Ag Input Concerns

March 22, 2021

CAST-21 Workplan (Working Draft)

Approved data and method changes need to be finalized through the WQGIT by Sept. 1, 2021

Questions/ Comments?

KEY ACTION	STATUS
Task 1: Updates to data & methods that typically occur every 2 years.	• On-going • May AgWG update: on-going ag data collecting projects
Task 2: Investigate alternative forecasting methods for ag land uses & animals ✓	• Nov 19 AgWG: CBPO presentation on 4 methods of forecasting • Feb AgWG; March decision
Task 3: Investigate 2012-2017 Ag Census change for fallow/idle acres ✓	• AgWG Sept 17; NASS consulted; no new information; No further action; See Jan AgWG decision
Task 4: Investigate use of latest landcover & LiDAR imagery to better define changes in total ag (& other land use) acres	• Oct AgWG; Jan AgWG; Feb AgWG; decision pending updated landcover & LiDAR imagery for 14 prototype counties Apr AgWG
Task 5: Investigate alternatives for double-crop acre estimates	• Oct 15 AgWG; NASS consulted- no new information; No further action; no recommended change to methodology; April for decision (associated with Task 4 change to ag acre calculations)
Task 6: Consider supplemental NM for soybeans	• In process • Dec Ad Hoc; Jan Ad Hoc; Mar Ad Hoc; Apr-May AgWG
Task 7: QA/QC'd historic & current layer pop. data for Hillandale Farms (PA)	• In process • Feb Ad Hoc- general discussion; May AgWG
Task 8: Build-in Verification Ad Hoc Team products	• In process

Reminder - CAST 21 Schedule:
- Sept 1, 2021 - All data and methods approved
- Nov 1, 2021 - CAST-21 Beta release
- Jan 1, 2022 - Final CAST-21 release

https://www.chesapeakebay.net/channel_files/41834/cast21workplan_022221.pdf

Task 3: Investigate 2012-2017 Ag Census change for fallow/idle acres

Please send any objections WITH suggested modifications to the language below to Loretta Collins (lcollins@chesapeakebay.net) and Gary Felton (gfelton@umd.edu) by COB Thursday, February 4[th.]

No objections received

Decision:

- The AgWG reached consensus regarding CAST-21 Workplan Task 3: Investigate 2012-2017 Ag Census change for fallow/idle acres, recognizing that the 5-year census indicates a significant increase in fallow & idle acres within some counties in the Chesapeake Bay watershed.

- The AgWG acknowledges that investigation has not provided evidence to indicate that the 2017 Ag Census data is or is not reflective of on-the-ground change, therefore cannot recommend adjustment to CAST-21 model inputs at this time.

- The AgWG has exhausted its available resources to investigate this issue, but this decision does not preclude interested parties from pursuing further lines of inquiry and bringing information back to the workgroup for review.

Task 2: Investigate alternative forecasting methods for ag land uses & animals

Decision:

- The AgWG approved a path forward regarding CAST-21 Workplan Task 2: *Investigate alternatives to the current methods for forecasting agricultural land uses and animals and propose options for partnership consideration.*

- The AgWG achieved consensus to <mark>continue using the current projection method</mark> (Double Exponential Smoothing: Alpha = 0.8).

CONCLUSION & RECOMMENDATION (TASK 2)

Conclusion

- No single projection method that works for all states, all land and animal categories.
  - *Important to continue with the partnership decision to use one method across states and across animals and land use types.*
- "Linear Projection applying trend to recent year" (Method 2) is a better projection method.
  - But… only provides slightly better results than what we have now (Dbl. Exp. Smoothing: Alpha = 0.8)

Options

- Option #1: Keep current projection method (Dbl Exp. Smoothing: Alpha = 0.8) **RECOMMENDED**
- Option #2: Change to Linear Projection (Method 2)

Rationale

- 2022 Ag Census data… (we don't know what we don't know – predictions have uncertainty)
- Current method (Dbl. Exp. Smoothing: Alpha = 0.8) was thoroughly tested during Phase 6 development.
- Changing projection method might result in negative consequences for some jurisdictions.
- Data presented is summarized by State. Actual Projections are done at County level and could see more fluctuations if changes are made to current method.

