Membership-Phase 6 Cover Crop Panel

Name	Affiliation	Role
Ken Staver	University of Maryland	Panel Chair
Charlie White	Penn State University	Panel Member
Jack Meisinger	USDA – Agriculture Research Service	Panel Member
Paul Salon	USDA-Natural Resources Conservation Service	Panel Member
Wade Thomason	Virginia Tech	Panel Member
Jason Keppler	*Maryland Department of Agriculture*	*Watershed Technical Workgroup representative*
David Wood	*Chesapeake Bay Program Office*	*Modeling Team representative*
Mark Dubin	*University of Maryland*	*AgWG Coordinator*
Lindsey Gordon	*Chesapeake Research Consortium*	*Staff*

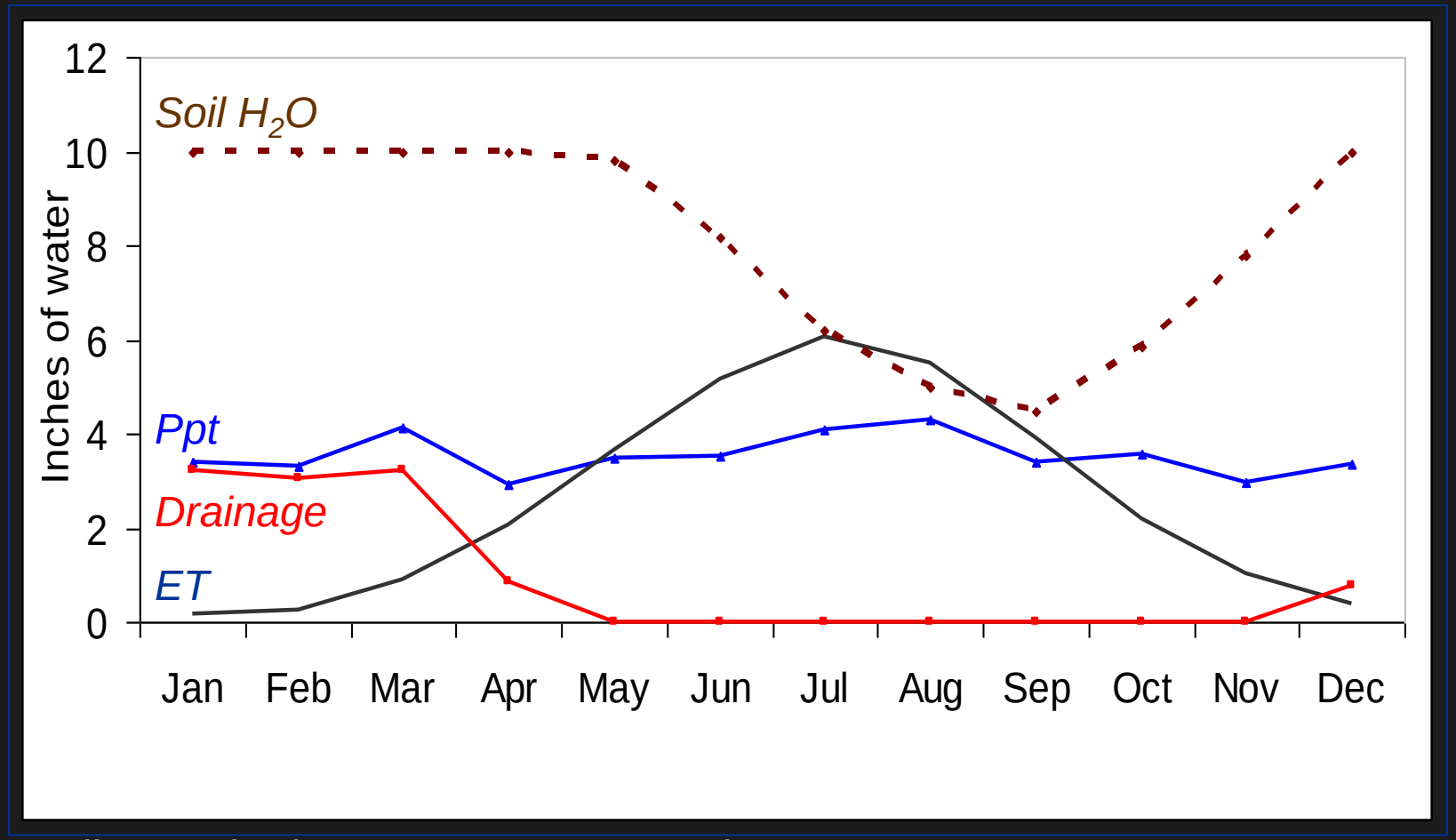
P6 CC panel three main tasks (May 19-2016)

- Use 5.3.2 panel table efficiencies for traditional cover crops as base and …

1. Modify efficiencies for mixtures based on new data from PSU and VT, probably a little higher.
2. Modify table to apply to cropland where manure is applied in fall, mostly corn silage.
3. Modify table to apply to winter cereal production fields (commodity) with no fall nutrients applied.

How does the General Hydrologic Cycle affect N Losses over a Calendar Year?

