Recommendations for Coordinating Phosphorus-Based Nutrient Management in the Chesapeake Bay Region

Developed by the Agriculture Nutrient Management Workgroup of the Chesapeake Bay Program's Nutrient Subcommittee

Membership

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Contributors to the Report

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Facilitators

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INTRODUCTION

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PHOSPHORUS-BASED NUTRIENT MANAGEMENT-PLANNING WORKSHOP AND QUESTIONNAIRE

The Agriculture Nutrient Reduction Workgroup of the Chesapeake Bay Program's Nutrient Subcommittee held a one-day conference on "Coordinating Phosphorus-Based Nutrient Management Policies in the Chesapeake Bay Region" on March 29, 2001. Agronomic scientists and program implementation staff came together and presented information on phosphorus management in agricultural systems. The objective of the conference was to begin building consensus concerning questions and issues pertaining to phosphorus-based (P-based) nutrient management policies within the region.

Several weeks after the conference, the workgroup distributed a questionnaire to all participants following up on a formal discussion at the end of the conference. The follow-up discussion focused on remaining issues and the use of a phosphorus index. (See Appendix 1 for a summary of the questionnaire and results.) The original workshop focused on the current science and implementation of phosphorus management, and the participants were selected accordingly.

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PHOSPHORUS-BASED NUTRIENT MANAGEMENT PLANS: THREE FEDERAL MANAGEMENT OPTIONS

NRCS guidelines and proposed EPA regulations would require states to use one of the following three methods to develop phosphorus-based nutrient management plans for recipients of NRCS technical and financial assistance or for those operations that fall under the requirement to obtain animal waste permits.[2]

(1) **Soil Test Phosphorus (STP)**
When STP levels are used, phosphorus may be applied at rates consistent with the following: If the STP level is low or medium, plans can be nitrogen-based. If the STP level is high, very high or excessive, plans will be phosphorus-based. For example, a high test level could allow phosphorus application based on crop removal, and an excessive test level would not allow any phosphorus application.

(2) **Soil Phosphorus Threshold Level (PTH)**
When soil-specific phosphorus threshold values are available, phosphorus may be applied at rates consistent with the following: If a soil test is less than ¾ PTH, plans can be nitrogen-based. If the STP is equal or greater than ¾ PTH and less than 1 ½ PTH, phosphorus can be applied at the level of crop removal. If the soil test phosphorus is equal or greater than 1 ½ PTH and less than 2 PTH, phosphorus can be applied at ½ the level of crop removal. If the soil test phosphorus is equal or greater then 2 PTH, no phosphorus can be applied.

(3) **Phosphorus Index (PI)**
When the PI is used, phosphorus may be applied at rates consistent with the following. If the PI rating is low or medium risk, the plan can be nitrogen-based. If the PI rating is high risk, phosphorus can be applied at the crop removal level. If the PI rating is very high risk, phosphorus cannot be applied. (Some jurisdictions refer to the PI as the Phosphorus Site Index, or PSI.)

A fourth alternative not addressed in NRCS guidance is a combination of any previously mentioned options. For example, use of Soil PTH to determine if a PI needs to be used.

WORKGROUP ISSUES

In deciding which method to recommend, the individuals polled had to consider many variables, for example, ease of administration, political feasibility, regional flexibility and scientific validity, among others. Of those that responded, 60 percent recommended that the Bay region states adopt the use of the PI. Of the 40 percent that did not pick the PI, 30 percent picked a combination of methods and 10 percent picked STP or the Phosphorous Threshold. Eighty percent believed that if a PI is adopted for use, a simplified screening tool, based on a limited number of inputs such as soil test and slope, should be used to determine whether a detailed PI value must be calculated for the field. Key advantages of a PI include: state-to-state flexibility, a balanced approach to protecting the environment

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that would take into consideration farming constraints, and a consideration of all parameters that affect water quality. While the majority of those responding chose the use of a PI, it was also recognized that such a choice has its pitfalls.

Major concerns regarding the use of PI were the complexity and the feasibility of performing it on every field or management unit. Of those responding, 78 percent concurred that states should have the flexibility to incorporate a "screening tool" within the PI, which should make its field use more practical. One probable such tool is STP. The PI could be calculated for those sites that exceed a predetermined value of the screening tool used. Other possible screening tools could include the amount of soil erosion and the proximity to surface water.

The participants were asked to what degree of specificity the input data should be gathered for the more subjective components of a PI, for example, field slope, soil permeability, distance to stream, etc. Fifty percent of the respondents suggested that the use of existing data sets, such as soil surveys, should be used to the maximum extent practical. The remaining respondents were concerned about the validity of using such broad data, adding that proper nutrient management planning requires a field visit during which the necessary data is collected.

