Western Region Sustainable Agriculture Research and Education
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Annual Results

SW00-018

Utilization of compost made from agricultural and forestry wastes for improving the economic and ecological sustainability of agronomic crop production on low-organic-matter soils in the San Luis Valley of Colorado

Location:
Colorado

Funding Period:
Aug. 15, 2000 - Dec. 31, 2003

Grant Award:
$137,916

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SUMMARY

This study seeks to improve water conservation and the sustainability of crop production on soils low in organic matter in the San Luis Valley of Colorado. The work will be accomplished through on-farm demonstrations that examine the impact of field-incorporated compost made from agricultural and forestry wastes on 1) reducing the use of synthetic fertilizers and fungicides by improving nutrient retention in the root zone and the health and diversity of the soil's biomass, 2) improving the water utilization, thereby reducing water and power use in center-pivot irrigation systems and 3) improving crop yields and reducing production costs for potatoes, barley and alfalfa.

OBJECTIVES/PERFORMANCE TARGETS

1. Develop local end markets for agricultural and forestry wastes, improve the sustainability of potato, barley and alfalfa crop production and demonstrate the impact of field incorporation of compost through:
    a. the change in the diversity of the soil's microbiology and biomass
    b. variations in disease levels in the crops
    c. potential improvement in nutrient retention in the root zone
    d. potential reduction in the use of synthetic fertilizers and pesticides
    e. potential improvement in water utilization and associated reduction in water and electrical power use by center-pivot systems
    f. net economic value of compost applications
2. Disseminate results to farmers in the San Luis Valley to demonstrate the economic and ecological value of using compost on the long-term sustainability of their operations

The schedule for achieving the objectives: Baseline soil samples were taken in late summer 2000 and analyzed to establish nutrient and microbial levels at each site. A water sample was taken from each center pivot system and analyzed before the compost was applied. Compost is applied in the fall for each year of the project, except for a spring application on one field in year two owing to wind erosion in the fall and winter. During the growing season, the project team will measure disease levels, crop health, water use and nutrient uptake. Three cuttings of alfalfa will be harvested during each growing year, and potato and barley yields will be measured. Harvest data collected will be summarized at the end of the growing season.

In years two and three, summary bulletins will be printed and posted on the Colorado State University Web site, www.colostate.edu/Depts/SLVRC/disease/2001PotatoDiseaseResearchReports.htm. Field days will be held at each site in years two and three during the growing season and a summary of results will be reported each year at potato and grain grower conferences in the San Luis Valley.

ACCOMPLISHMENTS/MILESTONES

Compost was spread at 0, 4, 8 and 12 tons per acre on two alfalfa and four potato/barley sites in the fall of 2001. Treatment blocks were marked out at each of the six sites during the 2001 growing season.

Compost samples were collected and analyzed for nutrient content, and three weather stations and 30 tensiometers were set out to measure the soil's water content and water-holding ability. Soil moisture readings were taken every half hour throughout the 2001 and 2002 growing seasons to determine if the water-holding capacity of the soil was affected by the compost. Soil samples were taken in April 2001 and 2002, before the growing season, and in October 2001 and 2002, after the season for each of the four treatments at each site. The samples were taken to determine soil biodiversity before compost was applied.

Disease readings were taken at all four potato sites throughout the 2001 growing season and at two sites in 2002. One set of readings was taken on plant vigor, stem number, stolon number and percent of stems and stolons with Rhizoctonia. In 2001 and 2002, readings were taken at each potato site measuring the severity of foliar early blight during the latter part of the season.

Alfalfa yields were measured for three cuttings in 2001 and 2002, and the alfalfa was sampled for moisture content. Potato yields were also taken for both years, and a post-harvest analysis was conducted to determine the severity of Rhizoctonia black scurf.

Compost was spread at 0, 4, 8, and 12 tons per acre at both alfalfa sites and at two the potato/barley sites in November of 2001 and 2002, and in April and November at the two remaining potato/barley sites.

Results to date show no significant differences in biomass or microbial diversity among the treated sites. Likewise, there was no significant difference in the amount of disease in the potato crops across the four potato/barley sites. The nutrient retention of the soil and potential reduction in fertilizer and pesticide use has yet to be determined. Changes in soil water retention and long-term net changes in crop yields also remain to be fully determined. Still, there appears to be a trend toward lower potato yields among plots that received the high rate (12 tons per acre) of compost.

A short summary of the project was presented and handouts were distributed at the San Luis Valley Research Center's field day in August 200. The handouts included an outline and background information on the composting project. An article with the headline, "Commercial composting digs in," was published in Nov. 16, 2001 in the *Ag Journal*. It discussed the project's project, work to be done and the potential benefits of using compost in agricultural situations.

The January 2002 issue of CSU's potato newsletter, *Pomme de terre, Information for Colorado Potato Growers*, was devoted to a report on the compost project. Field data from the project were included in the research report to the Colorado potato industry.

IMPACTS AND CONTRIBUTIONS/OUTCOMES

The San Luis Valley faces two problems from agricultural waste streams – sawdust from the local forest-products industry and culls from the local potato industry. Cull potatoes, an average of 9.6% of each year's crop, are especially problematic because cull piles can harbor spores of late blight (*Phytophthora infestans*), which can be transported by wind to affect the next year's crop. Late blight is a devastating potato disease that requires an increased use of fungicides, adding an economic burden to growers and a negative burden to the environment.

Research in Maine has shown that properly managed hot aerobic composting of cull potatoes with sawdust can destroy disease pathogens (including *P. infestans*) and produce an excellent soil conditioner. Each two tons of compost contains 12 pounds of nitrogen, 4 of phosphorus, 9 of potash, 18 of calcium and about 400 pounds of organic matter.

The researchers in this SARE-funded project suggest that the sustainability of most soils in the San Luis Valley, which are sandy and extremely low in organic matter (less than 0.5%), could be improved by adding compost. Further, the water table is often quite shallow, 5 to 30 feet below the surface, creating the potential for leached nutrients to contaminate ground water. Adding organic matter through compost could improve soil structure and holding capacity of nutrients and water.

While the materials to make the compost are readily available, and in close proximity to each other, marketing compost to distant markets is not cost effective. Further, local growers are reluctant to purchase and apply compost because they are trying to minimize production costs after several years of low market prices. What's more, growers fear they may be introducing disease into their crop through the compost.

"The long-term productivity gains that can be realized by improving the soils with compost are not yet recognized," adds Zink, who explains that the project's impact will be assessed in several ways:

1. The quantity of compost applied to San Luis Valley cropland will be monitored annually
2. The number acres that have compost applied to them will be recorded
3. Growers using compost will be surveyed to assess changes in water and fertilizer utilization
4. Volumes of waste sawdust and cull potatoes transformed into compost will be monitored

The hope, says Zink, is that through this project the stockpiles of sawdust will be reduced and the disposal of waste potatoes will become less of a burden on the industry.This project will assess the long-term value of using the compost to see if the projected values obtained from its use can actually be achieved.

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