Conservation Tillage Phase 6 Panel

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Recommendations for Expert Panel Member Expertise

- Tillage and cropping practices in the Chesapeake Bay watershed jurisdiction(s). Knowledge of the CTIC National Crop Residue Management Survey.
- Experience with carrying out research projects relating to conservation tillage.
- Expertise in fate and transport of nitrogen, and/or phosphorus, and/or sediment in agricultural systems under various tillage management systems.
- Knowledge of how BMPs are tracked and reported, and the Chesapeake Bay Program partnership's modeling tools.
- Experience with verification of conservation tillage practice implementation.
- Knowledge of, and experience with, USDA-NRCS conservation practice standards and codes.

Panel Membership

Name	Affiliation	Role
Wade Thomason	VT	Panel Chair
Bill McCollum	DuPont Pioneer	Panel Member
Kevin Ganoe	Cornell	Panel Member
Dale Gates	NRCS	Panel Member
Mark Reiter	VT	Panel Member
Sjoerd Duiker	PSU	Panel Member
Bill Keeling	VADEQ	Watershed Technical Workgroup representative
Jeff Sweeney	CBPO	Modeling Team representative
Mark Dubin	UMD	AgWG Coordinator
Emma Giese	CRC	Staff

Prior to the last 5.3.2 Tillage EP

Conventional Tillage	Conservation Tillage	Existing Approved CNT for Annual Data Reporting (1)	
TOTN High-Till High-Till with Manure lbs/acre 46.4	TOTN Low-Till Low-Till with Manure lbs/acre 42.0 High-Till → Low-Till Load Reduction -9.5%	TOTN Uplands ContinuousNoTill (Not Stackable - Uplands) lbs/acre 35.7 Low-Till → ContinuousNoTill (Not Stackable) Load Reduction -15.0%	TOTN Coastal Plain ContinuousNoTill (Not Stackable - Coastal Plain) lbs/acre 37.8 Low-Till → ContinuousNoTill (Not Stackable) Load Reduction -10.0%
TOTP High-Till High-Till with Manure lbs/acre 2.16	TOTP Low-Till Low-Till with Manure lbs/acre 1.64 High-Till → Low-Till Load Reduction -24.1%	TOTP Uplands ContinuousNoTill (Not Stackable - Uplands) lbs/acre 0.98 Low-Till → ContinuousNoTill (Not Stackable) Load Reduction -40.0%	TOTP Coastal Plain ContinuousNoTill (Not Stackable - Coastal Plain) lbs/acre 1.31 Low-Till → ContinuousNoTill (Not Stackable) Load Reduction -20.0%
TSS High-Till High-Till with Manure tons/acre 0.86	TSS Low-Till Low-Till with Manure tons/acre 0.50 High-Till → Low-Till Load Reduction -41.4%	TSS Uplands ContinuousNoTill (Not Stackable - Uplands) tons/acre 0.15 Low-Till → ContinuousNoTill (Not Stackable) Load Reduction -70.0%	TSS Coastal Plain ContinuousNoTill (Not Stackable - Coastal Plain) tons/acre 0.15 Low-Till → ContinuousNoTill (Not Stackable) Load Reduction -70.0%

After the last 5.3.2 Tillage EP

Conventional Tillage	Conservation Tillage	HR Till BMP	
TOTN High-Till High-Till with Manure lbs/acre 46.4	TOTN Low-Till Low-Till with Manure lbs/acre 42.0 High-Till → Low-Till Load Reduction -9.5%	TOTN Uplands – NOT receiving manure Continuous High-Residue Minimum Soil-Disturbance lbs/acre Low-Till → ContinuousNoTill (Stackable) Load Reduction -5.25%	TOTN Coastal Plain– NOT receiving manure Continuous High-Residue Minimum Soil-Disturbance lbs/acre Low-Till → ContinuousNoTill (Stackable) Load Reduction -2.25%
TOTP High-Till High-Till with Manure lbs/acre 2.16	TOTP Low-Till Low-Till with Manure lbs/acre 1.64 High-Till → Low-Till Load Reduction -24.1%	TOTP Uplands– NOT receiving manure Continuous High-Residue Minimum Soil-Disturbance lbs/acre Low-Till → ContinuousNoTill (Stackable) Load Reduction -10.0%	TOTP Coastal Plain– NOT receiving manure Continuous High-Residue Minimum Soil-Disturbance lbs/acre Low-Till → ContinuousNoTill (Stackable) Load Reduction -5.0%
TSS High-Till High-Till with Manure tons/acre 0.86	TSS Low-Till Low-Till with Manure tons/acre 0.50 High-Till → Low-Till Load Reduction -41.4%	TSS Uplands Continuous High-Residue Minimum Soil-Disturbance tons/acre Low-Till → ContinuousNoTill (Stackable) Load Reduction -64.0%	TSS Coastal Plain Continuous High-Residue Minimum Soil-Disturbance tons/acre Low-Till → ContinuousNoTill (Stackable) Load Reduction -64.0%

HR-Till BMP

- The HR BMP is a new crop planting and residue management practice in which soil disturbance by plows and implements intended to invert residue is eliminated. Any disturbance must leave a **minimum of 60%** crop residue cover on the soil surface as measured after planting. HR involves all crops in a multi-crop, multi-year rotation and the crop residue cover requirement (including living or dead material) is to be met immediately after planting of each crop.

