Establishing Nutrient Spread Rules for July Calibration

AMS Presentation to Agricultural Workgroup

Curtis Dell, USDA-ARS-PSWMRU

Matt Johnston, UMD

Proposed Nutrient Spread Approach

States will revise nutrient application tables

- Row crops rates will correspond with LGU recommendations
- Pasture and hay application rates will be reduced from LGU recommendation in proportion with the fraction of low intensity management
  - State reps will convene to develop consistent approach
  - A mechanism to assign ‘low intensity” hay and pasture into land uses separate from intensely managed hay and pasture will be pursued

Proposal: July beta runs will test two nutrient spreads

- Beta a: Utilize fertilizer sales data as used in previous Ver. 6 beta runs
- Beta b: Utilize county yield data and application rate table to estimate quantities applied (no fertilizer sales data)
- Both runs use revised application rate tables with both NM and non-MN
- In counties where the results from the two methods have significant divergence:
  - States review data inputs for those counties and outline corrective measures
  - AMS reviews corrective measures and reports to AgWG

Proposed Timeline

- After AgWG decision, CBPO staff and subgroup leadership coordinate coding needs for Beta runs
- By May 20: CBPO distributes LGU recommendation tables to states
- By May 2: each state partner will completed QC/QA on LGU recommendation table
- By June 3: State AgWk members reach agreement on a methodology to address application rates for pasture and hay
- When Beta output is available, state reps will identify outlier counties and propose remedial measures
- As states develop corrective approaches, AMS schedules meetings to evaluate corrective approaches
- August AgWG meeting , AMS presents evaluation of Beta runs and corrective measures for outlier counties.

Include Nutrient Management Acres?

Scenario 1 (No Nutrient Management Acres)

State-supplied N goal **x** NM acres **=**
NM total N application (pounds)

~~State-supplied N goal x (1.2) X Non-NM acres = Non-NM total N application (pounds)~~

SUM

Total N Application Goal (pounds) by Land Use per County

Scenario 2 (Inclusion of Nutrient Management Acres)

State-supplied N goal **x** NM acres **=**
NM total N application (pounds)

State-supplied N goal **x** (1.2) X Non-NM acres **=**
Non-NM total N application (pounds)

