PHASE 6 NUTRIENT MANAGEMENT EXPERT PANEL

MAY 19, 2016

IDENTITY AND EXPERTISE OF PANEL MEMBERS

Name	Affiliation	Role
Frank Coale	University of Maryland	Panel Chair
Deanna Osmond	North Carolina State University	Panel Member
Doug Beegle	Penn State University	Panel Member
Jack Meisinger	USDA-Agriculture Research Service	Panel Member
Tom Fisher	UMCES	Panel Member
Quirine Ketterings	Cornell	Panel Member
Chris Brosch	Delaware Department of Agriculture	Watershed Technical Workgroup representative
Matt Johnston	CBPO	Modeling Team representative

Technical support provided by Mark Dubin (University of Maryland), Lindsey Gordon (CRC Staffer), and Steve Dressing (Tetra Tech).

PRACTICE NAME(S)

- Nutrient Management Core N
- Nutrient Management Core P
- Nutrient Management Supplemental N Rate Adjustment
- Nutrient Management Supplemental N Placement Adjustment
- Nutrient Management Supplemental N Timing Adjustment
- Nutrient Management Supplemental P Rate Adjustment
- Nutrient Management Supplemental P Placement Adjustment
- Nutrient Management Supplemental P Timing Adjustment

DEFINITION OF THE PRACTICE

Nutrient management has four basic components: the nutrient type, rate, timing, and placement which are managed on a field scale, or on a within-field scale, in a manner which is consistent with high N-use efficiency and/or high P-use efficiency in order to minimize nutrient loss to the environment while maintaining crop yield. These four basic components interact with each other

on a site-specific basis due to the varying degrees of interactions among the N and P basic components, as further modified by local soil properties and weather conditions. Thus, the Nutrient Management Panel defines Nutrient Management as the implementation of a site-specific combination of nutrient type, rate, timing, and placement into a strategy for N and P with the goal of improving nutrient-use efficiency, along with the documentation of the nutrient management strategy implementation that is suitable for verification.

Nutrient Management also provides other important benefits to the agricultural and the environmental communities. These benefits include the long-standing education of producers into basic and state-of-the art nutrient management practices/tools, establishing an initial base-line for nutrient management to allow estimating progress over time, and improved communication with other Expert Panels that will provide better coordination of each Panel's BMPs.

Nutrient management for the Phase 6 is separated into independent sets of elements for nitrogen (N) and phosphorus (P) management due to the marked difference in the fate and transport of these nutrients in agricultural systems. The structures for both N and P nutrient management are similar, however, with supplemental management elements stacked onto a required core set of management elements. The panel will further refine the definitions and equivalent practice elements for core and advanced supplemental N and P practices in the final panel recommendation report.

Figure 1:
Nutrient Management Core N: The core set of N management elements consists of:

NITROGEN Core Nutrient Management BMP (ALL core elements required to be implemented and verified)
N rate according to LGU recommendations at field level
Manure analysis and volume - test value or book value
Spreader/applicator calibration
Yield estimates and cropping plan at field level
Cropping and manure history at field level

Figure 2:
Nutrient Management Core P: The core set of P management elements consists of:

PHOSPHORUS Core Nutrient Management BMP (ALL core elements required to be implemented and verified)
P rate according to LGU recommendations at field level
P soil tests at field level
Manure analysis and volume - test value or book value
Spreader/applicator calibration
Yield estimates and cropping plan at field level
Cropping and manure history at field level

Nutrient Management Supplemental N: Credit for advanced supplemental N management elements requires satisfactory implementation of all respective N core management elements. The advanced assessment N tools are utilized to inform the application of the appropriate N adjustment practices, but do not represent an N credit in and of themselves. If more than one qualifying adjustment practice option is available for the supplemental N management element; e.g. N Rate Adjustment, N Placement Adjustment, or N Timing Adjustment, implementing one or more of the practice options will enable full supplemental N crediting for that element.