AgWG CAST Concerns Ad Hoc

Jurisdictional reps reviewing submitted concerns
Monthly updates to the AgWG
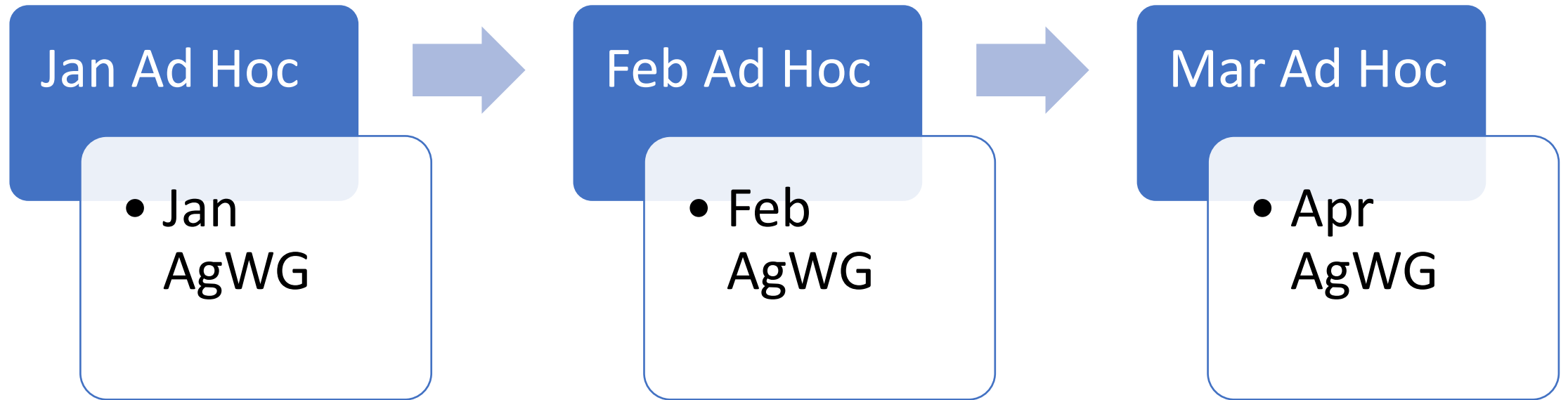
Jan Ad Hoc
- Jan AgWG

Feb Ad Hoc
- Feb AgWG

Mar Ad Hoc
- Apr AgWG

Ad Hoc November Recommendation: Create a tracking mechanism for jurisdictions' wish list for 2-year CAST updates & the next model phase.

Task 6: Consider additions to current methods for "crediting" Nutrient Management on soybeans and propose options

- **Soybeans** - The nutrient management expert panel did not consider that the Nutrient Management BMP could be applied to full season soybeans' nitrogen load. That should be reevaluated since there is a minimal amount of nitrogen applied to the full season soybean crop.

From Water Quality GIT Presentation to Management Board 7/9/20

What is Driving N Load Concerns?

No consensus in Ad Hoc yet…

Agricultural Loading Rates?

Ag Census (i.e., Source Of Crop Data) **?**

NM BMP Recommendations?

- Changing an Approved Expert Panel Recommendation Must Follow Science (BMP Protocol)
  - <u>Protocol for the Development, Review, and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model</u>

Agricultural Loading Rates

Based on Available Literature & Best Professional Judgement

"N losses from soybeans are only somewhat lower than corn, because N fixation inputs (which are poorly characterized) are apparently substituting for fertilizer inputs." (p.11)

Ag Loading Rate Review Steering Committee: Agricultural Loading Rates

Census of Agriculture

Concern Regarding Accuracy of Ag Census Crop Acres

Spatially Distributed Land Use from the Land Cover/Land Use Data Team Starting With the CAST-21 Could Mitigate Concern

Method of Modeling Double-Crop Soybeans Approved by CBP Partnership

Determined Sound by USDA-NASS

CAST-21 Workplan TASK 6

NM Expert Panel Recommendations

Land Use: Full-Season Soybeans

NM on Soybeans Controls for P (*not N*)

