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

MF2572 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 edge of field surface runoff of a contaminant, and an estimated cost of implementing BMPs.

The percent reduction in surface 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 encourage 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 edge of field surface runoff of contaminants from the adoption of various BMPs under conventional tillage systems.

The data on reduction of surface 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 before crop emergence), phosphorus and nitrogen fertilizer broadcast applied before 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 edge of field surface runoff of contaminants from the adoption of various BMPs in a no-till system. The data on reduction of surface 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 before crop emergence), phosphorus and nitrogen fertilizer broadcast applied before 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 before 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 edge of field surface runoff of contaminants associated with the application of livestock waste. The data on reduction of surface 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 surface runoff by adopting BMP) -----------				
Preplant incorporate into the top two inches of soil before the first runoff	9.92	70	60	20	50	0
Use postemergence herbicide applications	5.48	50	0	0	0	0
Use alternative herbicides	11.69	100	0	0	0	0
Use in-season cultivation to minimize herbicide use	17.10	30	0	0	0	0
Band herbicides, nitrogen, and phosphorus on the soil surface before or at planting; typically 30 percent surface area, weeds between rows controlled with cultivation	7.95	50	20	20	25	0
Subsurface apply phosphorus or nitrogen fertilizer	13.25	0	60	30	60	0
Apply atrazine in fall for next year's row crop	5.48	50	0	0	0	0
Apply herbicide in early spring, before May 1	5.48	50	0	0	0	0
Use split applications of herbicide, e.g., ½ to ⅔ before May 1 and ½ to ⅓ at planting	5.48	25	0	0	0	0
Use reduced soil-applied herbicide application rates followed by a postemergence application	5.48	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
Cover Crops (fall, winter, spring)	e/	0	40	50	25	40

[a] Establishment cost of $150 per acre plus an annual cost equal to the average per acre land rental rate for the acreage within the 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 $522 per treated acre plus an annual cost of $13.20 acre.

[d] One-time installation cost of $320 per treated acre plus an annual cost of $13.20 per acre plus an annual cost equal to the average per acre land rental rate for the acreage within the grassed waterway.

[e] Cover crop seed mixes range from $10-50 per acre, average no-till planting costs of $15.48 per acre, chemical costs of $11.69 per acre, and chemical application costs of $5.48 per acre.

Best Management Practice for No-till	Cost/Acre	Atrazine Herbicide	Nutrients			Suspended Solids
			Soluble Phosphorus	Total Phosphorus	Nitrogen	
	($)	---------- (percent reduction in surface runoff by adopting BMP) ----------				
Use postemergence herbicide applications	5.48	50	0	0	0	0
Use alternative herbicides	11.69	100	0	0	0	0
Band herbicides, nitrogen, and phosphorus on the soil surface before or at planting; typically 30 percent surface area, weeds between rows controlled with cultivation	7.95	50	20	20	25	0
Subsurface apply phosphorus or nitrogen fertilizer	13.25	0	70	50	70	0
Apply atrazine in fall for next year's row crop	5.48	50	0	0	0	0
Apply herbicide in early spring, before May 1	5.48	50	0	0	0	0
Use split applications of herbicide, e.g., ½ to ⅔ before May 1 and ½ to ⅓ at planting	5.48	25	0	0	0	0
Use reduced soil-applied herbicide application rates followed by a postemergence application	5.48	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)	9.43	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
Cover Crops (fall, winter, spring)	e/	0	Insufficient data[f]			

[a] Establishment cost of $150 per acre plus an annual cost equal to the average per acre land rental rate for the acreage within the 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 $522 per treated acre plus an annual cost of $13.20 acre.

[d] One-time installation cost of $320 per treated acre plus an annual cost of $13.20 per acre plus an annual cost equal to the average per acre land rental rate for the acreage within the grassed waterway.

[e] Cover crop seed mixes range from $10 to 50 per acre, average no-till planting costs of $15.48 per acre, chemical costs of $11.69 per acre, and chemical application costs of $5.48 per acre.

[f] At the present there is insufficient data to determine reductions from the use of cover crops in a no-till production system. Research has been initiated in Kansas and Iowa.

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 surface runoff by adopting BMP) ----------				
Incorporate with tillage equipment	9.92	90	70	20	50	0
Subsurface inject liquid waste	35.37	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

Source for Custom Farm Rates: *www.agmanager.info/farmmgt/machinery/Tools/KCD_CustomRates(Feb2014).pdf*

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