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On-Farm Research Trial on Iowa Strawberry Production with USDA/NRCS Soil Quality Test Kit

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Abstract
The profitability of strawberry production is dependent in large part on the condition, or quality, of the soil being used. Soils with poor physical structure, chemical properties, or biological activity require more cultivation, fertilizers, and other inputs to maintain economic viability. In general, cultivation of the soil for crop production degrades the soil. At some point, the cost of inputs will outweigh the value of the strawberry crop being produced. It is therefore essential for growers to monitor the productive capacity of their soil.

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Introduction

The profitability of strawberry production is dependent in large part on the condition, or quality, of the soil being used. Soils with poor physical structure, chemical properties, or biological activity require more cultivation, fertilizers, and other inputs to maintain economic viability. In general, cultivation of the soil for crop production degrades the soil. At some point, the cost of inputs will outweigh the value of the strawberry crop being produced. It is therefore essential for growers to monitor the productive capacity of their soil.

This project was initiated to familiarize Iowa fruit growers with a method to improve their ability to monitor soil quality trends in a relatively quick and cost-effective manner. The overall objectives were 1) to assist two commercial strawberry growers in the use of a soil quality test kit on their farm in order to collect soil quality data and obtain perspective on its usefulness; 2) to present state and regional fruit growers with information and research results about soil quality testing; and 3) to conduct a soil quality interest survey of Iowa small fruit growers.

Materials and Methods

The research trial was conducted at three farm sites in Iowa: 1) central Iowa, 2) west-central Iowa, and 3) the ISU Horticulture Research Station, Ames. Each grower selected production fields where the research trial would take place. Three random sample sites were selected within each production field. The growers were instructed on the use of the soil quality test kit and were assisted by ISU personnel in data collection. Fields received conventional production practices, including herbicide and synthetic fertilizer applications, except the west-central farm. Soil measurements were taken from the outer edge of the matted strawberry plant row. The following data were collected: soil respiration, infiltration, bulk density, electrical conductivity, pH, soil nitrate, earthworm presence, and soil physical and moisture observations. Data were collected in November 2004 and in May, August, October, and November 2005.

Results and Discussion

Nonstatistical observations and data of the research trial measurements follow.

Incorporation of large amounts of organic matter in the central Iowa farm research field in 2005 showed that the middle and north field sample sites had lower bulk density, volumetric water content, and increased water-filled pore space (Table 1) than in 2004. The south and north field sites had higher soil respiration rates in 2005 than in 2004. At the west-central Iowa farm site, where no amendments had been made since the previous year, bulk density was lower in the east and middle sample sites, soil respiration decreased sharply overall at all three sites in 2005, and infiltration rate was highly variable, compared with 2004 (Table 2).

At the central Iowa farm, a field recently amended and cultivated (Site A) and a field that was planted to a perennial crop two years before (Site B) were sampled. Bulk density was lower in the recently tilled field, but other measurements were similar or highly variable (Table 3). At the west-central Iowa farm, a field that had been in strawberries for four years (Site A) and a field that also had been in strawberries for four years but was recently plowed and

cultivated (Site B) were sampled. Data collected at the ISU Horticulture Research Station are currently being analyzed.

Two or more years of data are required to determine trends in soil quality. However, after one year the soil quality test kit measurements reveal potential changes taking place in the soil due to differing soil management. The variability of the data shows the importance of taking multiple samples at multiple sites. Continued monitoring can lead to improved soil quality by aiding appropriate management decisions. This study will be continued in 2006.

Acknowledgments

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Table 1. Soil property measurements collected using a soil quality test kit at a central Iowa farm in fall 2004 and 2005. [1]

On-farm site	Bulk density (g/cm^3)		Volumetric water content (g/g)		Water-filled pore space (%)		Soil respiration (lb CO_2-C/acre/day)		Infiltration rate (in./hr)	
Central	11/6/04	10/28/05	11/6/04	10/28/05	11/6/04	10/28/05	11/6/04	10/28/05	11/6/04	10/28/05
South	1.26	1.33	0.20	0.21	38.9	42.0	108.5	204.7	13.74	10.03
Middle	1.40	1.31	0.16	0.31	34.5	60.8	88.4	73.3	14.06	15.13
North	1.33	1.13	0.13	0.24	26.8	42.6	98.8	168.0	2.50	40.91

[1]Data obtained are approximately one year apart (2004 and 2005) to observe longitudinal trends in soil condition. Data presented are not means; each value represents one sample.

Table 2. Soil property measurements collected using a soil quality test kit at a west-central Iowa farm in fall 2004 and 2005. [1]

On-farm site	Bulk density (g/cm^3)		Volumetric water content (g/g)		Water-filled pore space (%)		Soil respiration (lb CO_2-C/acre/day)		Infiltration rate (in./hr)	
W-central	11/6/04	10/28/05	11/6/04	10/28/05	11/6/04	10/28/05	11/6/04	10/28/05	11/6/04	10/28/05
East	1.45	1.33	0.38	0.21	83.0	41.2	133.0	25.1	81.8	19.8
Middle	1.21	1.09	0.29	0.15	53.3	25.3	121.8	42.1	47.4	5.6
West	1.09	1.18	0.30	0.15	50.8	26.4	87.1	30.5	76.6	144.0

[1]Data obtained are approximately one year apart (2004 and 2005) to observe longitudinal trends in soil condition. Data presented are not means; each value represents one sample.

Table 3. Soil property measurements collected using a soil quality test kit at central Iowa and west-central Iowa farms in 2005.[1]

On-farm site 8/21/05	Bulk density (g/cm^3)		Volumetric water content (g/g)		Water-filled pore space (%)		Soil respiration (lb CO_2-C/acre/day)		Infiltration rate (in./hr)	
Central	Site A	Site B	Site A	Site B	Site A	Site B	Site A	Site B	Site A	Site B
South	0.76	1.21	0.28	0.23	39.2	43.0	160.0	178.9	171.4	29.3
Middle	1.11	1.22	0.26	0.29	44.1	53.5	76.4	149.4	26.9	25.2
North	1.01	1.11	0.31	0.17	50.4	29.9	95.7	120.2	18.5	46.2
August 19 W-central	Site A	Site B	Site A	Site B	Site A	Site B	Site A	Site B	Site A	Site B
East	1.06	1.16	0.18	0.22	30.3	40.0	21.0	11.2	171.4	27.7
Middle	1.15	1.23	0.17	0.20	30.5	37.0	16.2	10.4	59.0	17.5
West	1.36	1.01	0.27	0.18	55.2	28.7	53.2	15.3	27.5	33.0

[1]Data obtained from differently managed fields at approximately the same date to observe effects of crop management on soil quality. Data presented are not means; each value represents one sample.