Guide to Conservation Practice Definitions for Indiana Science Assessment – Version 1

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The **General information/General Practice Definition & Benefits** is intended to provide a broad overview of the practice, and to provide a basis for the definition used in this project.

The **Criteria for Inclusion into the Science Assessment** is to provide a basis for deciding which studies to include in the systematic review. For this purpose, the definition should focus on the required characteristics of implementation or management, not the purpose or goal.

Note: Definitions of other conservation practices will be available in future editions of this guide as practices are added to the Indiana Science Assessment process.

No-Till

General information/General Practice Definition & Benefits

No-till farming is an agricultural technique for growing crops or pasture without disturbing the soil through tillage. It limits soil disturbance to manage the amount, orientation, and distribution of crop and plant residue on the soil surface year-round, which can reduce erosion, increase soil health, and conserve soil moisture. Strip-till, which fits the definition of no-till, is the practice of tilling the row where the seed and/or fertilizer will be placed, keeping the residue between the rows undisturbed.

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This practice includes planting methods commonly referred to as no-till, quality no-till, never-till, zero-till, slot plant, zone-till, strip-till, or direct seed. Approved implements are no-till and strip-till planters; certain drills and air seeders; strip-type fertilizer and manure injectors and applicators; and similar implements that only disturb strips and slots.

Full-width disturbance of any kind is not used for any operation considered a no-till system. Full-width disturbance is any operation that disturbs more than 70% of the soil surface and residue within the implement impact area (i.e. – the soil surface and residue between the plant rows is not disturbed).
The current NRCS definition of no-till for the purpose of conservation practice standard 329 is that the soil tillage intensity rating (STIR) value, which shall include all field operations that are performed during the crop interval between harvest and termination of the previous cash crop and harvest or termination of the current cash crop (includes fallow periods), shall be no greater than 20.

A no-till operation for a single crop year is not a no-till system. See reduced tillage definition.

Criteria for Inclusion into the Science Assessment

To be included in the assessment for **no-till**, a study must meet the following criteria:

1. The study must compare the nutrient loads from the preferred (BMP) and non-preferred practices.
   - Preferred (BMP): No-till
   - Non-preferred: Conventional Tillage

2. Duration: a no-till system should be accomplished continuously for at least 3 years to be defined as no-till. Less than 3 years could be called transitional no-till or rotational no-till. Improved benefits of a no-till system are typically measurable after five years of continuous years of this practice.

Reduced Tillage

General information/General Definition & Benefits

NRCS online photo gallery

Reduced tillage refers to any farming operation or system that disturbs the surface, but leaves at least 30% residue cover after planting. It is less intensive and aggressive than conventional tillage, but more intensive than no-till (i.e. – full-width disturbance is used for at least one crop cycle). A conventional tillage system leaves less than 30% of the soil surface covered with crop residue.

This practice includes tillage methods commonly referred to as mulch tillage, which include full-width disturbance operations such as vertical tillage, chiseling and disking. It applies to stubble mulching on summer-fallowed land, to tillage for annually planted crops and to tillage for planting perennial crops. It also includes some planting operations, such as hoe drills that disturb a large percentage of the soil surface during the planting operation and cropping systems in which the majority of surface area is disturbed during harvest operations. Also included is the use of a "modified no-till" system that uses full width tillage but leaves as much as 85% of the initial residue on the soil surface.

Current NRCS definition is that crop residue coverage meets the NRCS crop residue cover requirement (30-59% crop residue coverage) and STIR value ranges from 20 to 80.

Criteria for Inclusion into the Science Assessment

To be included in the assessment for **reduced tillage**, a study must meet the following criteria:

1. The study must compare the nutrient loads from the preferred (BMP) and non-preferred practices.
   - Preferred (BMP): Reduced tillage
   - Non-preferred: Conventional tillage
2. Historical studies that use ridge till may also be included, although the term is rarely used currently. Ridge tillage refers to a conservation tillage practice in which planting is completed in a seedbed prepared on ridges. Residue is left on the surface between ridges (see NRCS Tillage Equipment Pocket Identification Guide).

Cover Crops

General information/General Definition & Benefits

Cover crops are planted to cover the soil for seasonal protection and soil improvement. Cover crops manage soil erosion, soil structure, soil fertility, soil quality, water, weeds, pests, diseases, biodiversity, and wildlife in an agroecosystem. They can be seeded using a variety of methods including drilling the seed after crop harvest, broadcasting the seed after crop harvest, or aerial broadcasting the seed before harvest. The planting date (early, standard, or late) is based on the average frost date for the area.

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Criteria for Inclusion into the Science Assessment

To be included in the assessment of **cover crops**, a study must meet the following criteria:

1. The study must compare the nutrient loads from the preferred (BMP) and the non-preferred practices.
   - Preferred (BMP): Cover crop
   - Non-preferred: No cover crop
2. The cover crop should be established between successive productive (cash) crop harvests, which in Indiana typically means Fall/Winter.
3. Latitude (or regions of the state) will be included as a factor in the effectiveness of the cover crop.
4. The species of the cover crop (winterkill vs. winter hardy) will also be included as a factor in the effectiveness of the cover crop.