Land Grant Universities Do Not Recommend N Application (Via Fertilizer or Manure)

<u>Core</u> NM BMP ☐ **N & P**

- Applies to Crop Application Goal (What is Applied/Distributed to Crop)
  - Small CAG for N on soybeans allows for appropriate distribution of nutrients across land uses (see reference slides)

<u>Supplemental</u> NM BMPs (Rate, Timing, Placement) ☐ **P only**

- Applies to Soybean **Edge-of-Field Total N Load**
  - **TN Load is Primarily Residual N From Fixation**
  - Applied (CAG) N is Tiny Fraction of TN Load
- Rate: Excess N Reduced is Still Excess N Subject to Loss…
- **Timing & Placement** of Excess N Irrelevant (Still Subject to Loss)

Next Step NM on Soybeans
Task 7
(Further Deliberation March Ad Hoc)

ACTION: PA will work on gathering information to better understand what real-world soybean management looks like. Other jurisdictions are encouraged to do the same.

ACTION: Clarify with CBPO how the simulation of how N assumptions are handled in the model (e.g. reduction of N fixation in the model with applied N).

Improving Ag Data? (TASK 1)

Crop Acreage Data

Crop Application Goal

Alternative methods to account for fitting Ag Census data to CBP needs?
- Adjusting methods for estimating crop acres (e.g. double crops)

Alternative/supplemental data sets
- Other data sets at the state or federal level?

Animal Population Data

Additional NASS Annual Survey Data may be available to inform population trends between census years (incorporated every two years)
- Dairy, Beef Cattle, Layers, Swine…

Direct from industry data can inform animal population **_trends_** between census years.
- Requires careful cooperation
- Legal, privacy assurances

Manure Generated

Other Data Issues (new data incorporation every 2 years)

Soil P data
- Gary Shenk Sept 2018 presentation to AgWG on data set incorporated into the CBWM
- **Additional soil P data is welcome and encouraged (NY & WV have made inquiries)**

Manure Nutrient Concentration Data
- Changes in management may result in changes in nutrient concentrations
- **Additional manure concentration data is welcome and encouraged**

Fertilizer Data
- More accurate allocation of fertilizer within the CBW?
- **Jurisdictions working with state chemists**

4. Define Inorganic Fertilizer Available to Crops

CRITICAL CONCEPT:

To maintain integrity of CBWM there are two options for new data sets:
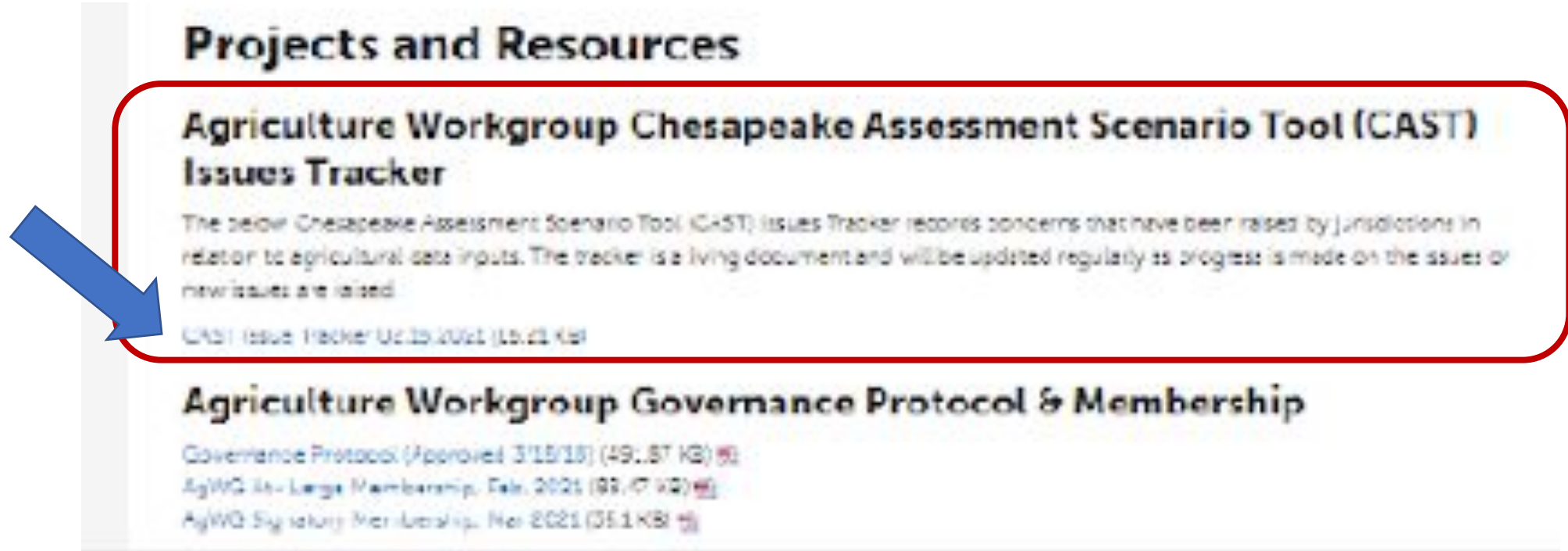
- Provide data all the way back through 1985.
  OR
- Use the **trend** in new data sets for the years available.

