PHASE 6 MANURE INJECTION & INCORPORATION EXPERT PANEL

MAY 19, 2016

IDENTITY AND EXPERTISE OF PANEL MEMBERS

Name	Affiliation	Role
Curt Dell	USDA-Agriculture Research Service	Panel Chair
Art Allen	University of Maryland – Eastern Shore	Panel Member
Dan Dostie	USDA-Natural Resources Conservation Service	Panel Member
Robb Meinen	Penn State University	Panel Member
Rory Maguire	Virginia Tech	Panel Member
Chris Brosch	Delaware Department of Agriculture	Watershed Technical Workgroup representative
Jeff Sweeney	CBPO	Modeling Team representative

Technical support provided by Mark Dubin (University of Maryland), Lindsey Gordon (CRC Staffer), and Don Meals (Tetra Tech).

PRACTICE NAME(S)

- Manure Injection
- Manure Incorporation High Disturbance
- Manure Incorporation Low Disturbance

DEFINITION OF THE LAND USE OR PRACTICE

In the current version of the Chesapeake Bay Program (CBP) Partnership's Watershed Model (version 5.3.2), manure injection is recognized as an interim practice used for planning purposes only. The practice of manure incorporation is not currently recognized in the Phase 5.3.2 Model as an existing or interim BMP. Due to recent increased implementation of this practice by recommendation of several state nutrient management programs, the Agriculture Workgroup has requested a review for the Phase 6.0 Model.

Manure injection is a specialized category of placement in which organic nutrient sources (including manures, biosolids, and composted materials) are mechanically applied into the root zone with surface soil closure at the time of application. Injection is expected to provide the greatest level of nutrient loss reduction from both atmospheric and surface runoff pathways, as well as odor reduction, due to limited quantities of material left on the soil surface, limited soil disruption, and immediate soil closure.

Manure incorporation is defined as the mixing of dry, semi-dry, or liquid organic nutrient sources (including manures, biosolids, and compost) into the soil profile within a specified time period from application by a range of field operations. These methods can provide nutrient loss reductions which may differ for P and N by method used. Nutrient loss reductions are primarily due to lower ammonia-N volatilization and in some cases lower P losses in surface runoff. Nutrient loss reductions may vary with timing between application and soil mixing, degree of soil mixing, and percent soil disturbance. The Panel is considering two general types of incorporation:

- **High disturbance incorporation**, providing the highest degree of mixing of organic nutrient sources into the root zone, but eliminating the erosion control benefits of conservation tillage; and
- **Low disturbance incorporation**, leaving greater quantities of organic nutrient sources on the soil surface, but maintaining most of the benefits of conservation tillage.

The panel will work with the Conservation Tillage Panel to designate specific "low disturbance" tillage operations that are consistent with the listing of practices eligible for conservation tillage credit.

Reduction efficiencies will be determined only for N and P with these practices. Any sediment loss reductions associated with adoption of injection or low disturbance incorporation will be addressed through credits for corresponding conservation tillage BMPs.

Qualifying Practice Conditions

In fully defining the practice(s), the Panel is considering the following qualifying practice conditions, including:

- Identification of appropriate manure application technologies;
- Compatibility with the NRCS definitions of manure injection and incorporation and how the recommended practice(s) will impact residue management and soil disturbance, as defined by either NRCS or the states.
- Potential negative effects of the recommended practice(s) on sediment losses with regard to assigning reduction efficiencies for incorporation. As erosion potential increases, incorporation will increase the potential for sediment and sediment-bound nutrient losses, which will offset reductions in dissolved nutrient losses; and
- Permissible elapsed time between initial manure application and incorporation

Practice Model Simulation Description

Manure injection and incorporation practices are simulated as BMPs with associated nutrient and sediment reduction efficiencies. Manure injection and incorporation practices are annual practices.

LAND USES TO WHICH THE PRACTICE IS APPLIED

Manure injection and incorporation practices apply to all land uses that include manure eligible crops for the following Phase 6.0 Agricultural Land Uses:

Land Use	Description
Full Season Soybeans	Soybeans ineligible for double cropping
Grain with Manure	Corn or sorghum for grain eligible for manure application and ineligible for double cropping
Legume Hay	Legume forage crops eligible for manure
Silage with Manure	Corn or sorghum for silage eligible for manure application and ineligible for double cropping
Small Grains and Grains	Small grains and grains other than corn or sorghum eligible for manure and ineligible for double cropping
Specialty Crop High	Specialty crops with relatively high nutrient inputs with some crops eligible for manure
Specialty Crop Low	Specialty crops with relatively low nutrient inputs with some crops eligible for manure
Other Agronomic Crops	Other high commodity row crops such as tobacco, cotton, etc., with some crops eligible for manure

UNIT OF MEASURE

Manure injection and incorporation practices can be reported in acres implementing the practice.

LOCATIONS WITHIN THE CHESAPEAKE BAY WATERSHED WHERE THIS PRACTICE IS APPLICABLE

Manure injection and incorporation practices can be applied to specified land uses everywhere within the Chesapeake Bay watershed. The practices may have localized limitations on applicability, including steep slopes, stony soils, and wet conditions.

POTENTIAL VERIFICATION METHODS

Verification will likely be challenging. Because incorporation within a specified time period will be a requirement, verification will likely require a review of operational records in addition to visual confirmation. Because timely incorporation is often a component of nutrient management planning, the panel will coordinate verification recommendations with the Nutrient Management Panel, as well as the Conservation Tillage Panel.

Potential Methods to Estimate Historic Implementation Units

Representing new BMPs, manure injection and incorporation practices have not been historically tracked and implementation reported to the Chesapeake Bay Program models. Manure injection technologies are new, with only limited current use and no significant use in the past. Therefore, the panel recommends that injection only be considered for future crediting. Manure incorporation by tillage has long been common, but timing of incorporation must be considered to determine eligibility for historic implementation. Because timely incorporation of manures is a component of many nutrient management plans, the panel will work with the Nutrient Management Panel to develop recommendations for extracting estimates of the applicable utilization of manure incorporation by tillage.

Potential for Panel adjustments in final report

The Panel is fairly confident in the definition of manure injection and incorporation practice elements, but additional elements such as practice efficiencies, Permissible elapsed time between initial manure application and incorporation, and the final set of recommended manure application technologies have not been determined. Efficiencies and the remaining practice elements for both nitrogen and phosphorus will be decided upon for the final report.