Transformations of nitrogen from animal manures and biofuel byproducts amended to a sandy soil

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USDA ARS – Prosser, Washington

Introduction

- Animal manures as fertilizers in the Pacific Northwest
  - Poultry litter
  - Dairy manure compost
  - Widely available, much slower release of N
  - Recommendation of litter and compost
- Biofuel byproducts as fertilizers in the Pacific Northwest
  - Rises in number of ethanol and biodiesel plants
  - Seven new ethanol plants, twelve biodiesel plants, and two oilseed crushers

Methods and Materials

- Manure amendments
  - Poultry litter – Layer Hans
  - Dairy manure compost
  - Composting 3 months
  - 1/3 poultry, 2/3 compost
- Biofuel byproduct amendments
  - Mustard meal
  - Triple cold pressed white mustard seed
  - Dry distillers grains
  - Elbonard plant in Iowa
  - Aerobic incubations
  - Sealed polystyrene bags in dark growth chamber

Sampling scheme

- 200 mg N kg-1
- Determined NO3-N and NH4-N concentrations at 0, 1, 3, 7, 14, 21, 28, 42, 56, 70, 84, 98, 126, 154, and 210 days of incubation
- Determined soil pH monthly
- Temperature changed to simulate soil temperature at a 20 cm depth for a spring/summer growing season in eastern Washington

Discussion

- Dairy manure compost
  - No N mineralization from compost over 154 days
  - 2 to 14 % available N under similar conditions from dairy manure composts (Gale et al. 2006)
- Approximately 10 % from Van Kessel et al. 2002
- Compost would not provide any benefits in enhancing the rate or duration of N availability from litter.
- Poultry litter
  - Nitrification initiated after 28 days of incubation
  - Occurs at day = 0 for incubation studies at 25 degrees C
  - 13 degrees C during first month
- Biofuel byproducts as fertilizers in the

Conclusions and Future Work

- Organic N was rapidly mineralized for poultry litter and Perfect Blend 7-2-2, and relatively slow for biofuel byproducts
- Compounds in mustard meal and distillers grains likely delay the process of nitrification, thus causing varying degrees of NH4-N accumulation in the soil
- Nitrogen mineralization from dairy manure compost was rather negligible during the entire incubation period, therefore would not be an effective source of available N for annual plants for the first growing season
- Further investigation is necessary to evaluate the N mineralization, and plant availability from the above local and commonly available byproducts containing sources of organic nutrients.

Table 1. Predicted cumulative N mineralization using a first order equation for nitrogen mineralization, as percent of total N in the amendment, from various organic N sources applied to a Quincy fine sand at 200 mg total N kg-1.

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Table 2. Chemical properties of soil amendments evaluated in this study.

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## References