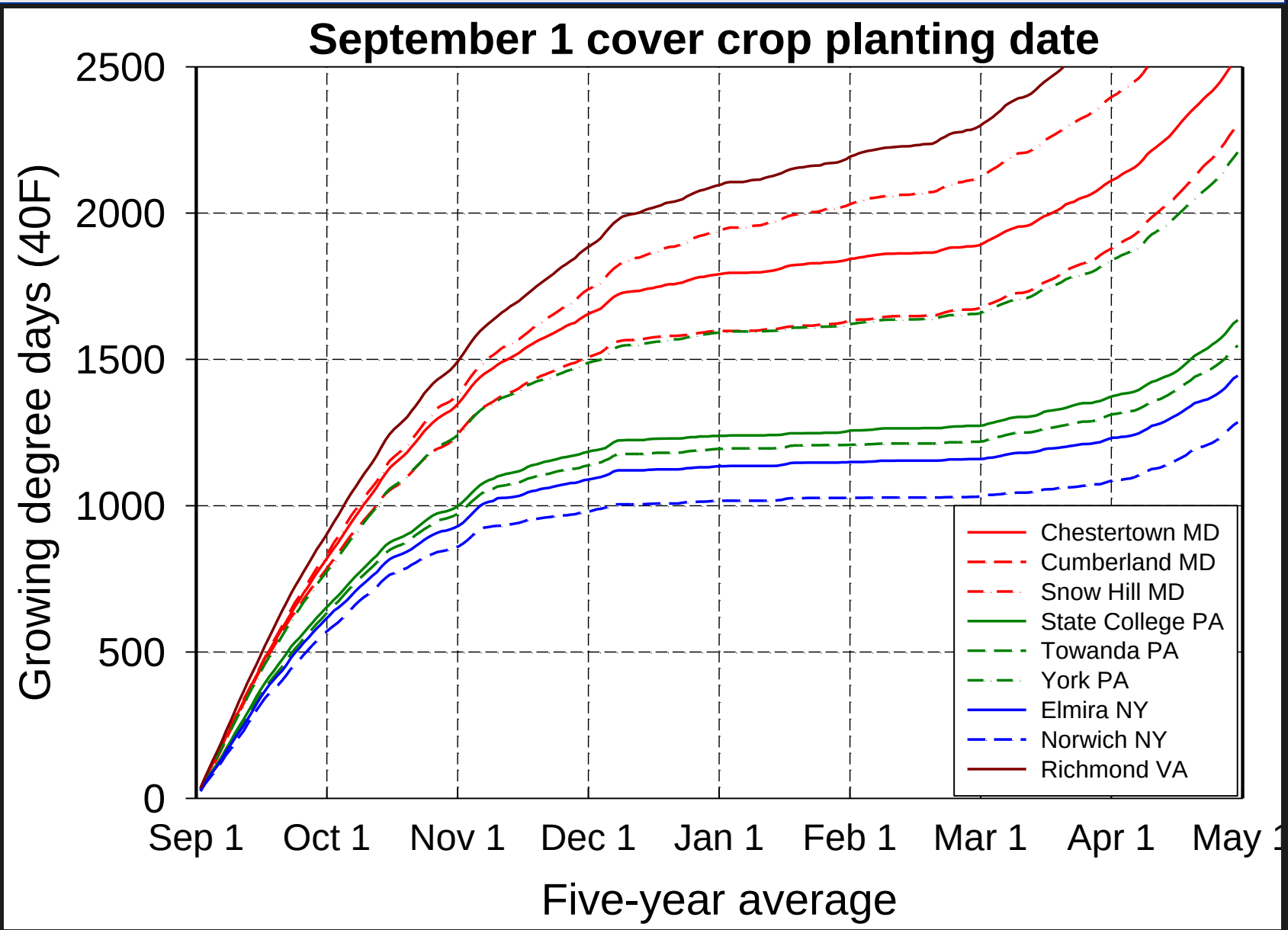
(Meisinger & Delgado, 2002)

