TECHNICAL NOTES

UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE
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AGRONOMY TECHNICAL NOTE NO. 93

AVOIDING PHOSPHORUS BUILDUP PROBLEMS WHEN USING ANIMAL MANURE AS PLANT NUTRIENTS

Nutrients contained in manure are not balanced in the same proportions required by crops. Most animal manure has an N-P_2O_5-K_2O ratio of 3-2-3 or 2-1-2. Plants require nutrients in an 8-1-3 or a 3-1-2 ratio. N in manure is lost through storage and handling, volatilization, leaching, and denitrification while nearly all of the phosphate and potash remain in place. Losses of 30-45 percent of the total N in a sample of broiler litter are not uncommon. For example, a ton of mature (4-5 flocks) broiler litter containing 50 lbs. N/ton which is broadcast and left on the surface of a pasture with a moderately well drained very fine sandy loam soil, a leaching index of 2-10, and less than two percent organic matter may provide only 26 lbs of N per ton of litter. If the forage required 200 lbs N/acre, nearly 8 tons of litter would be required to meet the N requirement. Consequently, if that same 8 tons of broiler litter contained 50 lbs P_2O_5/ton, then phosphate would have been applied at a rate of more than 10x the requirement for a 4.5 ton yield of a warm season perennial grass. In a recently completed study at the LSU Agricultural Center's Hill Farm Research Station, soil test phosphorus levels increased from very low to very high in only 3 years of applying poultry litter at nitrogen based rates.

Nitrogen or phosphorus based application of animal manures are determined by the index value calculated using the Phosphorus Index (PI). Nitrogen based application rates are acceptable with a low or medium PI value. Phosphorus based application rates are recommended when the PI value falls into the high category. No manure should be applied when the PI value is in the very high category.

Phosphorus index values indicate the relative risk of phosphorus movement offsite when applying animal manure at a specific rate and time. The PI does not predict the speed at which soil test P values will increase. Continuous applications of manure at nitrogen based rates will increase soil test phosphorus levels rapidly which will eventually raise the PI value. Simply because the PI indicates nitrogen based application is acceptable when the index value is either low or medium it does not mean that it is the prudent thing to do.

Comprehensive Nutrient Management Plans (CNMPs) and nutrient management plans where manure or other organic by products are used in the production system should contain a general discussion about the relationship between nitrogen and phosphorus transport and water quality and a site specific discussion on soil phosphorus relative to the field(s) being planned for waste utilization. Examples of each are included in the sample CNMPs distributed to all area and field offices in the state. The potential problems associated with long-term nitrogen based application

rates should be included in the discussion along with ways to avoid phosphorus build-up which include:

1. Phosphorus based application, regardless of PI value
2. Annual soil testing to monitor soil test levels of phosphorus.
3. Rotating application sites so that fields do not receive manure on a continual basis.
4. Avoiding applications on pasture or other land uses where large amounts of biomass are not removed annually.
5. Apply to high yielding crops and forages and/or woodland where a large amount of biomass is removed in the form of grain, hay, or fiber on a routine basis.
6. Apply to soils with high calcium content. Recent research has shown that soils high in calcium are excellent sinks for phosphorus.
7. Export the manure or organic by-products. There is an abundance of land in Louisiana where these materials can be used safely and effectively. According to soil test results from the LSU Agricultural Center's Soil Testing and Plant Analysis laboratory 22% of upland soils and 20% of alluvial soils test low or very low for phosphorus and 45% of upland soils and 33% of alluvial soils test low or very low for potassium. It makes far better agronomic and environmental sense to move this material to areas where it is needed rather than to continue to apply it where it could present potential problems or to use additives to try to fix the nutrients in the waste, thus rendering them unavailable.

In summary, use common sense when planning nutrient management and waste utilization with clients planning to use animal waste or organic by-products in their production systems. Point out potential problems with continuous nitrogen based application rates. Proper nutrient management and waste utilization planning includes recognizing potential problems and offering alternatives to limit the environmental impacts of using animal manure and other organic by-products as a source of plant nutrients.

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REFERENCES

1. Eichhorn, M.M., Jr. 2001. BEST MANAGEMENT PRACTICES FOR BROILER LITTER USE ON BERMUDAGRASS HAY FIELDS: A Summary of the Effects of Broiler Litter Rates on Bermudagrass Hay Yields, Crop Uptake and Removal of Phosphorus, Soil Phosphorus, and Phosphorus Runoff Loads. Poultry Litter Demonstration Project Final Report.