CBWM= Chesapeake Bay Watershed Model

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Prioritizing Concerns (post CAST-21)

- AgWG Home Page
  https://www.chesapeakebay.net/who/group/agriculture_workgroup

Projects and Resources

Agriculture Workgroup Chesapeake Assessment Scenario Tool (CAST) Issues Tracker

The below Chesapeake Assessment Scenario Tool (CAST) Issues Tracker records concerns that have been raised by jurisdictions in relation to agricultural data inputs. The tracker is a living document and will be updated regularly as progress is made on the issues or new issues are raised.

CAST Issue Tracker 02.15.2021 (16.21 KB)

Agriculture Workgroup Governance Protocol & Membership

Governance Protocol (Approved 3/15/18) (49.87 KB)
AgWG At-Large Membership, Feb. 2021 (83.47 KB)
AgWG Signatory Membership, Mar 2021 (35.1 KB)

Ad Hoc November Recommendation: Create a tracking mechanism for jurisdictions' wish list for 2-year CAST updates & the next model phase.

File | Home | Insert | Page Layout | Formulas | Data | Review | View | Help | Acrobat

Cell reference: IG — Revisit in March 2021 in CAST Ad Hoc to clarify ask and resources needed

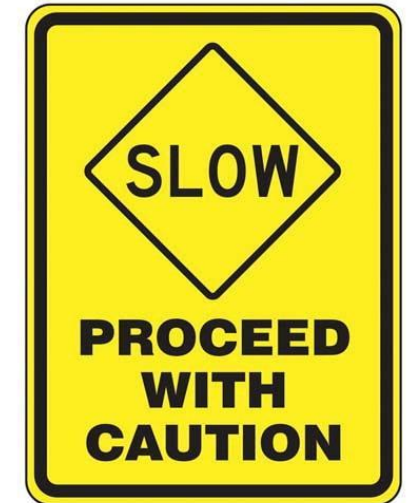|	A	B	C	D	E	F	G	H	I	J	K
1	BMPs	ORIGINAL APPROVAL	Priority Level	CAST-21	TIMELINE	JURSDICTIONS	LEAD	CBPO Contact	ACTION	NOTE	Status
2	Dairy Precision Feeding	Simpson & Weammert, 2009	PA leading	Possible for 2021 Progress- If approved by relevant groups in the partnership.	TBD	PA	Bill Argstact (PA)	Mark Dubin	Presentation to AgWG/Ad Hoc on recent MUN research and suggested change in implementation tracking based on updated science. Dairy expertise necessary (e.g. Penn State dairy specialist).	PA actively working on solution to tracking challenges. Seeking flexibility in CBP requirements. This would require a change to the Simpson & Weammert (2009) report recommendations. Dr. Virginia Ishler (Penn State) and Dr. Kathy Soder (ARS), both involved in original recommendations, have more recent research on dairy herds and MUN levels. Jennifer Reed Harry (Penn Ag Ind. Assoc.) & Ron Ohrel (Mid Atlantic Dairy Assoc.) working on dairy processor co-op sub-population verification. Brady Seeley (DEP) writing up a narrative of path forward. Interested in tracking % of PA dairy population under DPF versus individual herd management. Up to 70% of PA dairy population may use DPF.	Bringing dairy expertise to AgWG/Ad Hoc to review new science team to discuss new science, tracking, and reporting for dairy Team expects to have info for CBP in June 2021.
3	Rotational/Precision Grazing	STAC, 2010	N/A	N/A	N/A	PA (withdrawn)	N/A	N/A	No Action		Withdrawn