Figure 1A:
Nutrient Management Supplemental N: The set of supplemental N management elements consists of the following practices for rate adjustments:

N Rate Adjustment Practice (implementation of one or more BMPs required)
N rate less than LGU recommendations
Split N applications for reduced total rate
Variable rate N application

Figure 1B:
Nutrient Management Supplemental N: The set of supplemental N management elements consists of the following practices for placement adjustments:

N Placement Adjustment Practice (implementation of one or more BMPs required)
Subsurface injection or incorporation of applied Inorganic N
N application setbacks from water

Figure 1C:
Nutrient Management Supplemental N: The set of supplemental N management elements consists of the following practices for timing adjustments:

N Timing Adjustment Practice (implementation of one or more BMPs required)
Split N applications

Figure 1D:
Nutrient Management Supplemental N Tools: The set of supplemental N management tools consists of the following practices for supporting advanced N management practices:

Advanced N Assessment Tools
PSNT
Manure analysis < 3 years old
On-farm replicated research

CSNT
N-loss risk assessments & models - Ammonia loss
Yield mapping
ISNT
On-farm strip trials
N-loss risk assessments & models - Leaching loss
FSNT
N-loss risk assessments & models - Denitrification losses
Whole farm balances
In-season sensors/remote sensing in general
Geo-spatial mapping

Nutrient Management Supplemental P: Credit for advanced supplemental P management elements requires satisfactory implementation of all respective P core management elements. The advanced assessment P tools are utilized to inform the application of the appropriate P adjustment practices, but do not represent a P credit in and of themselves. If more than one qualifying adjustment practice option is available for the supplemental P management element; e.g. P Rate Adjustment, P Placement Adjustment, or P Timing Adjustment, implementing one or more of the practice options will enable full supplemental P crediting for that element.

Figure 2A:
Nutrient Management Supplemental P: The set of supplemental P management elements consists of the following practices for rate adjustments:

P Rate Adjustment Practice (implementation of one or more BMPs required)
P-based manure rate based on annual crop P removal
P rate less than LGU recommendations
Variable rate P
Split P applications

Figure 2B:
Nutrient Management Supplemental P: The set of supplemental P management elements consists of the following practices for placement adjustments:

P Placement Adjustment Practice (implementation of one or more BMPs required)
Subsurface injection or incorporation of applied inorganic P
P application setbacks from water

Figure 2C:
Nutrient Management Supplemental P: The set of supplemental P management elements consists of the following practices for timing adjustments:

P Timing Adjustment Practice (implementation of one or more BMPs required)
P application in lower P-loss risk season

Figure 2D:
Nutrient Management Supplemental P Tools: The set of supplemental P management tools consists of the following practices for supporting advanced P management practices:

Advanced P Assessment Tools
Soil test P remediation/declining
Soil tests < 3 years old
P Index assessment
Grid soil sampling
Manure analysis < 3 years old
On-farm replicated research
Yield mapping
On-farm strip trials
Whole farm balances
Geo-spatial mapping

QUALIFYING PRACTICE CONDITIONS

Credit for core nutrient management N and P requires all respective core elements to be implemented and verified on the implementation acres reported for nutrient reduction crediting. Credit for advanced supplemental N and P management elements requires satisfactory implementation of all respective N and P core management elements first before receiving credit for implementing and verifying respective N and P supplemental elements. The advanced assessment N and P tools are utilized only to inform the application of the appropriate N and P adjustment practices, but do not represent a unique N or P credit by themselves. The implementation of the supplemental adjustments for rate, placement, and/or timing for N and/or P provides the recommended advanced supplemental nutrient management credits. If more than one qualifying adjustment practice option is available for the supplemental N and/or P management element; e.g. Rate Adjustment, Placement Adjustment, or Timing Adjustment, implementing one or more of the practice options will enable full supplemental N and/or P crediting for that element(s).

