Report for 2003DC35B: Effect of Pelletized Poultry Manure and Vegetable Production on Vadose Zone Water Quality

There are no reported publications resulting from this project.

Report Follows

Effect of Pelletized Poultry manure on Vegetable Production and Vadose Zone Water Quality

Annual Progress Report for FY 2004

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Date: May 2005

Prepared for the DC Water Resources Research Institute
Funds provided by USGS through the US Department of Interior

Effect of Pelletized Poultry manure on Vegetable Production and Vadose Zone Water Quality

Introduction

Poultry produced from the Delaware, Maryland, and Virginia (DELMARVA) poultry industries in applied on farmland along with chemical fertilizer for crop production. However, a significant amount of unused manure is stored for future usage or remains to be disposed of. Perdue AgriRecycle Inc. has cleaned, sterilized, and pelletized poultry manure for easy handling and movement in crop and vegetable production. This material has been analyzed for nutrient content; however, not much data is available to demonstrate its effectiveness in crop and vegetable production as well as its effect on ground water quality or pfeisteria proliferation. Residents of Washington DC grow vegetables in their backyard and could potentially use this material as a soil amendment. Therefore, this experiment is designed to determine the effectiveness of pelletized poultry manure as a soil amendment in vegetable production and its potential effect on DC water resources. Information generated will be used for extension and outreach to benefit the residents of Washington DC. This project will impact both our sustainable agriculture project of recycling waste as a soil amendment and our efforts in enhancing environmental quality.

The Chesapeake Bay Agreement signed by leaders of Delaware, Maryland, Washington DC, and Virginia promises a 40% reduction in the Bay's nitrogen and phosphorus level by the year 2010. This reduction campaign was initiated particularly because of a chemical fertilizer and poultry manure in crop production areas. Eutrophication, caused by excess nitrogen and phosphorus, has also reduced the Bay's sub-aquatic vegetation significantly. The most recent Chesapeake Bay report, July 2002, indicates no improvement in the Bay's water quality. On a scale of 100, the Bay's environmental quality was graded as 27, which is extremely low. In fact, this grade did not change from the previous year regardless of clean up efforts.

Objectives:

1. To determine the extent to which pelletized poultry manure affects water quality when used as a soil amendment in growing vegetables.
2. To determine the feasibility of using pelletized poultry manure as a substitute for commercial fertilizer in the growing of vegetables in urban areas.

Progress Toward Achieving Objective 1

To achieve experimental objectives, an experimental plot has been established with soil of silt loam. The experimental design is a randomized block with three replications per treatment. This design has six blocks with each block representing one of six treatments. This six treatments being used are:

1. 1800 lbs/acre of chicken manure pellets + 400 lbs/acre of commercial fertilizer (10-10-10).
2. 400 lbs/acre of commercial fertilizer (10-10-10) only.
3. 900 lbs/acre of chicken manure pellets + 400 lbs/acre of commercial fertilizer (10-10-10).
4. 1800 lbs/acre of chicken manure pellets.
5. 900 lbs/acre of chicken manure pellets.
6. No chicken manure pellets or commercial fertilizer. (Control or check plots).

In the experimental design, main plots are the six above named treatments and the crop varieties are butterbeans and collards as subplots. After clearing seed beds of surface debris, chicken manure pellets were added by broadcasting over the field surface with a manually operated garden seed spreader. Each main plot is 60ft. x 15ft. and subplot 15ft. x 10ft.

After treatments were added (Nov 20, 2004), two lysimeters were added to sample the water of vadose layer in each main plot at the distance of 20ft. apart. These lysimeters were each placed at two different depths, one 18 inches and the other 36 inches (Figs. I, II, III). The lysimeters installed were model 1920 FI pressure/vacuum soil water sampler. Each lysimeter at the 36 inch depth had a 1.5ft. long PVC pipe 1.5 inches in diameter. They both had a 2 bar porous ceramic cup at the bottom end and two ¼ inch tubes

protruding from the top (area about one foot above the soil surface) which was otherwise sealed. One of the tubes is

Figure I. **Lysimeters being installed in the poultry pellet amended plot by William Hare and James Allen.**

Figure II. **Lysimeter in place at a depth of 18 inches.**

connected to a 2006 G2 pressure/vacuum hand pump which will be used to collect water samples. The lysimeters were put in place on November 20, 2004.