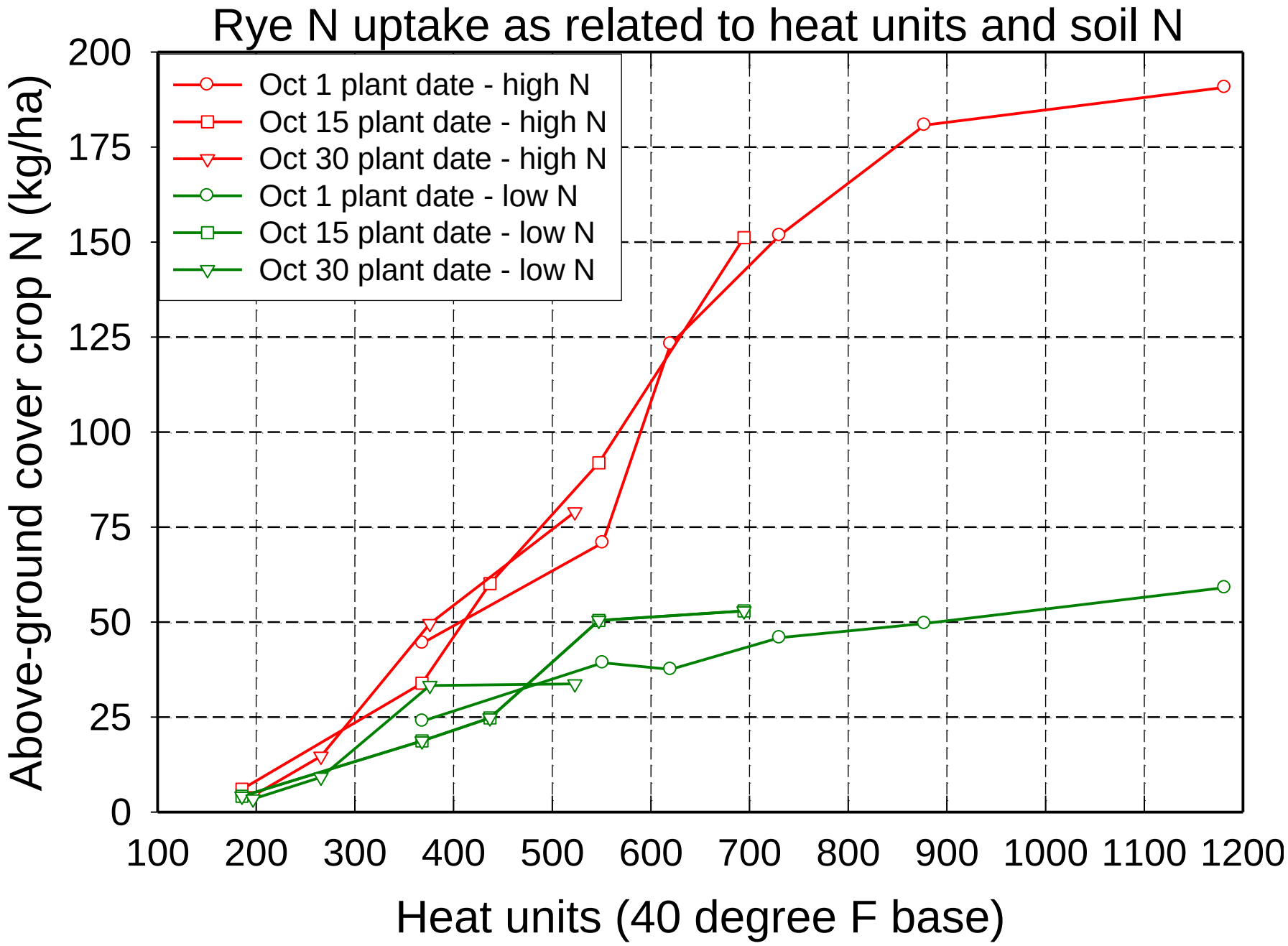


Soil water budget – Lower eastern shore

The Bay watershed has large north-south differences in growing season, how do fall heat units vary within the watershed?

(Staver, Pers. Comm. 2008)




Rye N uptake as related to heat units and soil N
Above-ground cover crop N (kg/ha)
Heat units (40 degree F base)
Oct 1 plant date - high N
Oct 15 plant date - high N
Oct 30 plant date - high N
Oct 1 plant date - low N
Oct 15 plant date - low N
Oct 30 plant date - low N
0
25
50
75
100
125
150
175
200
100
200
300
400
500
600
700
800
900
1000
1100
1200

The essential cover crop effect on N losses

- Reduce soil nitrate pool outside of summer growing season to minimize potential for nitrate leaching, which is the major route of N loss from cropland in many parts of the Bay watershed.
- Pretty simple in traditional case of pure stands planted in otherwise winter fallow settings with no fall nutrients (basically the 5.3.2 approach).
- P6, considering real world situations where nitrate pool is adjusted (up for fall manure, down for commodity cover crops), and cover crop uptake potential is reduced by reducing grass content in mixtures with legumes.

Basically trying to put numbers on one big sliding scale between root zone nitrate and cover crop uptake potential

- Considering more complicated situations in P6 with limited data to cover all the options
- First principles, efficiency goes down as root zone nitrate pool goes up and cover crop uptake potential goes down.
- Commodity cover crop, concept is that eliminating fall N reduces root zone nitrate so efficiency increases, but baseline is not well defined (maybe not panel's purview?)

Many studies but many gaps. Consistent findings:

- Winter cereals respond to higher soil N, producing more biomass and moving more soil nitrate-N into above-ground biomass as soil N availability increases.
- The reference cover crop used in past panel reports (cereal rye planted at 2 bu/acre) when planted in early or standard planting periods is capable of taking more N out of the soil than is generally available post-harvest in summer annual row crop settings.
- Reducing cover crop uptake potential by reducing planting rates, or delaying planting, increases the likelihood that nitrate will be leached out of reach of cover crop roots before uptake can occur.
- Increasing the fall soil nitrate pool by applying manure or inorganic N will increase winter cereal N uptake but also increase the potential for nitrate leaching.

A couple of key changes from 5.3.2

- Traditional and commodity cover crops can be applied to all row crop land uses except for some minor specialty crops (e.g., spinach)
- Cover crop efficiencies will be applied to specific land uses, rather than the average crop acre
- Commodity cover crop effect will only consider impact of no fall nutrient applications. After Jan. 1 dealt with in the winter cereals land use with NM

One more key change from 5.3.2

- The low-till and high-till land uses that were a part of all earlier model versions do not exist in P6.
- Different sediment and P cover crop reductions for these two land uses no longer relevant.
- Conservation tillage BMP deals with this issue.
- But not possible to have exclusionary BMPs.
- Solution: sediment and P reductions for cover crop only apply to silage, other row crop, and high input specialty crops.

P6 Cover crop panel recommendations

- All coefficients developed so far for traditional single species cover crops left unchanged, but P6 land use changes will lead to some changes in load reductions.
- Fall manure and mixture cover crop BMPs working off of traditional cover crop table values
- Commodity cover crop a limited data BPJ recommendation.

P6 Cover crop panel recommendations

- 5.3.2 grass/legume mixture values should apply to mixtures that are 25-50% of the monoculture grass planting rate (from 50-100%)
- Grass/legume mixture category added to include mixtures that are 50-100% of the monoculture grass planting rate. N reduction credit 0.7 of monoculture grass planting rate.
- 50-100% monoculture grass planting eligible for this credit in early and standard planting period.

P6 Cover crop panel recommendations–II

- Crop land where fall manure application is unavoidable are a high priority for cover crop use and should be eligible for the cover crop BMP.
- The N reductions from cover crops planted where fall manure is applied are estimated as 0.7 of existing values for traditional full rate monoculture winter hardy grass and brassica cover crops.

P6 Cover crop panel recommendations–III

- Baseline condition is summer crop followed by a winter cereal for production that receives a 30 lb/acre N application.
- Commodity cover crop BMP is elimination of fall N application.
- N reduction credit increases moving later as N uptake capacity of crop decreases and fraction of applied N leached increases.

P6 Cover crop panel recommendations–IV

- Limited data on this specific case
- Withholding fall N application from a winter cereal crop planted for harvest credited to reduce annual N losses from from land use where planted by 5, 10, and 15% for early, standard and late planting dates in Coastal Plain/Piedmont Crystalline/Karst regions and 4, 8, and 12 % in Mesozoic Lowlands/Valley and Ridge Siliciclastic regions.