SUM

Total N Application Goal (pounds) by Land Use per County

Draft Non-NM Multiplier to Crop Goal

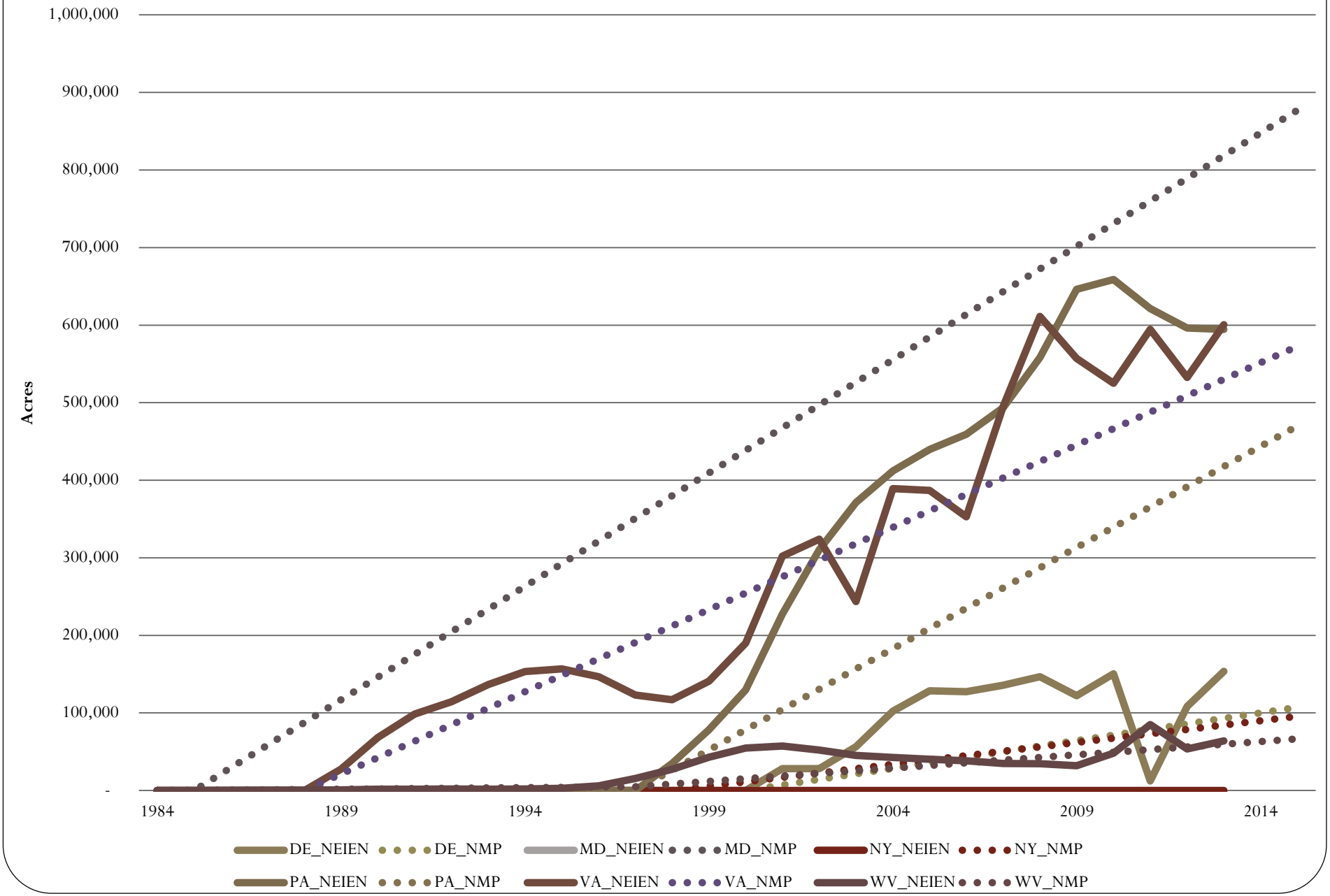
Land Use	N Core NM	N Non-NM	P Core NM	P Non-NM
Full Season Soybeans	1	1.2	1	1.5
Grain w/ Manure	1	1.3	1	3
Grain w/o Manure	1	1.2	1	1.5
Legume Hay	1	1.2	1	1
Silage w/ Manure	1	1.4	1	3
Silage w/o Manure	1	1.2	1	1.5
Small Grains and Grains	1	1.2	1	1.5
Small Grains and Soybeans	1	1.2	1	1.5
Specialty Crop High	1	1.3	1	2
Specialty Crop Low	1	1.2	1	2
Other Agronomic Crops	1	1.1	1	1.5
Other Hay	1	0.7	1	2
Pasture	1	0.25	1	1

Prepared for proof-of-concept analysis by NM Panel in May, 2016.

Estimating NM Acres

- 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 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.

Comparing April Calibration Nutrient Management Acres to Draft NMP Acres



Statewide NM Results

% Difference in Inorganic N Applications due to NM

Year	DE	MD	NY	PA	VA	WV
1984	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1985	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1986	0.0%	-0.2%	0.0%	0.0%	0.0%	0.0%
1987	0.0%	-0.3%	0.1%	0.1%	0.0%	0.0%
1988	0.1%	-0.5%	0.1%	0.1%	0.1%	0.1%
1989	0.1%	-0.6%	0.1%	0.2%	0.1%	0.1%
1990	0.2%	-0.8%	0.2%	0.3%	0.1%	0.1%
1991	0.2%	-1.0%	0.2%	0.3%	0.1%	0.2%
1992	0.4%	-1.1%	0.3%	0.5%	-0.1%	0.3%
1993	0.4%	-1.3%	0.3%	0.5%	0.0%	0.3%
1994	0.4%	-1.5%	0.3%	0.6%	0.0%	0.3%
1995	0.5%	-1.6%	0.4%	0.6%	0.0%	0.3%
1996	0.5%	-1.8%	0.4%	0.7%	0.0%	0.3%
1997	0.6%	-2.0%	0.4%	0.8%	0.0%	0.3%
1998	0.7%	-2.1%	0.5%	0.8%	0.0%	0.5%
1999	0.9%	-2.3%	0.6%	0.9%	-0.1%	0.7%
2000	1.1%	-2.7%	0.7%	1.1%	-0.3%	0.7%
2001	0.9%	-2.7%	0.5%	0.9%	0.1%	0.9%
2002	1.1%	-3.2%	0.4%	1.2%	0.0%	1.0%
2003	0.8%	-3.0%	0.7%	0.9%	0.2%	1.1%
2004	0.8%	-3.1%	0.6%	1.1%	0.1%	1.3%
2005	0.7%	-3.2%	0.8%	1.1%	0.2%	1.3%
2006	0.6%	-3.4%	0.9%	1.1%	0.3%	1.4%
2007	0.6%	-3.5%	1.0%	1.3%	0.1%	1.6%
2008	0.5%	-3.6%	1.1%	1.2%	0.2%	1.7%
2009	0.5%	-3.6%	1.2%	1.1%	0.3%	1.8%
2010	0.5%	-3.7%	1.3%	1.1%	0.3%	2.5%
2011	0.4%	-3.8%	1.4%	1.1%	0.2%	2.2%
2012	0.4%	-3.8%	1.6%	1.2%	0.1%	2.4%