Scope of work – panel charge

- Evaluate the existing Phase 5.3.2 representation of Conventional Tillage (HiTill) and Conservation Tillage (LoTill) land uses and provide recommendations where scientifically supported to define low residue management systems as BMPs vs. land uses, with associated nutrient and sediment efficiency values, using existing CTIC data and other sources of relevant data as references.
- Provide recommendations on how to structure Conservation Tillage BMPs to incorporate the HRTill BMP and determine whether the HRTill BMP will need any adjustments to fit with the management levels proposed for Phase 6.0.
- If feasible, develop a relationship matrix between visual assessments of residue cover (e.g. CTIC) and residue levels predicted by USDA-NRCS index tools (e.g. RUSLE2) to allow cross-referencing between the two assessment methods.
- If possible, incorporate winter vegetation cover as part of a definition value for enhancing crop residue levels for crediting.
- If possible, provide recommendations on sediment and nutrient load reductions as a function of soil health.

Proposal for Phase 6 strategy

Category	Description
Conventional/Hi Till	<15% cover
	15-30% cover, full width tillage
Low residue, strip till/notill	15-30% cover, strip till or NT, <40% soil disturbance, NRCS 329
new category	
Conservation tillage	30-60% cover, NRCS 345
High residue no tillage (HRTill)	>60% cover, min disturbance

Strategy – using RUSLE2 for "breaks"

Description	*Cons. plan. soil loss*	*Soil conditioning index (SCI)*	*STIR value*	*Residue after planting*	*Proposed CB Class*
Conventional Till Corn Silage. Full inversion primary tillage with two pass secondary tillage. Less than 1% residue cover after planting.	5.1	-0.44	117	<1	Full Width Conventional Tillage
Reduced Till Corn Silage. Chisel plow primary tillage with two pass secondary full width tillage. 6% residue after planting.	4.5	-0.33	101	6	Full Width Conventional Tillage
Reduced Till Corn Silage. One pass full width tillage with field cultivator. 24% residue after planting.	3.9	-0.0076	29.7	24	Full Width Conventional Tillage
Strip Till Corn Silage. In-row subsoiler/zone builder disturbing no more than 40% of soil surface, followed by planter in strips/zones. 26% residue after planting.	3.1	0.11	15.6	26	No-Till/Strip Till
Zone-Till Corn Silage. One pass with strip till planter. 30% residue after planting	2.1	0.24	5.48	30	No-Till/Strip Till
No-Till Corn Silage. One pass with no- till planter. 31% residue after planting.	1.6	0.29	3.85	31	No-Till/Strip Till

Treatment	1971	1972	1973	1974	1975	1976	Average Annual
	mm						
Conventional for grain	29 c†	255 b	230 ab	143 c	160 c	53 a	145 bc
Reduced-tillage for grain	33 bc	219 b	189 b	99 c	139 c	35 b	119 c
No-till for grain	50 b	261 b	210 b	155 b	198 b	59 a	156 b
No-till silage with cover	10 c	206 b	178 b	135 bc	182 bc	20 b	122 c
No-till silage without cover	100 a	442 a	292 a	244 a	332 a	62 a	245 a

*From primary tillage date to primary tillage date the following year.
†Values within years followed by the same letter are not significantly different ($p < 0.05$).

Table 3. Annual soil losses by tillage year.

Treatment	Annual Soil Loss by Tillage Year*						Average Annual
	1971	1972	1973	1974	1975	1976	
	Mg ha^{-1}						
Conventional for grain	1.3 b†	1.6 b	1.8 b	11.7 b	5.9 b	0.8 b	3.9 b
Reduced tillage for grain	1.0 bc	1.2 bc	1.1 c	4.6 c	4.3 bc	0.4 c	2.1 c
No-till for grain	0.4 c	0.4 d	0.3 d	0.9 d	1.4 d	0.2 c	0.6 e
No-till silage with cover	0.2 c	0.9 cd	0.7 c	0.9 d	2.4 cd	<0.1 c	0.9 d
No-till silage without cover	10.5 a	50.7 a	10.4 a	19.6 a	39.0 a	2.1 a	22.0 a

*From primary tillage date to primary tillage date the following year.
†Values within years followed by the same letter are not significantly different ($p < 0.05$).

Table 4. Seasonal and annual cover and management (C) factor values.

Treatment	C-Factor Values						
	Crop Stage Period					Annual	
	F	SB	1 and 2	3	4	Observed	Handbook*
Conventional tillage for grain	0.026	0.555	0.121	0.018	0.075	0.091	0.281†
Reduced tillage for grain	0.063	0.215	0.073	0.012	0.048	0.049	0.086‡
No-till for grain	N/A	0.039	0.036	0.003	0.016	0.014	0.042§
No-till for silage with cover	N/A	0.025	0.026	0.003	0.030	0.020	0.190#
No-till for silage without cover	N/A	0.692	0.518	0.073	0.825	0.519	-

*Computed from seasonal soil loss ratios using EI weightings from table 6.
†Table 5, line 1; crop stage 4 from table 5C for 95% cover.

Lo Residue NT/ST

- Objective is to capture the positive effect of long-term NT on soil structure and infiltration, in systems with less than 30% cover (year round)
- Will likely allow **no more than** ~40% soil disturbance