4	Heavy Use Area Protection (HUAP)	Loafing Lot BMP, 2003	PA Leading	Possible for 2021 Progress- If approved by relevant groups in the partnership		PA	Ted Tesler	Mark Dubin, Loretta Collins	No Action. RESOLVED 01/13/20	Track & Reporting issue. Can NRCS 561 reported as Loafing Lot Management? Is 561 exclusive to Loafing Lots (non-poultry) across all jurisdictions? Every state tracks differently, some can differentiate poultry pads from loafing lots.	Withdrawn
5	Heavy Use Area Protection (HUAP, - Poultry Pads	AWMS EP 2016	N/A	N/A	N/A	MD, DE, WV (withdrawn)	N/A	N/A	No Action. RESOLVED 11/13/20	Concern regarding crediting for poultry pads. Language included in 2016 AWMS EP report. Poultry pads defined as part of AWMS BMP.	Withdrawn
6	Winter Crop (proposed)	NM Expert Panel 2015	?Determine in AgWG	No	Next Watershed Model (possibly sooner)	PA, NY, MD		Vanessa Van Note	Revisit in March 2021 in CAST Ad Hoc to clarify ask and resources needed	PA no change in EP recs, "WINTER CROP" proposal (EP)- corn silage-man-forage (multi-species foraging & feed- greenchop. "triple cropping" over two years. Charlie White (Penn State) research. Man N uptake (not leached) NEW SCIENCE AgWG consider EP for winter crop. legume/legume-grass 'hay LU as most appropriate for application of BMP.	Charlie White Jan 2021 AgWG call.
7											
8	MODELING	ORIGINAL APPROVAL/CROSSOVER	Priority Level	CAST-21	TIMELINE	JURSDICTIONS	LEAD	CBPO Contact	ACTION	NOTE	Status
9	Manure Treatment & Transport	MTT EP 2016, Phase 6 CBWM 2017	?/next model phase	No	Next Watershed Model	PA, MD		Vanessa Van Note	PA request to AgWG for study group; Check w/ MWG on progress on refined modeling efforts and efforts in general for the CBWM.	Backfill, local tracking of manure; 1. PA needs better tracking and reporting- pilot project Penn Ag Industries lead. SCC, PA 4r Alliance, manure-haulers & brokers possible regulatory change 2. PA wants study group on inter-county manure transport county-level budgets. AgWG study group: how to do this? Need farmers to reduce applications but need to move. Liq manure is short distance- NEED INCENTIVES for short-distance MT. MTT-Jason/Ted	Further discussion needed with MWG.
	Ag Loading Rates	Ag Loading Rate Review Steering Committee	High	No	Next Watershed Model				Review of ag loading rates determined by committee under the Agricultural Modeling Subcommittee (AMS) in development of the Phase 6 model. Associated		

Sheet1

- March AgWG CAST Concerns Ad Hoc:
  - Discussion NM on Soybeans
  - Clarification "Winter Crop" BMP Ask (time permitting)

- April AgWG
  - Decision Landcover/ LiDAR Data (Task 4)
  - Decision Double Crop Methods (Task 5)
  - Detailed update NM on Soybeans (Task 6)

- May AgWG
  - NM on Soybeans (Task 6)
  - Hillandale Data (Task 7)