% Difference in Inorganic P Applications due to NM

Year	DE	MD	NY	PA	VA	WV
1984	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1985	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1986	0.0%	-0.3%	0.0%	0.1%	0.1%	0.0%
1987	0.1%	-0.5%	0.1%	0.1%	0.1%	0.0%
1988	0.1%	-0.8%	0.1%	0.2%	0.2%	0.1%
1989	0.2%	-1.1%	0.2%	0.3%	0.2%	0.2%
1990	0.3%	-1.3%	0.3%	0.4%	0.2%	0.1%
1991	0.4%	-1.6%	0.4%	0.5%	0.2%	0.2%
1992	0.5%	-2.0%	0.5%	0.6%	0.2%	0.4%
1993	0.6%	-2.3%	0.6%	0.7%	0.1%	0.5%
1994	0.7%	-2.6%	0.7%	0.8%	0.1%	0.6%
1995	0.9%	-2.9%	0.8%	1.0%	0.1%	0.7%
1996	1.0%	-3.2%	0.9%	1.1%	0.0%	0.8%
1997	1.1%	-3.6%	1.0%	1.3%	-0.1%	0.8%
1998	1.2%	-3.8%	1.1%	1.3%	0.0%	0.9%
1999	1.4%	-4.2%	1.2%	1.3%	0.0%	1.0%
2000	1.0%	-3.3%	1.1%	0.8%	-0.1%	0.5%
2001	1.0%	-3.7%	1.3%	0.8%	-0.1%	0.7%
2002	0.9%	-3.8%	1.4%	0.7%	0.0%	0.7%
2003	0.9%	-4.0%	1.5%	0.8%	0.0%	0.9%
2004	0.9%	-4.3%	1.7%	0.9%	0.1%	1.0%
2005	0.6%	-4.6%	1.8%	0.9%	0.1%	1.2%
2006	0.7%	-4.7%	1.9%	0.9%	0.2%	1.3%
2007	0.3%	-5.0%	2.1%	1.0%	0.3%	1.5%
2008	0.4%	-5.0%	2.1%	0.9%	0.4%	1.6%
2009	0.1%	-5.2%	2.3%	0.9%	0.5%	1.8%
2010	-0.1%	-5.3%	2.4%	0.8%	0.6%	1.9%
2011	0.2%	-5.2%	2.5%	0.7%	0.6%	1.9%
2012	0.2%	-5.4%	2.7%	0.7%	0.7%	2.2%

Countywide NM Results

Top 10 Counties for Lower N Applications (2012)

County	State	Non NM N	NM N	Difference	% Difference
Caroline	MD	7,974,939	7,729,200	-245,739	-3.1%
Carroll	MD	5,284,916	5,082,024	-202,892	-3.8%
Dorchester	MD	5,371,069	5,090,766	-280,303	-5.2%
Frederick	MD	6,256,365	5,933,353	-323,012	-5.2%
Kent	MD	6,748,915	6,426,506	-322,409	-4.8%
Queen Annes	MD	9,136,885	8,641,553	-495,332	-5.4%
Talbot	MD	6,629,941	6,461,506	-168,435	-2.5%
Washington	MD	3,756,561	3,535,605	-220,956	-5.9%
Lancaster	PA	18,430,870	18,164,292	-266,578	-1.4%
Essex	VA	2,984,663	2,840,187	-144,476	-4.8%

Top 10 Counties with Higher N Applications (2012)

County	State	Non NM N	NM N	Difference	% Difference
Livingston	NY	6,817,305	6,967,062	149,757	2.2%
Ontario	NY	5,913,820	6,026,223	112,403	1.9%
Adams	PA	5,971,516	6,124,726	153,209	2.6%
Bedford	PA	4,846,223	4,970,779	124,555	2.6%
Berks	PA	12,808,763	13,008,120	199,356	1.6%
Bradford	PA	6,633,786	6,851,075	217,289	3.3%
Somerset	PA	5,264,501	5,412,544	148,043	2.8%
Susquehanna	PA	3,001,057	3,109,826	108,769	3.6%
Tioga	PA	4,649,656	4,806,271	156,614	3.4%
York	PA	12,276,878	12,560,366	283,488	2.3%