PRACTICE MODEL SIMULATION DESCRIPTION

Core nutrient management for N and P is represented as an annual efficiency practice for N and P application rates respectively. Advanced supplemental N and P practices are represented as an

edge of field to edge of stream delivery reduction efficiency. The panel is recommending that 1985 conditions be used as the starting baseline for representing practice efficiencies and implementation, which is consistent with other agricultural BMPs and other Phase 6 Expert Panels.

Land uses to which the practice is applied

Core and advanced supplemental elements of nutrient management for both N and P practices apply to the following partnership approved Phase 6 agricultural land uses:

Land Use	Description
Full Season Soybeans	Soybeans ineligible for double cropping
Grain with Manure	Corn or sorghum for grain eligible for manure application and ineligible for double cropping
Grain without Manure	Corn or sorghum for grain ineligible for manure application and ineligible for double cropping
Silage with Manure	Corn or sorghum for silage eligible for manure application and ineligible for double cropping
Silage without Manure	Corn or sorghum for silage ineligible for manure application and ineligible for double cropping
Legume Hay	Legume forage crops eligible for manure
Small Grains and Grains	Small grains and grains other than corn or sorghum eligible for manure and ineligible for double cropping
Small Grains and Soybeans	Soybeans double cropped with small grains and ineligible for manure
Specialty Crop High	Specialty crops with relatively high nutrient inputs with some crops eligible for manure
Specialty Crop Low	Specialty crops with relatively low nutrient inputs with some crops eligible for manure
Other Agronomic Crops	Other high commodity row crops such as tobacco, cotton, etc., with some crops eligible for manure
Other Hay	Non-legume forage crops eligible for manure
Pasture	Grazed land that receives direct manure deposition from animals

Unit of measure

Core nutrient management can be reported in either acres or percentage of acres implementing the practice.

Locations within the Chesapeake Bay watershed where this practice is applicable

Nutrient management can be applied to specified land uses everywhere within the Chesapeake Bay watershed.

Potential Methods to Estimate Historic Implementation Units

The Panel recommends that historic implementation on a state-by-state basis be based on the premise that the baseline of 1985 is set at zero, or near zero acres for Nutrient Management Core N and Core P implementation, and the highest level of implementation be represented at 2015 reported implementation acreages. Due to the differences between state Nutrient Management program initiation dates and implementation reporting for the six-state partnership, the "baseline" year is recommended to reflect these state partnership differences. Thus, the initial Nutrient Management implementation year for each state will be unique.

The increasing level of historic implementation between the state Nutrient Management program initiation year and the 2015 reported implementation acreages represent two points on a state-by-state basis. The intervening annual representation of implementation acreages may be represented as a linear progression if there is a paucity of implementation data, or inferred by state implementation data representative of the definitions of nutrient management proposed by the panel. Historic implementation estimation shall consider additional sources of nitrogen and phosphorous reduction credits commensurate with State QAPPs currently in place, given they are consistent with the BMPs and efficiency credits described by the Nutrient Management Expert Panel.

In cooperation with the Chesapeake Bay Program Office, a state-by-state representation of Nutrient Management reported implementation following the Panel's recommendations for historic implementation levels in default of additional state implementation data is enclosed as **Attachment A** with this Preliminary Panel Report. The state-by-state representation was developed for N Core Nutrient Management only, and with the following methodology:

- Assume straight-line interpolation between 2015 Progress acres and a starting year for each state.
  - Starting year was evaluated by looking at historic NEIEN data to determine when states started reporting information.
  - 2015 Progress has acres on crop, pasture and hay. Interpolation was made for each of these categories.
  - Interpolation was made in each county.
- Assume all acres on crops for NY, PA, and WV only apply to crop acres eligible for receiving manure.
- Assume all acres on crops for DE, MD and VA can be distributed to crop acres with or without manure.
- All acres assumed to qualify for core N.
  - No acres yet determined for core P.

