Water Quality Best Management Practices, Effectiveness, and Cost for Reducing Contaminant Losses from Cropland

Kansas State University

Department of Agronomy & Department of Agricultural Economics

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Water Quality

K-State Research and Extension faculty have conducted field, laboratory, and computer modeling studies on the effect of crop management practices and land application of livestock waste on the runoff of pesticides, nutrients, and sediments/suspended solids from crop fields. This publication lists recommended best management practices (BMP) for conventional and no-till cropping systems and for land application of livestock waste. This publication also shows the effectiveness of a BMP in reducing runoff of a contaminant, and an estimated cost of implementing BMPs.

The percent reduction in runoff by adopting a listed BMP is the effectiveness obtained from adoption of a single new BMP. It is not appropriate to consider the effectiveness of the adoption of several BMPs to be additive.

A reported BMP cost is the expected loss in producer profitability associated with adoption. Alternatively, it can be treated as the payment-to-producer required to induce adoption. BMP costs and effectiveness figures are based on research, farm data, and professional estimates.

Conventional Tillage

The table on page 2 contains the cost and effectiveness of reducing the runoff of contaminants from the adoption of various BMPs under conventional tillage systems.

The data on reduction of runoff by adopting a BMP are relative to a corn and grain sorghum field where atrazine herbicide is applied preemergence (herbicide broadcast, surface applied following crop planting, but prior to crop emergence), phosphorus and nitrogen fertilizer broadcast applied prior to planting the crop and unincorporated, conventional tillage (less than 30 percent residue cover following planting), with greater than 1 percent slope on upland clay or clay loam soils. For wheat and other crops, the comparison benchmark is phosphorus and nitrogen fertilizer broadcast applied, unincorporated, conventional tillage, with greater than 1 percent slope on upland clay or clay loam soils.

No-till

The table on page 3 contains the cost and effectiveness of reducing the runoff of contaminants from the adoption of various BMPs in a no-till system. The data on reduction of runoff by adopting a BMP are relative to a no-till corn and grain sorghum field where atrazine herbicide is applied preemergence (herbicide broadcast, surface applied following crop planting but prior to crop emergence), phosphorus and nitrogen fertilizer broadcast applied prior to planting the crop, with greater than 1 percent slope on upland clay or clay loam soils. For wheat and other crops, the comparison benchmark is phosphorus and nitrogen fertilizer broadcast applied, unincorporated, no-till prior to planting the crop, with greater than 1 percent slope on upland clay or clay loam soils.

Additional Best Management Practices for Livestock Waste Applications to Cropland

The table on page 4 contains the cost and effectiveness of various BMPs for reducing the runoff of contaminants associated with the application of livestock waste. The data on reduction of runoff by adopting a BMP are relative to livestock waste application broadcast applied in summer months without incorporation to conventionally tilled fields, with greater than 1 percent slope on upland clay or clay loam soils.

Best Management Practice for Conventional Tillage	Cost/Acre ($)	Atrazine Herbicide	Nutrients			Suspended Solids
			Soluble Phosphorus	Total Phosphorus	Nitrogen	
		---------- (percent reduction in runoff by adopting BMP) ----------				
Preplant incorporate into the top two inches of soil prior to the first runoff	7.15	70	60	20	50	0
Use postemergence herbicide applications	6.02	50	0	0	0	0
Use alternative herbicides	10.12	100	0	0	0	0
Use in-season cultivation to minimize herbicide use	15.93	30	0	0	0	0
Band herbicides, nitrogen, and phosphorus on the soil surface prior to or at planting; typically 30 percent surface area, weeds between rows controlled with cultivation	3.40	50	20	20	25	0
Subsurface apply phosphorus or nitrogen fertilizer	3.50	0	60	30	60	0
Apply atrazine in fall for next year's row crop	8.34	50	0	0	0	0
Apply herbicide in early spring, prior to May 1	5.56	50	0	0	0	0
Use split applications of herbicide, e.g., ½ to ⅔ prior to May 1 and ½ to ⅓ at planting	6.02	25	0	0	0	0
Use reduced soil-applied herbicide application rates followed by a postemergence application	6.02	33	0	0	0	0
Crop rotations	0	30	25	25	25	25
Establish vegetative buffer strips	a/	25	25	50	35	50
Do not spray/apply herbicides or nutrients within 100 feet of streams or near where runoff enters a stream	b/	20	25	25	25	0
Use weed scouting/integrated pest management	5.00	0 - 50	0	0	0	0
Conservation tillage farming (>30 percent residue cover following planting)	0	20	0	35	15	30
No-till farming	0	0	0	40	25	75
Contour farming (without terraces)	6.80	20	20	30	20	35
Terraces with tile outlets	c/	10	10	30	10	30
Terraces with grass waterways (with contour farming)	d/	30	30	30	30	30
Soil sampling and testing	1.00	0	0 - 25	0 - 25	0 - 25	0
Sound fertilizer recommendations	0	0	0 - 25	0 - 25	0 - 25	0

[a] Establishment cost of $100 per acre plus an annual cost equal to the average per acre land rental rate for the acreage within the vegetative buffer strip.