- June
  - Update from Dairy Precision Feeding Group

Reference Slides

BMP Concern	CBP BMP Effectiveness Source	Next Steps
Dairy Precision Feeding (PA)	Definitions and reductions approved by the WQGIT in **2009**	**PA Action Team**
Rotational/Prescribed Grazing (PA)	Definitions and benefits were reviewed and approved by the Agriculture Workgroup and WQGIT in **2010**	**RESOLVED**
Heavy Use Area Protection-NRCS 561 (PA)	Loafing Lot Management definitions and reductions approved by the Chesapeake Bay Program's Nutrient Subcommittee in **2003**.	**RESOLVED**
Nutrient Management on Pasture (NY/PA)	Nutrient Management Practices for use in the Phase 6.0 Chesapeake Bay Program Watershed Model (**2016**)	**RESOLVED**
Commodity Cover Crops (NY/PA)	Cover Crops Practices for use in Phase 6 of the Chesapeake Bay Watershed Model (**2016**)	**EP Chair discussion with AgWG (Dec 2020) Charlie White, Penn State @ AgWG Jan 2021**
Manure Transport / Manure Treatment Technologies (PA)	• *Manure Treatment Technologies*: Recommendations from the Manure Treatment Technologies Expert Panel to the CBP's WQGIT to define Manure Treatment Technologies as a Best Management Practice (**2016**) • *Manure Transport*: definition and benefits have remained in use **since review and approval by the CBP partnership's source sector workgroups for tributary strategy development**.	**Work with MWG**

SLOW PROCEED WITH CAUTION

Protocol for the Development, Review, and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model

N Application on Soybeans

- **Soybeans** - The nutrient management expert panel did not consider that the Nutrient Management BMP could be applied to full season soybeans' nitrogen load. That should be reevaluated since there is a minimal amount of nitrogen applied to the full season soybean crop.

From Water Quality GIT Presentation to Management Board 7/9/20

[Comments](#) on CAST-19:
Soybean nitrogen application (p.2)

- With the increase in full-season soybeans and decrease in double cropped soybeans in CAST-19, the N application rates were examined. Chris Brosch-DDA, Jill Whitcomb-PA-DEP; James Martin-VA-DEQ

[Comments](#) on CAST-19:
Soybean nitrogen application □ Response (p.3)

- N applications on soybeans depend on whether the soybeans are full season or double cropped.

- Double-cropped receive 0 N applications.

- Full season have a N crop need of 0.12 lb./bu (5.70 lbs./ac)
  - watershed-wide avg
    - 2.23 inorganic lbs./acre applied
    - 1.35 organic lbs./acre applied

- The University of Maryland, Penn State, and Virginia Tech nutrient management guidelines recommend zero N on full-season or double-cropped soybeans.

[Comments]{.underline} on CAST-19:
Soybean nitrogen application_Resolution (p.3)

- A comparative analysis of changing full-season soybeans to corn and the resulting nitrogen loads was provided to PA-DEP.

- The soybean N application and N fixation assumed for Lancaster County and the average in the rest of PA's watershed were provided to Jill Whitcomb, PA-DEP.

- The CBP will provide to Jill Whitcomb, PA-DEP, and other states the peer reviewed research and other sources that document nutrient runoff/leaching rates from legumes, and how it is applied in the modeling tools (e.g., is it a constant throughout the year or is there a difference in seasonality, is there a difference depending on what crop preceded/followed, etc.) by the May 25, 2020 WQGIT.

- The AgWG will be asked to consider establishing a group to evaluate nutrient management BMPs for nitrogen on full season soybeans. [see Workplan Task 6]

Concern:

Nutrient management on full-season soybeans?

YES: "core NM"

    NO: "supplemental NM" for N rate, placement & timing

        Why? NM on soybeans is controlling for P…

        N application not NM (soybeans don't need N)

Given the same acreage…

A shift from double-crop to full-season soybeans can result in an increase in attributed N load (primary driver is N fixation).

Without supplemental NM for N…

Jurisdictions stuck with "uncontrollable load."

CRITICAL CONCEPT:

N load attributed to soybean acres includes estimated leaching/runoff of residual N based on scientific literature review.