A second independent source of representing historic Nutrient Management implementation has been requested from the USDA Natural Resources Conservation Service (NRCS) Conservation Effects Assessment Project (CEAP) based on the two existing reports published on the Chesapeake Bay Watershed. The requested information will be evaluated on a HUC-4 scale based upon the CEAP program's methodology of interviewing producers at randomly selection field points from the Natural Resources Inventory (NRI) lists.

In utilizing the Panel's practice recommendations for tracking and reporting practice implementation, the Panel recommends that acres, or percentage of acres, be reported by Phase 6 land use, or grouping of similar land uses, by year as an annual practice. Nutrient Management Core N and P are stand-alone practices which should be tracked and reported separately. Likewise, advanced supplemental N and P practices should be tracked and reported separately, but only when the corresponding Core N or P elements have been met by the Panel's recommended practice definitions.

Initial Preliminary Placeholder BMP Efficiencies

Initial preliminary placeholder efficiencies for both nitrogen and phosphorus have been developed by the Panel, and are enclosed with this Preliminary Panel Report as **Attachment B**. These initial preliminary placeholder efficiencies were developed using best professional judgement only by the Panel members, and are not based on a full review of the available literature references that will be utilized by the Panel for the final Panel Recommendation Report. **Final BMP efficiencies** will be decided upon for the final Panel Recommendation Report based upon the review of cited reference sources. Consequently, the Panel cautiously advises consideration of the Initial preliminary placeholder efficiencies with the understanding these are **highly vulnerable to change** between the Panel's Preliminary and Final Reports. Final decisions on efficiencies will be partly based on the review of literature references, and the Chesapeake Bay Program partnership's decision regarding recommendations for agronomic nutrient distribution to be represented by the Phase 6 model.

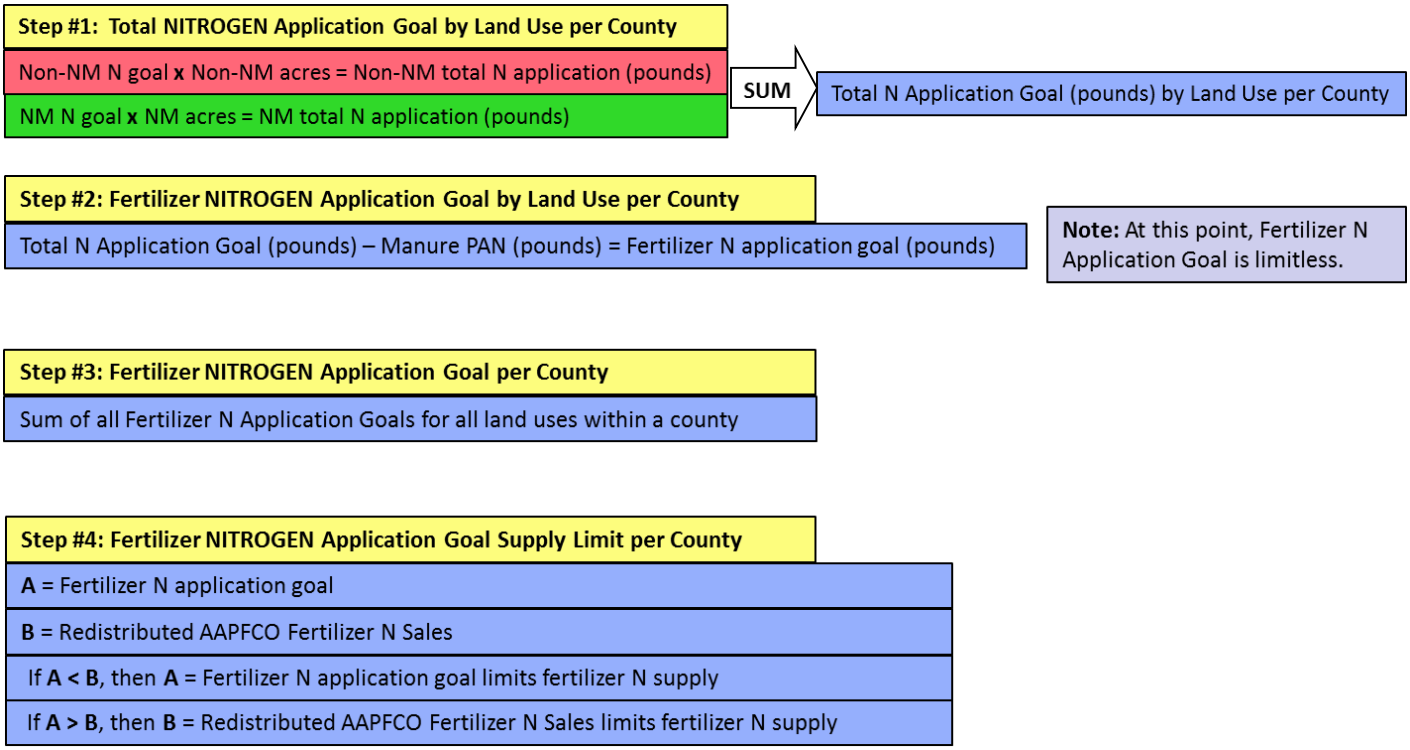
Potential for Panel adjustments in final report