[b] Annual cost equal to the average per acre land rental rate for the acreage where herbicides and nutrients are not applied (i.e., acres within 100 feet of streams or before runoff enters a stream).

[c] One-time installation cost of $40 per acre plus an annual cost of $13.60 per acre.

[d] One-time installation cost of $30 per acre plus an annual cost of $13.60 per acre (all crop acres in the field) plus an annual cost equal to the average per acre land rental rate for the acreage within the grass waterways.

Best Management Practice for No-till	Cost/Acre ($)	Atrazine Herbicide	Nutrients			Suspended Solids
			Soluble Phosphorus	Total Phosphorus	Nitrogen	
		---------- (percent reduction in runoff by adopting BMP) ----------				
Use postemergence herbicide applications	6.02	50	0	0	0	0
Use alternative herbicides	10.12	100	0	0	0	0
Use in-season cultivation to minimize herbicide use	15.93	30	0	0	0	0
Band herbicides, nitrogen, and phosphorus on the soil surface prior to or at planting; typically 30 percent surface area, weeds between rows controlled with cultivation	3.40	50	20	20	25	0
Subsurface apply phosphorus or nitrogen fertilizer	3.50	0	70	50	70	0
Apply atrazine in fall for next year's row crop	8.34	50	0	0	0	0
Apply herbicide in early spring, prior to May 1	5.56	50	0	0	0	0
Use split applications of herbicide, e.g., ½ to ⅔ prior to May 1 and ½ to ⅓ at planting	6.02	25	0	0	0	0
Use reduced soil-applied herbicide application rates followed by a postemergence application	6.02	33	0	0	0	0
Crop rotations	0	30	25	25	25	25
Establish vegetative buffer strips	a/	25	25	50	35	50
Do not spray/apply herbicides or nutrients within 100 feet of streams or near where runoff enters a stream	b/	20	25	25	25	0
Use weed scouting/integrated pest management	5.00	0 - 50	0	0	0	0
Contour farming (without terraces)	6.80	20	20	30	20	20
Terraces with tile outlets	c/	10	10	30	10	30
Terraces with grass waterways (with contour farming)	d/	30	30	30	30	30
Soil sampling and testing	1.00	0	0 - 25	0 - 25	0 - 25	0
Sound fertilizer recommendations	0	0	0 - 25	0 - 25	0 - 25	0

[a] Establishment cost of $100 per acre plus an annual cost equal to the average per acre land rental rate for the acreage within the vegetative buffer strip.
[b] Annual cost equal to the average per acre land rental rate for the acreage where herbicides and nutrients are not applied (i.e., acres within 100 feet of streams or where runoff enters a stream).
[c] One-time installation cost of $40 per acre plus an annual cost of $13.60 per acre.
[d] One-time installation cost of $30 per acre plus an annual cost of $13.60 per acre (all crop acres in the field) plus an annual cost equal to the average per acre land rental rate for the acreage within the grass waterways.

Best Management Practices for Livestock Waste Applications to Cropland	Cost/Acre ($)	Fecal Coliform Bacteria	Nutrients			Suspended Solids
			Soluble Phosphorus	Total Phosphorus	Nitrogen	
		---------- (percent reduction in runoff by adopting BMP) ----------				
Incorporate with tillage equipment	7.15	90	70	20	50	0
Subsurface inject liquid waste	25.50	90	70	20	50	0
No-till farming	0	60	0	40	0	60
Conservation tillage farming	0	50	0	35	0	50
Test livestock waste for nutrient value	1.00	0	0 - 30	0 - 30	0 - 30	0

Daniel Devlin
Extension Specialist
Environmental Quality
Department of Agronomy

Kevin Dhuyvetter
Agricultural Economist
Farm Management
Department of Agricultural Economics

Kent McVay
Extension Specialist
Soil and Water Conservation
Department of Agronomy

Terry Kastens
Agricultural Economist
Crop Production and Farm Management
Department of Agricultural Economics

Charles Rice
Soil Microbiologist
Department of Agronomy

Keith Janssen
Agronomist in Charge
East Central Experiment Field

Gary Pierzynski
Soil Chemist
Department of Agronomy

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

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