SYNERGISTIC EFFECT OF FGD BY-PRODUCT AND BROILER LITTER APPLICATION ON COTTON YIELD, N UTILIZATION AND SOIL NUTRIENT CONCENTRATIONS IN A NO-TILL FIELD

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Abstract

In Southeastern USA, where much of the poultry litter is generated, cotton farmers are recognizing broiler litter's value and are utilizing broiler litter in both tillage and no-till systems. However, surface application of broiler litter to no-till cotton without incorporation exposes broiler litter nutrients to the risks of loss in runoff and NH3 volatilization leading to reduction of fertilizer value of broiler litter. Any management practice in no-till cotton system that prevents broiler litter derived-nutrients from loss could conserve nutrients in the soil and enhance crop production. Flue gas desulfurization (FGD) is practiced at coal fired power plants to meet clean air regulations. This practice produces a by-product called FGD gypsum which is widely accepted as a soil amendment. Co-application of this chemical compound with broiler litter applied to no-till cotton field may provide extra plant nutrients such as Ca, S, Mn and B; may minimize the potential losses of P and N by binding litter NH_4^+ ion as $(NH_4)_2SO_4$) and soluble P as $Ca_3(PO4)_2$, and increase cotton yield. A field study was conducted in a private farm in Caledonia Mississippi on a silt loam soil to determine the potential synergistic effect of these two by-products on cotton growth and water soluble soil P and N in a no-till field. Treatment included a control, inorganic fertilizer N at the rate of 125 kg ha^{-1}, broiler litter at the rate of 4.5 Mg ha^{-1} supplemented with 67 kg N ha^{-1}. These three treatments were applied either alone or combined with FGD gypsum at the rate of 2.2 Mg ha^{-1} ending with a total of six treatments. The treatments were tested in a randomized complete block design with four replications. Cotton cultivar DP0924 was planted in the second week of May using a six-row planter. Broiler litter and FGD gypsum were applied two weeks after planting. At harvest, four middle rows in each plot were picked using a two-row spindle picker. Soil samples were collected at the 0-15 cm depth and analyzed for NO_3-N concentration and water soluble soil P. The results showed that addition of FGD gypsum to broiler litter resulted in 21 % greater lint yield (1027 kg ha^{-1}) than without FGD gypsum (813 kg ha^{-1}). Co-application of FGD gypsum with broiler litter reduced water soluble P concentrations in the soil by 51% (from 10.1 mg kg^{-1} to 4.9 mg kg^{-1}). The results demonstrate that combining broiler litter application with FGD gypsum in no-till cotton field represents an agronomically and environmentally sound application strategy to reduce soluble nutrient accumulations and subsequent risks of nutrient transport while improving crop yield.