Traditional Cover Crop Total Nitrogen, Phosphorus, and Sediment Efficiency Estimates

Total Nitrogen Efficiency Estimates

KEY: Black text indicates Phase 5.3.2 Cover Crop Efficiency Estimates. *Blue Italic text indicates Phase 6 updated Cover Crop Efficiency Estimates.*

High Till Applicable Land Uses: Silage with Manure, Silage without Manure, Specialty Crop High, Other Agronomic Crops

Low Till Applicable Land Uses: Full Season Soybeans, Grain with Manure, Grain without Manure, Small Grains, Double Cropped, Specialty Crop Low

Coastal Plain/Piedmont Crystalline/Karst Settings

Seeding method:	Drilled		Other		Aerial/soy		Aerial/corn			Drilled		Other		Aerial/soy		Aerial/corn			Drilled		Other		Aerial/soy		Aerial/corn	
Species:	Rye		Rye		Rye		Rye			Wheat		Wheat		Wheat		Wheat			Barley		Barley		Barley		Barley	
Till:	High	Low	High	Low	High	Low	High	Low		High	Low	High	Low	High	Low	High	Low		High	Low	High	Low	High	Low	High	Low
Early planting	0.45	0.45	0.38	0.38	0.31	0.31	0.18	0.18		0.31	0.31	0.27	0.27	0.22	0.22	0.12	0.12		0.38	0.38	0.32	0.32	0.27	0.27	0.15	0.15
Normal planting	0.41	0.41	0.35	0.35	NA	NA	NA	NA		0.29	0.29	0.24	0.24	NA	NA	NA	NA		0.29	0.29	0.24	0.24	NA	NA	NA	NA
Late planting	0.19	0.19	0.16	0.16	NA	NA	NA	NA		0.13	0.13	0.11	0.11	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Seeding method:	Drilled		Other		Aerial/soy		Aerial/corn			Drilled		Other		Aerial/soy		Aerial/corn			Drilled		Other		Aerial/soy		Aerial/corn	
Species:	Rye		Rye		Rye		Rye			Wheat		Wheat		Wheat		Wheat			Barley		Barley		Barley		Barley	
Till:	High	Low	High	Low	High	Low	High	Low		High	Low	High	Low	High	Low	High	Low		High	Low	High	Low	High	Low	High	Low
Early planting	0.34	0.34	0.29	0.29	0.24	0.24	0.14	0.14		0.24	0.24	0.2	0.2	0.17	0.17	0.10	0.10		0.29	0.29	0.25	0.25	0.2	0.2	0.12	0.12
Normal planting	0.31	0.31	0.27	0.27	NA	NA	NA	NA		0.22	0.22	0.19	0.19	NA	NA	NA	NA		0.22	0.22	0.19	0.19	NA	NA	NA	NA
Late planting	0.15	0.15	0.12	0.12	NA	NA	NA	NA		0.1	0.1	0.09	0.09	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA

Total Phosphorus Efficiency Estimates

Coastal Plain/Piedmont Crystalline/Karst Settings

Seeding method:	Drilled		Other		Aerial/soy		Aerial/corn			Drilled		Other		Aerial/soy		Aerial/corn			Drilled		Other		Aerial/soy		Aerial/corn	
Species:	Rye		Rye		Rye		Rye			Wheat		Wheat		Wheat		Wheat			Barley		Barley		Barley		Barley	
Till:	High	Low	High	Low	High	Low	High	Low		High	Low	High	Low	High	Low	High	Low		High	Low	High	Low	High	Low	High	Low
Early planting	0.15	0	0.15	0	0.15	0	0.15	0		0.15	0	0.15	0	0.15	0	0.15	0		0.15	0	0.15	0	0.15	0	0.15	0
Normal planting	0.07	0	0.07	0	NA	NA	NA	NA		0.07	0	0.07	0	NA	NA	NA	NA		0.07	0	0.07	0	NA	NA	NA	NA
Late planting	0	0	0	0	NA	NA	NA	NA		0	0	0	0	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Seeding method:	Drilled		Other		Aerial/soy		Aerial/corn			Drilled		Other		Aerial/soy		Aerial/corn			Drilled		Other		Aerial/soy		Aerial/corn	
Species:	Rye		Rye		Rye		Rye			Wheat		Wheat		Wheat		Wheat			Barley		Barley		Barley		Barley	
Till:	High	Low	High	Low	High	Low	High	Low		High	Low	High	Low	High	Low	High	Low		High	Low	High	Low	High	Low	High	Low
Early planting	0.15	0	0.15	0	0.15	0	0.15	0		0.15	0	0.15	0	0.15	0	0.15	0		0.15	0	0.15	0	0.15	0	0.15	0
Normal planting	0.07	0	0.07	0	NA	NA	NA	NA		0.07	0	0.07	0	NA	NA	NA	NA		0.07	0	0.07	0	NA	NA	NA	NA
Late planting	0	0	0	0	NA	NA	NA	NA		0	0	0	0	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA

Total Sediment Efficiency Estimates

Coastal Plain/Piedmont Crystalline/Karst Settings

Seeding method:	Drilled		Other		Aerial/soy		Aerial/corn			Drilled		Other		Aerial/soy		Aerial/corn			Drilled		Other		Aerial/soy		Aerial/corn	
Species:	Rye		Rye		Rye		Rye			Wheat		Wheat		Wheat		Wheat			Barley		Barley		Barley		Barley	
Till:	High	Low	High	Low	High	Low	High	Low		High	Low	High	Low	High	Low	High	Low		High	Low	High	Low	High	Low	High	Low
Early planting	0.2	0	0.2	0	0.2	0	0.2	0		0.2	0	0.2	0	0.2	0	0.2	0		0.2	0	0.2	0	0.2	0	0.2	0
Normal planting	0.1	0	0.1	0	NA	NA	NA	NA		0.1	0	0.1	0	NA	NA	NA	NA		0.1	0	0.1	0	NA	NA	NA	NA
Late planting	0	0	0	0	NA	NA	NA	NA		0	0	0	0	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Seeding method:	Drilled		Other		Aerial/soy		Aerial/corn			Drilled		Other		Aerial/soy		Aerial/corn			Drilled		Other		Aerial/soy		Aerial/corn	
Species:	Rye		Rye		Rye		Rye			Wheat		Wheat		Wheat		Wheat			Barley		Barley		Barley		Barley	
Till:	High	Low	High	Low	High	Low	High	Low		High	Low	High	Low	High	Low	High	Low		High	Low	High	Low	High	Low	High	Low
Early planting	0.2	0	0.2	0	0.2	0	0.2	0		0.2	0	0.2	0	0.2	0	0.2	0		0.2	0	0.2	0	0.2	0	0.2	0
Normal planting	0.1	0	0.1	0	NA	NA	NA	NA		0.1	0	0.1	0	NA	NA	NA	NA		0.1	0	0.1	0	NA	NA	NA	NA
Late planting	0	0	0	0	NA	NA	NA	NA		0	0	0	0	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA

Total Nitrogen Efficiency Estimates

Coastal Plain/Piedmont Crystalline/Karst Settings

Drilled Forage Radish		Other Forage Radish		Aerial/soy Forage Radish		Aerial/corn Forage Radish		Drilled Forage Radish plus		Other Forage Radish plus		Aerial/soy Forage Radish plus		Aerial/corn Forage Radish plus		Drilled Annual Legume		Other Annual Legume		Aerial/soy Annual Legume		Aerial/corn Annual Legume	
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.26	0.26	0.22	0.22	0.18	0.18	0.10	0.10	0.29	0.29	0.25	0.25	0.20	0.20	0.12	0.12	0.07	0.07	0.06	0.06	0.05	0.05	0.03	0.03
NA	NA	NA	NA	NA	NA	NA	NA	0.22	0.22	0.18	0.18	NA	NA	NA	NA	0.06	0.06	0.06	0.06	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Drilled Forage Radish		Other Forage Radish		Aerial/soy Forage Radish		Aerial/corn Forage Radish		Drilled Forage Radish plus		Other Forage Radish plus		Aerial/soy Forage Radish plus		Aerial/corn Forage Radish plus		Drilled Annual Legume		Other Annual Legume		Aerial/soy Annual Legume		Aerial/corn Annual Legume	
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.20	0.20	0.17	0.17	0.14	0.14	0.08	0.08	0.22	0.22	0.19	0.19	0.15	0.15	0.09	0.09	0.05	0.05	0.05	0.05	0.04	0.04	0.02	0.02
NA	NA	NA	NA	NA	NA	NA	NA	0.16	0.16	0.14	0.14	NA	NA	NA	NA	0.05	0.05	0.04	0.04	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total Phosphorus Efficiency Estimates

Coastal Plain/Piedmont Crystalline/Karst Settings

Drilled Forage Radish		Other Forage Radish		Aerial/soy Forage Radish		Aerial/corn Forage Radish		Drilled Forage Radish plus		Other Forage Radish plus		Aerial/soy Forage Radish plus		Aerial/corn Forage Radish plus		Drilled Annual Legume		Other Annual Legume		Aerial/soy Annual Legume		Aerial/corn Annual Legume	
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.06	0.00	0.06	0.00	0.06	0.00	0.06	0.00	0.08	0.00	0.08	0.00	0.08	0.00	0.08	0.00	0.06	0.00	0.06	0.00	0.06	0.00	0.06	0.00
NA	NA	NA	NA	NA	NA	NA	NA	0.04	0.00	0.04	0.00	NA	NA	NA	NA	0.03	0.00	0.03	0.00	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Drilled Forage Radish		Other Forage Radish		Aerial/soy Forage Radish		Aerial/corn Forage Radish		Drilled Forage Radish plus		Other Forage Radish plus		Aerial/soy Forage Radish plus		Aerial/corn Forage Radish plus		Drilled Annual Legume		Other Annual Legume		Aerial/soy Annual Legume		Aerial/corn Annual Legume	
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.06	0.00	0.06	0.00	0.06	0.00	0.06	0.00	0.08	0.00	0.08	0.00	0.08	0.00	0.08	0.00	0.06	0.00	0.06	0.00	0.06	0.00	0.06	0.00
NA	NA	NA	NA	NA	NA	NA	NA	0.04	0.00	0.04	0.00	NA	NA	NA	NA	0.03	0.00	0.03	0.00	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total Sediment Efficiency Estimates

Coastal Plain/Piedmont Crystalline/Karst Settings

Drilled Forage Radish		Other Forage Radish		Aerial/soy Forage Radish		Aerial/corn Forage Radish		Drilled Forage Radish plus		Other Forage Radish plus		Aerial/soy Forage Radish plus		Aerial/corn Forage Radish plus		Drilled Annual Legume		Other Annual Legume		Aerial/soy Annual Legume		Aerial/corn Annual Legume	
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.09	0.00	0.09	0.00	0.09	0.00	0.09	0.00	0.12	0.00	0.12	0.00	0.12	0.00	0.12	0.00	0.08	0.00	0.08	0.00	0.08	0.00	0.08	0.00
NA	NA	NA	NA	NA	NA	NA	NA	0.06	0.00	0.06	0.00	NA	NA	NA	NA	0.04	0.00	0.04	0.00	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Drilled Forage Radish		Other Forage Radish		Aerial/soy Forage Radish		Aerial/corn Forage Radish		Drilled Forage Radish plus		Other Forage Radish plus		Aerial/soy Forage Radish plus		Aerial/corn Forage Radish plus		Drilled Annual Legume		Other Annual Legume		Aerial/soy Annual Legume		Aerial/corn Annual Legume	
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.09	0.00	0.09	0.00	0.09	0.00	0.09	0.00	0.12	0.00	0.12	0.00	0.12	0.00	0.12	0.00	0.08	0.00	0.08	0.00	0.08	0.00	0.08	0.00
NA	NA	NA	NA	NA	NA	NA	NA	0.06	0.00	0.06	0.00	NA	NA	NA	NA	0.04	0.00	0.04	0.00	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total Nitrogen Efficiency Estimates

PS.3.2 mixture values but redefined to apply to 25-50% full grass planting rate

Coastal Plain/Piedmont Crystalline/Karst Settings

Drilled Legume plus grass		Other Legume plus grass		Aerial/soy Legume plus grass		Aerial/corn Legume plus grass	
High	Low	High	Low	High	Low	High	Low
0.20	0.20	0.17	0.17	0.14	0.14	0.08	0.08
0.19	0.19	0.16	0.16	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