Nutrient Management

General information/General Definition & Benefits

Nutrient Management involves using crop nutrients and manure as efficiently as possible to improve productivity while protecting the environment. The key principle behind nutrient management is balancing soil nutrient inputs with crop requirements. It requires managing the amount (rate), source, placement (method of application), form, and timing of the application of plant nutrients and soil amendments. A nutrient management plan includes utilizing soil testing and nutrient applications to maximize nutrient use efficiency.

Four individual components of nutrient management are defined as of 2021. Other components of nutrient management will be added in the future.

A. Nitrogen (N) Rate

General information/General Definition & Benefits

Nitrogen strip trials on corn – Shalamar Armstrong, Purdue University

Applying nitrogen at the rate needed by the crop can reduce nitrate loads in subsurface drainage water. "Base the nutrient management plan on current soil test results in accordance with land grant university (LGU) guidance, or industry practice when recognized by the LGU." In Indiana, this means using Purdue guidelines for the Economically Optimum Nitrogen Rate (EONR) found at (https://www.agry.purdue.edu/ext/corn/news/timeless/NitrogenMgmt.pdf) or online at the multi-state Corn Nitrogen Rate Calculator Web site (http://cnrc.agron.iastate.edu).

B. Nitrogen (N) Timing

General information/General Definition & Benefits

The timing of nitrogen application allows for efficient use of applied nitrogen and can reduce the risk of nitrogen loss to the environment. It includes applying nitrogen close to the time when crops can utilize it; making side-dress nitrogen applications close to the time of most rapid uptake; split applications, involving more than one application; and using nitrogen stabilizers in the soil to extend the availability of nitrogen in the root zone during critical growth stages.

Y-drop N side-dress application into standing corn – CCSI, Mike Starkey

C. Phosphorus (P) Rate (based on soil test P)

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General information/General Definition & Benefits

Soil testing allows for nutrient-use efficiency of phosphorus applications, and the soil test results give farmers the information they need for proper application amounts and placement of fertilizers. "Base the nutrient management plan on current soil test results in accordance with land grant university (LGU) guidance, or industry practice when recognized by the LGU." In Indiana, this means using the Tri-State Fertilizer Recommendations.

D. Subsurface Phosphorus (P) Application

Subsurface manure application – NRCS online photo gallery

General information/General Definition & Benefits

Subsurface phosphorus application, whether synthetic or manure, is the practice of getting nutrients placed into the soil profile versus leaving nutrients on the soil surface.

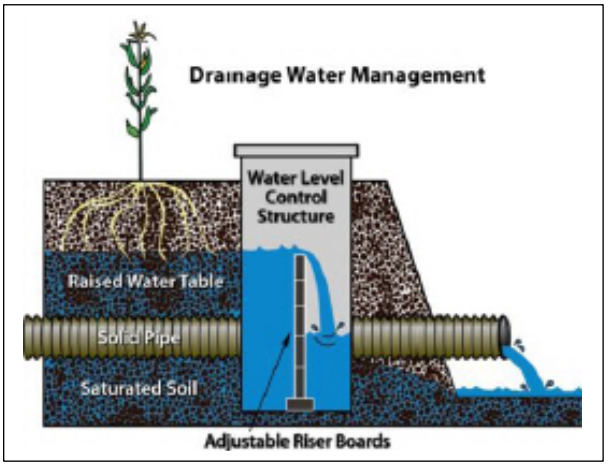
Criteria for Inclusion into the Science Assessment for Nutrient Management Practices

Nutrient Management Practice		Preferred (BMP)	Non-preferred
N rate		Total N application (sum of all applications for a single season) at [or below] Purdue recommended Economic Optimum N rate (EONR)	Total N application above EONR
N timing		Application at or within 2 weeks of planting, or in-season (sidedress)	Fall application or early spring pre-planting
P rate		If soil test P is above maintenance limit, no P fertilizer application.	P fertilizer application when soil test P is above maintenance limit.
P placement (application method)	No-till systems	Subsurface application (injected, deep banded, or strip till)	Surface application (broadcast)
	Tillage systems	Injected or incorporation before rainfall, usually within one week of application	Incorporation more than one week after application.

Drainage Water Management

General information/General Definition & Benefits

Drainage Water Management (DWM) is a practice in which the outlet from an underground drainage system is intercepted by a water control structure that effectively functions as an in-line dam, allowing the drainage outlet to be artificially set at levels ranging from the soil surface to the bottom of the drains. Water can be adjusted and held in the field reducing the overall amount of drainage water and nitrogen that moves downstream.



Criteria for Inclusion into the Science Assessment

Other terms that have been used in published studies include controlled drainage, controlled tile drainage, water table control, controlled agricultural drainage, and drainage control. Water table management is also used but more commonly refers to controlled drainage with subirrigation.