Other Improvements for July (Beta 3)

- Legume Fixation
  - AMS approved use of new equation to estimate legume fixation based upon estimates of nitrogen available from soils, manure and inorganic fertilizer.
- Crop Removal
  - AMS will review new crop removal rates and compare them to Phase 5 uptake rates before recommending their use in Beta 3.
- Barnyard Area for Other Cattle
  - Area will be adjusted so it better reflects NRCS estimates of area used by cattle.

Example Calculation of N_2 Fixation

	-------- State Average Yields --------		
Crop	**MD**	**PA**	**VA**
Soybeans, bu/ac	45	48	39
Alfalfa Hay, (dry) tons/ac	3.2	3.3	3.0
Dry Edible Beans, cwt/ac	----	24	----
Peanuts, lbs/ac	----	----	3,964

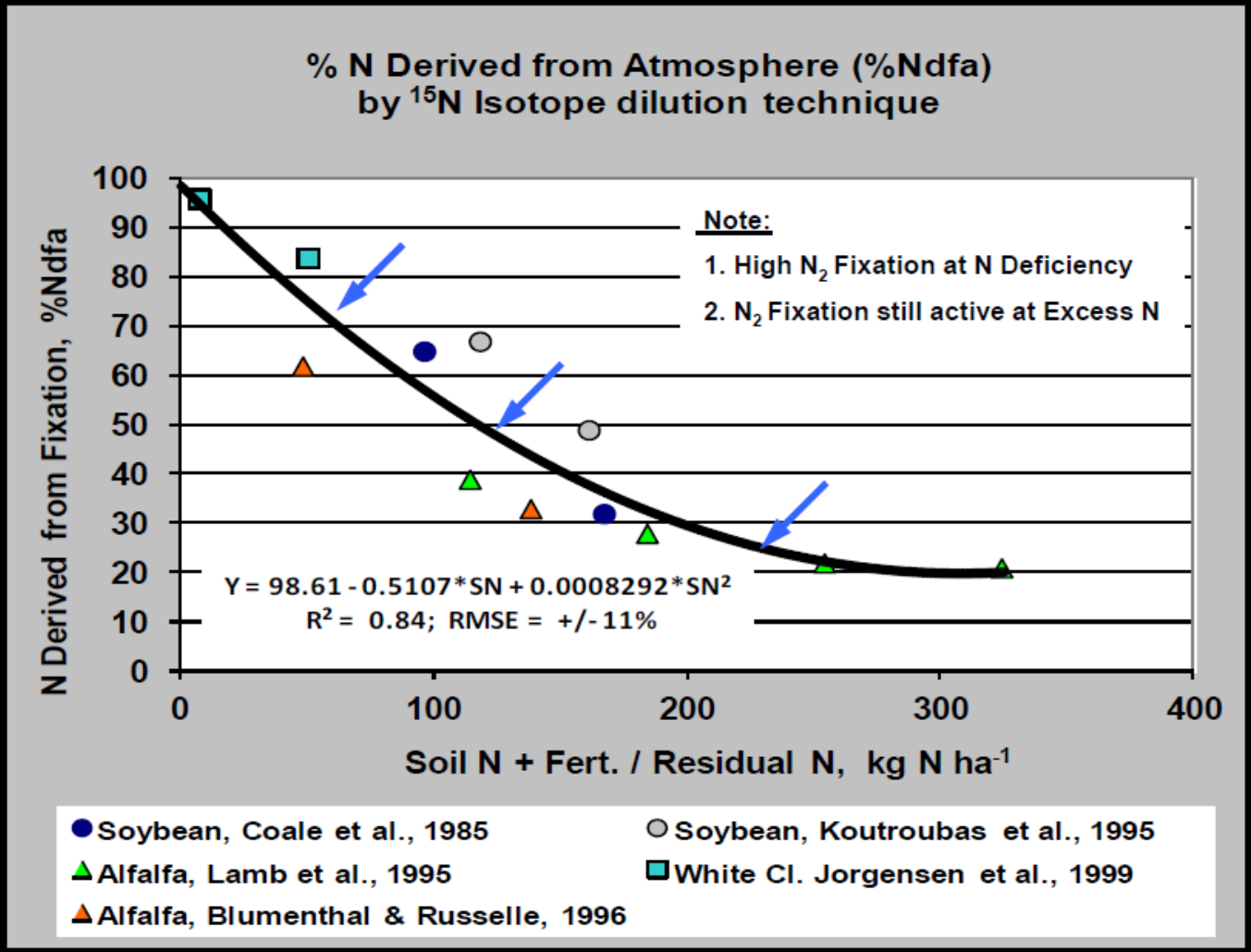
N_2 Fix. = Yield (bu/ac) * lbs N /bu * % N_2 Fix. * 1.5 = lbs N_2 Fix./ac

