# Soil Microfauna in the Organic Transition Experiment at the Center for Environmental Farming Systems

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Soil organisms are functionally linked to above-ground interactions and are critical to organic matter decomposition and nutrient cycling, carbon storage, and biological control of human and agricultural pests. Soil quality is at the center of discussions related to agricultural sustainability. Most agricultural practices alter soil biological, chemical and physical properties, but they are not often viewed in terms of (or an opportunity for) managing beneficial soil organisms. Questions that address the balance of crop health/plant protection (e.g. constrain pathogens and consumers of plants) and soil quality (practices that benefit organic matter decomposition and nutrient cycling) must be addressed. Rather than studying the effects of specific pest management tactics on a single type of pest, examination of the effects of the agricultural system on the community of pest and beneficial organisms provides for a more holistic approach. Knowledge of the effects of agricultural practices on soil organisms and development of indices associated with "healthy" soil, low pest populations and/or increased crop tolerance to pests will enhance our understanding of the relationship between soil characteristics and productivity in different agroecosystems.

Soil microarthropod communities and populations of entomopathogenic nematodes and fungi were evaluated in a transition experiment located at the Center for Environmental Farming systems near Goldsboro, NC[1]. Year of initiation ("Start") of the experiment and crop appear to have had greater effects on the measured organisms than did treatment (Tables 1 and 2). The interaction between year of start and crop was significant for all measured organisms except for "other microarthropods". When data from all sample dates were combined, treatment significantly affected abundance of soil mites and macroarthropods. In general, treatment effects on soil arthropods were detected only in the sweetpotato crop. In sweetpotatoes, abundance of soil mites, springtails, and other microarthropods tended to be higher in the organic and gradual transition treatments compared with other treatments.

Among soil-dwelling insect pathogens, crop effects were detected for *S. carpocapsae* but not for *S. glaseri*, *H. bacteriophora*, or insect-pathogenic fungi. Numbers of sentinel insects killed by *S. carpocapsae* tended to be greater in sweetpotato than in other crops, and greater in the organic pest management treatment compared with other treatments in sweetpotato.

These preliminary analyses were conducted on broad groups of organisms. Arthropods are currently being identified to family or genus, and analyses including more specific information may reveal treatment effects on soil community composition.

**Table 1. Mean numbers (±S.E.) of sentinel insects infected with entomopathogenic nematodes or fungi per 6 cm x 2.5 cm soil core.**

| Start 1 – 2001 | | | | |
|---|---|---|---|---|
| Treatment[1] | *S. carpocapsae* | *S. glaseri* | *H. bacteriophora* | *B. bassiana* + *M. anisopliae* |
| 1. Conventional | 0.061 (0.021) | 0.168 (0.036) | 0.239 (0.096) | 0.189 (0.098) |
| 2. Organic | 0.052 (0.020) | 0.158 (0.052) | 0.278 (0.095) | 0.193 (0.055) |
| 3. Organic Fert. | 0.078 (0.049) | 0.128 (0.026) | 0.133 (0.070) | 0.133 (0.102) |
| 4. Org. Weed | 0.100 (0.029) | 0.144 (0.045) | 0.067 (0.034) | 0.156 (0.036) |
| 5. Organic Pest | 0.083 (0.026) | 0.172 (0.028) | 0.289 (0.115) | 0.156 (0.055) |
| 6. Gradual | 0.039 (0.023) | 0.106 (0.028) | 0.094 (0.054) | 0.274 (0.051) |
| **Start 2 – 2002** | | | | |
| 1. Conventional | 0.048 (0.022) | 0.187 (0.046) | 0.104 (0.065) | 0.274 (0.093) |
| 2. Organic | 0.033 (0.015) | 0.215 (0.038) | 0.081 (0.056) | 0.230 (0.106) |
| 3. Organic Fert. | 0.074 (0.032) | 0.185 (0.034) | 0.000 (0.000) | 0.259 (0.078) |
| 4. Org. Weed | 0.129 (0.068) | 0.235 (0.055) | 0.074 (0.074) | 0.357 (0.125) |
| 5. Organic Pest | 0.120 (0.056) | 0.252 (0.085) | 0.000 (0.000) | 0.302 (0.067) |
| 6. Gradual | 0.050 (0.022) | 0.196 (0.063) | 0.035 (0.022) | 0.191 (0.094) |

**Table 2. Mean numbers (±S.E.) of mites, springtails, other microarthropods, and macroarthropods per 6 cm x 2.5 cm soil core.**

| Start 1 – 2001 | | | | |
|---|---|---|---|---|
| Treatment[1] | Mites | Springtails | Other microarthropods | Macro-arthropods |
| 1. Conventional | 12.8 (3.96) | 2.0 (0.69) | 0.50 (0.07) | 0.12 (0.038) |
| 2. Organic | 18.1 (6.29) | 3.6 (0.62) | 0.92 (0.13) | 0.22 (0.051) |
| 3. Org. Fert. | 13.1 (2.24) | 2.8 (0.52) | 0.78 (0.09) | 0.08 (0.019) |
| 4. Org. Weed | 12.1 (2.79) | 3.1 (0.59) | 0.63 (0.13) | 0.10 (0.033) |
| 5. Organic Pest | 15.7 (2.70) | 3.7 (0.74) | 0.71 (0.13) | 0.24 (0.048) |
| 6. Gradual | 14.5 (2.65) | 4.2 (0.76) | 0.72 (0.10) | 0.17 (0.048) |
| **Start 2 – 2002** | | | | |
| 1. Conventional | 6.4 (0.99) | 3.1 (0.25) | 0.83 (0.21) | 0.15 (0.048) |
| 2. Organic | 8.1 (1.32) | 2.6 (0.38) | 1.07 (0.15) | 0.17 (0.034) |
| 3. Org. Fert. | 7.0 (1.08) | 2.8 (0.46) | 0.87 (0.17) | 0.11 (0.033) |
| 4. Org. Weed | 6.0 (0.82) | 2.3 (0.41) | 0.84 (0.13) | 0.08 (0.022) |
| 5. Organic Pest | 8.5 (0.79) | 2.6 (0.37) | 0.79 (0.09) | 0.23 (0.063) |
| 6. Gradual | 7.0 (0.91) | 3.2 0.77) | 0.97 (0.15) | 0.24 (0.080) |

[1]Creamer, N. et al., 2005. Introduction to Organic Transition Experiment Center for Environmental Farming Systems. This volume.