were planted to snap bean cv. 'Caprice' to assess the accumulated effects of the tested treatments and their combinations. Results obtained in 2011 showed that pod yield of the indexing snap bean crop was highest in the ridge-till and in the zone-till plots and was lowest in the plow-till plots in both crop rotations (Table 1). In addition, it was difficult to machine harvest the plow-till plots due to excessive rainfall during the growing season (Figure 1), but there was no problem harvesting the reduced tillage plots and also the ridge-till plots. Root rot severity assessment in the field and in the greenhouse bean bioassay did not differ greatly among the various treatments, but it was lower on roots of plants grown in the ridge-till plots. Again, the reduced tillage practices appear to improve measured soil health indicators, but final mining of the data is still in progress. Again, the three cover crop treatments were re-established in early September 2011 for re-evaluations in 2012.

A second year evaluation of the replicated 9 cover crop treatments (winter rye grain + hairy vetch, oat, sudex, forage radish, red clover, rapeseed, buckwheat, wheat, and a fallow/control) was completed in 2011. Results obtained showed that the pod yield of snap beans cv. 'Caprice' was highest in the field with the highest soil

health quality (Future-IPM/cover cropped production system) and lowest in the conventionally managed field. In the conventionally managed field, bean yield was highest in the rye+vetch cover crop plots and lowest in the buckwheat plots. Root rot development was moderate to severe, but varied only slightly among the treatments. All cover crop treatments were re-established in the same plots for final evaluation in 2012 and for complete analyses of the data accumulated during the 3-year cycles of this collaborative, multi-state (NY, PA, CT) project.

Table 1. Impact of tillage practices and crop rotations on stand establishment, root rot severity and yield on snap beans at the Soil Health Site, Gates Farm, 2011.

Rotation 1 - Vegetables

Tillage	**#Plant/10ft**	**RRS (1-9)**	**Pod Wt Lb/100ft**
Ridge	46.8	4.2	53.5
Zone-Till	47.5	4.5	45.1
Plow	46.9	5.3	29.8
LSD	*3.85*	*0.55*	*10.21*

Rotation 2 - Grain/Forage/Vegetables

Tillage	**#Plant/10ft**	**RRS (1-9)**	**Pod Wt Lb/100ft**
No-Till	41.2	4.3	44.5
Zone-Till	46.6	4.4	55.2
Plow	44.5	4.0	34.1
LSD	4.2	0.45	11.0

Figure 1. Photos illustrating the benefit of reduced tillage practices on soil conditions during harvest (August 20110 after excessive rainfall events. No-till & Zone-till and plow-till plots are represented by the top and lower photos, respectively