Figure III. Lysimeter placement at the experimental site being reviewed by James Allen.

To protect the field from erosion, and ordinary cover crop variety of rye was broadcasted on the field plot at about a rate of four bushels per acre. They were planted on December 10, 2004 and the field plot is now well covered with the rye vegetation.

Water sampling of the Vadose layer of each plot will begin in mid-January, 2005 and continue on a regular basis from that time onward. Collards will be planted from seedlings on April 15, 2005 and butterbeans from seeds on the same date. The two crop varieties will be planted in each main plot. These main plots will each have six subplots 15ft. x 10ft. with 36 inches wide rows. Collards will be planted 18 inches apart within rows from seedlings approximately 4.0 inches high while butterbeans will be planted from seeds within rows about 12 inches apart. During the growing season plots will be kept well cultivated with the use of a garden cultivator or by hoeing.

Data to be collected during the growing season will be Vadose water sample, soil Bulk Density, soil porosity, seed yield of butterbeans and biomass data of both butterbeans and collards. Vadose water samples will be analyzed for nutrients such as phosphorus,

nitrogen and heavy metals where feasible. Data collected will be statistically analyzed, using the analysis of variance (ANOVA) to correlate the amount of chicken pellet manure added to crop yield and water quality (amount of the above named chemicals in the soil water samples).

Research findings will be communicated by paper presentations in professional meetings and the publications of journal articles.

Progress Towards Achieving Objective 2

Experimental plots seeded to rye as a cover crop in November, 2004 are now well covered with lush vegetable growth (Fig. I). Soil samples were taken from experimental plots on April 26, 2005. Sampling techniques included the following:

a) Sampling at depths 0-6", 6-12" and 12-18".
b) The field was divided into sections and duplicate soil samples were taken from each treated section in order to increase accuracy of analysis. (Figs. IV, V, VI, VII, VIII, IX).

Figure IV. Experimental plots covered with rye showing early lush spring growth.

Soil samples are now being air dried and will be sent to analytical labs for analysis to determine concentration of N, P and organic matter (OM) content of the soil given the palletized poultry manure compared to that amended with commercial fertilizer.

Figure V. **Student Assistant Raphil Billy take soil samples at the 0-6" depth.**

Figure VI. **William Hare taking soil sample at the 6-12” depth.**

Figure VII. **Soil samples being collected by researchers James Allen and William Hare.**

Figure VIII. **Soil Sample being examined before sent off to a laboratory for chemical analysis.**

Water samples from Lysimeters located in each treatment block at depths of 18 and 36″. In addition to the N and P concentrations mentioned for the soil samples, the water samples will also be tested for coliforms.

Figure IX. **Student intern, Mary Farrah, taking water samples.**

After soil and water sampling are completed, plots will be planted to collard greens and lima beans. These two crops varieties were chosen to see if they reduce or increase the amount of N or P entering the vadose zone of the soil. On a long term basis, different types of crop varieties will be tried so that more detailed comparisons can be made so that recommendations can be made concerning crop culture when pelletized poultry manure is used as the soil amendment. Planting of these crops will be done on May 15th, 2005.

PLANS FOR FY 2005-2006

1. Yield data will be collected from the two test crops, collards and lima beans. Harvesting of collards is expected to begin by mid-June and that of lima beans by the end of June to the first week in July. Data to be collected and analyzed will be exclusively fresh market collard leaves and lima beans.
2. Soil and water samples will be taken at specific intervals during the year. The next soil sample will be taken on June 15th. Water sampling may be done at the same time depending on when it rains. Both water and soil sampling will be done again at the end of August when harvesting is expected to be ended.
3. In the fall of 2005, plots will be lightly disked and poultry pellets added. The amount to be added will depend on preliminary soil and water test results.
4. Soil and water sampling data will be analyzed statistically and correlated to fresh weight of marketable yield of collards and lima beans to determine how well the pelleted poultry manure does as a soil amendment in the growing of fresh vegetables.
5. As mentioned before, in the fall, plots will again be seeded to cover crop rye and more poultry pellets added.
6. All fresh market yield and soil and water analytical data will be analyzed using ANOVA along with appropriate test of significance techniques.
7. Test crops for FY 2006-2007 will remain collards and lima beans. However, to institute a rational rotation system, the crops will be changed to sweet corn and black-eyed peas in FY 2007-2008.