Source: St. or Co. Ylds. ; T. 5.4 [1] ; Graph ; 67% Harvest [1] 33% Residue

Example:
MD Soybeans = 45 bu/ac * 3.3 lbs N/bu * 75% N_2 Fix. * 1.5 = 168 lbs N/ac or 188 kg N /ha
Low SN, CP

[1] Meisinger & Randal, 1991, Est. N Budgets for Soil-Crop Sys. pp.85-124, *In* Managing N for Ground Water Qual.....

Estimating N_2 Fixation: Percent of Crop N Yield from N_2 Fixation and Influence of Soil N



Defining Inorganic N Available

† Available soil N equals percent organic matter times 30. Also add fertilizer N applied (if any) plus one-half of manure N (or three-fourths of poultry manure N) plus residual NO_3-N from prior crop. For soils with >3% organic matter, use values at lower end of range. Soils with <3% organic matter, use upper end of range.

Meisinger and Randall, 1991.

- **Short-Term Solution (Beta 3):**
  - Assume Average % Organic Matter = 1.5% for EVERY County
  - Assume 45 lbs N from Soil for EVERY County (1.5 X 30).
  - Add lbs PAN from Manure and Fertilizer
  - Use regression to determine % N2 fixed by crop.

Proposal: July beta runs will test two nutrient spreads

- Beta a: Utilize fertilizer sales data as used in previous Ver. 6 beta runs
- Beta b: Utilize county yield data and application rate table to estimate quantities applied (no fertilizer sales data)
- Both runs use revised application rate tables with both NM and non-MN
- In counties where the results from the two methods have significant divergence:
  - States review data inputs for those counties and outline corrective measures
  - AMS reviews corrective measures and reports to AgWG

Cap Applications at Crop Goal and Redistribute Unused Fertilizer?

- NM Panel recommended fertilizer applications be capped at crop application goal in a county.
- AMS agreed with logic, but recommended that any fertilizer that was "poofed" due to cap should be redistributed to all other counties in the watershed based upon each county's crop application goal.
  - Logic: maintain total watershed-wide fertilizer use

Countywide Cap Results (2012)

Top 10 Counties for Lower N Applications (2012)

County	State	Lbs N Initial	Lbs N Post-Cap	Difference in Lbs N	% Difference in Lbs N
Chester	PA	22,762,288	12,380,849	-10,381,439	-45.6%
Prince Georges	MD	1,009,874	817,361	-192,513	-19.1%
Lancaster	VA	525,406	426,696	-98,710	-18.8%
Cumberland	VA	310,360	230,910	-79,450	-25.6%
Prince George	VA	1,008,147	939,774	-68,373	-6.8%
Grant	WV	135,511	83,134	-52,377	-38.7%
Nottoway	VA	760,011	710,320	-49,690	-6.5%
Amelia	VA	801,382	755,969	-45,413	-5.7%
Chesterfield	VA	259,621	214,238	-45,383	-17.5%
Isle Of Wight	VA	2,489,776	2,465,260	-24,517	-1.0%

Top 10 Counties with Higher N Applications (2012)

County	State	Lbs N Initial	Lbs N Post-Cap	Difference in Lbs N	% Difference in Lbs N
Lancaster	PA	17,599,452	18,164,292	564,840	3.2%
Sussex	DE	15,737,587	16,147,333	409,747	2.6%
York	PA	12,172,711	12,560,367	387,656	3.2%
Franklin	PA	9,240,730	9,545,063	304,333	3.3%
Bradford	PA	6,560,207	6,851,069	290,861	4.4%
Berks	PA	12,726,230	13,008,119	281,890	2.2%
Kent	DE	9,041,073	9,293,709	252,637	2.8%
Tioga	PA	4,590,257	4,806,267	216,010	4.7%
Queen Annes	MD	8,436,293	8,641,552	205,259	2.4%
Caroline	MD	7,528,972	7,729,196	200,224	2.7%