Ag Loading Rate Review Steering Committee

Agricultural Loading Rates

Model Assumption

Full Season (under Core NM):
Assume 40 bu/ac @ 100 ac

40 bu/ac x 0.12 lbs N/bu x 1.0 x 100 ac =

480 lbs N applied

Double-Crop
Assume 25 bu/ac @ 100 ac

25 bu/ac x 0 lbs N/bu x 1.0 x 100 ac

**0 lbs N applied (on beans)
N applied to sm grain**

Crop Application Goal on Major Crops

lbs of N/Year = State-Supplied lbs of N/Application Goal Yield Unit/Year X Yield/Year X 1.1*

Crop	DoubleCrop	Nutrient	Yield Unit	DE_1	MD_1	NY_1	PA_1	VA_1	WV_1
Alfalfa Hay Harvested Area	N	TN	dry tons	1	1	1	1	1	1
Alfalfa Hay Harvested Area	N	TP	dry tons	5	5	5	6	5	5
Corn for Grain Harvested Area	N	TN	bushels	0.92	0.92	0.92	0.92	0.92	0.92
Corn for Grain Harvested Area	N	TP	bushels	0.12	0.12	0.12	0.12	0.12	0.12
Corn for Grain Harvested Area	Y	TN	bushels	0.92	0.92	0.92	0.92	0.92	0.92
Corn for Grain Harvested Area	Y	TP	bushels	0.12	0.12	0.12	0.12	0.12	0.12
Wheat for Grain Harvested Area	N	TP	bushels	0.31	0.31	0.31	0.31	0.31	0.31
Wheat for Grain Harvested Area	N	TN	bushels	1.25	1.25	1	1	1.25	1.25
Wheat for Grain Harvested Area	Y	TP	bushels	0.465	0.465	0.465	0.465	0.465	0.465
Wheat for Grain Harvested Area	Y	TN	bushels	1.25	1.25	1	1	1.25	1.25
Pastureland and rangeland other than cropland and woodland pastured Area	N	TN	acres	15	15	15	15	15	15
Pastureland and rangeland other than cropland and woodland pastured Area	N	TP	acres	4	4	4	4	4	4
Soybeans for beans Harvested Area	**N**	**TN**	**bushels**	**0.12**	**0.12**	**0.12**	**0.12**	**0.12**	**0.12**
Soybeans for beans Harvested Area	**N**	**TP**	**bushels**	**0.33**	**0.33**	**0.33**	**0.33**	**0.33**	**0.33**
Soybeans for beans Harvested Area	**Y**	**TN**	**bushels**	**0**	**0**	**0**	**0**	**0**	**0**
Soybeans for beans Harvested Area	**Y**	**TP**	**bushels**	**0**	**0**	**0**	**0**	**0**	**0**

CRITICAL CONTEXT:
"Crop Application Goal" assumes Core NM is in place

Full Season Beans receive
0.12 lb N/bu
&
0.33 lb P/bu

Double Crop Beans
0 lb N/bu
&
0 lb P/bu

NM on full season beans is controlling/managing for phosphorus!

Data provided by states after consultation with nutrient management program staff.

*AMS elected to multiply yearly yield by 1.1 assuming farmers are optimistic, and average yields are often under-estimated.

Application Goal Multipliers

Land Use	Non NM N Multiplier	NM N Multiplier	Non NM P Multiplier	NM P Multiplier
Full Season Soybeans	**1.2**	**1.0**	1.5	1.0
Grain with Manure	1.3	1.0	3	1.0
Grain without Manure	1.2	1.0	1.5	1.0
Legume Hay	1.2	1.0	1	1.0
Silage with Manure	1.4	1.0	3	1.0
Silage without Manure	1.2	1.0	1.5	1.0
Small Grains and Grains	1.2	1.0	1.5	1.0
Small Grains and Soybeans	1.2	1.0	1.5	1.0
Specialty Crop High	1.3	1.0	2	1.0
Specialty Crop Low	1.2	1.0	2	1.0
Other Agronomic Crops	1.1	1.0	1.5	1.0
Other Hay	1	1.0	1	1.0
Pasture	1	1.0	1	1.0