The workgroup also discussed the use of "caps" on each individual component of the PI. A cap is a level of a particular PI element that, when reached by the single element of the index, places that field or management unit into the highest level of phosphorus restrictions, regardless of the level of the other PI parameters documented for that factor. The group concluded that more study is needed to determine if caps on individual components (e.g. erosion, runoff or leaching risks) of the PI would be beneficial to the process.

The survey also centered on the bioavailability of phosphorus in the soil and the subsequent risk to loss via biological and physical pathways. Specifically, should the various forms of phosphorus (organic and inorganic) be weighted in the PI? The respondents concluded that further analysis is needed to quantify the effects of various forms of phosphorus on water quality. Regarding the use of aluminum sulfate (alum), the general consensus was that because of the many questions associated with the use of alum (such as the potential for aluminum toxicity); a credit for alum use should not be considered at this time. Again, further work is needed to assess the long-term benefits and risks of alum use.

See Appendix 2 for a list of potential information gaps and research needs identified by the workshop and survey results.

MOVING SURVEY RESULTS INTO RECOMMENDATIONS

Results of the questionnaire were reviewed at a September 13, 2001 follow-up meeting (see Page 3 for list of attendees). From that meeting, the results of the questionnaire were evaluated and a list of recommendations developed for consideration by the Chesapeake Bay Program's Nutrient Subcommittee. The recommendations were developed based on consensus. Consensus was defined as a decision that everyone could support. The

Agricultural Nutrient Reduction Workgroup prepared the following summary of the recommendations from that meeting. The survey and the survey results are also included.

RECOMMENDATIONS FOR PHOSPHORUS MANAGEMENT IN THE CHESAPEAKE BAY REGION

The Chesapeake Bay Program should consider the following recommendations when promoting phosphorus management within the Bay watershed:

1. States should consider adopting a PI approach as the basis for the phosphorus component of their nutrient management planning. The PI may incorporate a screening tool in the nutrient management planning process (where the site exceeds a predetermined screening tool value).

2. Implementation of the PI should be simplified as much as possible while still maintaining technical credibility by using existing data sets, such as the use of soil survey map units to determine the average slope of each site.

3. Sensitivity analysis concerning the effects of various forms of phosphorus (e.g., ortho, organic or insoluble particulate phosphorus) on Bay water quality should be performed as a basis for individual weights for the forms of phosphorus within the index.

4. The benefits of placing caps on individual components of the PI should be based on existing and future research. Caps could be placed on relevant components of the PI (for example, those that exceed certain soil test or erosion levels) that would automatically require full PI analysis.

5. There is a nutrient imbalance in the Chesapeake Bay region. The PI is a tool to assist farmers and nutrient management planners in prioritizing the application of animal wastes to minimize the impact of the current imbalance, but in itself the PI is not a solution to the nutrient surplus in the Bay region. The members of this group and the Chesapeake Bay Program should continue to investigate a broad array of solutions to the nutrient surplus problem.

APPENDIX I
QUESTIONNAIRE RESULTS SUMMARY

Question 1: What assistance is needed to implement P-based nutrient management planning in your area?

General Responses: Education, financial assistance for manure transport, other off-farm uses, value-added processing and marketing. Planning and research where applicable is also needed.

Question 2: NRCS guidance and proposed EPA regulations would require states to use one of three methods to develop phosphorus-based nutrient management plans for permits. Which of the following methods should be adopted by states in the region: A. STP Level; B. Threshold; C. PI; or D. a combination of the above?

Question 3: If a PI is adopted, should a simplified screening tool based on a very limited number of inputs such as soil test phosphorus and slope be used to determine if a detailed PI value needs to be calculated?

Related Considerations Provided for Question 3:

1. Ease of implementation.
2. Ability to exclude areas that do not contribute to the phosphorus problem.
3. Discriminating quality of the method used.
4. Political feasibility: citizens, producers and political representatives.
5. Scientific validity.
6. Overall effectiveness in treating the problem.
7. Prior experience in using the method (education).
8. Includes the ability to evaluate or measure the transport potential.
9. Accounts for all factors affecting P export from agricultural lands.
10. Site specific.
11. Flexible instrument.
12. Provides management options for producers.
13. Serves as an educational tool.
14. Impact on producers' burden.
15. Possess the technical capacity to implement.
16. Ease of monitoring outcome.
17. Allows phosphorus application at replacement rate.
18. Cost to landowners.

Final recommendation for questions 2 and 3: We recommend the adoption of a PI as the basis for the phosphorus component of nutrient management planning. The PI may incorporate a screening tool as an integral element of the nutrient management planning process.

