Broiler Litter: Blessing or Curse?

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Georgia broiler producers grew 1,182 million birds in 1997. This state ranked first in the number of broilers produced and accounted for 16% of the nation's production. Poultry accounts for 43.5% of total cash agricultural receipts in Georgia. On the majority of poultry farms, beef cattle are also raised with the poultry litter being applied on pastures.

The blessings of poultry litter

With so many broilers being produced each year, nearly two million tons of litter have to be removed from broiler houses and additional amounts from layer houses. Broiler litter consists of poultry excreta, feathers, wasted feed, and bedding material. This broiler litter varies greatly in nutrient content with averages of about 2% nitrogen, 2% phosphate, and 1.6% potash according to analyses of Owen Plank and Bill Segars at the University of Georgia in 1989. Sometimes, litter may contain values considerably higher than the above. Broiler litter would appear to be an excellent source of nutrients and economical alternative to commercial fertilizer for pastures and hayfields.

Some problems with poultry litter

(1) Poultry litter nutrient analysis may not match that needed by the crop. If poultry litter is being applied to crops such as corn or Coastal bermudagrass hay fields, it is necessary to calculate nutrient removal each year based on yield of the crop. If this is not done, along with soil testing and supplemental application of potash, there will be an imbalance of nutrients and crop yields will suffer.

(2) Unfortunately, most broiler litter is produced on farms of the upper Piedmont area with tall fescue or mixed tall fescue-bermudagrass pastures. On these pastures, nutrients are not removed to the same extent as when continuously harvested for hay. If three tons/acre of broiler litter were applied annually to meet the recommended nitrogen recommendation of 120 lb N/acre, this would also add 120 lb/acre of phosphate and 96 lb/acre of potash. The sale of a 500 lb calf removes only 12.5 lb of nitrogen, 3.4 lb of phosphorus, and 0.75 lb of potassium. Usually, it requires two or more acres per cow-calf unit so the nutrient removal per calf sold is only one-half that shown above. Some nitrogen and potassium are both lost by leaching, especially on sandy soils, while substantial nitrogen is also lost by volatilization into the air when cattle urinate. However, little phosphorus is lost so that over time there will be a net accumulation of this nutrient while potassium will be limiting. Excessive accumulations of phosphorus can cause problems over time.

(3) A major problem on many poultry farms is that they have large amounts of broiler litter and limited pasture land on which to spread it. Since the cost of transporting this bulky material to distant farms may be too costly, the surplus litter is often applied at disposal rather than pasture utilization rates. At high application rates of 6 to 8 tons/acre or more over several years, phosphorus, sodium, potassium, magnesium, zinc, and copper can accumulate to very high levels in the soil and some of these elements can become toxic, especially to new seedlings.

(4) Continued application of broiler litter makes it difficult to maintain clover in pastures, are a result of vigorous grass competition.

Broiler litter a curse?

Broiler litter is normally an excellent product for pasture application. However, when applied at high rates, there is the potential for contamination of ground and surface water with nitrate nitrogen and dissolved reactive phosphorus. Nitrate-nitrogen has been linked to human health problems and eutrophication with degradation of water supplies. Dissolved reactive phosphorus may cause excessive growth and decay of plant and animal life in streams and lakes. The US Environmental Protection Agency has established maximum guidelines of 0.05 and 0.1 mg phosphorus/liter for lakes and streams, respectively. The standard for nitrate-nitrogen in drinking water is no more than 10 mg/liter.

Recent research in Georgia on two grass watershed studies where nutrient runoff was measured provide some answers on broiler application rates. R.W. Vervoort, D.E. Radcliffe, M.L. Cabrera, and M. Latimore, Jr. applied annual rates of 4.5 and 9.0 tons/acre of broiler litter on mixed bermudagrass-tall fescue harvested for hay at Fort Valley State University over two years. This study was funded by USDA and the U.S. Poultry and Egg Association. Nitrate-nitrogen concentrations were below the standards so no problems can be expected even with high rates of litter application. However, dissolved reactive phosphorus in surface runoff water was well above EPA guidelines, even at the 4.5 ton/acre application rate. Phosphorus concentration was greatest in the top inch of soil. Composted litter gave results similar to fresh litter.

A cooperative pasture broiler litter study on red clay soil funded by the USDA-NRCS and the University of Georgia was located at the Central Georgia Branch Station, Eatonton. H.A. Kuykendall, M.L. Cabrera, C. S. Hoveland, and M.A. McCann compared rotational and continuous grazing of steers on mixed tall fescue-bermudagrass pastures fertilized annually with six tons/acre of broiler litter. Runoff water from six pasture watersheds was measured and nutrients sampled throughout the two-year grazing period. Nutrient results were similar to the Fort Valley study in that nitrate-nitrogen concentrations were below EPA standards and dissolved reactive phosphorus levels were 5 to 8 mg phosphorus/liter, well above the guidelines. Phosphorus runoff was much higher when a heavy runoff event followed recent application of litter. This of course does not mean that water from

the pastures reaching streams or lakes would still be at this high level but it certainly suggests caution in application of high broiler litter rates. Rotational and continuous grazing were similar in nutrient runoff rates.

Both of these studies suggest that potential problems exist for livestock producers applying very high rates of broiler litter. Clean water is increasingly being demanded by the public and more monitoring of nutrient levels can be expected in the future. Phosphorus in runoff water from pastures fertilized with high rates of broiler litter has the potential to cause difficulties.

The solution

Broiler litter is a waste product from the poultry industry that can be a curse if it is improperly used. In the past, recommendations were to apply not over 5 to 6 tons/acre annually. These rates are acceptable when incorporated into the soil for crop production. However, recent nutrient runoff studies in Georgia indicate that these rates are too high when surface applied on pasture and hay land and may result in water pollution. Continued application of rates higher than needed to supply the nutrient needs of pasture plants has the potential to pollute water supplies. Successful use of litter involves soil testing, applying rates more closely matching the pasture nutrient needs, supplementing with mineral fertilizer to supply deficiencies, making two litter applications per year with not over 4 tons/acre annually, and delaying litter application when there is a high probability of substantial runoff-producing rainfall.

Some new technologies are now available that offer the potential to reduce phosphorus in runoff water from pastures fertilized with poultry litter. (1) Adding phytase to broiler diets to increase bird utilization of organic phosphorus in the feed results in less inorganic phosphorus needed to be fed. This can reduce the phosphorus content of poultry manure by 25%. (2) Adding aluminum sulfate (alum) to bedding material in poultry houses can reduce the soluble phosphorus in the manure as the alum binds to form aluminum sulfate which is insoluble. This practice can reduce the phosphorus in runoff water by three fold. Alum also reduces ammonia in the poultry house, resulting in better animal health.

With good management and improved technologies, poultry litter can be a blessing and not a curse.