Quantification and Implications of Surplus Phosphorus and Manure in Major Animal Production Regions of Maryland, Pennsylvania, and Virginia

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Executive Summary

Background:

- ✓ Phosphorus (P) is an essential element for plant and animal growth but excessive P causes, along with nitrogen (N), algal blooms in fresh and coastal waters that lead to the low- or no- oxygen conditions in the Chesapeake Bay and other areas.
- ✓ About 40% of the P entering the Chesapeake Bay annually is estimated to be from agriculture so agricultural P loss reductions are critical to Bay restoration efforts.
- ✓ Animal manure contains both N and P, but in ratios that result in over application of P when manure is applied to meet crop N requirements, particularly for poultry litter.
- ✓ With intensification of animal production on farms with limited land, manure application rates have exceeded crop needs and P retention capacity of soils.
- ✓ Soils have the ability to retain large amounts of P (soil fixation); however, once soils are 20-30% P saturated (P-Sat), release of P to water in contact with the soil rapidly increases.
- ✓ Usually, only soils with a history of receiving manure (including poultry litter) have these high P-Sat levels.
- ✓ Currently, most states use the Phosphorus Site Index (PSI) to estimate relative risk of P loss and based on this, allowable P application rate. Soil test P is used when application considers current soil P levels and application is limited to crop needs. Crop P removal is used, primarily on high P soils, when it is desirable to stabilize soil P at its current level, and the P-Sat approach is used to reduce P levels on soils that are greater than 20-30% saturated and prone to releasing P to water, as discussed above. The PSI is the basis for manure applications in the Bay states so the current management approach is assumed to represent a PSI-based approach.

This report compares:

- estimated surplus P and manure in 11 MD, VA, and PA counties with intensive animal agriculture based on soil test P needs, crop P removal, or P-Sat based applications
- amount of surplus P by different animal types in each of the 11 counties
- the amount of surplus P resulting from each of the three P application approaches discussed above
- the pros and cons of alternative manure uses that may prove to be economically viable

Results include:

- ✓ Based on the results of this study and assessment of the current P Site Index (PSI) approach to nutrient management on numerous farms by the authors and other nutrient management professionals, P-Sat is less conservative than soil test P (crop need) but more conservative than the current PSI , as used in the Bay states.
- ✓ The PSI, as currently used in the Bay states, allows continued application of P to soils with P-Sat levels above 30% and only limits P application on a small percentage of fields while its accuracy at the field and watershed scale is not well understood.
- ✓ The PSI should continue to be used to identify those soils that have P-Sat levels below 20% but still have a substantial risk of loss due to erosion potential, application rate, method or timing and/or position on the landscape (e.g. adjacent to stream)
- ✓ On an annual basis, there are about 3,800,000 tons of surplus manure, most of which is liquid dairy manure in two counties, and about 18,500 tons of surplus manure-P above soil test P crop needs. The surplus manure-P is primarily from poultry litter in the 11 counties.

Options for managing surplus manure phosphorus:

- ✓ Managing fields based on P-Sat will better prepare farmers for future expectations rather than continuing to increase P levels on soils with greater than 20% P-Sat.
- ✓ A P-Sat based approach to manure P management allows application above crop need but not where risk of release to water is high and can allow a long-term transition to soil test based P applications to meet crop production needs.
- ✓ Transitional assistance programs will likely be needed to commercialize alternative manure uses and the cost of replacing N and K that was in the manure.
- ✓ It is critical that economically viable alternative uses, preferably community based with the farmer sharing in any profits generated, are developed that divert much manure, particularly dry manure, from field application
- ✓ Alternative technologies that concentrate P in a form that allows export to P deficit areas would slow P resource depletion.
- ✓ Expanded government and/or industry investment in alternatives uses is essential to address excess manure P.

Global implications of applying surplus P:

- ✓ Concern has arisen over “Peak Phosphorous”, comparable to Peak Oil, with Peak P about 20 years away. Unlike oil, P can be recycled after use but also unlike oil there is no alternative for P in plants, animals and food production. Therefore, P resources must be used efficiently if future food and feed needs are to be met.

The full report is available at http://www.waterstewardshipinc.org/phosphorus

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