Question 4: If a screening tool is adopted, should the method: A. Require a PI to be calculated for all sites that exceed a predetermined value of the screening level; B.)

Require a PI to be calculated for all sites below a predetermined value of the screening level; or C.) a combination of the above?

Final Recommendation: If a screening tool is adopted, the complete PI should be calculated for all sites that exceed a predetermined screening tool value(s).

Question 5: Inorganic, water-soluble forms of phosphorus are immediately available to aquatic plants, while particulate phosphorus associated with sediment or organic matter becomes available slowly, over time. Both forms are lost to surface waters. How should particulate phosphorus be weighted relative to inorganic water-soluble phosphorus losses in a PI?

Final Recommendation: Consideration of the relative weighting of the various forms of phosphorus should be based on the short- and long-term impact of each form on water quality.

Question 6: Should there be caps on individual components of the PI?

Final Recommendation: The consideration of caps on individual components of the PI should be based on existing or future research. Possible caps could include soil test phosphorus level, erosion loss and fertilizer/manure phosphorus loading rates.

Question 7: Concerning the level of complexity of data input for a PI, what process should be adopted in the Chesapeake Bay region—detailed field data collection vs. use of existing data sets and proxies?

Final Recommendation: Collect and assess data onsite and use existing data sets where relationships have been established.

Question 8: Should alum use be given credit in phosphorus-based nutrient management plans?

Final Recommendation: There is promising research that could qualify the use of alum, but researchers are not able to answer this question at the present time. More study of the long-term affects and use of alum is needed.

Question 9: A previously unmanured site that tests medium in soil test phosphorus is being considered for a new swine operation. A PI is calculated to arrive at a moderate risk. However, once soil test phosphorus levels reach 280 ppm phosphorus for this site, the PI will be very high, indicating that no further phosphorus applications are recommended. If you are the permit issuing authority, what should you do?

Final Recommendation: Farmers should be advised of their options and the consequences of every action. Ultimately this is a business decision made in relation to program and permit requirements. The permit issuing authority needs to educate the farmer in all the implications of the law.

Question 10: If phosphorus-based nutrient management planning identifies a surplus of manure for a given farming operation, what policy should be put in place to deal with the exported manure?

General Responses: Financial assistance for manure transport. Keep manure in the state where it is generated. A nutrient management plan should be required for receiving farms. Rely on the market value approach. Use a phosphorus screening tool and run the PI on the receiving farm. Soil test the receiving farm. Nitrogen- and phosphorus-based plans – all users of fertilizer should be treated equally.

Question 11: Do you think the use of a PI will improve water quality?

General Responses: The bulk of the responses supported use of the PI for improving water quality. The detailed comments stated that the PI is currently the best method to achieve P reductions, but monitoring and efficient implementation is needed. The water quality effects of the PI were not discussed extensively in follow-up discussions.

Question 12: What other suggestions or questions do you have pertaining to implementation of phosphorus-based nutrient management policies in the Chesapeake Bay region?

General Responses: We need to educate citizens and farmers, and to promote research and monitoring; other tools need to be explored as well, such as dietary changes. Consider the remediation and redistribution of manure. We need more education and technical training, and to understand the economics of phosphorus-based nutrient management planning. In addition, there should be uniformity on phosphorus-based planning among the states. Nutrient balances should be completed county-by-county for all sources. We need to understand overtime how soil phosphorus levels change as phosphorus-based nutrient management takes place.

APPENDIX II
INFORMATION AND RESEARCH NEEDS RELATED TO THE PHOSPHORUS INDEX

The following items are extracted from the report text and questionnaire results:

- The complexity and the feasibility of performing the PI on a large number of fields or management units.
- The validity of using existing reference data sets compared to onsite collected data.
- More study is needed to determine if "caps" on individual components (e.g., erosion, runoff or leaching risks) of the PI would be appropriate.
- Long-term effects of alum use.
- Continue to investigate a broad array of solutions to the nutrient surplus problem.
- Further analysis of the scientific validity of the PI.
- Overall effectiveness in treating phosphorous problems.
- Capacity to implement phosphorus management programs.
- Monitoring results.
- Understanding economics related to the PI.
- How soil phosphorus levels change as phosphorus-based nutrient management takes place.

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- Long-term effects of alum use.
- Continue to investigate a broad array of solutions to the nutrient surplus problem.
- Further analysis of the scientific validity of the PI.
- Overall effectiveness in treating phosphorous problems.
- Capacity to implement phosphorus management programs.
- Monitoring results.
- Understanding economics related to the PI.
- How soil phosphorus levels change as phosphorus-based nutrient management takes place.