To be included in the assessment for **drainage water management**, a study must meet the following criteria:

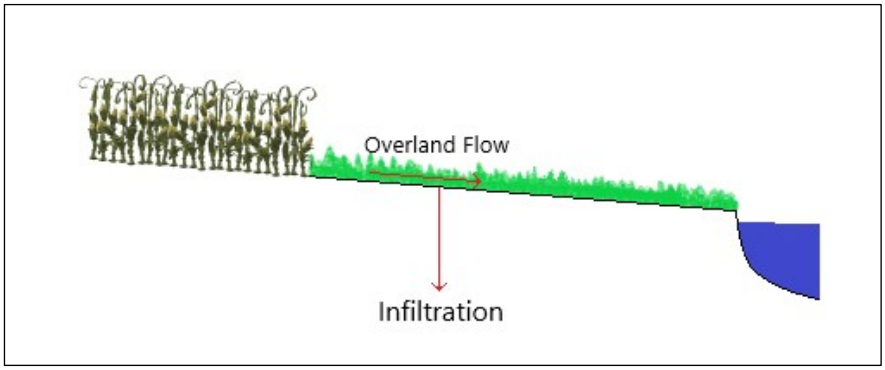
1. The study must compare the nutrient loads from the preferred (BMP) and non-preferred practices.
   - Preferred (BMP): Drainage water management
   - Non-preferred: Conventional free drainage
2. The comparison of free drainage and controlled drainage must be in the same year with consistent drainage treatments for at least one year.
3. Studies that combine subirrigation with controlled drainage are excluded.

Grassed Filter Strip

General information/General Definition & Benefits

A Filter strip is an area of grass or other permanent vegetation planted between cropland and a stream or other water body, which acts as a filter to trap sediment, fertilizers, and other pollutants from surface runoff and wastewater before they reach a water body. Filter strips have habitat benefits, provide animal corridors, reduce sediment transport from fields, provide a zone of no nutrient and pesticide applications near sensitive areas, and stabilize stream banks.

ISDA photo gallery



Criteria for Inclusion into the Science Assessment

To be included in the assessment for a **filter strip** practice, a study must meet the following criteria:

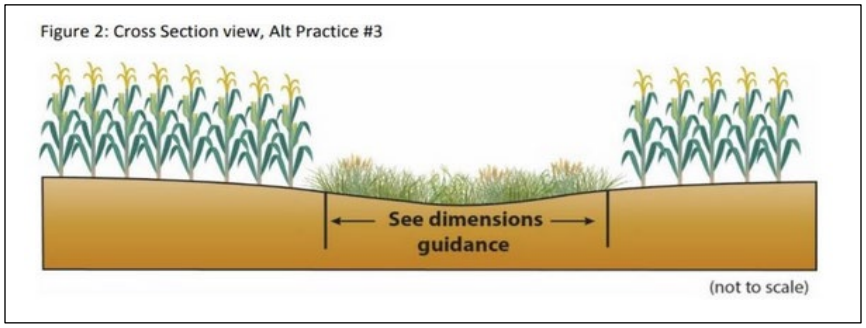
1. The study must compare the nutrient loads from the preferred (BMP) and non-preferred practices.
   - Preferred (BMP): Filter strip
   - Non-preferred: no filter strip
2. The filter strip should be located immediately downslope from the source area of contaminants. Loads should be measured upslope and downslope of the filter strip.
3. It must have permanent vegetation (grasses and legumes).
4. It must be designed so that overland flow entering the filter strip is uniform sheet flow. Concentrated flow is dispersed before it enters the filter strip.
5. The slope of the filter strip and also the width must be provided, as these will be used in factors of effectiveness. (NRCS criteria is 30 feet to reduce dissolved contaminants in runoff and 20 feet to reduce suspended solids in runoff, but studies do not need to meet these criteria.)

Grassed Waterway

General information/General Definition & Benefits

A grassed waterway is a natural or constructed channel that is shaped or graded and planted with suitable vegetation for the stable conveyance of runoff from a field or diversion without causing erosion in the channel and flowing to a stable outlet. The vegetation in the waterway slows the water as it flows through the waterway and may uptake nutrients before reaching nearby surface waters.

ISDA photo gallery



Criteria for Inclusion into the Science Assessment

The purpose of grassed waterways is to convey water without erosion, not to trap sediment or increase infiltration. Therefore, we will use the current (Region 5 model) method of estimating erosion reduction, which uses dimensions of the gully to calculate sediment, with a ratio for particulate N and P estimation and an assumption that 100% of gully erosion sediment is delivered offsite. We do not expect any significant reduction in dissolved nutrients because infiltration is not the purpose, and we will not address any possibility that waterways could become a source of dissolved P because that would have been the same without the waterway.

To be included in the assessment for **grassed waterways**, criteria and assumptions include the following:

1. The study must compare the nutrient loads from the preferred (BMP) and non-preferred practices.
   - Preferred (BMP): Grassed waterway
   - Non-preferred: gully resulting from no waterway
2. Any study with the name “grassed waterway” will be included.