Drilled Triticale		Other Triticale		Aerial/soy Triticale		Aerial/corn Triticale	
High	Low	High	Low	High	Low	High	Low
0.39	0.39	0.33	0.33	0.27	0.27	0.15	0.15
0.35	0.35	0.30	0.30	NA	NA	NA	NA
0.16	0.16	0.14	0.14	NA	NA	NA	NA

Drilled Annual Ryegrass		Other Annual Ryegrass		Aerial/soy Annual Ryegrass		Aerial/corn Annual Ryegrass	
High	Low	High	Low	High	Low	High	Low
0.30	0.30	0.25	0.25	0.20	0.20	0.12	0.12
0.27	0.27	0.23	0.23	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Drilled Legume plus grass		Other Legume plus grass		Aerial/soy Legume plus grass		Aerial/corn Legume plus grass	
High	Low	High	Low	High	Low	High	Low
0.15	0.15	0.13	0.13	0.10	0.10	0.06	0.06
0.14	0.14	0.12	0.12	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

Drilled Triticale		Other Triticale		Aerial/soy Triticale		Aerial/corn Triticale	
High	Low	High	Low	High	Low	High	Low
0.29	0.29	0.25	0.25	0.21	0.21	0.12	0.12
0.27	0.27	0.23	0.23	NA	NA	NA	NA
0.13	0.13	0.10	0.10	NA	NA	NA	NA

Drilled Annual Ryegrass		Other Annual Ryegrass		Aerial/soy Annual Ryegrass		Aerial/corn Annual Ryegrass	
High	Low	High	Low	High	Low	High	Low
0.22	0.22	0.19	0.19	0.16	0.16	0.09	0.09
0.20	0.20	0.18	0.18	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

Total Phosphorus Efficiency Estimates

PS.3.2 P and sediment values changed to be the same as rye, wheat, and barley

Coastal Plain/Piedmont Crystalline/Karst Settings

Drilled Legume plus grass		Other Legume plus grass		Aerial/soy Legume plus grass		Aerial/corn Legume plus grass	
High	Low	High	Low	High	Low	High	Low
0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00
0.05	0.00	0.05	0.00	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

Drilled Triticale		Other Triticale		Aerial/soy Triticale		Aerial/corn Triticale	
High	Low	High	Low	High	Low	High	Low
0.15	0	0.15	0	0.15	0	0.15	0
0.07	0	0.07	0	NA	NA	NA	NA
0	0	0	0	NA	NA	NA	NA

Drilled Annual Ryegrass		Other Annual Ryegrass		Aerial/soy Annual Ryegrass		Aerial/corn Annual Ryegrass	
High	Low	High	Low	High	Low	High	Low
0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00
0.05	0.00	0.05	0.00	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Drilled Legume plus grass		Other Legume plus grass		Aerial/soy Legume plus grass		Aerial/corn Legume plus grass	
High	Low	High	Low	High	Low	High	Low
0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00
0.05	0.00	0.05	0.00	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

Drilled Triticale		Other Triticale		Aerial/soy Triticale		Aerial/corn Triticale	
High	Low	High	Low	High	Low	High	Low
0.15	0	0.15	0	0.15	0	0.15	0
0.07	0	0.07	0	NA	NA	NA	NA
0	0	0	0	NA	NA	NA	NA

Drilled Annual Ryegrass		Other Annual Ryegrass		Aerial/soy Annual Ryegrass		Aerial/corn Annual Ryegrass	
High	Low	High	Low	High	Low	High	Low
0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00
0.05	0.00	0.05	0.00	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

Total Sediment Efficiency Estimates

Coastal Plain/Piedmont Crystalline/Karst Settings

Drilled Legume plus grass		Other Legume plus grass		Aerial/soy Legume plus grass		Aerial/corn Legume plus grass	
High	Low	High	Low	High	Low	High	Low
0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00
0.07	0.00	0.07	0.00	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

Drilled Triticale		Other Triticale		Aerial/soy Triticale		Aerial/corn Triticale	
High	Low	High	Low	High	Low	High	Low
0.2	0	0.2	0	0.2	0	0.2	0
0.1	0	0.1	0	NA	NA	NA	NA
0	0	0	0	NA	NA	NA	NA

Drilled Annual Ryegrass		Other Annual Ryegrass		Aerial/soy Annual Ryegrass		Aerial/corn Annual Ryegrass	
High	Low	High	Low	High	Low	High	Low
0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00
0.07	0.00	0.07	0.00	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Drilled Legume plus grass		Other Legume plus grass		Aerial/soy Legume plus grass		Aerial/corn Legume plus grass	
High	Low	High	Low	High	Low	High	Low
0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00
0.07	0.00	0.07	0.00	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

Drilled Triticale		Other Triticale		Aerial/soy Triticale		Aerial/corn Triticale	
High	Low	High	Low	High	Low	High	Low
0.2	0	0.2	0	0.2	0	0.2	0
0.1	0	0.1	0	NA	NA	NA	NA
0	0	0	0	NA	NA	NA	NA

Drilled Annual Ryegrass		Other Annual Ryegrass		Aerial/soy Annual Ryegrass		Aerial/corn Annual Ryegrass	
High	Low	High	Low	High	Low	High	Low
0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00
0.07	0.00	0.07	0.00	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA

