Phosphorus Best Management Practices

Protecting Water Quality

Conservation Tillage and Crop Residue Management

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Definition:

Managing the intensity (frequency and aggressiveness) of soil-disturbing activities related to residue management, seedbed preparation, nutrient application, planting and pest control while planting and growing crops.

Purposes:

- Reduce erosion and transport of adsorbed particulate phosphorus (P)
- Reduce runoff and transport of soluble P
- Conserve soil moisture for crop use and increased yield
- Reduce particulate emission to the atmosphere

How Does This Practice Work?

Leaving crop residue on the soil surface year around, before and after planting, provides soil surface protection at critical times to protect the soil against wind and water erosion. Reducing tillage operations improves soil surface properties, including improved soil aggregation accounting for increased infiltration and percolation; less compaction due to less usage of field implements; and more biological activity due to an increase in organic matter.

Adding soil surface cover increases water infiltration, reducing soil drying and maintains more moisture for crop utilization.

Where This Practice Applies and Its Limitations:

This set of management practices applies to all cropland where tillage is commonly performed to loosen soil, prepare a seedbed, seed crops and control pests.

Both are a most effective control measures where soil erosion processes are carrying particulate phosphorus and where runoff can desorb phosphorus and carry soluble phosphorus from the soil surface.

Although the premises that conservation tillage and crop residue management enhance soil surface properties and prevent soluble nutrient runoff and soil erosion are valid, the use of reduced tillage limits fertilizer and manure (organic) application to surface positions. This builds a stratified layer of crop nutrients (including phosphorus) on or near the soil surface. The

Soybeans planted into residue of previous crop.

P concentrated at the soil surface is vulnerable to extreme rainfall, runoff and wind events that can remove this highly concentrated material from the soil surface. While reduced tillage and soil organic buildup contribute to stable soil structure deep into the soil profile, this undisturbed structure produces macropores and preferential flow channels that can direct nutrients (including phosphorus) downward into deeper parts of the soil profile.

Effectiveness:

Conservation tillage and crop residue management are very effective at reducing soil erosion. Crop, climate and soil conditions impact the efficiency and effectiveness of this set of management practices, and can reduce soil erosion from 30 to 90 percent. No tillage/direct seeding is entirely successful for controlling erosion. The use of current erosion prediction models (RUSLE2 for water and WEQ for wind) will provide an estimate of soil erosion losses or reductions.

Absence of soil disturbance and build up of soil organic matter will improve water and nutrient infiltration with time. Up to a 100 percent reduction in runoff has been reported using both conservation tillage and crop residue management. Residue mulch and reduced soil surface disturbance can conserve up to 30 percent more soil water for crop uptake, and, therefore, increase crop nutrient utilization during critical periods of crop production.

Cost of Establishing and Putting the Practice in Place:

Conservation tillage and crop residue management will reduce the number of unnecessary tillage passes. Each tillage pass would bury additional crop residue. Tillage operations require operator time, fuel and depreciation of equipment, all of which have a cost to the producer. The initial cost of equipment changeover and increased management required by the producer/operator will be offset by eventual savings in time, fuel and equipment depreciation. Every ton of soil saved by controlling erosion will reduce P transport by a minimum of 0. 1 pound.

Operation and Maintenance:

Long-term tillage reduction and increased crop residue management provide the greatest benefit to the soil over time. Up to seven years of continuous management may be required before full benefits of these practices can be realized. Less tillage and greater amounts of crop residue on the soil surface provide the greatest protection from both soil erosion and nutrient runoff. Existing soil compaction, as well as perennial weed control, must be addressed early in the tillage modification. Perennial weeds can be controlled with crop rotations and mode of herbicide action.

Crop residue remaining after harvest.

References:

Residue Management, Mulch Tillage (329B) NRCS Conservation Practice Standard. USDA-NRCS National Handbook of Conservation Practices, March 1999.

Residue Management, No-Till and Strip Till (329A) NRCS Conservation Practice Standard. USDA-NRCS National Handbook of Conservation Practices, March 1999.

Residue Management, Ridge Till (329C) NRCS Conservation Practice Standard. USDA-NRCS National Handbook of Conservation Practices, March 1999.

Residue Management, Seasonal (344) NRCS Conservation Practice Standard. USDA-NRCS National Handbook of Conservation Practices, November 2002.

For Further Information:

Contact your local Soil Conservation District, USDA Natural Resources Conservation Service, or Cooperative Extension Service office. Cost-share assistance may be available. Contact your state/local USDA Web site, or the national NRCS Web site at http://www.nrcs.usda.gov.