INTRODUCTION

Application of broiler litter to soil provides potential benefits of improving the soil fertility and reducing the needs of commercial fertilizer on crop production. Crop rotation is known to beneficially influence the physical, chemical, and biological properties of soil, thereby improving its quality. Combination of crop rotation and broiler litter applications may maintain high yield production of cotton (*Gossypium hirsutum* L.) and corn (*Zea mays* L.). Most of the work on long-term effects of crop rotation and manuring has been done to evaluate its sustainability on agricultural crop production in Europe and Northern U.S. but relative impact of these management and cultural practices on crop growth, soil nutrient dynamics and soil quality in southeast U.S. particularly in Mississippi agro-ecosystems is lacking in the literature and is not well documented.

OBJECTIVE

To quantify the effect of broiler litter application and cropping systems on some of the indices of soil quality

MATERIALS AND METHODS

- The experiment was conducted in a Calapla silty clay loam and crop rotation types were continuous cotton, corn-cotton-cotton and cotton-corn.

- Before conducting the experiment, background soil samples were taken at the top 30 cm depth and analyzed for initial soil characteristics.

- Broiler litter was applied and incorporated to the soil in the spring before planting cotton and corn at the rate of 0, 4.5, 9.0 and 13.5 Mg ha–1 yr–1 and commercial fertilizer was applied at the recommended rate for each crop and corn as determined by the Mississippi Soil Testing Laboratory.

- Each year, post-harvest soil samples were taken for each cropping system and divided into the depth of 0-5, 5-15, 15-30, 30-60 and 60-90, air dried, ground to pass 2 mm sieve for analyses.

ANALYSES

- Soil pH was determined in a 1:1 soil/water suspension and broiler litter pH was also determined with the same ratio as litter/water suspension.

- Soil samples were extracted with 2M KCl for total inorganic N.

- Soil NH4-N and NO3-N were determined using a Lachat system.

- Soil samples were extracted using Mehlich 3 and analyzed for potential bio-available P, K, Ca, Mg, Na, Cu, Mn, and Zn concentrations using inductively coupled plasma spectrophotometer (ICP).

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RESULTS AND DISCUSSIONS

- Crop rotation and broiler litter application did not have significant effects on soil pH at the surface 0-15 cm depth, however, broiler litter application at the high rate (13.5 Mg ha-1) increased soil pH only with the cotton-corn-cotton system (Fig. 1).

- Inclusion corn into the cropping system resulted in increased total soil C and microbial biomass C at the surface 0-15 cm depth with increasing broiler litter applications and at high broiler litter rate (13.4 Mg ha–1) total soil C and microbial biomass C increased by 20% and 34% as compared to continuous cotton system, respectively (Fig 1).

- Total soil N significantly decreased with inclusion corn into the cropping system and at high broiler litter application rate soil total N was 25% lower in cotton-corn-cotton as compared to continuous cotton system (Fig. 1).

- The position of corn in the rotation with cotton did not have significant effects on soil chemical and biological properties (Fig. 1).

- Regardless to the cropping system, soil surface (0-15 cm) zinc (Zn) concentration increased with increasing broiler litter applications (Fig 2).

- Soil surface (0-15 cm) copper (Cu) concentration was lower with inclusion corn into the cropping system than continuous cotton system, indicating greater Cu removal by grain corn than seed cotton (Fig. 2).

- Post-harvest soil residual NO3-N significantly increased with increasing broiler litter applications at the top 15 cm soil depth.

- At high broiler litter rate soil residual NO3-N was 24% lower with inclusion corn into the cropping system as compared to continuous cotton system (Fig. 3).

CONCLUSIONS

In terms of crop management along with broiler litter application, inclusion of corn into the rotation system with cotton plays a key role in sequestering C, building up soil fertility, reducing the potential leaching of NO3-N which would be agronomically and environmentally beneficial.