Total Nitrogen Efficiency Estimates

Coastal Plain/Piedmont Crystalline/Karst Settings

Drilled Oats, Winter Hardy		Other Oats, Winter Hardy		Aerial/soy Oats, Winter Hardy		Aerial/corn Oats, Winter Hardy		Drilled Oats, Winter Killed		Other Oats, Winter Killed		Aerial/soy Oats, Winter Killed		Aerial/corn Oats, Winter Killed		Drilled Brassica		Other Brassica		Aerial/soy Brassica		Aerial/corn Brassica	
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.25	0.25	0.21	0.21	0.17	0.17	0.10	0.10	0.18	0.18	0.15	0.15	0.13	0.13	0.07	0.07	0.32	0.32	0.27	0.27	0.22	0.22	0.13	0.13
0.23	0.23	0.19	0.19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Drilled Oats, Winter Hardy		Other Oats, Winter Hardy		Aerial/soy Oats, Winter Hardy		Aerial/corn Oats, Winter Hardy		Drilled Oats, Winter Killed		Other Oats, Winter Killed		Aerial/soy Oats, Winter Killed		Aerial/corn Oats, Winter Killed		Drilled Brassica		Other Brassica		Aerial/soy Brassica		Aerial/corn Brassica	
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.19	0.19	0.16	0.16	0.13	0.13	0.08	0.08	0.14	0.14	0.12	0.12	0.10	0.10	0.06	0.06	0.24	0.24	0.20	0.20	0.17	0.17	0.10	0.10
0.17	0.17	0.15	0.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total Phosphorus Efficiency Estimates

Coastal Plain/Piedmont Crystalline/Karst Settings

Drilled Oats, Winter Hardy		Other Oats, Winter Hardy		Aerial/soy Oats, Winter Hardy		Aerial/corn Oats, Winter Hardy		Drilled Oats, Winter Killed		Other Oats, Winter Killed		Aerial/soy Oats, Winter Killed		Aerial/corn Oats, Winter Killed		Drilled Brassica		Other Brassica		Aerial/soy Brassica		Aerial/corn Brassica	
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.09	0.00	0.09	0.00	0.09	0.00	0.09	0.00	0.06	0.00	0.06	0.00	0.06	0.00	0.06	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00
0.04	0.00	0.04	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Drilled Oats, Winter Hardy		Other Oats, Winter Hardy		Aerial/soy Oats, Winter Hardy		Aerial/corn Oats, Winter Hardy		Drilled Oats, Winter Killed		Other Oats, Winter Killed		Aerial/soy Oats, Winter Killed		Aerial/corn Oats, Winter Killed		Drilled Brassica		Other Brassica		Aerial/soy Brassica		Aerial/corn Brassica	
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.09	0.00	0.09	0.00	0.09	0.00	0.09	0.00	0.06	0.00	0.06	0.00	0.06	0.00	0.06	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00
0.04	0.00	0.04	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total Sediment Efficiency Estimates

Coastal Plain/Piedmont Crystalline/Karst Settings

Drilled Oats, Winter Hardy		Other Oats, Winter Hardy		Aerial/soy Oats, Winter Hardy		Aerial/corn Oats, Winter Hardy		Drilled Oats, Winter Killed		Other Oats, Winter Killed		Aerial/soy Oats, Winter Killed		Aerial/corn Oats, Winter Killed		Drilled Brassica		Other Brassica		Aerial/soy Brassica		Aerial/corn Brassica	
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.14	0.00	0.14	0.00	0.14	0.00	0.14	0.00	0.08	0.00	0.08	0.00	0.08	0.00	0.08	0.00	0.13	0.00	0.13	0.00	0.13	0.00	0.13	0.00
0.07	0.00	0.07	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Drilled Oats, Winter Hardy		Other Oats, Winter Hardy		Aerial/soy Oats, Winter Hardy		Aerial/corn Oats, Winter Hardy		Drilled Oats, Winter Killed		Other Oats, Winter Killed		Aerial/soy Oats, Winter Killed		Aerial/corn Oats, Winter Killed		Drilled Brassica		Other Brassica		Aerial/soy Brassica		Aerial/corn Brassica	
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.14	0.00	0.14	0.00	0.14	0.00	0.14	0.00	0.08	0.00	0.08	0.00	0.08	0.00	0.08	0.00	0.13	0.00	0.13	0.00	0.13	0.00	0.13	0.00
0.07	0.00	0.07	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Total Nitrogen Efficiency Estimates

P6 grass legume mixtures with grass at least 50% of full planting rate

P6 reduction coefficients for situtions where manure is applied in the fall before cover crop planting

Coastal Plain/Piedmont Crystalline/Karst Set

Drilled Legume plus grass		Other Legume plus grass		Aerial/soy Legume plus grass		Aerial/corn Legume plus grass		Drilled Rye		Other Rye		Drilled Wheat		Other Wheat		Drilled Barley		Other Barley		Drilled Triticale		Other Triticale		Dril
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0.26	0.26	0.22	0.22	0.18	0.18	0.10	0.10	0.32	0.32	0.27	0.27	0.22	0.22	0.19	0.19	0.27	0.27	0.22	0.22	0.27	0.27	0.23	0.23	0.17
0.25	0.25	0.21	0.21	NA	NA	NA	NA	0.29	0.29	0.25	0.25	0.20	0.20	0.17	0.17	0.20	0.20	0.17	0.17	0.25	0.25	0.21	0.21	0.16
NA	NA	NA	NA	NA	NA	NA	NA	0.13	0.13	0.11	0.11	0.09	0.09	0.08	0.08	NA	NA	NA	NA	0.11	0.11	0.10	0.10	NA

Mesozoic Lowlands/Valley and Ridge Silicicl

Drilled Legume plus grass		Other Legume plus grass		Aerial/soy Legume plus grass		Aerial/corn Legume plus grass		Drilled Rye		Other Rye		Drilled Wheat		Other Wheat		Drilled Barley		Other Barley		Drilled Triticale		Other Triticale		Dril
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0.20	0.20	0.17	0.17	0.14	0.14	0.08	0.08	0.24	0.24	0.20	0.20	0.17	0.17	0.14	0.14	0.20	0.20	0.18	0.18	0.20	0.20	0.17	0.17	0.13
0.19	0.19	0.16	0.16	NA	NA	NA	NA	0.22	0.22	0.19	0.19	0.15	0.15	0.13	0.13	0.15	0.15	0.13	0.13	0.19	0.19	0.16	0.16	0.12
NA	NA	NA	NA	NA	NA	NA	NA	0.11	0.11	0.08	0.08	0.07	0.07	0.06	0.06	NA	NA	NA	NA	0.09	0.09	0.07	0.07	NA