The Panel is confident in the definition of core nutrient management elements and advanced supplemental practices, as evidenced by their unanimous voice approval for these components, but the components could be modified because the final quantitative practice efficiencies have not been determined. Initial preliminary placeholder efficiencies for both nitrogen and phosphorus have been developed by the Panel, and are enclosed with this preliminary report as a separate attachment (Attachment B). Final BMP efficiencies will be decided upon for the final Panel Recommendation Report. Consequently, the Panel cautiously advises consideration of the Initial Placeholder Efficiencies with the understanding these are highly vulnerable to change between the Panel's Preliminary and Final Reports. Final decisions on efficiencies will be partly based on the review of literature references, and the Chesapeake Bay Program partnership's decision regarding recommendations for agronomic nutrient distribution to be represented by the Phase 6 model.

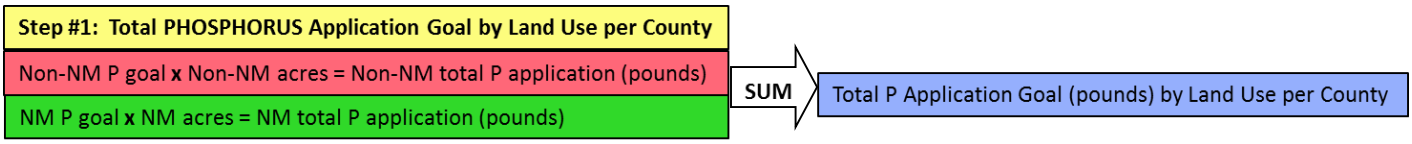
PROPOSED REPRESENTATION OF NUTRIENT SPREAD IN PHASE 6 MODEL

The graphics below detail the proposed representation of nutrient spread in the Phase 6 model that was developed by the Panel, in consultation with the Agricultural Modeling Subcommittee. This revised approach incorporates nutrient management acres to help establish application goals.

Nitrogen:



Phosphorous:



Step #2: Fertilizer PHOSPHORUS Application Goal by Land Use per County

Total P Application Goal (pounds) – Manure P (pounds) = Fertilizer P application goal (pounds)

Note: At this point, Fertilizer P Application Goal is limitless.

Step #3: Fertilizer PHOSPHORUS Application Goal per County

Sum of all Fertilizer P Application Goals for all land uses within a county

Step #4: Fertilizer PHOSPHORUS Application Goal Supply Limit per County

A = Fertilizer P application goal

B = Redistributed AAPFCO Fertilizer P Sales

If **A < B**, then **A** = Fertilizer P application goal limits fertilizer P supply

If **A > B**, then **B** = Redistributed AAPFCO Fertilizer P Sales limits fertilizer P supply