Data provided by Phase 6.0 Nutrient Management Expert Panel

Full Season Soybeans:
40 bu/ac @ 100 ac

Core NM:
40 bu/ac x 0.12 lbs N/bu x 1.0 x 100 ac =
480 lbs N applied
40 bu/ac x 0.33 lbs P/bu x 1.0 x 100 ac =
1,320 lbs P applied

Non NM:
40 bu/ac x 0.12 lbs N/ac x 1.2 x 100 ac =
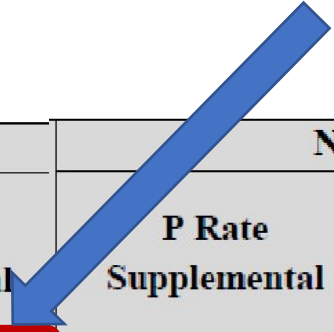**570 lbs N applied**
40 bu/ac x 0.33 lbs P/bu x 1.5 x 100 ac =
1,980 lbs P applied

CRITICAL CONCEPT:
Multipliers are applied to Crop Application Goal

NM Supplemental Percent Reductions
(Only after Core NM is applied)

Land Use	Nutrient Management BMP			Nutrient Management BMP		
	N Rate Supplemental	N Placement Supplemental	N Timing Supplemental	P Rate Supplemental	P Placement Supplemental	P Timing Supplemental
Full Season Soybeans	0%	0%	0%	5%	10%	1%
Grain w/ Manure	15%	5%	10%	10%	20%	20%
Grain w/o Manure	5%	3%	5%	5%	10%	1%
Legume Hay	0%	0%	0%	1%	10%	1%
Silage w/ Manure	15%	5%	10%	10%	20%	20%
Silage w/o Manure	5%	3%	5%	5%	10%	1%
Small Grains and Grains	5%	3%	10%	5%	10%	1%
Small Grains and Soybeans	5%	3%	10%	5%	10%	1%
Specialty Crop High	15%	5%	5%	5%	10%	1%
Specialty Crop Low	5%	3%	5%	5%	10%	1%
Other Agronomic Crops	5%	3%	5%	5%	10%	1%
Other Hay	0%	3%	5%	0%	10%	1%
Pasture	0%	0%	0%	0%	0%	0%

Data provided by Phase 6.0 Nutrient Management Expert Panel

CRITICAL CONCEPT:
Supplemental NM is applied to Edge of Stream Delivery

Soybean Crop Application Goal

Full Season Soybeans

- 0.12 lbs N/bu (~5.7 lbs N/ac)

- CBW Average: (~3.58 lb/N ac)

- UME, Penn State, VT recommend zero N application

Double Cropped Soybeans

- Zero N applications

- UME, Penn State, VT recommend zero N application

Assumption: "Nitrogen application is not recommended for soybean production, however, **use of commercially available fertilizer formulations may result in application of up to 50 lb N / acre when fertilizer formulation and application rate is determined by crop P2O5, K2O, S, or other nutrient needs**. Organic waste nitrogen application to full-season soybean is not recommended because it is an agronomically inefficient use of applied nutrients. Organic wastes should only be applied to small grain - double-crop soybean rotations at rates and timings to supply the recommended nitrogen rate to the small grain crop." – UME SFM-1

1. Define Crop Application Goal

2. Define Manure Available to Crops

4. Define Inorganic Fertilizer Available to Crops

A Crop Application Goal/Yield Unit

B Yields/Acre

C Acres

Crop Application Goal

Manure Generated

Feed Additive BMPs

AAPFCO Fertilizer Sales Data

A AMS
B NASS Annual Survey
C Ag Census

Direct Deposition on Pasture

Direct Deposition to Riparian Pasture Areas

Deposited within Barnyard

Ag Census or NASS Annual Surveys (Animal populations dictate manure load estimates)

Ammonia Reduction BMPs

Stored Manure

Storage and Handling Loss

Barnyard BMPs

Available for Transport

Manure Transport

Available for Application

Mineralization

Volatilization

3. Spread Manure to Crops

5. Spread Fertilizer to Crops

AMS= Agricultural Modeling Subcommittee