Total Phosphorus Efficiency Estimates

No change to P and sediement values from 5.3.2 mixture values

No change to P and sediement values from

Coastal Plain/Piedmont Crystalline/Karst Settings

Drilled Legume plus grass		Other Legume plus grass		Aerial/soy Legume plus grass		Aerial/corn Legume plus grass		Drilled Rye		Other Rye		Drilled Wheat		Other Wheat		Drilled Barley		Other Barley		Drilled Triticale		Other Triticale		Dril
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00	0.09
0.05	0.00	0.05	0.00	NA	NA	NA	NA	0.07	0.00	0.07	0.00	0.07	0.00	0.07	0.00	0.07	0.00	0.07	0.00	0.07	0.00	0.07	0.00	0.04
NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	0.00	0.00	0.00	0.00	NA

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Drilled Legume plus grass		Other Legume plus grass		Aerial/soy Legume plus grass		Aerial/corn Legume plus grass		Drilled Rye		Other Rye		Drilled Wheat		Other Wheat		Drilled Barley		Other Barley		Drilled Triticale		Other Triticale		Dril
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00	0.12	0.00	0.12	0.00	0.09
0.05	0.00	0.05	0.00	NA	NA	NA	NA	0.07	0.00	0.07	0.00	0.07	0.00	0.07	0.00	0.07	0.00	0.07	0.00	0.06	0.00	0.06	0.00	0.04
NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	0.00	0.00	0.00	0.00	NA

Total Sediment Efficiency Estimates

Coastal Plain/Piedmont Crystalline/Karst Settings

Drilled Legume plus grass		Other Legume plus grass		Aerial/soy Legume plus grass		Aerial/corn Legume plus grass		Drilled Rye		Other Rye		Drilled Wheat		Other Wheat		Drilled Barley		Other Barley		Drilled Triticale		Other Triticale		Dril
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00	0.20	0.00	0.20	0.00	0.20	0.00	0.20	0.00	0.20	0.00	0.20	0.00	0.17	0.00	0.17	0.00	0.14
0.07	0.00	0.07	0.00	NA	NA	NA	NA	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.08	0.00	0.08	0.00	0.07
NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	0.00	0.00	0.00	0.00	NA

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Drilled Legume plus grass		Other Legume plus grass		Aerial/soy Legume plus grass		Aerial/corn Legume plus grass		Drilled Rye		Other Rye		Drilled Wheat		Other Wheat		Drilled Barley		Other Barley		Drilled Triticale		Other Triticale		Dril
High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0.15	0.00	0.15	0.00	0.15	0.00	0.15	0.00	0.20	0.00	0.20	0.00	0.20	0.00	0.20	0.00	0.20	0.00	0.20	0.00	0.17	0.00	0.17	0.00	0.14
0.07	0.00	0.07	0.00	NA	NA	NA	NA	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.08	0.00	0.08	0.00	0.07
NA	NA	NA	NA	NA	NA	NA	NA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	0.00	0.00	0.00	0.00	NA

-only N values are changed from PS.3.2, P and sediment values unchanged

:tings

led	Other		Drilled		Other		Drilled		Other		Drilled		Other	
ter Hardy	Oats, Winter Hardy		Annual Ryegrass		Annual Ryegrass		Brassica		Brassica		Forage Radish plus		Forage Radish plus	
Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.17	0.15	0.15	0.21	0.21	0.18	0.18	0.22	0.22	0.19	0.19	0.20	0.20	0.17	0.17
0.16	0.14	0.14	0.19	0.19	0.16	0.16	NA	NA	NA	NA	0.15	0.15	0.13	0.13
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

astic

led	Other		Drilled		Other		Drilled		Other		Drilled		Other	
ter Hardy	Oats, Winter Hardy		Annual Ryegrass		Annual Ryegrass		Brassica		Brassica		Forage Radish plus		Forage Radish plus	
Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.13	0.11	0.11	0.16	0.16	0.13	0.13	0.17	0.17	0.14	0.14	0.15	0.15	0.13	0.13
0.12	0.10	0.10	0.14	0.14	0.12	0.12	NA	NA	NA	NA	0.12	0.12	0.10	0.10
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.3.2 mixture values

led	Other		Drilled		Other		Drilled		Other		Drilled		Other	
ter Hardy	Oats, Winter Hardy		Annual Ryegrass		Annual Ryegrass		Brassica		Brassica		Forage Radish plus		Forage Radish plus	
Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.00	0.09	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.08	0.00	0.08	0.00
0.00	0.04	0.00	0.05	0.00	0.05	0.00	NA	NA	NA	NA	0.04	0.00	0.04	0.00
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

led	Other		Drilled		Other		Drilled		Other		Drilled		Other	
ter Hardy	Oats, Winter Hardy		Annual Ryegrass		Annual Ryegrass		Brassica		Brassica		Forage Radish plus		Forage Radish plus	
Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.00	0.09	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.10	0.00	0.08	0.00	0.08	0.00
0.00	0.04	0.00	0.05	0.00	0.05	0.00	NA	NA	NA	NA	0.04	0.00	0.04	0.00
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

led	Other		Drilled		Other		Drilled		Other		Drilled		Other	
ter Hardy	Oats, Winter Hardy		Annual Ryegrass		Annual Ryegrass		Brassica		Brassica		Forage Radish plus		Forage Radish plus	
Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.00	0.14	0.00	0.15	0.00	0.15	0.00	0.13	0.00	0.13	0.00	0.12	0.00	0.12	0.00
0.00	0.07	0.00	0.07	0.00	0.07	0.00	NA	NA	NA	NA	0.06	0.00	0.06	0.00
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

led	Other		Drilled		Other		Drilled		Other		Drilled		Other	
ter Hardy	Oats, Winter Hardy		Annual Ryegrass		Annual Ryegrass		Brassica		Brassica		Forage Radish plus		Forage Radish plus	
Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
0.00	0.14	0.00	0.15	0.00	0.15	0.00	0.13	0.00	0.13	0.00	0.12	0.00	0.12	0.00
0.00	0.07	0.00	0.07	0.00	0.07	0.00	NA	NA	NA	NA	0.06	0.00	0.06	0.00
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA