Phase 6 Nutrient Management Panel Update

Frank Coale, UMD, Panel Chair

Agriculture Workgroup

August 24, 2016

The Charge Presented to the Phase 6 Nutrient Management Expert Panel

General Scope

Define and configure the nutrient management (NM) BMPs in the Phase 6 model.

Specific Charges

1. Review the Phase 5.3.2 definitions and effectiveness estimates and evaluate the "Tier System" for identifying NM BMP implementation.

2. Determine how NM BMPs can be applied to the new Phase 6 land uses with a focus on nutrient mass balance and nutrient spreading routines.

3. Make recommendations to account for soil residual nutrients and how soil residual nutrient concentrations should be credited to annual crop nutrient requirements.

4. Collaborate with the Cropland Irrigation Management Expert Panel on fertigation effectiveness and accounting practices.

5. Address NM reduction efficiencies for nitrogen (N) and phosphorus (P).

Phase 6 Nutrient Management Expert Panel

Name	Affiliation
Frank Coale, chair	University of Maryland
Deanna Osmond	North Carolina State University
Doug Beegle	Penn State University
Jack Meisinger	USDA, Agricultural Research Service
Tom Fisher	Univ. MD Center for Environ. Science
Quirine Ketterings	Cornell University
Watershed Technical Workgroup	
Chris Brosch	Delaware Dep. of Agriculture
CBP Modeling Team	
Matt Johnston	University of Maryland, CBPO
Agriculture Workgroup Coordinator	
Mark Dubin	University of Maryland, CBPO

Phase 6 Nutrient Management Expert Panel: Summary Conclusions

1. Nitrogen (N) and phosphorus (P) assessments are handled similarly but separately.

2. Historical base-line conditions (i.e.1985) are used as a uniform reference point for pre-BMP, non-nutrient management conditions.

3. Core Nutrient Management BMP efficiency factors for N and P are based on state LGU recommendations, as modified by CBP state partners, and represent land-use and cropping system specific N and P application rates.

4. Core Nutrient Management BMP efficiency factors for N and P modify the nutrient application rate goals.

5. Supplemental Nutrient Management BMP efficiencies for rate, timing and placement of N and P are additive to the Core Nutrient Management BMP efficiencies for N and P, but can not be applied without application of the Core BMPs.

6. Supplemental Nutrient Management BMP efficiency factors modify the edge of field nutrient loss to the receiving stream.

7. All BMP efficiency values (n=130) for N and P are numeric variables that have been defined by the Nutrient Management Expert Panel.

8. County-level redistribution of CBW N fertilizer sales data should be used as an independent cross-reference for and validation of the modified LGU recommendation based N application rate goals.

9. LGU recommendations for P application are based on soil-test P concentration. Soil P concentration data are not available to CBP but should be collected and utilized in the future. In the absence soil-test P based application rate goals, county-level redistribution of CBW P fertilizer sales data may serve as a surrogate.

Phase 6 Nutrient Management BMPs

Core Nutrient Management BMPs

Nitrogen Core Nutrient Management BMP

Phosphorus Core Nutrient Management BMP

Supplemental Nutrient Management BMPs

Nitrogen Rate Supplemental Nutrient Management BMP
Nitrogen Placement Supplemental Nutrient Management BMP
Nitrogen Timing Supplemental Nutrient Management BMP

Phosphorus Rate Supplemental Nutrient Management BMP
Phosphorus Placement Supplemental Nutrient Management BMP
Phosphorus Timing Supplemental Nutrient Management BMP

Nitrogen Nutrient Management BMP Efficiency Factors

NITROGEN Core Nutrient Management BMP (ALL core elements required to be implemented and verified)
N application goal (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

NO → No credit for N Core Nutrient Management BMP → N application goal = **LGU recommendation x A**

YES → Credit for N Core Nutrient Management BMP efficiency → N application goal = **LGU recommendation x B**

NITROGEN Supplemental Nutrient Management BMPs
If Core Nutrient Management BMP efficiency is applied, follow with advanced assessment for Supplemental Nutrient Management BMPs

Advanced N Assessment
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

IMPLEMENTATION →

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

YES → **N Rate Supplemental BMP Efficiency = EOF load x C**

IMPLEMENTATION →

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

YES → **N Placement Supplemental BMP Efficiency = EOF load x D**

IMPLEMENTATION →

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

YES → **N Timing Supplemental BMP Efficiency = EOF load x E**

Phosphorus Nutrient Management BMP Efficiency Factors

PHOSPHORUS Core Nutrient Management BMP (ALL core elements required to be implemented and verified)
P application goal (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

NO → No credit For P Core Nutrient Management BMP → P application goal = **LGU recommendation x F**

YES → Credit for P Core Nutrient Management BMP efficiency → P application goal **= LGU recommendation x G**

PHOSPHORUS Supplemental Nutrient Management BMPs
If Core Nutrient Management BMP efficiency is applied, follow with advanced assessment for Supplemental Nutrient Management BMPs

Advanced P Assessment
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

IMPLEMENTATION →

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

YES → **P Rate Supplemental BMP Efficiency = EOF load x H**

IMPLEMENTATION →

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

YES → **P Placement Supplemental BMP Efficiency = EOF load x I**

IMPLEMENTATION →

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

YES → **P Timing Supplemental BMP Efficiency = EOF load x J**

* Some site-specific exceptions apply, as defined in the NM Panel draft report

Nutrient Management BMP Efficiency Values – draft version

Nutrient Management BMP	BMP Efficiency Variable	Action of BMP	How the math works
Nitrogen Core **Non-Nutrient Management** BMP efficiency	A	modifies N application rate goal on the nutrient input side	efficiency is multiplied by the LGU N application rate goal
Nitrogen Core **Nutrient Management** BMP efficiency	B	modifies N application rate goal on the nutrient input side	efficiency is multiplied by the LGU N application rate goal
Nitrogen Rate Supplemental BMP efficiency	C	modifies edge of field N loss to the stream on the outflow side	efficiency is multiplied by the calculated edge of field N load
Nitrogen Placement Supplemental BMP efficiency	D	modifies edge of field N loss to the stream on the outflow side	efficiency is multiplied by the calculated edge of field N load
Nitrogen Timing Supplemental BMP efficiency	E	modifies edge of field N loss to the stream on the outflow side	efficiency is multiplied by the calculated edge of field N load
Phosphorus Core **Non-Nutrient Management** BMP efficiency	F	modifies P application rate goal on the nutrient input side	efficiency is multiplied by the LGU P application rate goal
Phosphorus Core **Nutrient Management** BMP efficiency	G	modifies P application rate goal on the nutrient input side	efficiency is multiplied by the LGU P application rate goal
Phosphorus Rate Supplemental BMP efficiency	H	modifies edge of field P loss to the stream on the outflow side	efficiency is multiplied by the calculated edge of field P load
Phosphorus Placement Supplemental BMP efficiency	I	modifies edge of field P loss to the stream on the outflow side	efficiency is multiplied by the calculated edge of field P load
Phosphorus Timing Supplemental BMP efficiency	J	modifies edge of field P loss to the stream on the outflow side	efficiency is multiplied by the calculated edge of field P load

Development of Phase 6 Nutrient Management BMP Efficiency Values

- Nutrient management practices are implemented at either the field or sub-field level.

- The diverse landforms, hydrology, climate and cropping systems of the agricultural landscapes in the CBW have a multitude of impacts on biogeochemical transformations of N and P.

- Changes in hydrological pathways alone can have dramatic effects on nutrient loads to streams when viewed from the Atlantic Coastal Plain to the Appalachian Plateau.

- Site-specific physical conditions and management factors have a strong influence on the effectiveness of imposed conservation practices.

- Nutrient management BMP effectiveness must represent the average condition over a wide range of real-world scenarios.

- It was essential to distill numerous lines of evidence to arrive at a single efficiency value for each of the N and P BMPs that could be applied equitably across the CBW.

Development of Phase 6 Nutrient Management BMP Efficiency Values

Efficiency factors for the Core NM BMPs and the NM Supplemental BMPs represent:

1. A collection of required elements, or

2. The impact of numerous applicable on-site management practices.

In order to develop broadly pertinent NM BMP efficiency factors, multiple sources of information and data were necessarily synthesized.

Nitrogen Nutrient Management BMP Efficiency Factors

NITROGEN Core Nutrient Management BMP (ALL core elements required to be implemented and verified)
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Variable rate N application

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YES → **N Placement Supplemental BMP Efficiency = EOF load x D**

IMPLEMENTATION →

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

YES → **N Timing Supplemental BMP Efficiency = EOF load x E**

Nutrient Management BMP Efficiency Values

Nutrient Management BMP	BMP Efficiency Variable	Full Season Soybeans	Grain w/ Manure	Grain w/o Manure	Legume Hay	Silage w/ Manure	Silage w/o Manure	Small Grains and Grains	Small Grains and Soybeans	Specialty Crop High	Specialty Crop Low	Other Agronomic Crops	Other Hay	Pasture
Nitrogen Core **Non-Nutrient Management** BMP efficiency	A	1.20	1.30	1.20	1.20	1.40	1.20	1.20	1.20	1.30	1.20	1.10	1.00	1.00
Nitrogen Core **Nutrient Management** BMP efficiency	B	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Nitrogen Rate Supplemental BMP efficiency	C	1.00	0.85	0.95	1.00	0.85	0.95	0.95	0.95	0.85	0.95	0.95	1.00	1.00
Nitrogen Placement Supplemental BMP efficiency	D	1.00	0.95	0.97	1.00	0.95	0.97	0.97	0.97	0.95	0.97	0.97	1.00	1.00
Nitrogen Timing Supplemental BMP efficiency	E	1.00	0.90	0.95	1.00	0.90	0.95	0.90	0.90	0.95	0.95	0.95	1.00	1.00
Phosphorus Core **Non-Nutrient Management** BMP efficiency	F	1.50	3.00	1.50	1.00	3.00	1.50	1.50	1.50	2.00	2.00	1.50	1.00	1.00
Phosphorus Core **Nutrient Management** BMP efficiency	G	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Phosphorus Rate Supplemental BMP efficiency	H	0.95	0.90	0.95	0.99	0.90	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00
Phosphorus Placement Supplemental BMP efficiency	I	0.90	0.80	0.90	0.90	0.80	0.90	0.90	0.90	0.90	0.90	0.90	1.00	1.00
Phosphorus Timing Supplemental BMP efficiency	J	0.99	0.80	0.99	0.99	0.80	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.00


Finish Line
Just Ahead