ORGANIC FARMING RESEARCH FOUNDATION

Organic farming research project report submitted to the Organic Farming Research Foundation:

Project Title:

Investigating the Impact of Green Manures and Weed Mat on Soil Biota and Tree Growth in Organic Peach Tree Orchards

1st Year Report

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Project locations: Western Colorado Research Center
Rogers Mesa
Orchard Mesa

Project period: 2 years; report constitutes results of first year.

Project budget: $25,650

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INTRODUCTION

In the spring of 2001, organic peach blocks were established at two Western Colorado Research Center sites: Rogers Mesa and Orchard Mesa. These plantings were established to allow multi-disciplinary research, systems comparisons, and demonstration of an organic production system for peaches. The objective of this project is to study the effects of different organic management practices on the soil microbial and faunal communities within peach orchards on the western slope of Colorado. The plots were established with and without weed mat to determine the effect of these treatments on the soil microbial and faunal communities. Secondly, we are examining the effects of two different green manures, alfalfa-grass mix and grass alone, on the soil microbial and faunal communities. This project will allow us to determine if a correlation exists between the applied management practices, soil community structure and functioning, and tree growth and vigor. In order to carry out the objective set forth, we will enumerate numbers of bacteria, fungi, protozoa, nematodes (bacterivorous, fungivorous, omnivorous, predatory, and phytophagous), microarthropods (collembola and mites), and earthworms. Based on the obtained biomass estimates for each organism and published physiology values, we will then use the detrital FOOD WEB model (Hunt *et al*., 1987) to model nitrogen flow and nitrogen mineralization rates through the decomposer subsystem in each treatment. As these organisms are responsible for the decomposition of organic matter and maintaining normal nutrient cycling, quantifying their numbers and modeling N-flow and N-mineralization rates will allow us to make recommendations as to which green manures will enhance microbial activity, and in turn, nutrient uptake and growth by plants. Additionally, this study will allow us to elucidate the effect of weed mat on the decomposition process, as mediated by soil biota, and its effect on nutrient cycling and uptake by plants. Upon conclusion of this study, we will provide fruit growers with information and recommendations for green manure selection, as well as information concerning the interaction between green manures, weed mat, and the soil biota.

METHODS

Establishment of Treatment Blocks

Four blocks were established at the Rogers Mesa and Orchard Mesa sites. In each block, four treatment plots were established:

1.) Alfalfa "AV120" (5 lbs/acre) + NewHigh Grass (8lbs/acre) without weed mat
2.) NewHigh Grass (8lbs/acre) without weed mat
3.) Weed mat only
4.) Without weed mat

Treatment #1 plots were planted with alfalfa "AV120" (Arkansas Valley Seeds, Denver CO) and New Hi grass (Arkansas Valley Seeds, Denver, CO). New High grass is a cross between Blue bunch wheat, *Pseudoroegneria spicata* ssp. *spicata*, and quackgrass, *Elytrigia repens*. We chose an alfalfa-grass mix because alfalfa has a large taproot capable of penetrating the hard clay soil typical of Western Colorado. Penetration of the soil increases soil porosity, enhancing water

and nutrient movement through the soil profile. Additionally, alfalfa adds approximately 238 lbs N / ac annually to the soil. There is no weed mat in these plots. Treatment #2 plots had the New High grass planted in the alley adjacent to the tree row and will not be covered with weed mat. We chose a pure grass stand because in other parts of the U.S., alfalfa is a host species for lygus bug (*Lygus lineolaris*), a common pest in fruit orchards. A pure grass stand was chosen so that this study could be applicable in other parts of the country. There is also no weed mat in these plots. Treatment #3 plots have weed mat only. These plots received10 tons/ ac chicken manure in the spring of 2001. Treatment #4 plots have no weed mat or green manure. The alleyways adjacent to the trees in plots 3 and 4 were planted with the alfalfa-New High grass as in Treatment #1.

Plots were established in mid- May immediately after the peach trees were planted and the weed mat was installed. All plots received 10 ton/ac of chicken manure. Due to the late start in planting and in establishment of the green manures, soil sampling did not take place until the first week of June, July, and August. Placement of green manure onto the plots did not take place until late July due to the late establishment and growth in the plots. In western Colorado, covercrops do not establish strong stands until the second year due to competition with weeds and climate.

RESULTS

The first years data showed no significant treatment effect on the number of colony forming units of bacteria or fungal biomass at Rogers Mesa and Orchard Mesa on all three sample dates or across all three sample dates. There were also no significant site and/or date effects ($p > .5$). The results of data collected on protozoan biomass and soil microarthropod diversity are currently being analyzed and sorted.

DISCUSSION

The first years results revealed no significant trends in population changes in any of the faunal groups. There are probably several reasons why there were no significant changes in the faunal populations. One reason is that the peaches were planted into sites which had been fallow for more than one growing season. During this time the sites were not irrigated which resulted in a minimum amount of vegetation cover. Rainfall at the Rogers Mesa and Orchard Mesa site is not significant enough to encourage significant plant growth during the growing season. Thus there was insignificant amounts of organic matter being added back to the soil. Also, the fact that there was minimal plant cover in the plots, the soil was exposed to direct sunlight resulting in higher soil temperatures, and greater evaporation rates, which may have resulted in population declines in the microbial and macrofaunal populations.

During preparation of the plots for planting, the soil was ripped, followed by discing and rototilling. There have been several studies which have shown that traumatic soil disturbance can result in the destruction of habitat required for most microbial and microfaunal populations.

Soil sampling will begin the first week of April 2002 and continue every 4 weeks through the first week of September. A few additions/changes will be made to the experimental protocol. Soil moisture and soil temperature will be continually monitored with field data loggers in each of the four treatments. Also, the green manure will be weighed after cutting and prior to placement on the treated plots. In addition, the moisture content of the green manure

will be determined. Otherwise experimental protocol will be followed as outlined in the grant proposal. OFRF suggested soil samples be taken to determine soil nutrient levels, but this would require a budget increase of $800 for the analysis of 32 soil samples (16 plots x 2 sites) for one sampling date. Soil samples for analysis should be taken in mid-April. Other than the soil analysis there will be no additional requests for a budget increase. An additional $3000 will be added to the project by R. Zimmerman to cover additional labor costs which were not foreseen in the original proposal

This is the first study of its kind to be conducted on the western slope of Colorado. The information gathered from this study could improve soil management techniques for growers of perennial crops in semi-arid regions. We also feel that this study will provide a base for further granting opportunities and studies.

LITERATURE CITED:

Hunt, H.W., D.C. Coleman, E.R. Ingham, R.E. Ingham, E.T. Elliott, J.C. Moore, S.L. Rose, C.P.P. Reid, and C.R. Morley. 1987. The detrital food web in a shortgrass prairie. *Biology and Fertility of Soils* 3: 57-68.