CHAPTER 1
INTRODUCTION

Phosphorus is a major limiting plant nutrient in acidic agricultural soils high in Al and Fe oxides. The capacities of acid soil to adsorb P strongly affect plant yield response to fertilizer application (Bolan et al.,1988). Therefore, the various physicochemical reactions that occur when P is added to soil must be considered in P fertilization decisions. Soluble P may precipitate with Al and Fe or may be adsorbed by soil mineral fractions. Amendment of acidic soil with $CaCO_3$ increases the soil pH and, thereby, increases P availability by reducing P adsorption (Iyamuremye, 1996; Holford, 1983; Smyth and Sanchez, 1980). As such, the study of P sorption is important for a knowledge of the P adsorption capacity that may serve as a guide to determine the fertilizer requirement of soil. The reduction of P fixation involves either amending soil to change chemical properties, or adding P as an organic amendment. Organic P amendments such as animal wastes and yard waste compost have been widely utilized to increase P concentration in soils (Reddy et al., 1980; Mankolo, 1994).

Soil scientists have long recognized the beneficial effects of poultry litter (PL) application to soil. Addition of PL to soil results in an increase of a crop yield due to improved physicochemical soil properties. The addition of the organic component of poultry litter increases the number of small pores which hold water needed for plant growth. Furthermore, PL application decreases the bulk density of mineral soils (McConnell, 1993). Poultry litter also is a valuable source of both macronutrients (e.g., N and P) and micronutrients that are essential for plant growth. Compost application to soil was found to provide the same beneficial effects as PL (Mays et al., 1973; Tester, 1990). Application of composted material has similar effects on soil as previously described for PL application.

If not properly managed wastes generated by animals have been implicated as potential contributors to nonpoint source pollution. Poultry litter contains a substantial amount of N and P and, therefore, appropriate management of the organic waste is required to control surface and

groundwater pollution. Environmental problems associated with NO_3^- and P lead to methemoglobinemia (a fatal child disease) and to eutrophication in bodies of water, respectively. Consequently, the management and the disposal of poultry waste may become limiting factors in the expansion of the poultry industry, since much poultry production often is located in small areas.

The goal of this research was to develop reliable PL management from the agronomical and environmental standpoints. This new approach was to develop a poultry litter-yard waste compost (PYC) for use as a soil conditioner and as an organic P fertilizer. Composting a mixture of yard waste (YW) and PL could provide slow release of N and P from the end product. Therefore, use of PYC could be beneficial from both agricultural and environmental standpoints.

Conventional strategies for animal waste application have been based on the N requirement of the crops to minimize NO_3^- leaching losses. The principal objective of this research was to evaluate the suitability of PYC for corn (*Zea mays L.*) production. Agronomic and environmental effects of PYC were considered in this research.

Specific objectives of this research were as follows:

1. To determine the rate of P release from PYC in acidic soils,
2. To evaluate effects of the pre-compost C:N ratio on P availability from PYC,
3. To compare P availability from inorganic P and PYC application, and
4. To study effects of PYC application on Melhich-1 extractable P in soil.

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