Understanding Nitrogen Dynamics of Poultry Litter in Continuous Corn Production

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Introduction

Nitrogen (N) availability from organic nutrient sources, such as poultry litter (PL), varies and is influenced by manure type, application method, environmental conditions, and application rate. Completing a mass balance of N from PL may provide better management options that improve nitrogen use efficiency (NUE) for row crop production. Understanding the most influential factors affecting NUE for corn production systems will allow producers to focus on management practices that maximize nutrient inputs and crop returns while minimizing potential negative environmental consequences in Kentucky.

Objectives

To quantify inputs and outputs of N supplied by PL to develop a greater understanding on how to improve NUE and a more accurate application rate.

Complete a mass balance of N from PL contributions to determine:

- **How PL application rate influences NUE**
- **If PL incorporation influences NUE**
- **The fate of N from PL to determine pathway losses**

Materials and Methods

A three-year field study will be conducted in Bowling Green, Kentucky at Western Kentucky University's Research Farm on a Crider silt loam soil. Application rates are based on year one availability coefficient estimated to be 50% plant available nitrogen (PAN) from PL at a rate of 184 kg ha^{-1}

There will be four replications with six treatments as followed:

- PL surface applied 5 cm depth (minimal tillage)
- PL surface applied broadcasted
- 46% urea control 5 cm depth (minimal tillage)
- 46% urea control broadcasted
- Untreated control 5 cm depth (minimal tillage)
- Untreated control broadcasted

Average annual meteorological conditions in Bowling Green, KY

Air Temperature (°C)	14.4	Precipitation (cm)	126.33

Main loss of specific N species will be measured in the field with the appropriate instrumentation

- Ammonia volatilization
- Nitrate leaching
- Denitrification (^{15}N technique)
- Aboveground biomass uptake
- Grain N removal

Semi Static Chambers to quantify NH_3 volatilization

Proposed study site in Bowling Green Kentucky on Western Kentucky University's farm 36° 93' N, 86° 46' W

Nitrogen Balance will consist of

- Inputs from PL
- Inorganic fertilizer
- Organic N mineralization
- Nitrogen losses
- Nitrogen removal

Lysimeters placed at 15 and 30 cm deep to collect NO_3^- leachate

Gas flux chambers to quantify N_2O emissions

Outcomes

Cost effective and agronomically optimum N rates can be established by knowing the NUE, defined as the portion of applied N that is utilized by the plant. Knowing NUE for organic and/or inorganic N will help a producer apply the proper amount of N.

Knowing the fate and factors that contribute to N transformations of PL may provide insight to management practices that improve the NUE and lead to more cost-effective use of PL.